KAUHALE LANI

Draft Environmental Assessment

Prepared for:
The Accepting Authority,
State of Hawai'i Land Use Commission
&

Maui Land & Pineapple Company Inc.

Prepared by:

PBR HAWAII

June 2005

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

(This page intentionally left blank.)

1.0 INTRODUCTION

This environmental assessment is prepared in accordance with Chapter 343, *Hawaii Revised Statutes* for the Kauhale Lani community in Pukalani, Maui.

1.1 PROJECT SUMMARY

Project Name:	Kauhale Lani
Applicant:	Maui Land & Pineapple Company, Inc.
Landowner:	Maui Land & Pineapple Company, Inc.
Location:	Pukalani, Maui, Hawai'i
Tax Map Key:	2-3-09:007 and 064
Existing Use:	Vacant land and fallow pineapple fields
Proposed Use:	Residential community
Project Area:	TMK 2-3-09:007 – 50 acres TMK 2-3-09:064 – 39 acres **Total Area: 89 acres**
Land Use Designations:	State Land Use: Agricultural Community Plan: Single Family (SF) Zoning: Agricultural Special Management Area (SMA): Not within the SMA
Actions Requested:	Chapter 343, *Hawaii Revised Statutes* (HRS) compliance
Approving Agency:	State Land Use Commission
Permits and Approvals Required:	Chapter 343, HRS compliance State Land Use District Boundary Amendment (Agricultural to Urban) Change in Zoning (Agricultural to Residential (R-1)) National Pollutant Discharge Elimination System (NPDES) Permit Subdivision Approval Wastewater System Approval Grading/Building Permits

1.2 LOCATION

The Kauhale Lani community site is in Pukalani, Maui, Hawai‘i (Figure 1) on property identified by TMK 2-3-09:007 (50 acres) and TMK 2-3-09:064 (39 acres) (Figure 2). Old Haleakalā Highway bisects the two parcels. The 50-acre site is adjacent to and west of Old Haleakalā Highway. The 39-acre site is a linear parcel that extends up from the "Y" created by the intersection of Haleakalā Highway and Old Haleakalā Highway.

1.3 LAND OWNERSHIP

Maui Land & Pineapple Company, Inc. (ML&P) owns both properties: TMK 2-3-09:07 and TMK 2-3-09:64 (Figure 2).

1.4 IDENTIFICATION OF THE APPLICANT

The applicant is Maui Land & Pineapple Company, Inc.

Contact Person: Ryan Churchill Vice President/Community Development
Kapalua Land Company, Ltd.
1000 Kapalua Drive
Kapalua, Maui, Hawai‘i 96761
Telephone: (808) 669-5625
Facsimile: (808) 669-5454

1.5 PLANNING CONSULTANT

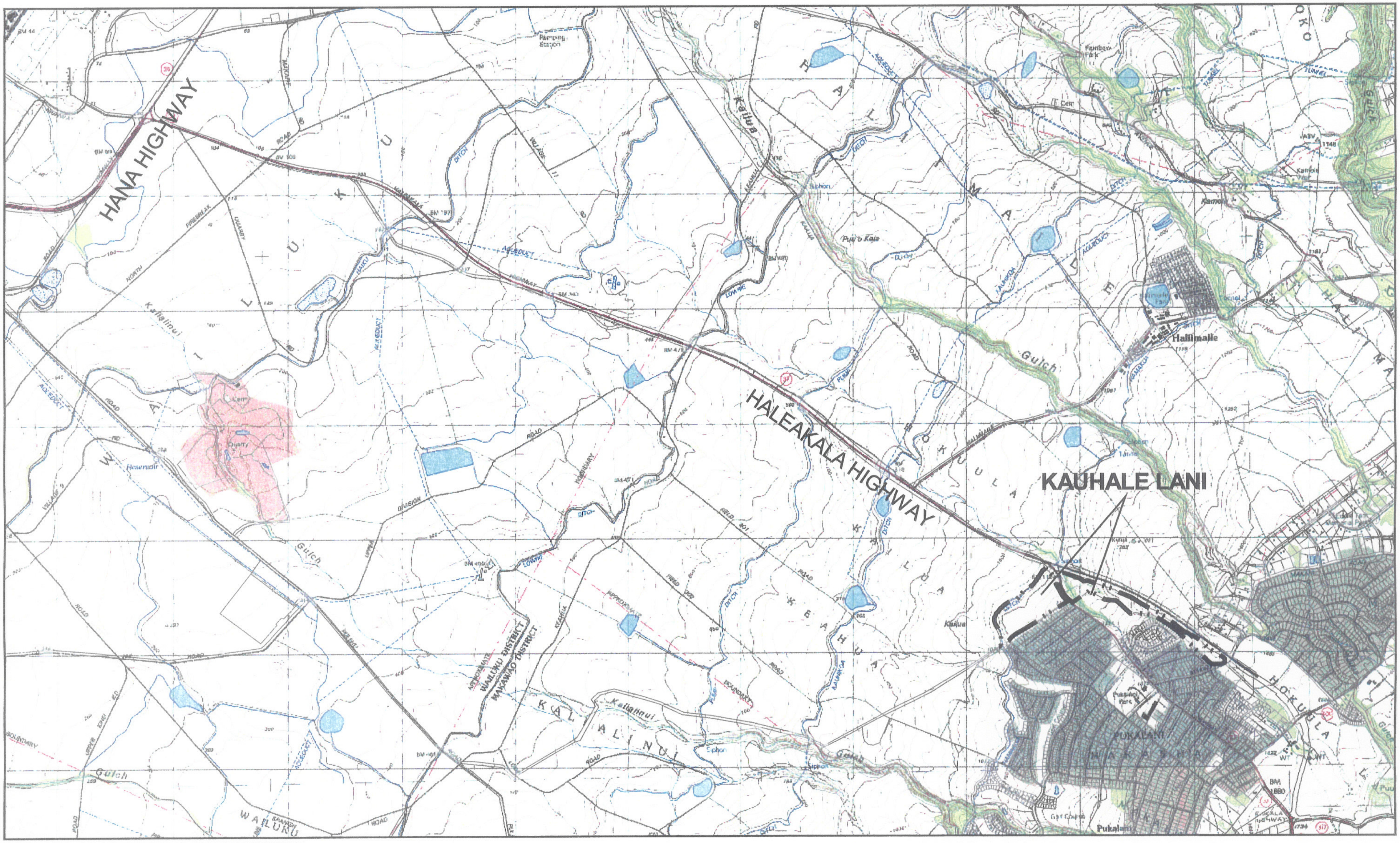
Maui Land & Pineapple Company, Inc.'s planning, environmental, and entitlement consultant is PBR HAWAII.

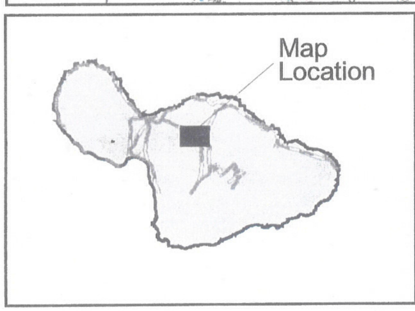
Contact Person: Tom Schnell, AICP
PBR HAWAII
1001 Bishop Street
ASB Tower, Suite 650
Honolulu, Hawai‘i 96813
Telephone: (808) 521-5631
Facsimile: (808) 523-1402

1.6 IDENTIFICATION OF THE APPROVING AGENCY

The State of Hawai‘i Land Use Commission is the approving agency for the environmental assessment.

Contact Person: Anthony Ching, Executive Officer
State Land Use Commission
P.O. Box 2359
Honolulu, Hawai‘i 96804
Telephone: (808) 587-3822
Facsimile: (808) 587-3827





Source:
U.S. Geological Survey
The State of Hawaii GIS Database

Disclaimer:
This map has been prepared for
general planning purposes only.

Figure 1
Regional Location Map

KAUHALE LANI

MAUI LAND & PINEAPPLE COMPANY, INC.

ISLAND OF MAUI

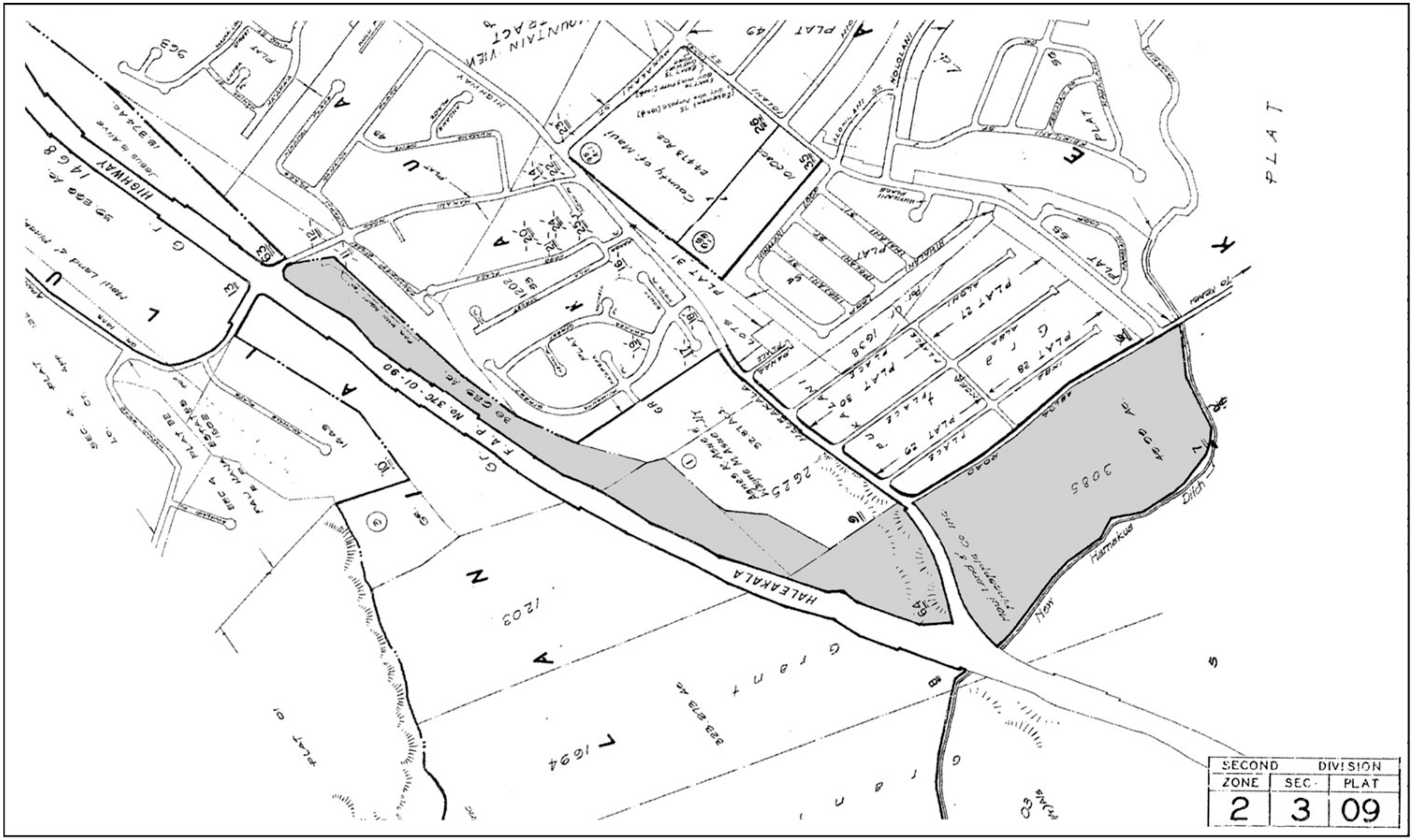
NORTH

LINEAL SCALE (FEET)

0 2,000 4,000 8,000

PBR HAWAII

JUNE 2004



LEGEND

Kauhale Lani

Source:
County of Maui Tax Map Key

Disclaimer:
This map has been prepared for general planning purposes only.

Figure 2
Tax Map Key Map

KAUHALE LANI

MAUI LAND & PINEAPPLE COMPANY, INC.
ISLAND OF MAUI

NORTH

LINEAL SCALE (FEET)
0 500 1,000 2,000

PBR HAWAII

1.7 ENVIRONMENTAL COMPLIANCE

This document has been prepared in accordance with the provisions of *Hawaii Revised Statutes* (HRS) Chapter 343 and *Hawaii Administrative Rules* (HAR) Title 11, Department of Health, Chapter 200, Environmental Impact Rules. Section 343-5, HRS, establishes nine "triggers" that require compliance with these regulations. The Kauhale Lani community will feature approximately 165 single-family residences, requiring the development of a wastewater facility. Whenever a wastewater facility serving more than 50 single-family dwellings is proposed, the preparation of an environmental assessment (EA) is required.

In addition, the creation of Kauhale Lani community may involve or impact State and/or County lands relating to infrastructure improvements for roadways, water, sewer, utility, drainage, or other facilities. While the specific nature of each improvement is not known at this time, this EA is intended to address all current and future instances involving the use of State and/or County lands relating to the Kauhale Lani community.

1.8 IDENTIFICATION OF AGENCIES, ORGANIZATIONS, AND INDIVIDUALS TO BE CONSULTED

In the course of preparing this EA, agencies (or agency documents), private companies, and individuals were consulted, including the following.

County of Maui

- Department of Housing & Human Concerns
- Department of Parks and Recreation
- Department of Planning
- Department of Public Works and Environmental Management
- Department of Water Supply
- Fire Department
- Police Department

State of Hawai‘i

- Department of Agriculture
  - Maui Office
  - State Office
- Department of Business, Economic Development & Tourism
  - Office of Planning
  - State Land Use Commission
- Department of Education
- Department of Health
  - Clean Water Branch
  - Maui District Health Office
  - Office of Environmental Quality Control
  - Safe Drinking Water Branch
  - Wastewater Branch

- Department of Land and Natural Resources
  - Historic Preservation Division
- Department of Transportation
- Office of Hawaiian Affairs

Federal Agencies

- Department of Agriculture
  - Natural Resources Conservation Service
- Federal Emergency Management Agency
- U.S. Geological Survey

Private Companies

- Maui Electric Company, Ltd.
- Verizon Hawaii

Pre-consultation letters were also sent to specific agencies and organizations. Appendix A contains pre-consultation letters and responses.

2.0 KAUHALE LANI DESCRIPTION

This section provides background information and a general description of the Kauhale Lani community.

2.1 BACKGROUND INFORMATION

2.1.1 Location

The Kauhale Lani community site is located on the slopes of Haleakalā at the entrance to Pukalani (Figure 1), where Old Haleakalā Highway branches off from Haleakalā Highway. Two parcels, identified by TMK 2-3-09:07 (50 acres) and TMK 2-3-09:64 (39 acres) comprise the community site (Figure 2). Old Haleakalā Highway bisects the parcels.

The 50-acre parcel is adjacent to and west of Old Haleakalā Highway. The 39-acre parcel is a linear property extending up from the "Y" created from the intersection of Haleakalā Highway and Old Haleakalā Highway. Haleakalā Highway borders this parcel to the east. Old Haleakalā Highway and residential homes are along the western boundary and Makani Road is at the southern boundary.

2.1.2 Description of the Property

The 50-acre parcel is a former pineapple field. Elevations range from about 1,088 feet at the northwest end of the property up to about 1,186 feet at the southeast end, providing an approximately seven percent grade. The elevation and gentle grade provide for expansive views of Central Maui from nearly all points on the property. The New Hāmākua Ditch bounds the parcel to the north and west, with the Lower Pukalani Terrace subdivision to the south.

The 39-acre parcel is currently not under agricultural cultivation but contains abandoned pineapple fields in some areas and heavy vegetation in other areas. A grove of Eucalyptus trees on the property borders Haleakalā Highway. Elevations range from approximately 1,110 feet to 1,440 feet and a shallow gulch cuts through the length of the linear parcel.

Figure 3 contains photographs of the property.

2.1.3 Surrounding Land Uses

Portions of Haleakalā Highway and the Old Haleakalā Highway are adjacent to the 50-acre parcel on its east side. While the New Hāmākua Ditch forms the boundary of the property on the north and west sides, it is not within the property and is owned by Alexander and Baldwin, Inc. (A&B). Beyond the ditch are sugarcane fields, which are operated by Hawaiian Commercial & Sugar Company (HC&S), a subsidiary of A&B. The County-owned right-of-way for A'eloa Road is at the southern boundary of the property, although this road has not been paved. On the other side of the A'eloa Road right-of-way are the single-family homes of the Lower Pukalani Terrace subdivision.

Haleakalā Highway is adjacent to the 39-acre parcel on both its north and east sides, with sugar cane fields beyond. The west side of the parcel is bound partially by Old Haleakalā Highway, a large vacant parcel and single-family homes. Makani Road forms the southern boundary of the 39-acre parcel, with primarily single-family homes beyond.

2.2 KAUHALE LANI DESCRIPTION

The Kauhale Lani community will provide approximately 165 new homes in Pukalani on a site already designated for residential use on the *Makawao-Pukalani-Kula Community Plan*. The 50-acre parcel west of Old Haleakalā Highway will contain the residential neighborhood, while the 39-acre parcel between Old Haleakalā Highway and Haleakalā Highway will contain open space, community trails, and other community amenities (Figure 4).

The goal of the Kauhale Lani community is to provide a cohesive addition to Pukalani in character with the Upcountry region. The community will be a walkable neighborhood designed to enhance connectivity by way of pedestrian-friendly streets, alley ways, and a perimeter pedestrian/bike trail. A centralized neighborhood park may feature a community pavilion and play courts, providing a neighborhood center and gathering place for the community.

Kauhale Lani's interior streets increase connectivity along a network of routes and create a pedestrian friendly environment through the use of short blocks, multiple routes, and landscaped right-of-ways. Internal roundabouts and on-street parking will calm traffic, enhancing pedestrian safety. Within interior blocks, an alley system will allow garages to be located toward the back of the homes. Siting vehicle storage, garbage collection, and other utilitarian needs away from the front of the homes fosters safer streets, improves pedestrian movement, and increases street parking. Roadways will be built to County of Maui standards.

A pedestrian/bike trail along the New Hāmākua Ditch will provide a secondary pedestrian circulation system and is envisioned to be a significant community amenity. This landscaped greenway will be approximately 25 feet wide and will wrap around the *makai* sides of the community, providing all residents with access to Central Maui views and an additional recreation area. Besides recreational benefits, the greenway provides a definite edge to the community and a transition between the community and agricultural lands beyond. For safety considerations, it is envisioned that the side of the greenway bordering the ditch will be fenced, if necessary.

To fully integrate with the existing community, Kauhale Lani roadways allow a connection to the existing Lower Pukalani Terrace subdivision, providing continuity between the two neighborhoods and alternative routes within Pukalani. Connectivity between the two neighborhoods is in compliance with provisions of the *Makawao-Pukalani-Kula Community Plan* and recommended by the County of Maui Planning Department.

The 39-acre parcel between Old Haleakalā Highway and Haleakalā Highway will include a trail running the length of the property from Old Haleakalā Highway to Makani Road. No homes are proposed for this parcel and the majority of the area will serve as open space. A small wastewater treatment facility serving Kauhale Lani may also be located on approximately two

1. The Kauhale Lani site provides expansive views of Central Maui.

2. The New Hamakua Ditch bounds the property on the northwest and southwest edges.

3. The neighboring Lower Pukalani Terrace subdivision is to the southeast of the Kauhale Lani site. The peak of Haleakala dominates the horizon.

4. The parcel along Haleakala Highway contains thick vegetation in some sections.

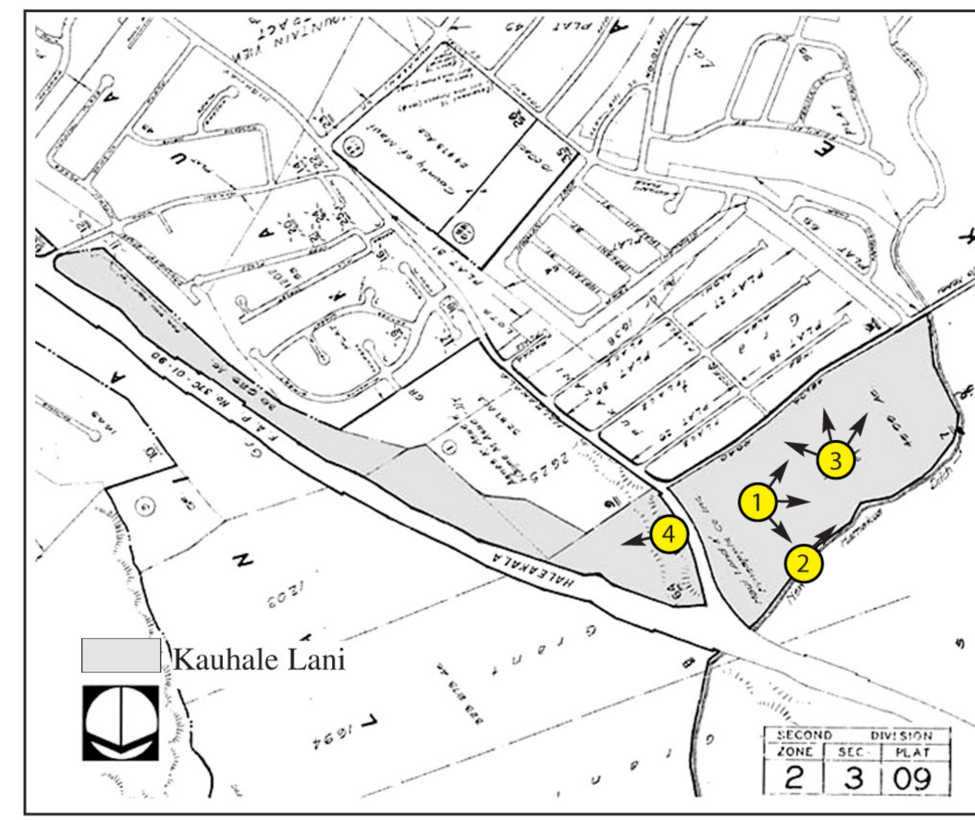


Figure 3
Site Photographs

KAUHALE LANI

MAUI LAND & PINEAPPLE COMPANY, INC.

ISLAND OF MAUI

PBR HAWAII

All photographs taken on August 10, 2004.

Figure 4
Conceptual Master Plan
KAUHALE LANI
ISLAND OF MAUI

PBR HAWAII

Source:
Sam O. Hirota, Inc.
Chris Hart and Partners

Disclaimer:
This graphic has been prepared for general planning purposes only.

*Landscape Design by Chris Hart and Partners acres within this area. Because of the small area required, the facility can be effectively screened from highway views with landscaping.

Lot sizes within Kauhale Lani will range from approximately 6,000 square feet to approximately 12,000 square feet (Table 1).

Table 1. Land Use Summary

	Gross Acres	Proposed Uses	Estimated Number of House Lots	Lot Size (Square Feet)
TMK 2-3-09:07	50	Homes, Park, & Recreation Areas	165	6,000 – 12,000
TMK 2-3-09:64	39	Open Space, Trails, & Community Amenities	0	-

This environmental assessment describes the area and the potential impacts and mitigative measures for the construction of the Kauhale Lani community.

2.3 ESTIMATED SALES PRICES

Homes within Kauhale Lani will be market priced. Based on recent marketing data for the Pukalani area it is estimated that home prices will start at approximately $650,000. Homes with larger lots will be priced accordingly, subject to the prevailing market prices.

2.4 DEVELOPMENT TIMETABLE AND APPROXIMATE COSTS

Development and sales of the Kauhale Lani community are projected to be completed within seven to eight years. Within this total time and before construction, permitting and entitlement processing is expected to take approximately one year. Construction of the major backbone infrastructure including the park/community center facility is estimated to take an additional 18 months, with the first homes being completed in 2007. Continued construction and full absorption should occur over the next five years.

Table 2. Development Timetable

	Years
Entitlement Processing and Permitting	1
Site Engineering, Infrastructure Construction	1.5
Construction and Sales	5
Total	**7 to 8**

Costs to develop the Kauhale Lani community are preliminary and will be better defined during detailed site engineering. The order of magnitude costs for the development of on-site infrastructure and final subdivision layout is expected to be approximately $74.7 million.

2.5 OPERATIONS AND MANAGEMENT OF PROPOSED USES

There are no businesses proposed for the Kauhale Lani community. Operations and management are primarily related to tasks associated with the community maintenance and upkeep, which will be administered through a Home Owners Association.

2.5.1 Number of Employees

Beyond community maintenance and upkeep, there are no uses proposed in Kauhale Lani that require employees.

2.5.2 Employee Housing Plan

It is not envisioned that any employee housing will be necessary.

2.5.3 Hours of Operations

There are no commercial uses proposed in Kauhale Lani.

2.5.4 Parking

Chapter 19.36 (Off Street Parking and Loading) of the Maui County Code states that single-family dwellings require two parking spaces for each dwelling unit. In conformance with the code, each home built at Kauhale Lani will have at least two parking spaces.

2.5.5 Fees Charged to Residents and Visitors

Based on the size of the community and the amenities currently envisioned, it is estimated the Home Owners Association (HOA) fees for Kauhale Lani will be similar to the fees found in similar associations (plus future escalation).

There are no uses envisioned within Kauhale Lani that would involve fees charged to visitors. Kauhale Lani's parks and recreation areas will be open to the public.

2.6 SUSTAINABLE BUILDING DESIGN

The Office of Environmental Quality Control (OEQC) has issued "Guidelines for Sustainable Building Design in Hawai'i: A Planner's Checklist" (OEQC May 1999) and has requested that consideration be made in applying sustainable building techniques to projects. The OEQC Guidelines state, "[a] sustainable building is built to minimize energy use, expense, waste and impact on the environment. It seeks to improve the region's sustainability by meeting the needs of Hawai'i's residents and visitors today without compromising the needs of future generations."

Techniques from "Guidelines for Sustainable Building Design in Hawai'i: A Planner's checklist" considered in the Kauhale Lani community design include:

<u>*Site Selection & Site Design:*</u>

1. *Select a site with short connections to existing municipal infrastructure (sewer lines, water, waste water treatment plant, roads, gas, electricity, telephone, data communication lines and services). Select a site close to mass transportation, bicycle routes and pedestrian access.*

Discussion: The Kauhale Lani site is adjacent to existing residential uses. While water and wastewater facilities will have to be provided, the site is adjacent to or close to existing roads, electrical and telephone facilities, and other services.

2. *Site building(s) to take advantage of natural features and maximize their beneficial effects. Provide for solar access, daylighting and natural cooling. Design ways to integrate the building(s) with the site that maximizes and preserves positive site characteristics, enhances human comfort, safety and health, and achieves operational efficiencies.*

Discussion: The site plan for Kauhale Lani has been optimized to minimize grading of the site. Buildings will be sited to take advantage of natural features and maximize their beneficial effects where practical.

3. *Locate building(s) to encourage bicycle and pedestrian access and pedestrian oriented uses. Provide bicycle and pedestrian paths, bicycle racks, etc. Racks should be visible and accessible to promote and encourage bicycle commuting.*

Discussion: The design of the Kauhale Lani community provides for pedestrian-friendly streets and a perimeter pedestrian/bike trail along the New Hāmākua Ditch. Street design includes slight cranks and bends of roads within the neighborhood to allow for natural traffic calming, and continuous sidewalks and street trees to provide a comfortable pedestrian environment. Moreover, the 39-acre parcel between Old Haleakalā Highway and Haleakalā Highway will provide trails, open space, and other community amenities.

<u>*Building Design:*</u>

1. *For natural cooling, use:*
    - *Reflective or light colored roofing, radiant barrier and/or insulation, roof vents;*
    - *Light colored paving (concrete) and building surfaces'*
    - *Tree planting to shade buildings and paved areas; and*
    - *Building orientation and design that captures trade winds and/or provides for convective cooling of interior spaces when there is no wind.*

Discussion: Natural cooling such as street trees that shade buildings and paved areas will be included within Kauhale Lani.

<u>*Energy Use:*</u>

1. *Use renewable energy. Use solar water heaters and consider the use of photovoltaics and Building Integrated Photovoltaics (BIPV).*

Discussion: Maui Land & Pineapple Company, Inc. (ML&P) will require the installation of solar water heaters in each home built in Kauhale Lani.

<u>Landscape and Irrigation</u>:

1. *Incorporate water efficient landscaping (xeriscaping) using the following principles:*
    a. *Soil analysis/improvement: Use (locally made) soil amendments and compost for plant nourishment, improved water absorption and holding capacity.*
    b. *Appropriate plant selection: Use drought tolerant and/or slow growing hardy grasses, native and indigenous plants, shrubs, ground covers, trees, appropriate for local conditions, tom minimize the need for irrigation.*
    c. *Mulches: Use mulches to minimize evaporation, reduce weed growth and retard erosion.*

Discussion: Where feasible, landscaping will include the use of locally-made soil amendments and compost for plant nourishment, improved water absorption, and holding capacity; the use of drought-tolerant and/or slow-growing hardy grasses, native and indigenous plants, shrubs, ground covers, and trees appropriate for local conditions to minimize the need for irrigation; and the use of mulches to minimize evaporation, reduce weed growth, and retard erosion.

2. *Irrigate with non-potable water or reclaimed water when feasible. Collect rainwater from the roof for irrigation.*

Discussion: Wastewater will be treated to a high level of quality to provide for reuse. The reclaimed water will be used to irrigate landscaped areas such as the community park.

2.7 COMMUNITY PLANNING

The *Makawao-Pukalani-Kula Community Plan* is one of nine community plans for Maui County. It reflects current and anticipated conditions in the Pukalani region and addresses planning goals, objectives, policies, and implementation considerations as a decision-making guide in the region through the year 2010. The *Makawao-Pukalani-Kula Community Plan* provides specific recommendations to address the goals, objectives, and policies contained in the General Plan, while recognizing the values and unique attributes of Makawao-Pukalani-Kula, to enhance the region's overall living environment.

The *Makawao-Pukalani-Kula Community Plan* was updated in July 1996. The update process started with the work of the Makawao-Pukalani-Kula Citizens Advisory Committee (CAC). This 13-member panel met 18 times for almost one year to identify, formulate, and recommend appropriate revisions to the *Makawao-Pukalani-Kula Community Plan*.

The update process incorporated technical studies and assessments. The technical studies included: 1) Social-Economic Forecast, 2) Land Use Forecast, 3) Infrastructure Assessment, and 4) Public Facilities and Service Assessment. As a result of this process, the Kauhale Lani site was designated Single Family (SF). The Land Use Forecast assessment provided a measure of existing vacant and undeveloped lands (by Community Plan land use designation) and addressed the future needs for each Community Plan region. Designating the Kauhale Lani site SF by the CAC reflects the consensus by the community for residential uses on the site.

3.0 DESCRIPTION OF THE ENVIRONMENT, POTENTIAL IMPACTS, AND MITIGATIVE MEASURES

This section describes the existing conditions of the physical or natural environment, the potential impacts of the Kauhale Lani community on the environment, and mitigative measures to minimize impacts.

3.1 PHYSICAL CHARACTERISTICS

3.1.1 Climate

The climate of the Pukalani region is generally mild, with warm days and cool evenings. Kauhale Lani's *mauka* location results in cooler temperatures compared to coastal locations at lower elevations. Average daily temperatures in Pukalani range between 60 and 75 degrees Fahrenheit. The Pukalani area receives a moderate amount of rainfall; historical records from Haleakalā Ranch show that this area averages about 43 inches of rain per year, with the summer months being the driest. Prevailing winds in the area are northeast tradewinds that reach speeds of 10 to 20 miles per hour. These tradewinds can be slightly stronger during the spring and summer months. During winter months, occasional strong winds from the south or southwest can occur.

Potential Impacts and Mitigation Measures

Kauhale Lani is not expected to have an effect on climatic conditions. As such, no mitigative measures are proposed.

3.1.2 Geology and Topography

Geologically, the island of Maui is characterized as East and West Maui, with East Maui dominated by Haleakalā Volcano. Kauhale Lani is located on the windward slopes of Haleakalā, a dormant volcano which last erupted around 1790. Haleakalā was formed through three distinct periods of volcanism. The Honomanu Series formed the primitive shield of Haleakalā during the Tertiary Period. In the Pleistocene Epoch these lavas were completely overlain by the Kula Series, which is composed of hawaiite with lesser amounts of alkalic olivine basalt and ankaramite. The Kula lavas are primarily composed of thick a'a flows with some pāhoehoe present near the vents. Following a lengthy period of erosion, a third series of eruptions and flows, named the Hāna Volcanic Series covered much of the Kula lavas. However, because the north rift zone of the Kula series did not reopen during the third period of volcanism, the Hāna series is absent from the entire northwestern section of East Maui, where Kauhale Lani is located (Macdonald, Abbott, and Peterson 1983).

The neighborhood site (50-acre parcel) is gently sloping with elevations ranging from approximately 1,088 feet up to 1,186 feet. The slope of the open space site (39-acre parcel) varies more, with elevations between 1,110 feet and 1,440 feet.

Potential Impacts and Mitigative Measures

No significant impacts on the geology and topography are anticipated as a result of developing the community. The roadways and homesites have been carefully designed and planned to minimize the need for extensive grading and conform to the natural contours of the land. However, some grading will be necessary for roads and house pads.

A National Pollutant Discharge Elimination System (NPDES) permit for Construction Storm Water Activities will be required from the State of Hawaiʻi Department of Health (DOH). During site preparation, storm runoff from the community site will be controlled in compliance with the County's "Soil Erosion and Sediment Control Standards". Typical mitigation measures include appropriately stockpiling materials on-site to prevent runoff and building over or establishing landscaping as early as possible on disturbed soils to minimize length of exposure.

3.1.3 Soils

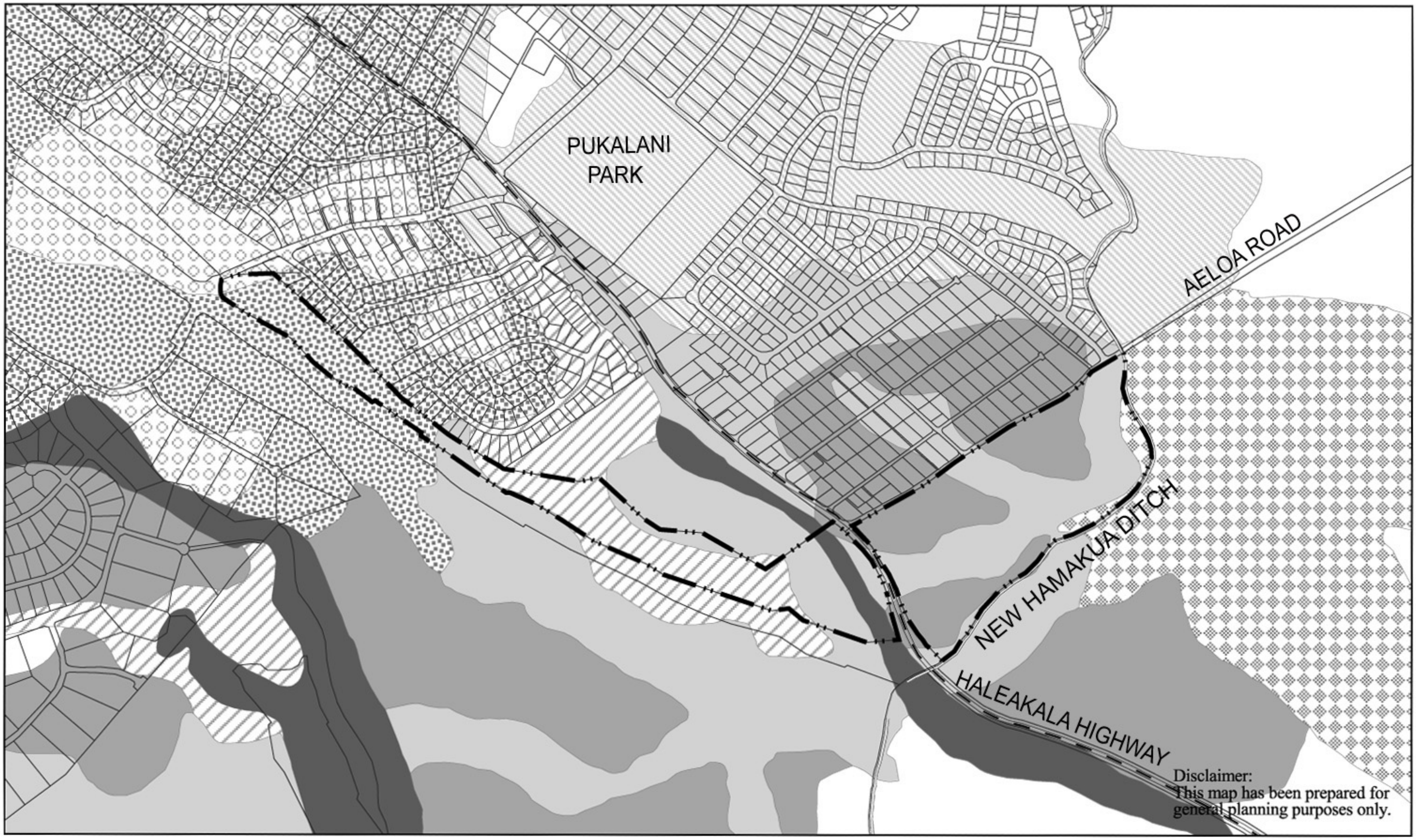
Three soil suitability studies have been prepared for lands in Hawaiʻi. These are the U.S. Department of Agriculture (USDA) Soil Conservation Service (now called the Natural Resources Conservation Service) *Soil Survey*, the University of Hawaiʻi Land Study Bureau *Detailed Land Classification*, and the State of Hawaiʻi Department of Agriculture *Agricultural Lands of Importance to the State of Hawaiʻi* (ALISH). The principal focus of these studies has been to describe the physical attributes of Hawaiʻi's lands and the relative productivity of different land types for agricultural production purposes.

Natural Resources Conservation Service (NRCS). According to the *United States Department of Agriculture Soil Conservation Service, Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii, 1972*, the soils of Kauhale Lani include: Hāliʻimaile Silty Clay, 3-7% slopes; Hāliʻimaile Silty Clay, 7-15% slopes; Rough Broken Land; Hāliʻimaile Gravelly Silty Clay, 7-15% slopes, eroded; Hāliʻimaile Silty Clay Loam, 3-7% slopes; Hāliʻimaile Silty Clay Loam, 7-15% slopes; and Keāhua Silty Clay Loam, 7-15% slopes (see Figure 5). Under the Soil Conservation Service's Land Capability Grouping, soil types are rated according to eight levels, ranging from the highest classification level, I, to the lowest level, VIII. Lower case letters following the classification level indicate specific subclasses. A brief description of these soils, along with their Land Capability Grouping rating follows.

Hāliʻimaile Silty Clay (HhB), 3-7 percent slopes. On these soils, permeability is moderately rapid, runoff is slow, and the erosion hazard is slight. This soil has subangular blocky and angular blocky structure. The soil is strongly acid in the surface layer and strongly acid to medium acid in the subsoil. This soil is used for sugarcane, pineapple, and homesites.

Approximately 22.8 acres (25 percent) of Kauhale Lani contain HhB soils. HhB soils are rated IIe, irrigated or nonirrigated. Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices. Subclass IIe soils are subject to moderate erosion if they are cultivated and not protected.

Hāliʻimaile Silty Clay (HhC), 7-15 percent slopes. On this soil, runoff is medium and the erosion hazard is moderate. The soils include cobbly areas and small, moderately steep areas. This soil is used for sugarcane, pineapple, and homesites.



LEGEND

Soil Classifications

- HhB: Haliimaile Silty Clay, 3-7% Slopes IIe
- HhC: Haliimaile Silty Clay, 7-15% Slopes IIIe
- rRR: Rough Broken Land
- HkC2: Haliimaile Gravelly Silty Clay 7-15% Slopes, Eroded
- HgB: Haliimaile Silty Clay Loam, 3-7% Slopes
- HgC: Haliimaile Silty Clay Loam, 7-15% Slopes
- KnC: Keahua Silty CLay Loam, 7-15% Slopes
- KncC: Keahua Silty Clay, 7-15% Slopes
- Kauhale Lani Boundary

Source:
Natural Resources Conservation Service
The State of Hawaii GIS Database

Figure 5

Soil Conservation Service Survey

KAUHALE LANI

MAUI LAND & PINEAPPLE COMPANY, INC. ISLAND OF MAUI

NORTH

LINEAL SCALE (FEET)

0 500 1,000 2,000

PBR HAWAII

Approximately 34.8 acres (39 percent) of Kauhale Lani contain HhC soils. HhC soils are rated IIIe, irrigated or nonirrigated. Subclass IIIe soils have severe limitations that reduce the choice of plants, require special conservation practices, or both. They are subject to severe erosion if they are cultivated and not protected.

Rough Broken Land (rRR). Rough Broken Land consists of very steep land broken by numerous intermittent drainage channels. In most places, this land type is not stony, runoff is rapid, and geologic erosion is active. This soil type is used primarily for watershed and wildlife habitat. In places it is used also for pasture and woodland.

Approximately 3.2 acres (3.5 percent) of Kauhale Lani contain rRR soils. These soils capability classification is VIIe, nonirrigated. Subclass VIIe soils are very severely limited by risk of erosion.

Hāliʻimaile Gravelly Silty Clay (HkC2), 7-15 percent slopes, eroded. This soil has a profile like that of Hāliʻimaile Silty Clay, 3 to 7 percent slopes, except that in most places about 50 percent of the original surface layer has been lost through erosion. Runoff is medium to rapid, and the erosion hazard is severe. This soil is used for pineapple and pasture.

Approximately 15.6 acres (17.5 percent) of Kauhale Lani contain HkC2 soils. HkC2 soils are classified as IVe, irrigated or nonirrigated. Subclass IVe soils are subject to severe erosion if they are cultivated and not protected.

Hāliʻimaile Silty Clay Loam (HgB), 3-7 percent slopes. This soil has a profile like that of Hāliʻimaile Silty Clay, 3 to 7 percent, except for the texture of the surface layer. Runoff is medium, and the erosion hazard is moderate. This soil is used for pineapple, pasture, and homesites.

Approximately 0.8 acres (1 percent) of Kauhale Lani contain HgB soils. HgB soils are classified as IIe, whether irrigated or nonirrigated. Subclass IIe soils are subject to moderate erosion if they are cultivated and not protected.

Hāliʻimaile Silty Clay Loam (HgC), 7-15 percent slopes. This soil has a profile like that of Hāliʻimaile Silty Clay, 3 to 7 percent, except for the texture of the surface layer. Runoff is medium, and the erosion hazard is moderate. This soil is used for pineapple, pasture, and homesites.

Approximately 9.6 acres (11 percent) of Kauhale Lani contain HgC soils. The capability classification of HgC soils is IIIe, irrigated or nonirrigated. Subclass IIIe soils are subject to severe erosion if they are cultivated and not protected.

Keāhua Silty Clay Loam (KnC), 7-15 percent slopes. The Keāhua Series consists of well-drained soils developed in material weathered from basic igneous rock. On this soil, runoff is slow to medium and the erosion hazard is slight to moderate. This soil is used for sugarcane and pasture. Small acreages are used for pineapple and truck crops.

KnC soil covers approximately 2.8 acres (3 percent) of Kauhale Lani. This soil is classified as IIIe if irrigated, IVe if nonirrigated. Subclass III e soils are subject to severe erosion if they are cultivated and not protected.

Detailed Land Classification. The University of Hawai'i Land Study Bureau document titled *Detailed Land Classification, Islands of Kauai, Oahu, Maui, Molokai, and Lanai* classifies the land of Kauhale Lani as Fair (C), Poor (D), and Very Poor (E) (see Figure 6). Approximately 21.6 acres are classified as C21, 18 acres as E96, and 49 acres as D44. For non urban areas the Detailed Land Classification classifies land based on a five-class productivity rating system using the letters A, B, C, D, and E, where A represents the highest class of productivity and E the lowest. The characteristics of the specific land types of Kauhale Lani are detailed in Table 3 below.

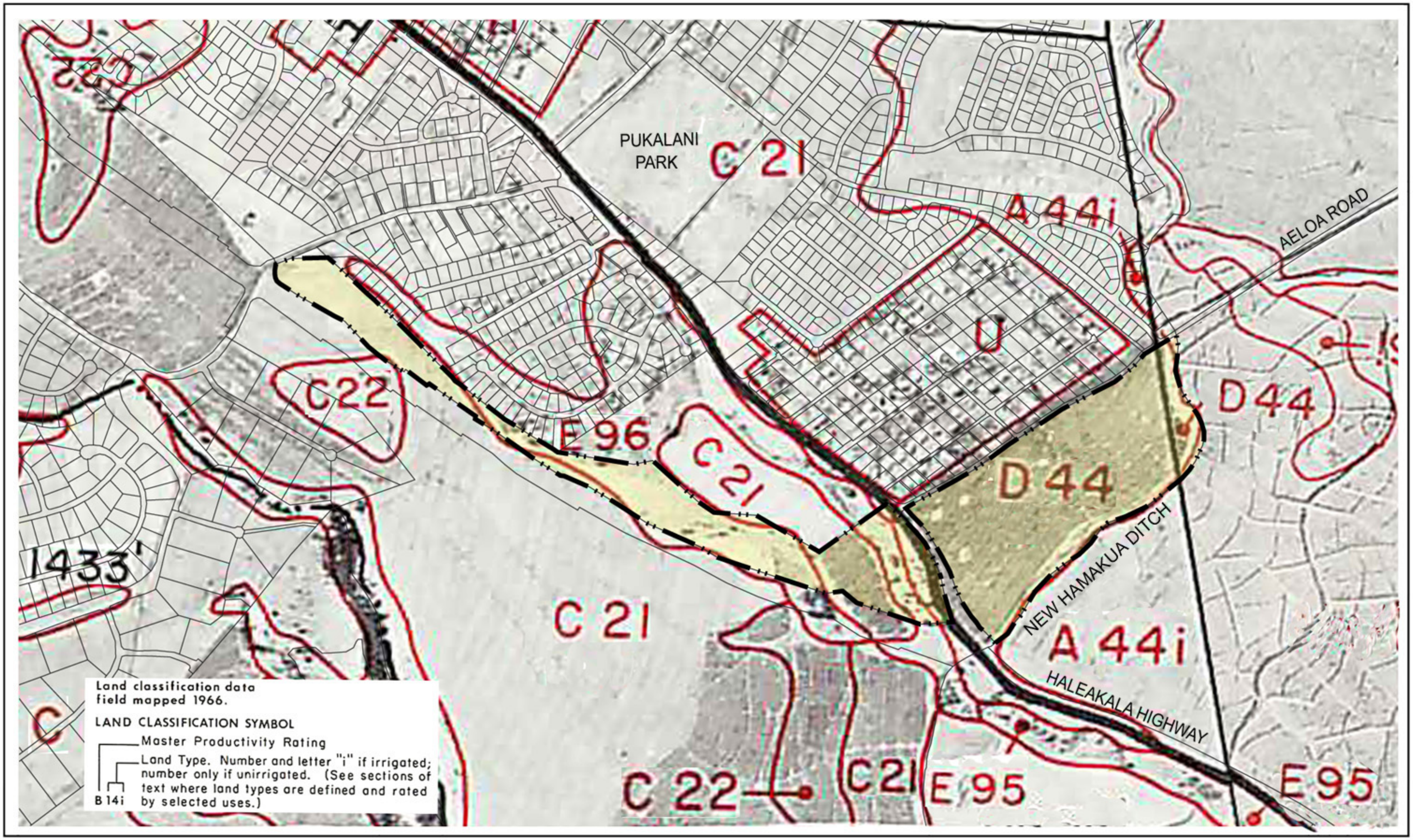
Table 3. Detailed Land Classification for Kauhale Lani

	C21	E96	D44
Machine Tilability	Well-suited	Not suited	Well-suited
Stoniness	Nonstony	Nonstony to rocky	Nonstony
Depth (inches)	Deep, over 30	Variable	Deep, over 30
Slope (%)	0-10, predominantly 5	36-80, predominantly 45	0-10, predominantly 8
Texture	Fine	Moderately fine to medium	Fine
Drainage	Well-drained	Well-drained	Well-drained
Mean Annual Rainfall (inches)	30 to 40	40 to 60	20 to 35
Elevation (feet)	100 to 1200	100 to 5000	0 to 1200
Color	Dark reddish brown	Dark brown to dark reddish brown	Dark reddish brown
Soil Series	Kahana, Haliimaile	Rough broken lands, C zones	Lahaina, Keahua
Major Existing Uses	Pineapple, sugar cane	Grazing, forest	Pineapple, sugar cane
District	Lahaina, Makawao	Lahaina, Wailuku, Hana, Makawao	Lahaina, Makawao

Agricultural Lands of Importance to the State of Hawai'i. The State of Hawai'i Department of Agriculture's *Agricultural Lands of Importance to the State of Hawai'i (ALISH)* system of defining agricultural suitability classifies the soils of Kauhale Lani as Prime Agricultural Land, Other Agricultural Land, and "not classified" (see Figure 7).

Prime Agricultural Land is land best suited for the production of food, feed, forage, and fiber crops. When treated and managed, including water management, according to modern farming methods, the land has the soil quality, growing season, and moisture supply needed to economically produce sustained high yields of crops. Approximately 30 acres of the 50-acre parcel are classified as Prime Agricultural Land.

Other Agriculture Land is land other than Prime or Unique Agricultural Land that is also of statewide or local importance for the production of food, feed, fiber, and forage crops. The lands in this classification are important to agriculture in Hawai'i yet they exhibit properties, such as seasonal wetness, erosion, limited rooting zone, slope, flooding, or drought, that exclude them



LEGEND

Kauhale Lani Boundary

A: Excellent
B: Good
C: Fair
D: Poor
E: Very Poor
U: Urban

Source:
Land Study Bureau
The State of Hawaii GIS Database

Disclaimer:
This map has been prepared for general planning purposes only.

Figure 6
Detailed Land Classification
KAUHALE LANI

MAUI LAND & PINEAPPLE COMPANY, INC. ISLAND OF MAUI

NORTH LINEAL SCALE (FEET) 0 1,000 2,000 4,000

PBR HAWAII

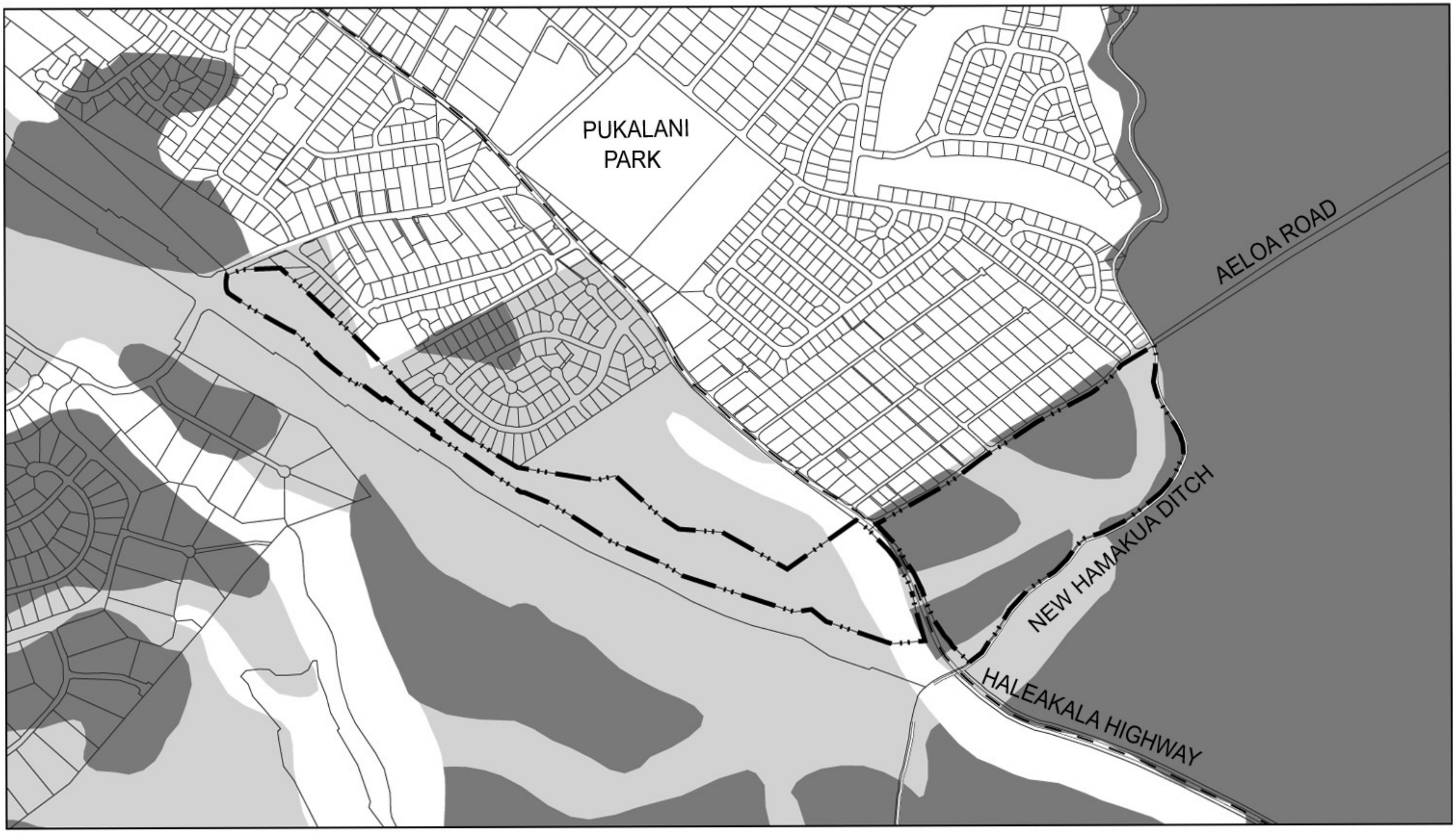


Figure 7

Agricultural Lands of Importance to the State of Hawaii (ALISH)

KAUHALE LANI

MAUI LAND & PINEAPPLE COMPANY, INC.

ISLAND OF MAUI

NORTH

LINEAL SCALE (FEET)

0 500 1,000 2,000

PBR HAWAII

LEGEND

ALISH Types

- Prime ALISH Land
- Other ALISH Land
- Not Classified

Kauhale Lani Boundary

Source:
The State of Hawaii GIS Database

Disclaimer:
This map has been prepared for general planning purposes only.

from the Prime or Unique Agricultural Land classifications. When properly managed, these lands can be farmed satisfactorily and produce fair to good crop yields by applying greater inputs of fertilizer and other soil amendments, providing drainage improvements, implementing erosion control practices, and providing flood protection . The remaining 20 acres of the 50-acre parcel and approximately 32.6 acres of the 39-acre parcel are classified as Other Agricultural Land, for a total of 52.6 acres. The remaining 6 acres of the 39-acre parcel are not classified.

Potential Impacts and Mitigation Measures

The 50-acre parcel of the Kauhale Lani site is dominated by Hāli'imaile Silty Clay, 3-7 percent slopes (HhB) and 7-15 percent slopes (HhC). In its natural state, this land is not irrigated. The non-irrigated capability classification of the 50-acre parcel has a subclass rating of IIIe, which indicates severe limitations and erosion potential when cultivated and not protected. Without irrigation, these lands are naturally unsuitable for agriculture. Therefore, the change in land use from agricultural to residential will not have a significant impact on the inventory of valuable agricultural lands. Maui Pineapple Company, Ltd. (MPC) (a subsidiary of ML&P) is currently using its existing pineapple fields more efficiently and has increased pineapple production without expanding its number of fields. This increase in productivity will balance the loss of agricultural land. Kauhale Lani will not have a negative impact on ML&P's agricultural operations.

The 39-acre parcel is not cultivated due to its topography and soil types. Upon completion of the Kauhale Lani community, adequate landscaping will be implemented to minimize erosion.

Impacts to the soils include the potential for soil erosion and the generation of dust during construction. Clearing and grubbing activities will temporarily disturb the soil retention values of the existing vegetation and expose soils to erosion forces. Some wind erosion of soils could occur without a proper watering and re-vegetation program. Heavy rainfall could also cause erosion of soils within disturbed areas of land.

To the extent possible, improvements will conform to the contours of the land, further limiting the need for extensive grading of the site. In addition, graded areas will be limited to specific areas for short periods of time.

Measures taken to control erosion during the site development period will include:

- Minimizing the time of construction;
- Retaining existing ground cover as long as possible;
- Constructing drainage control features early;
- Using temporary area sprinklers in non-active construction areas when ground cover is removed;
- Providing a water truck on-site during the construction period to provide for immediate sprinkling as needed;
- Using temporary berms and cut-off ditches, where needed, for control of erosion;
- Watering graded areas when construction activity for each day has ceased;
- Grassing or planting all cut and fill slopes immediately after grading work has been completed; and

- Installing silt screens where appropriate.

All construction activities will comply with all applicable Federal, State, and County regulations and rules for erosion control. Before issuance of a grading permit by the County of Maui, the final erosion control plan and best management practices required for the NPDES permit will be completed. All construction activities will also comply with the provisions of Chapter 11-60.1, HAR, Section 11-60.1-33, Fugitive Dust.

After construction, the establishment of permanent landscaping will provide long-term erosion control.

3.1.4 Agricultural Impact

Existing Conditions

Both the 50-acre and the 39-acre Kauhale Lani community parcels are former pineapple fields. Maui Pineapple Company, Ltd. (MPC) ended pineapple cultivation on these parcels in 2002. The fields have been fallow since then, with the exception of a small section of the 39-acre parcel, on which MPV cultivated organic pineapple until 2003.

Both parcels are inefficient to farm as part of MPC operations since the Pukalani Bypass separated these parcels from other contiguous, more suitable MPC pineapple fields. As MPC downsizes its operations to focus on the fresh fruit market, it is focusing on the best and most efficient land to farm. MPC is keeping its best land in cultivation and exploring options to cultivate pineapple on other more suitable lands.

Potential Impacts sand Mitigative Measures

Creation of Kauhale Lani will require that the approximately 89 acres of land previously used for pineapple cultivation be permanently withdrawn from agricultural use. This will amount to about one percent of the approximately 5,800 acres currently in pineapple cultivation by Maui Pineapple Company, Ltd. Kauhale Lani will not lead to a decrease in ML&P's agricultural viability.

In conformance with the *Makawao-Pukalani-Kula Community Plan*, Kauhale Lani will provide for the carefully considered expansion of Pukalani within a defined area, while preserving the surrounding agricultural land and open space that is so valuable to the character of the region. The New Hāmākua Ditch provides a natural boundary to the edge of Pukalani. By limiting residential uses to an appropriate area, Kauhale Lani allows for needed housing while respecting and acknowledging the value of agricultural land and open spaces.

ML&P maintains a long-term commitment to agriculture. Strengthening its agricultural operations is one of the company's foremost goals. While focusing on the market demand for fresh whole pineapple, MPC still produces pineapple for canning. However, the shift toward fresh pineapple production has allowed MPC to compete against other producers.

In addition to its pineapple operations, ML&P is exploring a wide array of diversified agricultural opportunities and conducting field trials on new crops.

To further diversify agriculture, ML&P is expanding their agricultural base via a new entity called Maui Agricultural Partners. Maui Agricultural Partners will support a diverse community of farming partnerships to enable the sharing of knowledge, infrastructure, and costs. The goal of Maui Agricultural Partners is to become a "grower of growers" through entrepreneurial programs allowing Maui farmers to develop the talent base necessary to grow Maui's diversified agriculture industry. As a partner, ML&P is committed to a long-term stake in sustaining farming operations as evidenced by its investment of land and technical and financial resources.

Removing the 89 acres of land slated for Kauhale Lani will not have a negative impact on ML&P's agricultural operations.

Regarding potential nuisance complaints from Kauhale Lani residents about ongoing neighboring sugar cultivation operations, ML&P will notify all prospective buyers and lessees that the Hawai'i Right to Farm Act (Chapter 165, HRS) limits the circumstances under which pre-existing farm activities may be deemed a nuisance.

3.1.5 Identification of Chemicals and Fertilizers

Existing Conditions

Maui Pineapple Company, Ltd. (MPC) formerly cultivated pineapple on the Kauhale Lani site. As part of its agricultural operations, MPC uses fertilizers, pesticides, fungicides, herbicides, and plant growth regulators in compliance with all product labeling and applicable government regulations.

Fertilizers. MPC uses the following fertilizers—which provide nutrients essential for plant growth—as part of its pineapple operations: UAN-32 (Urea-Ammonium nitrate), urea, potassium sulfate, potassium chloride, Treble Super Phosphate, rock phosphate, lime, magnesium sulfate, iron sulfate, and zinc sulfate.

Pesticides. MPC uses the following pesticides—to control nematodes, ants, or, other insects—as part of its pineapple operations: Telone II Soil Fumigant (1, 3 dichloropropene), Nemacur 3 (Fenamiphos), Vydate (Oxamyl), Thiodan (Endosulfan), Amdro Pro Fire Ant Bait (Hydramethylnon), and Diazinon 50W (Diazinon).

Fungicides, Herbicides, and Plant Growth Regulators. MPC uses the following fungicides, herbicides, and plant growth regulators—to regulate plant growth, induce flowering, control weeds, or control disease—as part of its pineapple operations: Ethrel 4 or Ethephon 2 (Ethephon), Ethylene gas (Ethylene), Karmex DF or Direx L (Diuron), Evik (Ametryne), Hyvar X (Bromacil), Aliette (Fosethyl-Al), Phosguard (Phosphorous acid), Tilt (Propiconazole), Herbimax, Assure II Herbicide (Qualifop-ethyl), Velpar (Hexazinone), and Round-up (Glyphosate).

Potential Impacts and Mitigative Measures

The creation of the Kauhale Lani community is expected to significantly reduce the amount of fertilizers, pesticides, fungicides, herbicides, and plant growth regulators used on the site relative to the former agricultural uses.

Overfertilization of Kauhale Lani landscaping will be avoided to ensure that the community does not contribute additional nutrients entering the ground. Common nitrogen/phosphorus/ potash mixed fertilizers are anticipated to be applied to lawn areas, groundcover, shrubs, and trees. With proper irrigation management practices, leaching and runoff of fertilizers should be negligible.

Within Kauhale Lani, the use of herbicides will generally be limited to the initial landscaping period on the site. Anticipated application of pesticides will be used as a treatment rather than a preventative measure. As a treatment, application will be limited. In addition, plant selection will be based on hardiness, drought tolerance, pest resistance, as well as aesthetic concerns.

3.1.6 Natural Hazards

Existing Conditions

Natural hazards impacting the Hawaiian Islands include hurricanes, tsunamis, volcanic eruptions, earthquakes, and flooding.

Devastating hurricanes have impacted Hawaiʻi twice since 1980: Hurricane ʻIwa in 1982 and Hurricane ʻIniki in 1992. While it is difficult to predict these natural occurrences, it is reasonable to assume that future events could be likely given the recent record.

Tsunamis are large, rapidly moving ocean waves triggered by a major disturbance of the ocean floor, which is usually caused by an earthquake but sometimes can be produced by a submarine landslide or a volcanic eruption. About 50 tsunamis have been reported in the Hawaiian Islands since the early 1800s. Seven caused major damage, and two of these were locally generated. The Kauhale Lani community is outside of the Civil Defense Tsunami Evacuation Zone.

Volcanic hazards in the Pukalani area are considered minimal due to the dormant status of Haleakalā Volcano, which last erupted in 1790 (MacDonald, Abbott, and Peterson 1983).

In Hawaiʻi, most earthquakes are linked to volcanic activity, unlike other areas where a shift in tectonic plates is the cause of an earthquake. Each year, thousands of earthquakes occur in Hawaiʻi, the vast majority of them so small they are detectable only with highly sensitive instruments. However, moderate and disastrous earthquakes have rocked the islands.

The 1938 Maui Earthquake, with a magnitude of 6.7-6.9 on the Richter Scale and an epicenter six miles north of Maui, created landslides and forced the closure of the road to Hāna. Damaged water pipes and ground fractures also were reported in Lahaina.

Flood hazards are primarily identified by the Flood Insurance Rate Map (FIRM) prepared by the Federal Emergency Management Agency (FEMA), National Flood Insurance Program. According to the FIRM, Kauhale Lani community is located in Zone C, areas of minimal flooding (Figure 8).

Potential Impacts and Mitigation Measures

Kauhale Lani will not exacerbate any hazardous conditions. All structures will be constructed for protection from earthquakes and the destructive winds and torrential rainfall of tropical hurricanes in accordance with the Building Code adopted by the County of Maui.

3.1.7 Flora

Existing Conditions

No threatened, endangered, or species of concern were observed on the Kauhale Lani site during a botanical field survey conducted in May 2004 (Char 2004). Former pineapple fields (fallow since 2002) covered the majority of the two parcels that make up the Kauhale Lani community site. Weedy species commonly associated with agricultural lands are usually found as a narrow band along the edges of fields that border roads, ditches, and other uncultivated areas. Further descriptions of the various botanical resources are summarized below. Appendix B contains the complete botanical survey.

50-acre Parcel. The 50-acre parcel was fallow at the time of the field survey. A few rock piles are scattered through the parcel, which support a cover of green panicgrass (*Panicum maximum var. trichoglume*) and sourgrass (*Digitaria insularis*). Flora found along the perimeter of this parcel consists mainly of weedy species including green panicgrass, Natal redtop grass *(Melinis repens*), Spanish needle (*Bidens pilosa*), fireweed (*Senecio madagascariensis*), spiny amaranth (*Amaranthus spinosus*), pualele (*Emilia fosbergii*), Crassocephalum crepidioides, Cuba jute (*Sida rhombifolia*), goosegrass (*Eleusine indica*), sourgrass, swollen fingergrass (*Chloris barbata*), Brachiaria subquadripara, and crabgrass (*Digitaria sp.*). A row of oleander shrubs (*Nerium oleander*) is planted alongside the highway. Additionally, two native species, popolo (*Solanum americanum*) and ‘uhaloa (*Waltheria indica*), were found.

Along the ditch, the weedy vegetation found includes: Spanish needle, sowthistle (*Sonchus oleraceus*), crabgrass, spiny amaranth, koa haole shrubs (*Leucaena leucocephala*), California grass (*Brachiaria mutica), castor bean (Ricinus communis), hairy abutilon (Abutilon grandifolium), ‘ilima (Sida fallax),* and *koali ‘awa (Ipomoea indica).*

The band of weedy vegetation adjacent to the residential area is similar to that found along the highway, but also includes cheeseweed (*Malva parviflora*), apple of Peru (*Nicandra physalodes*), Jimson weed (*Datura stramonium*), California grass, lion’s ear (*Leonotis nepetifolia*), prickly lettuce (*Lactuca serriola*), and a yellow-flowered morning glory (*Ipomoea ochracea*). A few landscape plantings from the adjacent yards spill over onto the parcel; these include New Zealand spinach (*Tetragonia tetragonioides*), aloe (*Aloe vera*), and guava (*Psidium guajava*).

39-acre Parcel. Flora on the 39-acre parcel consists mainly of overgrown pineapple fields. The pineapple fields on the eastern half of the parcel appear to have been more recently abandoned since the rows of pineapple plants are not as overgrown and the weedy assemblage of species, mostly Natal redtop grass and sourgrass, occur along the edge of the fields and on the dirt roads.

On the western half of the parcel, the old fields are open and grassy with a few remnant clumps of pineapple plants. Additional botanical resources found on the western half of this parcel include sourgrass, Natal redtop, Guinea grass (*Panicum maximum*), green panicgrass, sourbush shrubs (*Pluchea carolinensis*), spiny amaranth, golden crown-beard (*Verbesina encelioides*), castor bean, lion's ear, pualele, Spanish needle, Cuba jute, Fireweed, and a few koa haole shrubs with koali ʻawa vines growing on them.

On this parcel there is a planting of various Eucalyptus species, 40 to 70 feet tall, bordering Haleakalā Highway and also a few trees of silk oak (*Grevillea robusta*) and Chinaberry (*Melia azedarach*). Koa haole and Christmas berry (*Schinus terebinthifolius*) shrubs form scattered, small thickets under the tree canopy. Ground cover consists of scattered clumps of Guinea grass, along with a few weedy plants of maile hohono (*Ageratum conyzoides*), Spanish needle, burbush (*Triumfetta sp.*), and Jamaica vervain (*Stachytarpheta jamaicensis*). However, areas with bare soil and leaf and branch litter are common. Axis deer tracks and scats are occasionally encountered. A few native species are quite common in this forested area. Shrubs of ʻaʻaliʻi (*Dodonaea viscosa*) and ʻākia (*Wikstroemia oahuensis*), three to eight feet tall, are common to occasional. ʻUhaloa and ʻilima are found along the edge of the tree planting. Vines of Sicyos hispidus, a member of the cucumber or squash family, are found on the edge of the tree planting facing the highway. This species of Sicyos is easily identified by its fuzzy fruits.

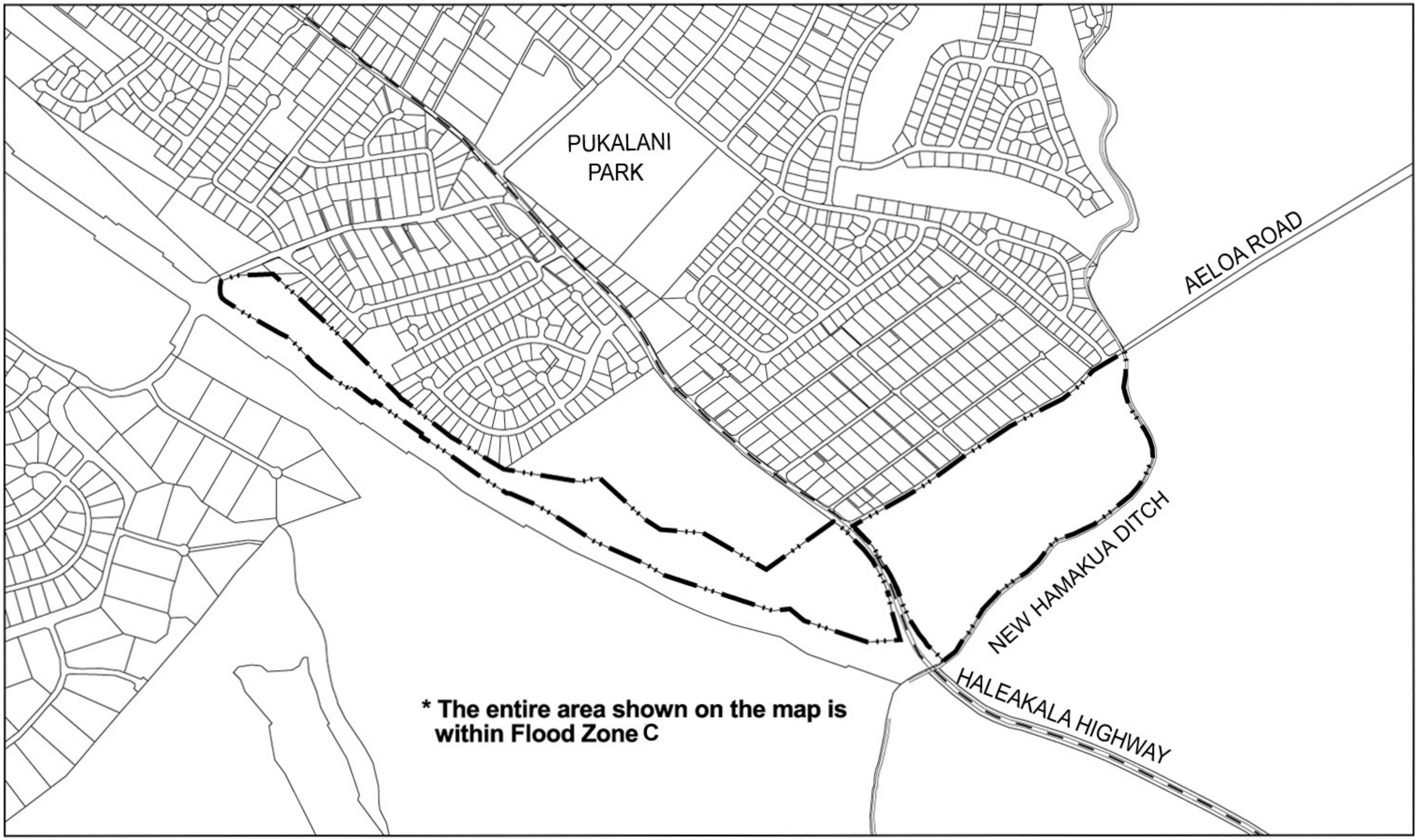
The small gully found between the Eucalyptus planting and the overgrown pineapple fields supports abundant patches of Napier or elephant grass (*Pennisetum purpureum*) as well as dense clumps of Guinea grass. *Neonotonia wightii*, a member of the pea family, is locally abundant in some places, forming tangled mats over the grasses and scattered koa haole shrubs.

There were seven native species observed on the site. Of the seven native species, five are indigenous, that is, they are native to the Hawaiian Islands and elsewhere and two are endemic that is, they are native only to the Hawaiian Islands. The native species found include: popolo (*Solanum americanum*), ʻuhaloa (*Waltheria indica*), koali ʻawa (*Ipomoea indica*), ʻilima (*Sida fallax*), and ʻaʻaliʻi (*Dodonaea viscosa*). The endemic species include: ʻākia (*Wikstroemia oahuensis*) and Sicyos.

Potential Impacts and Mitigative Measures

Kauhale Lani is not expected to have a significant negative impact on botanical resources since no threatened, endangered, or species of concern are known to occur on the site. If feasible, the Eucalyptus trees on the 39-acre parcel will be retained and kept in open space as the topography is rough and broken, and the erosion hazard is of some concern.

Kauhale Lani will include new landscaping appropriate to the residential setting. Design standards for the community will include a unified streetscape planting theme and program to ensure the appropriate use of landscaping and compliance with the Maui County Planting Plan.



LEGEND

Flood Zone

C: Areas of Minimal Flooding

Kauhale Lani Boundary

Source:
Federal Emergency Management Agency
Flood Insurance Rate Map 150003 0260B

Disclaimer:
This map has been prepared for general planning purposes only.

Figure 8

Flood Insurance Rate Map (FIRM)

KAUHALE LANI

MAUI LAND & PINEAPPLE COMPANY, INC. ISLAND OF MAUI

NORTH

LINEAL SCALE (FEET)

0 500 1,000 2,000

PBR HAWAII

New landscaping will include non-invasive species and, where feasible, native and indigenous plants. Drought-tolerant, hardy plants and grasses will also be use where feasible to minimize the need for irrigation.

3.1.8 Fauna

Existing Conditions

No threatened or endangered species of birds or mammals were observed on the Kauhale Lani site during an avifaunal and feral mammal field survey conducted on May 1 and 2, 2004 (Bruner 2004). In addition, no native land birds, native waterbirds, seabirds, or migratory birds were observed. The absence of these birds was expected, given the location of the site, the available habitats, and the time of year. Results of the survey are summarized below. Appendix C contains the complete survey.

Fourteen species of alien birds were tallied on the survey, which are listed below:

COMMON NAME	SCIENTIFIC NAME
Cattle Egret	*Bulbucus ibis*
Gray Francolin	*Francolinus pondicerianus*
Black Francolin	*Francolinus francolinus*
Red Junglefowl	*Gallus fallus*
Spotted Dove	*Streptopelia chinensis*
Zebra Dove	*Geopelia striata*
Japanese White-eye	*Zosterops japonicus*
Northern Mockingbird	*Mimus polyglottos*
Common Mynah	*Acridotheres tristis*
Red-crested Cardinal	*Paroaria coronata*
Northern Cardinal	*Cardinalis cardinalis*
House Finch	*Capodacus mexicanus*
Nutmeg Mannikin	*Lonchura punctulata*
Chestnut Mannikin	*Lonchura atricapilla*

Two cats (*Felis catus*) were the only type of mammal seen during the avifaunal and feral mammal field survey. Given the proximity of nearby homes it is possible that these cats are pets. It is likely that rats (*Rattus spp.*), Small Indian Mongoose (*Herpestes auropunctatus*), and mice (*Mus musculus*) occur in this area. Axis deer tracks and scats were also observed during the botanical survey. No endangered Hawaiian Hoary Bats (*Lasiurus cinereus semotus*) were detected on the night survey using the ultrasound detector, which was expected since there are very few bats on Maui.

Potential Impacts and Mitigative Measures

Kauhale Lani is not expected to impact threatened, endangered, or native species of wildlife, since none were observed on the site. All of the birds and mammals found on the site are alien species.

3.2 ASSESSMENT OF THE HUMAN ENVIRONMENT, POTENTIAL IMPACTS, AND MITIGATIVE MEASURES

This section describes the existing conditions of the human environment, potential impacts of the Kauhale Lani community, and mitigative measures to minimize any impacts.

3.2.1 Archaeological and Historic Resources

Archaeological Services Hawaii conducted an archaeological inventory survey of the Kauhale Lani community site in November 2004. Research was conducted in three stages: 1) research of archaeological and historical literature for background information and to enhance site predictability and interpretation; 2) a surface survey; and 3) subsurface testing. Findings of the survey are summarized below. Appendix D contains the complete report.

Existing Conditions

No cultural remains were encountered during the surface survey or in any of the trenches. A total of 15 trenches were excavated in the 50-acre parcel and 10 trenches in the 39-acre parcel.

Potential Impacts and Mitigative Measures

Based on the negative results of subsurface testing in both parcels, together with evidence for previous disturbances in the area from pineapple cultivation, no impacts to archaeological resources are anticipated. No further archaeological inventory work is recommended. However, due to the presence of significant sites in the vicinity but not within the Kauhale Lani site, archaeological monitoring is recommended during initial construction activities to ensure that any subsurface cultural remains or deposits underlying the till zone are properly documented. Prior to commencing any construction activities, an archaeological monitoring plan will be prepared for approval by the State Historic Preservation Division (SHPD).

All construction plans will include the following language as normally recommended by the State Historic Preservation Division:

> Should historic remains such as artifacts, burials, concentrations of shell or charcoal be encountered during the construction activities, work shall cease immediately in the immediate vicinity of the find and the find shall be protected from further damage. The contractor shall immediately contact the State Historic Preservation Division at 692-8015 which will assess the significance of the find and recommend an appropriate mitigation measure, if necessary.

The archaeological inventory survey has been submitted to the SHPD for review.

3.2.2 Cultural Resources

CKM Cultural Resources prepared a cultural assessment for the Kauhale Lani community in January 2005. The assessment included historical research and interviews with people knowledgeable of the area. Appendix E contains the complete report.

Existing Conditions

The cultural assessment concludes that "…no cultural or archaeological properties were found for preservation on this [Kauhale Lani] project site." The assessment also concludes that "no evidence of past or present use for Hawaiian cultural practices, resources, or beliefs were found in the study area."

Kauhale Lani is located in the ahupuaʻa of Kula, in the ʻili of Makaʻeha (the historical name for Pukalani). The report identified several areas of cultural importance in the neighboring ʻili. However, many of the culturally significant sites such as heiau and ahu no longer exist in Makaʻeha, primarily due to prior ranching in the area. Before it was under pineapple cultivation, the 50-acre parcel was a ranch established by the Enos family. During that time, much of the land was cleared for cattle ranching. After the ranching era, an influx of population moved to the area, leaving little behind of what was already destroyed during ranching times. No known Hawaiian cultural or spiritual practices were performed on the either the 39-acre or 50-acre parcel.

Historically, medicinal plants and other vegetation of cultural importance grew in the area. Today, the region is overrun with foreign plants, wild feral and fowl, which have left much of Kula's natural habitat destroyed.

Potential Impacts and Mitigative Measures

No impacts to cultural resources, practices, and beliefs are anticipated as a result of the proposed community. The cultural assessment concludes that the Kauhale Lani community "…will not have any significant adverse effects to native Hawaiian traditional and customary rights…" Although the area is culturally associated with neighboring ʻili, no significant cultural resources or ongoing cultural practices are associated with the Kauhale Lani site. Kauhale Lani will not substantially affect the economic welfare, social welfare, and cultural practices of the community or State.

3.2.3 Traffic

Phillip Rowell and Associates prepared a Traffic Impact Analysis Report (TIAR) for Kauhale Lani in May 2005 to: 1) determine and describe the traffic characteristics of Kauhale Lani; 2) quantify and document the traffic related impacts of Kauhale Lani; and 3) identify and evaluate traffic related improvements required to provide adequate access to and egress from Kauhale Lani and mitigate traffic impacts. Key elements of the analysis are summarized below. Appendix F contains the complete report.

Existing Conditions

Haleakalā Highway (Pukalani Bypass). Haleakalā Highway (Pukalani Bypass) forms the eastern boundary of the 39-acre parcel and serves as the primary arterial roadway in the Upcountry region. It is generally oriented in the *mauka-makai* direction and connects to other regional highway systems serving other parts of the island. Haleakalā Highway is connected to Old Haleakalā Highway, Hāna Highway, and Kula Highway.

Between Hāna Highway and Old Haleakalā Highway, Haleakalā Highway is a two-way, three-lane highway with a posted speed limit of 55 miles per hour (mph). East of the intersection with Old Haleakalā Highway, Haleakalā Highway is a divided two-way, four-lane highway with a 45 mph posted speed limit until its intersection with Makani Avenue. East of Makani Avenue, Haleakalā Highway is a divided two-way, four-lane highway with a 45 mph posted speed limit until its intersection with Makawao Avenue. East of Makawao Avenue until Kula Highway, Haleakalā Highway is a divided two-way, three-lane highway with a 45 mph posted speed limit.

Old Haleakalā Highway. Old Haleakalā Highway is a two-way, two-lane County-owned highway with a 35 mph posted speed limit. The intersection of Old Haleakalā Highway and Haleakalā Highway is unsignalized. The intersection of Old Haleakalā Highway and Makawao Avenue is controlled by a traffic signal system with eastbound and northbound left-turn lanes.

Makawao Avenue. Makawao Avenue is a two-way, two-lane County-owned roadway with a 30 mph posted speed limit. The intersection of Makawao Avenue and Haleakalā Highway is controlled by a traffic signal system with northbound, eastbound, westbound, and southbound left-turn lanes

Makani Road. Makani Road is a two-way, two-lane County-owned roadway with a 30 mph posted speed limit. The intersection of Makani Road and Haleakalā Highway is unsignalized; however, the State of Hawai‘i Department of Transportation plans to signalize the intersection. A scheduled completion date is not known, but it assumed that the signal will be installed by the time Kauhale Lani is built. The intersection has southbound and northbound left-turn lanes.

Hāna Highway. South of Haleakalā Highway, Hāna Highway is a divided two-way, two-lane State-owned highway with a 55 mph posted speed limit. North of Haleakalā Highway, Hāna Highway is a two-way, four-lane State-owned highway with a 55 mph posted speed limit. The intersection of Hāna Highway and Haleakalā Highway is controlled by a traffic signal system with eastbound and southbound left-turn lanes.

Pukalani Street. Pukalani Street is a two-way, four-lane County-owned roadway with a 20 mph posted speed limit. The intersection of Pukalani Street and Old Haleakalā Highway is controlled by a traffic signal system with southbound and westbound left-turn lanes.

Kula Highway. Kula Highway is a two-way, two-lane State-owned highway with a 45 mph posted speed limit. The intersection of Kula Highway and Haleakalā Highway is controlled by a traffic signal system with westbound left-turn lanes.

Koea Place. Koea Place is a two-way, two-lane County-owned roadway. Koea Place is a connection that is not intended to be an access and egress point of Kauhale Lani but could provide a connection between the existing Lower Pukalani Terrace subdivision and the Kauhale Lani community without having to use Old Haleakalā Highway.

A'eloa Road. A'eloa Road is a County-owned, unimproved right-of-way that runs along the southern boundary of the Kauhale Lani site. This right-of-way is not paved or in use and will not be used as an access point to Kauhale Lani.

The TIAR studied the following intersections:
1. Haleakalā Highway at Kula Highway/Old Haleakalā Highway
2. Haleakalā Highway at Makawao Avenue
3. Haleakalā Highway at Makani Road
4. Haleakalā Highway at Old Haleakalā Highway
5. Haleakalā Highway at Hāna Highway
6. Old Haleakalā Highway at Makawao Avenue
7. Old Haleakalā Highway at Pukalani Street
8. Old Haleakalā Highway at Makani Road
9. Old Haleakalā Highway the primary Kauhale Lani entrance (Drive B)
10. Old Haleakalā Highway the secondary Kauhale Lani entrance (Drive A)

Highway Capacity Analysis. A highway capacity analysis was conducted for the above intersections using data from: 1) manual traffic counts during AM and PM peak traffic times; and 2) other related development projects within and adjacent to the study area. Regarding other related development projects, this list included both development projects and anticipated roadway improvement projects.

The analysis indicates that, in general, several key intersections are currently operating below acceptable levels, meaning that traffic at the intersections experience long delays. However, the operations at these intersections are a result of regional traffic.

Potential Impacts

The traffic analysis indicates that peak hour traffic at several key intersections will continue to operate below acceptable levels with or without the Kauhale Lani community because of heavy background traffic levels. Traffic generated by Kauhale Lani will comprise a small percentage (1.3 percent or less) of the total projected number of vehicles that will use these intersections during peak hours. This is a clear indication that the delays at the intersections are a regional issue that must be addressed on a regional basis.

Mitigative Measures

To mitigate traffic concerns, improvements as identified in the *Maui Long-Range Land Transportation Plan* should be implemented. Maui Land & Pineapple Company Inc. will contribute its pro-rata share for these improvements based on the quantifiable impacts from Kauhale Lani.

Maui Land & Pineapple Company Inc. will provide a left-turn refuge lane on Old Haleakalā for left-turns into the primary Kauhale Lani entrance (Drive B). At the secondary entrance only right turns (in and out) will be allowed to prevent traffic delays at the intersection of Haleakalā Highway and Old Haleakalā Highway.

One of the positive results of Kauhale Lani's design is its compact community plan. This will further contribute to the feasibility of public transportation by providing a concentrated population within a walkable community, thus enabling many people to walk a short distance to get to a transit stop. Should transit service on Maui become available in future years, Kauhale Lani will be an ideal community to service.

3.2.4 Air Quality

B. D. Neal & Associates prepared an air quality impact assessment to: 1) examine the potential short- and long-term air quality impacts related to the Kauhale Lani community; and 2) suggest mitigative measures to reduce any potential air quality impacts where possible and appropriate. The air quality assessment is summarized below. Appendix G contains the full study.

Existing Conditions

The air quality in the Pukalani area is generally good. Existing impacts to air quality include periodic impacts from distant volcanic emissions (VOG) and possibly occasional localized impacts from traffic congestion or agricultural activities.

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 Pukalani area is very much affected by its mauka location on the slopes of Haleakalā. Winds are often breezy trade winds from the north or northeast. Temperatures in the Pukalani area are relatively cool due to the upcountry elevation with an average daily temperature range of about 60 to 75 degrees Fahrenheit. Average annual rainfall in the area amounts to about 43 inches.

Both Federal and State standards have been established to maintain ambient air quality. Seven parameters are regulated: particulate matter, sulfur dioxide, hydrogen sulfide, nitrogen dioxide, carbon monoxide, ozone, and lead. State of Hawaiʻi air quality standards are either equally or more stringent than the comparable national standards.

Potential Impacts

Short-Term Impacts. Short-term impacts from fugitive dust will likely occur during the Kauhale Lani construction phase. To a lesser extent, exhaust emissions from stationary and mobile construction equipment, from disruption of traffic, and from worker's vehicles may also affect air quality during the construction period.

Long-Term Impacts. After construction, motor vehicles coming to and from Kauhale Lani will result in a long-term increase in emissions in the area. To assess the impact of emissions from vehicles, an air quality modeling study was undertaken to estimate current ambient concentrations of carbon monoxide at several intersections in the Kauhale Lani vicinity and to predict future levels both with and without the community.

Model results indicated that present one-hour and eight-hour carbon monoxide concentrations are well within both Federal and State ambient air quality standards. In the year 2010, without Kauhale Lani, carbon monoxide concentrations are predicted to remain unchanged or decrease somewhat at two of the three locations studied despite the expected increase in ambient traffic volumes. This is because older vehicles that emit more air pollution will be replaced with newer vehicles during the intervening years. With Kauhale Lani in the year 2010, maximum carbon monoxide concentrations are estimated to increase by about seven percent or less in the vicinity compared to the without Kauhale Lani case. Nonetheless concentrations are predicted to remain within Federal and State standards. Implementing mitigation measures for traffic-related air quality impacts is thus unnecessary and unwarranted.

Electrical Demand and Solid Waste Disposal. The air quality study concludes that significant long-term impacts on air quality are unlikely due to indirect emissions associated with the community's electrical power and solid waste disposal requirements. Nevertheless, Kauhale Lani will include energy conservation design features (such as solar water heating), conservation and recycling programs to further reduce any associated impacts and conserve the island's resources.

Mitigative Measures

Mitigation measures will be implemented to minimize potential air quality impacts, as listed below.

Short-Term Construction Activities. All construction activities will comply with the provisions of HAR, Chapter 11-60.1, "Air Pollution Control," Section 11-60.1-33, Fugitive Dust. In compliance with these provisions a dust control plan will be implemented.

Fugitive dust emissions will 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 that may be implemented include limiting the area disturbed at any given time and/or mulching or stabilizing inactive areas that have been worked. Paving and landscaping early in the construction schedule will also reduce dust emissions.

Exhaust emissions from construction equipment can be mitigated by moving equipment and workers to and from the site during off-peak traffic hours.

Long-Term Operations. Because traffic-related emissions are expected to remain within Federal and State standards, the air quality study concludes that implementing mitigation measures for traffic-related air quality impacts is unnecessary and unwarranted.

While significant long-term impacts on air quality due to indirect emissions associated with Kauhale Lani electrical power and solid waste disposal requirements are unlikely, Kauhale Lani will include energy conservation design features (such as solar water heating) and conservation and recycling programs to further reduce any associated impacts and conserve the island's resources.

3.2.5 Noise

D.L. Adams Associates, Ltd. prepared an environmental noise assessment report for the Kauhale Lani community to examine potential noise impacts and suggest possible mitigation measures. Key elements of the report are summarized below. Appendix H contains the complete report.

Existing Conditions

The dominant noise sources in the vicinity of the Kauhale community site are from traffic on Haleakalā Highway (Pukalani Bypass). Other noise sources include vehicular traffic on other roads in the area, occasional aircraft flyovers, wind, birds, and crickets. Existing agricultural operations nearby can also contribute to noise in the area depending on field operations, such as harvesting and plowing. Noise measurements taken on property near Haleakalā Highway indicate noise levels ranging from 50 decibels (dBA) during low traffic times at night to 65 dBA during the daytime high traffic times.

Potential Impacts

Potential impacts on the ambient quality of the site and surrounding area due to the creation of the Kauhale Lani community are primarily limited to short-term construction activity and, in the long-term, human activity within the community and increases in ambient traffic.

Construction Noise. Creation of the Kauhale Lani community will involve excavation, grading, and construction of new buildings and infrastructure. Earthmoving equipment, such as bulldozers and diesel trucks, will likely be the dominant noise sources during construction. Typical road construction equipment, such as asphalt or concrete paving machines will also be required. Nearby residences may be impacted by construction noise depending on proximity to the site. The actual noise levels produced during construction will be a function of the methods employed during each stage of the construction process. Construction activity will occur during daytime hours. Noise from construction activity will be short-term and will comply with DOH noise regulations.

Traffic Noise. Traffic-generated noise impacts on the surrounding community and Kauhale Lani are not expected. While vehicular traffic volumes in the area will increase, the increase in noise due to traffic from Kauhale Lani is expected to be less than one dBA. This change in noise level is not perceptible to most people.

Mechanical Noise. Some of the new residences may incorporate stationary mechanical equipment typical for residential housing. Expected mechanical equipment may include air conditioning units.

Human Activity. After the establishment of the Kauhale Lani community, the ambient quality of the site will be changed from the previous agricultural uses to typical residential sound patterns. These include, people talking, children playing, cars entering and exiting the community, and other sounds from human habitation.

Mitigative Measures

All Kauhale Lani activities will comply with HAR, Chapter 11-46, Community Noise Control.

Construction Noise. Proper mitigative measures will be employed to minimize construction-related noise impacts and comply with all Federal and State noise control regulations. Increased noise activity due to construction will be limited to daytime hours and persist only during the construction period. Noise from construction activities will be short-term and will comply with DOH noise regulations (HAR, Chapter 11-46, Community Noise Control). When construction noise exceeds, or is expected to exceed the DOH's allowable limits, a permit must be obtained from the DOH. Specific permit restrictions for construction activities are:

- No permit shall allow any construction activities that emit noise in excess of the maximum permissible sound levels before 7:00 a.m. and after 6:00 p.m. of the same day, Monday through Friday.
- No permit shall allow any construction activities that emit noise in excess of the maximum permissible sound levels before 9:00 a.m. and after 6:00 p.m. on Saturday.
- No permit shall allow any construction activities that would emit noise in excess of the maximum permissible sound levels on Sundays and holidays.

The use of pile drivers, hoe rams, jack hammers 25 pounds or larger, high-pressure sprayers, and chain saws may be restricted to 9:00 a.m. to 5:30 p.m., Monday through Friday.

Traffic Noise. The increase in traffic-related noise due to Kauhale (less than one dBA) is not considered significant and will not be perceptible to most people. Therefore mitigation measures related to increases in traffic noise are not proposed. However, to buffer Kauhale Lani homes from Haleakalā Highway (Pukalani Bypass) noise, the design of Kauhale Lani provides for a wide landscaped greenway along Old Haleakalā Highway.

While a wide landscaped buffer will be provided at the edge of Kauhale Lani along Old Haleakalā Highway, noise mitigation measures will be considered for homes near the Old Haleakalā Highway/Haleakalā Highway (Pukalani Bypass) intersection. The following noise mitigation options may be considered:

- Install air conditioning in the new homes.
- Construct an earth berm or sound barrier wall to block the line-of-sight between the impacted residences and the highway.

Mechanical Noise. The design of the homes will give consideration to controlling noise emanating from any stationary mechanical equipment, such air conditioning, so as to comply with the DOH *Community Noise Control* rules. Noisy equipment will be located away from neighbors and residential units, as much as is practical.

Human Activity. Noise levels generated by residential uses within Kauhale Lani will conform to DOH rules and regulations, which state maximum permissible noise limits at individual property lines. Kauhale Lani design standards and building requirements will control noise emanating from stationary mechanical equipment, such as air conditioning units. Noisy equipment will be located away from homes, as much as is practical.

3.2.6 Social and Economic Impacts

The Hallstrom Group, Inc. prepared a market study, economic impact analysis, and public cost/benefit assessment for the Kauhale Lani community. Key findings of the analysis along with other social-economic information are provided below. Appendix I contains the complete study.

3.2.6.1 Population

Existing Conditions

The 2000 United States Census reported that the resident population of Maui County was 128,094 in 2000. This is more than double the 1980 total of 62,823 persons.

Population projections commissioned by the Maui Planning Department and calculated by SMS Research indicate that the Maui County population will reach 139,573 people in 2005[1] (SMS 2002).

Population projections calculated by SMS Research project that the population of the Upcountry region will be 23,369 people in 2005 (SMS 2002). The region is trending towards typical suburban status, with lowering household sizes (in persons), increasing income levels, and an escalating average age.

For the year 2005, it is projected that approximately 44,688 non-residents populate Maui County on any given day (SMS 2002). Approximately 221 of these visitors are estimated to stay in the Upcountry region.

Combining resident and visitor populations, the de facto population of Maui is estimated to be 186,438 people in 2005. The de facto population of Upcountry Maui is estimated to be 23,590 people on any given day in 2005.

In comparison to Maui as a whole, the Pukalani population is fairly representative of the island's age groups and ethnic composition; it has significantly fewer vacant housing units and a higher percentage of owner-occupied units (see Table 4).

Currently the Kauhale Lani site does not contain any residents.

---

[1] SMS projections presented here are their "baseline" projections, defined as "Current best guess by DBEDT of Maui County variables based on the long-term forecast model and incorporating year 2000 Census date where possible."

Table 4. Demographic Characteristics: 2000

Subject	Pukalani CDP		Maui County	
	Number	Percent	Number	Percent
Total Population	7,380	100.00	128,094	100.00
AGE				
Under 5 years	478	6.5	8,579	6.7
5 – 19 years	1,765	23.9	27,073	21.2
20 – 64 years	4,408	59.7	77,813	60.8
65 years and over	729	9.9	14,629	11.4
Median Age (years)	36.9	---	36.8	---
RACE (Alone or in combination with other races)				
White	4,132	56.0	62,688	48.9
Black or African American	59	0.8	1,272	1.0
American Indian and Alaska Native	138	1.9	2,738	2.1
Asian	3,661	49.6	61,148	47.7
Native Hawaiian and other Pacific Islander	1,937	26.2	33,019	25.8
Other	379	5.1	5,874	4.6
HOUSEHOLD (By type)				
Total Households	2,439	100.0	43,507	100.0
Family Households (families)	1,905	78.1	29,899	68.7
With own children under 18 years	991	40.6	14,361	33.0
Married-couple family	1,448	59.4	22,154	50.9
With own children under 18 years	711	29.2	10,171	23.4
Female householder, no husband present	313	12.8	5,200	12.0
With own children under 18 years	191	7.8	2,864	6.6
Non-families	534	21.9	13,608	31.3
Living alone	354	14.5	9,538	21.9
65 years and over	95	3.9	2,738	6.3
Average persons per household	3.03	---	2.91	---
HOUSING OCCUPANCY AND TENURE				
Total Housing Units	2,522	100.0	56,377	100.0
Occupied units	2,439	96.7	43,507	77.2
By owner	1,600	65.6	25,039	57.6
By renter	839	34.4	18,468	42.4
Vacant units	83	3.3	12,870	22.8
INCOME IN 1999				
Median household income	$62,778		$49,489	---

Source: U.S. Census Bureau, Census 2000.

Potential Impacts and Mitigative Measures

Projections indicate that the Maui County population will increase to 175,136 people in 2020, a 25.5 percent increase from the 2005 population. The SMS baseline models forecast the resident population of the Upcountry area to increase to 28,974 people in 2020; an approximately 24 percent increase from the 2005 population.

The daily visitor population for Maui County is projected to increase to 55,800 visitors in 2020. Approximately 714 (one percent) of these visitors will be in the Upcountry region. Therefore, the de facto population of Maui County in 2020 is estimated to be 230,936 people.

The population of Kauhale Lani is estimated to be approximately 548 persons, comprised of 475 full-time residents, 56 second home owners, and a guest allowance of 17 persons (one per every 10 finished homes). This represents a relatively insignificant increase of approximately two percent compared to the projected 2005 Upcountry population.

Upon completion and occupancy of homes, the residents will contribute to the long-term support of the local economy through the payment of income, property, and sales taxes, as well as via the purchase of goods and services from local businesses.

As the Kauhale Lani community is not expected to have a significant impact on population levels, no mitigative measures relating to population are planned. Analysis of projected tax revenues to the State of Hawaiʻi and Maui County (see Section 3.2.6.4) indicates the actual effect of governmental services relating to the population of Kauhale Lani would not create the need to expand additional County and State funding on Maui (Hallstrom 2005).

3.2.6.2 Housing

Existing Conditions

Historically, vast potentially habitable areas of Maui and significant water resources have been devoted to agriculture. Until the past decade, the long term viability of the sugar industry was unquestioned and the business remained a major employer and tax payer. As a result, cane land was reclassified for urban uses only after lengthy public agency reviews and negotiation with labor unions.

The long-term impact of this policy, in the face of unmet resident housing needs and off-island capital driven visitor-oriented land use demands, has been high appreciation in real estate prices on Maui since the early 1970s, primarily due to the high demand versus low supply of available residential land.

In April 2005, the median sales price of a home on Maui was $696,000, a 29 percent increase from the April 2004 median sales price of $500,000. In the Pukalani area, the median home price increased 28 percent from $459,000 in April 2004 to $630,000 in April 2005. These recent increases in median home prices are even more significant considering that in 2000 the island-wide median price of a home was $275,000 and the Pukalani median price was $261,000 (Realtors Association of Maui, Inc. 2005).

The Upcountry residential sector has been dominated by single family home, ranging from smaller plantation-style subdivisions (as at Hāliʻimaile) to bulk acreage ranch and agricultural lots (in Olinda and Kula). Prices cover a similar spectrum, from entry level homes to upscale gentleman farms. The low density "country" ambience and housing alternatives have been major attractions of the region.

As a result of the limited housing opportunities in Wailuku/Kahului, and the relative proximity of Upcountry to Maui economic centers, the Upcountry region is evolving into a bedroom community offering a variety of unit types typical of suburban development. The movement has gained inertia in recent years as the ease of commute has been enhanced through the expansion of Haleakalā Highway and completion of the Pukalani Bypass.

The Upcountry region has experienced subdued development recently; limited to less than 200 new home sites in the last three years. Forecasts of housing demand project a need for approximately 4,600-plus homes (mid-point estimate) in the Upcountry area during the next 16 years (Hallstrom 2005). Approximately 94 percent, or more than 4,200 of the homes, would need to be single-family homes. Fewer than 500 home sites are currently proposed for the area.

Potential Impacts and Mitigative Measures

The Kauhale Lani community will contain a total of 165 new single-family homes. While homes will be priced at market rates, it is estimated that 29 percent of the demand (over 900 homes) in the region will be for homes in this price range. The Kauhale Lani community needs only to capture a portion of this demand to achieve rapid absorption and be considered a meaningful source of residential inventory.

While the Kauhale Lani community will help to satisfy the demand for market rate homes within the region ML&P will work with the County Department of Housing and Human Concerns to satisfy all County affordable housing requirements.

3.2.6.3 Community Character

Existing Conditions

Pukalani is the youngest town in Upcountry Maui and is home to both businesses and residences. The Pukalani community is a highly desirable place to live, providing a rural-like lifestyle within close proximity to the economic centers of Maui. The location provides superior view panoramas in the midst of a cool climate while allowing residents to access employment centers and other areas of the island with relative ease.

The commercial component of Pukalani is not characterized by any one dominant architectural style. Since the area was not established as a commercial district until modern times, there are only a few potentially historic buildings in Pukalani. The architectural mix in Pukalani consists of western false-front, rustic style, modern style, and an unusual mix of commercial and residential style buildings (Country Town Design Guidelines April 1992).

Potential Impacts and Mitigative Measures

Kauhale Lani is the logical expansion of Pukalani, as the site designated for residential uses (single-family) on the *Makawao-Pukalani-Kula Community Plan*, and is adjacent to the existing

Lower Pukalani Terrace subdivision. Further, the New Hāmākua Ditch that borders Kauhale Lani on the makai sides provides a definite edge to the expansion of Pukalani. As part of the Kauhale Lani community, a wide greenway/trail will border the ditch, providing a transition zone between the community and the agricultural lands beyond.

To more fully integrate with the existing community, Kauhale Lani roadways allow a connection to the existing Lower Pukalani Terrace subdivision, providing continuity between the two neighborhoods and alternative routes within Pukalani. Connectivity between the two neighborhoods is in compliance with provisions of the *Makawao-Pukalani-Kula Community Plan,* and is recommended by the Maui County Planning Department.

Kauhale Lani will enrich the entrance to Pukalani by providing a prominent community at the forefront of the town with architectural cohesiveness, as there is no one dominant architectural theme that exists in Pukalani. Although Kauhale Lani will be built at the entrance to Pukalani, the community will not adversely affect the sense of place that currently exists. The 39-acre parcel remaining in open space will enhance the entrance to Pukalani, as landscaping on this parcel will be improved and maintained on a regular basis. Further, the 50-acre parcel will include a wide landscaped buffer area along Old Haleakalā Highway and design standards will include a unified streetscape planting theme and program to ensure the appropriate use of landscaping and compliance with the Maui County Planting Plan.

3.2.6.4 Economic Impacts

Existing Conditions

Notwithstanding a few minor stagnant periods focused in several submarkets during the early 1980s and from 1991 through late 1994, the Maui economy has generally “boomed” over the last two decades, growing at a long-term rate which places it among the more vibrant regions in the country. The island has been successfully transformed from a simple agrarian-based structure to a diversified service model founded on a widely recognized and well-established tourism industry.

The County has had one of the lowest unemployment rates in the nation, ranging from 2.2 to 7.6 percent over the last 20 years, and one of the highest incidences of multi-job workers. Only at the depths of the recession in 1992 to 1994 (when the unemployment rate rose to a record 7.6 percent) has the figure been above six percent during the last 15 years.

The investment value represented by the existing resort, industrial, commercial and residential components of the real estate market is many billions of dollars, and serves as a strong foundation for the island’s economy far exceeding the other neighbor islands. Base historical indicators support long-term conclusions favoring a vital and growing Maui economy.

Potential Impacts and Mitigative Measures

The creation of the Kauhale Lani community will generate significant efforts and expenditures that will favorably impact the Maui economy on both a direct and indirect basis, increasing the level of capital investment, capital growth, and capital flow in the region.

The community will generate approximately $81.7 million in direct, new capital investment and spending into the Maui economy during the planning and construction period. This will create an estimated $11.4 million in profits for local contractors and suppliers. On a stabilized basis after completion, some 21 maintenance/renovation workers and other on- and off-site positions will earn $597,000 in wages each year, and residents and guests of Kauhale Lani will spend $18.9 million annually in the local economy.

A total of 522 worker years of direct on-site employment will be created during the construction and operation study timeframe, along with an additional 209 worker years in associated and indirect off-site employment. The total wages paid during the initial decade of development and use will be $33.6 million.

Discretionary expenditures by residents and guests are expected to reach $18.9 million annually at build-out. The total household income of full-time residents is forecast to reach a stabilized level of $27.0 million per year.

The expenditure of employee wages, business profits, and resident/guest discretionary funds into the Maui economy will enhance hundreds of additional off-site, secondary/indirect jobs on the island, and generate several million dollars in additional wages.

The total direct, local economic impact to Maui (dollars flowing into the island economy) is estimated to be $162.4 million during the initial decade of construction and operation, and stabilize at $21.5 million annually thereafter. As these dollars move through the island market, they will have a multiplier effect increasing the economic impact of Kauhale Lani to Maui during its first 10 years to some $324.9 million.

The County of Maui will receive $6.1 million in real property tax receipts from the Kauhale Lani over the initial decade of construction and operation, and an estimated $864,000 per year thereafter. The County government operating costs associated with serving Kauhale Lani, using a per capita basis, will total $4.6 million for the initial decade, and be some $802,000 on a stabilized basis. The County will enjoy a net revenue benefit (taxes less costs), totaling $1.5 million during the first 10 years of construction and use, and $62,000 each year after that.

The State of Hawai‘i will also show a positive net revenue benefit from Kauhale Lani. The total gross tax revenues during the initial decade will reach $20.1 million from income and gross excise taxes, and will stabilize at $2.5 million annually following build-out. State costs associated with Kauhale Lani on a per capita basis will be $11.6 million during the first decade and $2.0 million per year subsequently. The State will experience a net profit of $8.5 million in the first 10 years and a stabilized benefit of $502,000 annually after build-out.

In no year does either the County or the State suffer a revenue shortfall due to Kauhale Lani.

3.2.7 Infrastructure and Utilities

3.2.7.1 Access and Roadways

The Kauhale Lani community site is located on the slopes of Haleakalā at the entrance to Pukalani, where Old Haleakalā Highway branches off from Haleakalā Highway. The 50-acre parcel is adjacent to and west of Old Haleakalā Highway. The 39-acre parcel is a linear property extending up from the "Y" created from the intersection of Haleakalā Highway and Old Haleakalā Highway.

Primary access and egress to Kauhale Lani will be provided by a primary and secondary entrance along the south side of Old Haleakalā Highway; both entrances will be unsignalized. The secondary entry closest to the intersection of Haleakalā Highway and Old Haleakalā Highway will be restricted to right turns only (in and out) to enhance traffic flow in that area.

Other roads near the community include A'eloa Road and Koea Place. A'eloa Road, bordering the southern side of the community site, is an unimproved County-owned right-of-way that is not currently in use and will not be used as an access to Kauhale Lani. Koea Place is also a County-owned road that services the Lower Pukalani Terrace subdivision along the southern boundary of Kauhale Lani. The Kauhale Lani site plan allows for a connection to Koea Place, providing continuity between the two neighborhoods, integrating Kauhale Lani with the rest of Pukalani, and thus perhaps diverting some traffic from Old Haleakalā Highway.

The *Makawao-Pukalani-Kula Community Plan* calls for the Koea Place connection in the implementing actions of the Urban Design, Transportation section:

> *Establish an additional roadway connection to Haleakalā Highway from Pukalani Terrace through the …single-family area located north of and adjacent to the existing Pukalani Terrace residential subdivision.*

Roadways within the community will be built to County of Maui standards, while keeping in character with the Upcountry region. Interior block alleyways will provide access to most garages, which will be located toward the back of the homes. The typical street section design was based upon Chapter 18.16.050 "Minimum Right-of-Way and Pavement Widths", Subdivision Design Standards of the County Code for rural streets:

Table 5. Minimum Right-of-Way and Pavement Widths

Type of Street	Area or Zone	Right-of-Way Width	Pavement Width
Collector Street	Rural	50'	24'
Minor Streets	Rural	40'	22'
Private Street (serving no more than 3 Lots)	All Districts	24'	16' (if needed)

In keeping with the goals of the *Makawao-Pukalani-Kula Community Plan,* rural development standards were used in the design of the interior roadways. The *Makawao-Pukalani-Kula Community Plan* supports rural development standards for Upcountry Maui by recognizing the need to preserve the unique design characteristics of Upcountry Maui. Several objectives and policies of the urban design standard that support rural concepts are:

- *Support the revision of subdivision and roadway design criteria and standards to be more compatible with the rural character of the Upcountry region.*
- *Preserve the unique characteristics of all of the Upcountry towns by recognizing and respecting architectural styles as described in the Country Town Design Guidelines.*
- *Support the development of pedestrian, equestrian and bikeway connections which provide safe and convenient linkages within and between Upcountry communities.*
- *Encourage the use of appropriate landscaping, with greenways where possible, along major roadways, parking areas and land use transition areas to establish and maintain landscape themes which are consistent with the character of each Upcountry community.*

Potential Impacts and Mitigative Measures

Kauhale Lani's interior streets provide connectivity along a network of routes and create a pedestrian friendly environment through the use of short blocks, multiple routes, and landscaped right-of-ways. Internal roundabouts and on street parking will calm traffic, enhancing pedestrian safety.

The alley system will allow most garages to be located toward the back of the homes. This design allows for homes with front porches to encourage neighbor interaction, community cohesion, and a safe neighborhood. Siting vehicle storage, garbage collection, and other utilitarian needs away from the front of the homes also fosters safer streets, improves pedestrian movement, and increases street parking.

3.2.7.2 Water System

Engineering Solutions Inc. prepared a Water Supply and Management Plan for Kauhale Lani. Key elements of the plan are summarized below. Appendix J contains the complete report.

Existing Conditions

Potable water service in the Pukalani area is currently provided from the County of Maui, Department of Water (DWS), Pukalani-Makawao Water System. The distribution system is fed from a 1.0 million gallon (mg) concrete reservoir located off Kula Highway near Makawao Avenue.

The transmission mains servicing the area range from six-inch to 16-inch diameter pipes of various materials. The nearest connection points to the existing water system include a six-inch main within Old Haleakalā Highway that terminates on Ikea Place, approximately 200 feet away from Kauhale Lani. This line services the Lower Pukalani Subdivision. There is also a second eight-inch water main under Old Haleakalā Highway, which services properties east of the highway and terminates at Mauna Street, approximately 2,200 feet mauka of Kauhale Lani. Properties southwest of Kauhale Lani are serviced by an eight-inch water main that terminates at Iolani Street, just south of Aʻeloa Road.

Potential Impacts and Mitigation Measures

Based on the Water System Standards, the proposed average daily demand for 165 single-family residences and a community park is 149,970 gallons. The maximum daily demand is 224,955 gallons, and the peak hour demand is 449,910 gallons.

To obtain potable water for Kauhale Lani community, ML&P proposes to construct a new well at about the 1,800-foot elevation along Piholo Road above Makawao, on ML&P property. The well will be constructed in accordance with the design requirements of the Maui County DWS. ML&P proposes to dedicate the well to the County for incorporation into County's system. The anticipated yield of the well is 0.67 million gallons per day (mgd). Under its proposal to the County, 45 percent of the daily yield, or 301,500 gallons per day (gpd) will be allocated to ML&P.

ML&P has obtained a permit for the well from the State Department of Land and Natural Resources Commission on Water Resource Management but has not yet finalized a dedication and allocation agreement with the DWS.

The Kauhale Lani water transmission system will consist of eight-inch water mains with valving, fire hydrants, and water meter connections appropriately provided and designed in accordance with the Water System Standards. Connection to the existing water system is proposed at either the water main at Ikea Place or the water main at Mauna Street.

Fire hydrants will be installed throughout the subdivision at intervals of 300 and 350 feet in accordance with DWS standards. The distribution system will be designed to satisfy the fire demand of 1,000 gallons per minute (gpm) for urban residential districts.

To reduce and conserve the consumption of potable water, non-potable water for irrigation of Kauhale Lani common areas will be obtained from the reclamation wastewater facility (see below). A separate water system of smaller piping will be provided. The recycled water system within Kauhale Lani will be built and operated in conformance with all applicable laws and regulations, including HAR, Section 11-62-27, Recycled Water Systems.

To further conserve water within Kauhale Lani:

- Single pass cooling will not be allowed pursuant to Maui County Code Section 14.21.20;
- Low-flow fixtures and devices will be used pursuant to Maui County Code Section 16.20A.680;
- Individual homeowners and businesses will be encouraged to maintain fixtures to prevent leaks;
- Climate-adapted native and other appropriate plants will be used in landscaping as practical; and
- Best management practices designed to minimize infiltration and runoff from daily operations will be implemented.

The Kauhale Lani community is not anticipated to have an adverse effect on water sources, storage facilities, and distribution and transmission systems. Kauhale Lani will provide additional water sources that will be made available within the Pukalani-Makawao area. The proposed water connections will also provide benefits to the adjacent residents by the installation of a looped system for redundancy and reliability.

3.2.7.3 Wastewater

Engineering Solutions, Inc. prepared a Basis of Design, Wastewater Treatment Plant plan for Kauhale Lani. Key elements of the plan summarized below. Appendix K contains the complete report.

Existing Conditions

The Makawao-Pukalani-Kula region is rural and agricultural in nature, although Makawao and Pukalani are becoming suburban communities. The majority of the region is not served by County wastewater facilities. Only the Hāliʻimaile subdivision is served by a County collection system while a portion of the Pukalani area is served by a private wastewater treatment system. Cesspools or septic tanks serve the remainder of the area (Maui Infrastructure Assessment Update).

The County of Maui Department of Public Works and Environmental Management, Wastewater Reclamation Division, has indicated that it does not have plans to provide collection and treatment facilities to service the area within the next 25 years. The County has also indicated that constructing and dedicating such facilities to the County is not an option.

The Department of Health (DOH) sets forth certain criteria that must be followed in the processing, disposal, and re-use of wastewater (Chapter 62, HAR, Subchapter 1). DOH desires to ensure that wastewater or wastewater sludge does not impact or "contaminate water resources, does not give rise to public nuisance, and does not become a hazard or potential hazard to public health safety and welfare".

As determined by DOH (HAR Chapter 62 (11-62-05)) the Kauhale Lani community site lies within a Critical Wastewater Disposal Area, and above the Underground Injection Control (UIC) Line (HAR Chapter 23). Designation of Critical Wastewater Disposal Areas is based on the protection of groundwater resources. Septic tank liquid wastes cannot be disposed of directly into the soil within these areas because of the possibility of ground water contamination. Thus, a feasible alternative to dispose of wastewater generated from Kauhale Lani must be evaluated.

Potential Impacts and Mitigative Measures

Maui Land & Pineapple Company, Inc. proposes to build a wastewater treatment plant to serve the Kauhale Lani community. Engineering Solutions, Inc. evaluated three types of wastewater systems and recommended a membrane bioreactor system.

Membrane bioreactors use naturally occurring microorganisms in wastewater to convert biodegradable organic and certain inorganic compounds into energy used in cellular respiration and reproductive processes. Air is used to mix the wastewater and provides the oxygen necessary for the microorganisms to convert the nutrients. The process combines the operations of aeration, secondary clarification, and filtration into a single process, producing a high quality effluent, simplifying operation, and greatly reducing space requirements. The effluent from membrane bioreactors is tertiary quality and requires minimal disinfection to meet R-1 quality criteria with no additional filtration required.

Based on design standards and assumptions, maximum wastewater flow from Kauhale Lani is projected to be equivalent to 273,350 gpd. This includes population and residential flows, infiltration and inflow (from groundwater entering the sewer system through cracks in the piping system or poorly fitted or loose pipe joints), community park flows, and peaking factors. Since Maui County does not have wastewater design standards, the wastewater flow generation is based on City and County of Honolulu Design Standards of the Department of Wastewater Management (DWWM).

A membrane bioreactor system capable of handling wastewater flow from Kauhale Lani would require an area of approximately two acres. This would allow for one aeration basin and two membrane bioreactors, one to be used for backup. Because of the small area required, a membrane bioreactor system could be located on the 39-acre Kauhale Lani parcel and effectively screened from highway views with landscaping.

Landscape irrigation within Kauhale Lani is the preferred method of wastewater disposal; however the R-1 irrigation demand for the community is projected to be less than the average daily plant effluent. Conversations with the General Manager at the Pukalani Golf Course have indicated that they are open to the idea of receiving recycled water for irrigation of their 150 acre golf course, if it becomes available.

All wastewater plans will conform to applicable provisions of the DOH's Administrative Rules, Chapter 11-62, "Wastewater Systems."

3.2.7.4 Drainage Facilities

Engineering Solutions Inc., prepared a Preliminary Drainage Report for Kauhale Lani. Key elements of the report summarized below. Appendix L contains the complete report.

Rainfall in the Upcountry area is greatest at about the 3,000-foot elevation along the windward slopes of Haleakalā. From this elevation, rainfall decreases rapidly above and below this area. Most of the Upcountry area receives between 30 to 60 inches of annual rainfall.

The majority of the Kauhale Lani site lies between elevations of 1,088 feet and 1,186 feet. The site is gradually sloped with an average slope of seven percent. There are two drainage ways that bound the community. The New Hāmākua Ditch traverses along the northern and western boundary. On the eastern boundary, a drainage swale adjacent to Old Haleakalā Highway discharges into the irrigation ditch. The existing drainage pattern from the future community site is generally for runoff to sheet flow from the south to the north toward the irrigation ditch. It is estimated that the present 10-year, one-hour runoff from community site is 108.7 cubic feet per second (cfs).

Potential Impacts and Mitigative Measures

The post development 10-year runoff from the Kauhale Lani community is estimated to be 152.2 cfs, with an increase of 43.5 cfs. The increase in onsite runoff will be diverted and detained in on-site detention basins located within the park and other open areas. No additional runoff will be released into the existing drainage ways or onto Old Haleakalā Highway. The net result of the proposed drainage improvements will be no increase in runoff from the community. Kauhale Lani will not have an adverse effect on the adjoining or downstream properties.

All drainage improvements will be developed in accordance with applicable DOH and County of Maui drainage requirements and standards.

Storm runoff during site preparation will be controlled in compliance with the County Code Chapter 20.08 "Soil Erosion and Sediment Control Minimum BMPs". Typical mitigation measures are appropriately stockpiling materials on-site to prevent runoff and building over or establishing landscaping as early as possible on disturbed soils to minimize length of exposure.

3.2.7.5 Utilities

Electricity. Electrical power on Maui is supplied by Maui Electric Company, Inc. (MECO). A MECO primary electrical distribution overhead pole-line is routed along the Old Haleakalā Highway on the side opposite the Kauhale Lani site. MECO will serve the community with a new underground line extension originating from the existing overhead line. MK Engineers prepared an Electrical Engineering Report in March 2005 for Kauhale Lani. Appendix M contains the complete report.

The estimated electrical demand for the Kauhale Lani community, including the wastewater pumping stations and the wastewater treatment plant, is 1,250 kVA. This calculation assumes that dwellings will have all-electric appliances, solar water heating, and limited air conditioning consisting of up to two window units or localized split systems.

Design standards will specify low-impact lighting and will encourage energy efficient building design and site development practices.

Where applicable, the following additional energy saving methods and technologies will be considered during the design phase of Kauhale Lani:

- Use of site shading to reduce cooling load;
- Maximum use of day lighting;
- Use of high efficiency compact fluorescent lighting;
- Exceeding Model Energy Code requirements;
- Roof and wall insulation, radiant barriers, and energy efficient windows;
- Use of solar parking lot lighting;
- Use of light color or "green" roofs;
- Use of roof and gutters to divert rainwater for landscaping; and
- Use of landscaping for dust control and to minimize heat gain to area.

No off-site electrical improvements are anticipated. The electrical distribution system on-site will consist of underground duct lines with manholes, hand holes and pull boxes. Underground primary distribution and secondary distribution cables will be installed in duct systems.

In it anticipated that public street lighting will be "dark sky" compliant to minimize light pollution and interference with observatories at the summit of Haleakalā.

Telephone. Verizon Hawaii, Inc. telephone service in the area of the community is also overhead. The telephone lines are on joint poles on the southwest or Wailuku side of the Old Haleakalā Highway. The telephone cables presently end at the *makai* end of the Lower Pukalani Terrace subdivision. The Pukalani area is served by the Makawao Central Office and Verizon presently has fiber optic lines extending to Pukalani Street.

To provide telecommunication services for the Kauhale Lani community, Verizon Hawaii will require an easement area to install a pair gain. Fiber optic cable and power lines will energize the pair gain to provide telecommunication services for Kauhale Lani. Maui Land & Pineapple Company Inc., will work with Verizon to resolve any easement issues.

The on-site telecommunications system will consist of underground duct lines, manholes, hand holes and pull boxes.

Cable Television. The Oceanic Time Warner Cable cable television (CATV) system in the area of the Kauhale Lani community is also overhead. The CATV cable shares the same poles as the telephone and electrical distribution system. CATV cable presently ends at the *makai* end of the Lower Pukalani Terrace subdivision. Oceanic Cable has indicated that CATV service will be extended to the community from the existing overhead pole-line.

No significant off-site CATV system improvements are anticipated. The on-site CATV system will consist of underground duct lines, manholes, hand holes and pull boxes.

3.2.7.6 Solid Waste Disposal

Currently, significant levels of solid waste are not being generated on the Kauhale Lani site; as the area is fallow fields.

The County provides weekly garbage pick-up for a fee. The Central Maui Landfill, which is located in the Wailuku-Kahului Community Plan region, receives residential solid waste from the area. Green waste is collected by Eko Compost, which is located at the Central Maui Landfill. Construction and demolition (C&D) waste is accepted at the privately operated C&D Landfill in Mā'alaea.

Plastic, glass, metal, cardboard, and newspaper can be recycled when left at various drop-boxes throughout the County. Green waste recycling is provided by several private organizations.

Potential Impacts and Mitigative Measures

In the *Public Facilities Assessment Update County of Maui* (2002), R.M. Towill Corporation projected that the Central Maui Landfill will have adequate capacity to accommodate residential and commercial waste through the year 2020, with a surplus of approximately one million cubic yards of landfill space. This projection was arrived at by multiplying the Maui County's de facto population projections by an estimated number of pounds per person per day of waste generated and assumes that solid waste generated by commercial and industrial growth will be captured by a corresponding trend in projected population growth.

The County of Maui's Solid Waste Division estimates that households on Maui generate approximately nine pounds of solid waste per day. Using this estimate, after build-out and sales of all Kauhale Lani homes, total waste from all households in the Kauhale Lani community would be approximately 1,485 pounds per day (nine pounds x 165 residences).

Waste generated by site preparation will primarily consist of vegetation, rocks, and debris from clearing, grubbing, and grading. Very little demolition material is expected, as the site is essentially vacant.

During the short term, construction activities will require the disposal of the existing onsite waste, as well as cleared vegetation and construction-related solid waste. A solid waste management plan will be coordinated with the County's Solid Waste Division for the disposal of onsite and construction-related waste material. Maui Land & Pineapple Company Inc., will work with the contractor to minimize the amount of solid waste generated during the construction of the project.

Provisions for recycling, such as collection systems and space for bins for recyclables, will be incorporated into the Kauhale Lani community. After the community is occupied by residents, to the extent practical, wastes such as aluminum, paper, newspaper, glass, and plastic containers will be recycled. Waste that cannot be recycled will be disposed of in the County's Central Maui Landfill in Puʻunēnē.

3.2.8 Public Services

As with any new community, the costs of providing expanded services that will impact public agency resources is a concern. Most new communities potentially affect the costs to the following governmental services and programs:

- Police Protection
- Fire Protection
- Public Oversight Agencies
- Infrastructure Services
- Recreational Demands
- Educational Needs
- Infrasturcture Costs
- Various Other Services and Financial Commitments

As a privately built, master-planned residential community, Kauhale Lani is not expected to increase many of the above costs on state or county levels. The major off-site public infrastructure items (roadways and primary water/sewer mains) are already in place; the community will require no specific public subsidies, welfare services, bonding, or capital improvements.

Direct tax benefits to the State and County will primarily flow from the community and its operation over time from three major sources: real property taxes, gross excise tax receipts, and state income taxes. Should the State and County choose to allocate these additional tax revenues to fund more services to protect public health, welfare, and safety, any cost to the public that may result will be effectively minimized.

During the build-out and sales period, Kauhale Lani is projected to generate approximately $5.6 million in taxes for the County of Maui; and approximately $19.3 million for the State of Hawaiʻi. After build-out, annual taxes generated from the community are projected to be approximately $780,000 for the County and approximately $2.3 million for the State. In no year will the State or the County suffer a revenue shortfall due to the community at Kauhale Lani (Hallstrom 2005).

3.2.8.1 Fire Protection

The Kauhale Lani community will be serviced by Maui County's Engine 5, the Makawao Fire Station. The fire station is located on Makawao Avenue approximately 1.3 miles southeast of the community and is equipped with a 1,500 gallon pumper.

Potential Impacts and Mitigative Measures

The Kauhale Lani community is not expected to adversely affect fire protection services. The property is located within the service area of the Makawao Fire Station.

3.2.8.2 Police Protection

The Kauhale Lani community falls within the Maui Police Department's (MPD) District 1 – Wailuku (Central). This police district is served by the Wailuku Station, with a substation located in Makawao. The Wailuku Station houses the MPD Headquarters for the entire County. Wailuku headquarters is located approximately 10.4 miles northwest of the community at 55 Mahalani Street.

A new police substation at Kulamalu was dedicated in May 2005. The police facility is a component of the Kulamalu Town Center, which encompasses Kamehameha Schools' 180-acre Maui campus in Pukalani and will soon house the University of Hawaiʻi Institute for Astronomy's new Advanced Technology Research Center (Pacific Business News 2005).

Potential Impacts and Mitigative Measures

As Maui's population grows there is a need for the County to allocate resources necessary to adequately fund police services. These additional funds could potentially be allotted from the increased tax revenues resulting from the construction of the Kauhale Lani community, as previously discussed.

3.2.8.3 Health Care Services

Maui Memorial Medical Center, located in Wailuku, currently is Maui's only acute care facility. The Center has 196 beds and provides emergency, acute, and general medical care. Maui Memorial Medical Center is located approximately 10.7 miles northwest of Kauhale Lani at 221 Mahalani Street.

Potential Impacts and Mitigative Measures

Kauhale Lani residents, at some time, may require health care and emergency medical services. There are several proposals for increased medical services on Maui. If these projects proceed, they will decrease some of the demand on Maui Memorial Medical Center. The projects include:

- The Maui Memorial Medical Center in Wailuku is currently undergoing a $42 million renovation which will add 45 additional beds by 2007.
- Kula Hospital plans to expand services by August 2005 to include emergency care.
- Plans are currently underway for the West Maui 24-Hour Acute Care Emergency Medical Facility, to be located on a 15-acre site near the Lahaina Civic Center.
- Malulani Health Systems proposes to build a 40-acre, $180 million, 100-bed hospital in Kīhei, which is estimated to open in 2009.
- Proposed Pulelehua Medical Facility in West Maui to include a 30 to 50-bed long-term care facility and an Urgent/Emergency Care Medical Clinic.

3.2.8.4 Schools

The Kauhale Lani Community is located within the State Department of Education's (DOE) King Kekaulike District, and is serviced by Kula Elementary, Makawao Elementary, Pukalani Elementary, Kalama Intermediate and King Kekaulike High School. Private schools in the area include the Kamehameha Schools Maui Campus, Seabury Hall, and St. Joseph School.

The DOE Facilities Division has compiled current school enrollment, school capacity and projected enrollment for the year 2009. As shown in Table 6, all schools in the area are currently under capacity and projected enrollment for the 2009 school year is not expected to exceed capacity.

Table 6. DOE School Capacity: King Kekaulike District

School	2004 Enrollment	2004 Capacity	2009 Projected Enrollment	2009 Enrollment Capacity
Kula Elementary	421	588	424	164
Makawao Elementary	489	614	436	178
Pukalani Elementary	493	542	450	92
Kalama Intermediate	1,066	1,105	954	151
King Kekaulike High	1,379	1,326	1,253	73

Potential Impacts and Mitigative Measures

The Department of Education estimates that Kauhale Lani could generate a total of 95 school students who would most likely attend the following schools: Pukalani Elementary, Kalama Intermediate, and King Kahaulike High.

The Kauhale Lani community is not expected to have an adverse effect on the public schools as enrollments are currently projected to remain below capacity in the year 2009. However, Maui Land & Pineapple Company, Inc., will work with the DOE to reach a school fair-share contribution agreement. It is also expected that some Kauhale Lani students will attend the private schools in the area, further reducing any impacts to public schools.

3.2.8.5 Recreation Facilities

There are a number of quality park facilities in the Makawao-Pukalani-Kula Community Plan region, despite a lack of an extensive park system in terms of acreage. The Upcountry area has three neighborhood parks, five district parks, six tennis courts, 21 sports fields, two sports courts, five community centers, and three gyms. Recreation facilities near the Kauhale Lani community site include:

- Pukalani Park, Pukalani Street
- Kula Community Center, E. Lower Kula Road
- New Kula Ballfield, Kula Highway
- Harold Rice Park, Lower Kula Road
- Eddie Tam Memorial Park, Makawao Avenue
- Hāli‘imaile Park and Tennis, Makomako Street

Potential Impacts and Mitigative Measures

A centralized neighborhood park may feature a community pavilion, play courts, and other recreational facilities that will provide a neighborhood center and gathering place for the community. The community pavilion will likely include multipurpose room(s). Since a detailed program has not yet been determined for the park, these are included as preliminary concepts that may be modified with further planning. A number of smaller, “pocket parks” will be dispersed throughout the community. The 39-acre parcel between Old Haleakalā Highway and Haleakalā Highway will provide further trails, open space, and other community amenities with plans to connect to the Upcountry Greenway Masterplan. No homes are planned for the 39-acre parcel. Kauhale Lani’s parks and recreation areas will be accessible to people of all ages and ability and will be open to the public.

4.0 LAND USE CONFORMANCE

The Relevant State of Hawai‘i and County of Maui land use plans, policies, and ordinances are described below.

4.1 STATE OF HAWAI‘I

4.1.1 State Land Use Districts

The State Land Use Law (Chapter 205, *Hawaii Revised Statutes* (HRS)), establishes the State Land Use Commission (LUC) and gives this body the authority to designate all lands in the State into one of four districts: Urban, Rural, Agricultural, or Conservation.

The Kauhale Lani site is presently in the Agricultural District (Figure 9). Maui Land & Pineapple Company, Inc. (ML&P) is seeking a State Land Use District Boundary Amendment to change the designation of the site to the Urban District. Single-family residential use is allowed within the Urban district.

Decision-making criteria to be used in the LUC's review of petition for reclassification of district boundaries is found in Section 205-17, HRS, and Section 15-15-77, *Hawaii Administrative Rules* (HAR). In addition, standards for determining the Urban district are contained in Section 15-15-18, HAR. The following is an analysis of how the Kauhale Lani community conforms to these criteria and standards.

<u>Land Use Commission Rules, Chapter 15-18, Hawaii Administrative Rules</u>

Land Use Commission Decision Making Criteria

§205-17 Land use commission decision making criteria. *In its review of any petition for reclassification of district boundaries pursuant to this chapter, the commission shall specifically consider the following:*

(1) The extent to which the proposed reclassification conforms to the applicable goals, objectives, and policies of the Hawai‘i state plan and relates to the applicable priority guidelines of the Hawai‘i state plan and the adopted functional plans;

- Kauhale Lani conforms to the goals, objectives, and policies of the *Hawaii State Plan* and functional plans, as discussed in sections below.

(2) The extent to which the proposed reclassification conforms to the applicable district standards; and

- Conformance of Kauhale Lani to the Urban district standards is discussed in following sections.

(3) The impact of the proposed reclassification on the following areas of state concern:
(A) Preservation or maintenance of important natural systems or habitats;

- The Kauhale Lani community will not impact natural systems; the parcels are former agricultural fields, which have been extensively cultivated.
- There are no rare, threatened, or endangered flora, fauna, or avifauna species, or habitats for these species, on the Kauhale Lani community site.

(B) Maintenance of valued cultural, historical, or natural resources;

- No archaeological resources have been identified on the Kauhale Lani site, however, Maui Land & Pineapple Company, Inc. and its contractors will comply with all laws and rules regarding the preservation of archaeological, cultural, and historic sites should any sites be found during construction (see Section 3.2.1).
- Kauhale Lani is not expected to impact cultural resources as no cultural resources have been identified on the property; there is no evidence of past or present use for Hawaiian cultural practices, resources, or beliefs (see Section 3.2.2).

(C) Maintenance of other natural resources relevant to Hawaii's economy, including, but not limited to, agricultural resources;

- Kauhale Lani will not impact Maui Land & Pineapple Company, Inc.'s long-term goals for continuing agricultural operations on Maui (see Section 3.1.4).
- Cultivation of the parcels was discontinued in 2002. Both parcels are inefficient to farm as part of Maui Pineapple Company, Ltd. operations since the Pukalani Bypass separated these parcels from other contiguous, more suitable Maui Pineapple Company, Ltd. pineapple fields.

(D) Commitment of state funds and resources;

- Use of State or County lands or funds is not expected, but could include, on-site and off-site infrastructure improvements relating to roadway, traffic, water, utility and drainage facilities affecting State and/or County roadways or other lands, however the specific nature of all potential improvements is not known at this time.

(E) Provision of employment opportunities and economic development; and

- Economic impacts associated with Kauhale Lani include:
  - $81.7 million in direct, new capital investment and spending into the Maui economy during the planning and construction period;
  - $20.1 million in total gross tax revenues for the State of Hawaiʻi and $6.1 million in taxes for the County of Maui during the build out period;
  - $2.5 million annually in stabilized taxes for the State and approximately $864,000 annually for the County after the build out period;
  - $8.5 million annually in net benefits (taxes minus costs) to the State and $1.5 million annually in net benefits to the County during the build out period;
  - $502,000 annually in stabilized net benefits (taxes minus costs) to the State and $62,000 annually in net benefits to the County;
  - 522 worker years (one worker/year is approximately equal to 2,000 hours) in construction related jobs during the build out period;
  - $33.6 million in total wages over the build out period;

LEGEND

State Land Use Districts
- Agricultural
- Rural
- Urban
- Kauhale Lani Boundary

Source:
U.S. Geological Survey
The State of Hawaii GIS Database

Disclaimer:
This map has been prepared for general planning purposes only.

Figure 9

State Land Use Districts

KAUHALE LANI

MAUI LAND & PINEAPPLE COMPANY, INC. ISLAND OF MAUI

NORTH

LINEAL SCALE (FEET)

0 500 1,000 2,000

PBR HAWAII

- 21 full-time equivalent jobs related to on-site activities, on a stabilized basis, after build-out; and
- $597,000 in annual wages after build out.

(F) Provision for housing opportunities for all income groups, particularly the low, low-moderate, and gap groups; and

- While the homes of the Kauhale Lani community will be priced at market rates, Maui Land & Pineapple Company Inc. will work with the County of Maui Department of Housing and Human Concerns to satisfy all County affordable housing requirements.

(4) The representations and commitments made by the petitioner in securing a boundary change.

- Conditions imposed on reclassification will be recorded as an encumbrance on the property.

***§15-15-77 Decision-making criteria for boundary amendments**.*

(a) The commission shall not approve an amendment of a land use district boundary unless the commission finds upon the clear preponderance of the evidence that the proposed boundary amendment is reasonable, not violative of section 205-2, HRS, and consistent with the policies and criteria established pursuant to sections 205-16, 205-17, and 205A-2, HRS.

(b) In its review of any petition for reclassification of district boundaries pursuant to this chapter, the commission shall specifically consider the following:

(1) The extent to which the proposed reclassification conforms to the applicable goals, objectives, and policies of the Hawai'i state plan and relates to the applicable priority guidelines of the Hawai'i state plan and the adopted functional plans;

(2) The extent to which the proposed reclassification conforms to the applicable district standards;

(3) The impact of the proposed reclassification on the following areas of state concern;

(A) Preservation or maintenance of important natural systems or habitats;

(B) Maintenance of valued cultural, historical, or natural resources;

(C) Maintenance or other natural resources relevant to Hawaii's economy including, but not limited to agricultural resources;

(D) Commitment of state funds and resources;

(E) Provision for employment opportunities and economic development; and

(F) Provision for housing opportunities for all income groups, particularly the low, low-moderate, and gap groups;

(4) In establishing the boundaries of the districts in each county, the commission shall give consideration to the general plan of the county in which the land is located;

- Kauhale Lani is in conformance with and implements the *Makawao-Pukalani-Kula Community Plan*. The entire area of Kauhale Lani is designated as "Single Family" on the *Makawao-Pukalani-Kula Community Plan* Land Use Map.

(5) The representations and commitments made by the petitioner in securing a boundary change, including a finding that the petitioner has the necessary economic ability to carry out the representations and commitments relating to the proposed use or development; and

(6) Lands in intensive agricultural use for two years prior to date of filing of a petition or lands with a high capacity for intensive agricultural use shall not be taken out of the agricultural district unless the commission finds either that the action:

(A) Will not substantially impair actual or potential agricultural production in the vicinity of the subject property or in the county or State; or

- Cultivation of the parcels was discontinued in 2002. Both parcels are inefficient to farm as part of Maui Pineapple Company, Ltd., operations since the Pukalani Bypass separated these parcels from other contiguous, more suitable Maui Pineapple Company, Ltd., pineapple fields.
- Kauhale Lani will not impact Maui Land & Pineapple Company, Inc.'s long-term goals for continuing agricultural operations on Maui (see Section 3.1.4).

(B) Is reasonably necessary for urban growth.

- Use of the land for housing is appropriate in the context of the *Makawao-Pukalani-Kula Community Plan* and the current need for new housing inventory.
- Forecasts of housing demand project a need for approximately 4,600-plus homes (mid-point estimate) in the Upcountry area during the next 16 years (Hallstrom 2005). Approximately 94 percent, or more than 4,200 of the homes, would need to be single-family homes. Fewer than 500 home sites are currently proposed for the area.

(c) Amendments of a land use district boundary in conservation districts involving land areas fifteen acres or less shall be determined by the commission pursuant to this subsection and section 205-3.1, HRS.
(d) Amendments of land use district boundary in other than conservation districts involving land areas fifteen acres or less shall be determined by the appropriate county land use decision-making authority for the district.
(e) Amendments of a land use district boundary involving land areas greater than fifteen acres shall be determined by the commission, pursuant to this subsection and section 205-3.1, HRS.

Standards for Determining Urban District Boundaries

§15-15-18 Standards for determining "U" urban district boundaries. *Except as otherwise provided in this chapter, in determining the boundaries for the "U" urban district, the following standards shall be used:*
(1) It shall include lands characterized by "city-like" concentrations of people, structures, streets, urban level of services and other related land uses;

- The Kauhale Lani site is contiguous to the town of Pukalani, which is characterized by "city-like" concentrations of people, structures, streets, urban level of services and other related land uses.

(2) It shall take into consideration the following specific factors:
(A) Proximity to centers of trading and employment except where the development would generate new centers of trading and employment;

- The Kauhale Lani site is contiguous to, and a natural extension of, Pukalani, a residential community in the State Land Use Urban District, which is a center of trading and employment.

(B) Availability of basic services such as schools, parks, wastewater systems, solid waste disposal, drainage, water, transportation systems, public utilities, and police and fire protection; and

- Basic services are available, or can be made available, to the Kauhale Lani site. Old Haleakalā Highway bisects the site and will provide access to both parcels. Electrical and telecommunication services are nearby. A water source has been identified and a wastewater treatment facility will be built to service the community. Public services such as police, fire, and emergency medical facilities, are nearby, as are educational and recreational facilities.

(C) Sufficient reserve areas for foreseeable urban growth;

- The *Makawao-Pukalani-Kula Community Plan* designates the site for single-family residential uses. The site is the logical expansion of Pukalani.

(3) It shall include lands with satisfactory topography, drainage, and reasonably free from the danger of any flood, tsunami, unstable soil condition, and other adverse environmental effects;

- Elevations of the Kauhale Lani site range from about 1,088 feet at the northwest end of the property up to about 1,186 feet at the southeast end, providing an approximately seven percent grade. The elevation and gentle grade provide for expansive views of Central Maui from nearly all points on the property.
- The site is reasonably free from danger of flood, tsunami, unstable soil conditions and other adverse environmental effects.

(4) Land contiguous with existing urban areas shall be given more consideration than non-contiguous land, and particularly when indicated for future urban use on state or county general plans;

- The Kauhale Lani site is contiguous to, and a natural extension of, Pukalani, a residential community in the State Land Use Urban District.
- The *Makawao-Pukalani-Kula Community Plan* designates the site for single family residential uses. The site is the logical expansion of Pukalani.

(5) It shall include lands in appropriate locations for new urban concentrations and shall give consideration to areas of urban growth as shown on the state and county general plans;

- As represented by the "single-family" designation on *Makawao-Pukalani-Kula Community Plan,* residential uses on the site are appropriate and represent the carefully thought out expansion of Pukalani.

(6) It may include lands which do not conform to the standards in paragraphs (1) to (5):
When surrounded by or adjacent to existing urban development; and
Only when those lands represent a minor portion of this district;

(7) It shall not include lands, the urbanization of which will contribute toward scattered spot urban development, necessitating unreasonable investment in public infrastructure or support services; and

- Kauhale Lani will not contribute to scattered spot urban development, necessitating unreasonable investment in public infrastructure or support services.

(8) It may include lands with a general slope of twenty per cent or more if the commission finds that those lands are desirable and suitable for urban purposes and that the design and construction controls, as adopted by any federal, state, or county agency, are adequate to protect the public health, welfare and safety, and the public's interests in the aesthetic quality of the landscape.

4.1.2 Chapter 226, Hawaii Revised Statutes, Hawaii State Plan

Chapter 226, HRS, also known as the *Hawaii State Plan*, is a long-range comprehensive plan that serves as a guide for the future long-range development of the State by identifying goals, objectives, policies, and priorities, as well as implementation mechanisms. The Kauhale Lani community is in accordance with the following goals of the *Hawaii State Plan*:

- *A strong, viable economy, characterized by stability, diversity, and growth, that enables the fulfillment of the needs and expectations of Hawai'i's present and future generations.*
- *A desired physical environment, characterized by beauty, cleanliness, quiet, stable natural systems, and uniqueness, that enhances the mental and physical well-being of the people.*
- *Physical, social, and economic well-being, for individuals and families in Hawai'i, that nourishes a sense of community responsibility, of caring, and of participation in community life.*

<u>Objectives and Policies of the Hawaii State Plan</u>

The Kauhale Lani Community is in conformance with the following objectives and policies of the *Hawaii State Plan*.

Chapter 226-5, HRS, Objective and Policies for Population

226-5(b)(1), HRS: *Manage population growth statewide in a manner that provides increased opportunities for Hawai'i's people to pursue their physical, social, and economic aspirations while recognizing the unique needs of each county.*

226-5(b)(3), HRS: *Promote increased opportunities for Hawai'i's people to pursue their socio-economic aspirations throughout the islands.*

Chapter 226-6, HRS, Objectives and Policies for the Economy – in General

226-6(b)(6), HRS: *Strive to achieve a level of construction activity responsive to, and consistent with, State growth objectives.*

Chapter 226-11, HRS, Objectives and Policies for the Physical Environment – Land Based, Shoreline, and Marine Resources

226-11(b)(3), HRS: *Take into account the physical attributes of areas when planning and designing activities and facilities.*

226-11(b)(8), HRS: *Pursue compatible relationships among activities, facilities, and natural resources.*

Chapter 226-12, HRS, Objective and Policies for the Physical Environment – Scenic, Natural Beauty, and Historic Resources

226-12(b)(5), HRS: *Encourage the design of developments and activities that complement the natural beauty of the islands.*

4.2 CHAPTER 226-13, HAWAII REVISED STATUTES, OBJECTIVES AND POLICIES FOR THE PHYSICAL ENVIRONMENT – LAND, AIR, AND WATER QUALITY

226-13(b)(6), HRS: *Encourage design and construction practices that enhance the physical qualities of Hawai'i's communities.*

226-13(b)(7), HRS: *Encourage urban developments in close proximity to existing services and facilities.*

Chapter 226-19, HRS, Objectives and Policies for Socio-Cultural Advancement – Housing

226-19(a)(2), HRS: *The orderly development of residential areas sensitive to community needs and other land uses.*

226-19(b)(1), HRS: *Effectively accommodate the housing needs of Hawai'i's people.*

226-19(b)(3), HRS: *Increase home ownership and rental opportunities and choices in terms of quality, location, cost, densities, style, and size of housing.*

226-19(b)(5), HRS: *Promote design and location of housing developments taking into account the physical setting, accessibility to public facilities and services, and other concerns of existing communities and surrounding areas.*

226-19(b)(7), HRS: *Foster a variety of lifestyles traditional to Hawai'i through the design and maintenance of neighborhoods that reflect the culture and values of the community.*

Priority Guidelines of the Hawai'i State Plan

The Kauhale Lani community is in accordance with the following priority guidelines of the *Hawaii State Plan*.

Chapter 226-103, HRS, Economic Priority Guidelines

226-103(1), HRS: *Seek a variety of means to increase the availability of investment capital of new and expanding enterprises.*

226-103(1)(a), HRS: *Encourage investments which:*
- *(i) Reflect long-term commitments to the State;*
- *(ii) Rely on economic linkages within the local economy;*
- *(iii) Diversify the economy;*
- *(iv) Reinvest in the local economy;*
- *(v) Are sensitive to community needs and priorities; and*
- *(vi) Demonstrate a commitment to management opportunities to Hawai'i residents.*

Chapter 226-104, HRS, Population Growth and Land Resources Priority Guidelines

226-104(a)(1), HRS: *Encourage planning and resource management to insure that population growth rates throughout the State are consistent with available planned resource capacities and reflect the needs and desires of Hawai'i's people.*

226-104(b)(1), HRS: *Encourage urban growth primarily to existing urban areas where adequate public facilities are already available or can be provided with reasonable public expenditures and away from areas where other important benefits are present, such as protection of important agricultural land or preservation of lifestyles.*

226-104(b)(2), HRS: *Make available marginal or non-essential agricultural lands for appropriate urban uses while maintaining agricultural lands of importance in the agricultural district.*

226-104(b)(12), HRS: *Utilize Hawai'i's limited land resources wisely, providing adequate land to accommodate projected population and economic growth needs while ensuring the protection of the environment and the availability of the shoreline conservation lands, and other limited resources for future generations.*

4.2.1 State Functional Plans

The *Hawaii State Plan* directs State agencies to prepare functional plans for their respective program areas. There are 13 state functional plans that serve as the primary implementing vehicle for the goals, objectives, and policies of the *Hawaii State Plan*. The functional plans applicable to the Kauhale Lani community, along with each plan's applicable objectives, policies, and actions are discussed below.

Agriculture

The *Agriculture Functional Plan* seeks to increase the overall level of agricultural development in Hawai'i, in accordance with the two fundamental *Hawaii State Plan* objectives for agriculture: 1) continued viability of Hawai'i's sugar and pineapple industries, and 2) continued growth and development of diversified agriculture throughout the State.

- Kauhale Lani will not impact Maui Land & Pineapple Company, Inc.'s long-term goals for continuing agricultural operations on Maui (see Section 3.1.4).
- Cultivation of the parcels was discontinued in 2002. Both parcels are inefficient to farm as part of Maui Pineapple Company, Ltd. operations since the Pukalani Bypass separated these parcels from other contiguous, more suitable Maui Pineapple Company, Ltd. pineapple fields.

Historic Preservation

The long-term philosophy of the *Historic Preservation Functional Plan* highlights the importance of maintaining a record of Hawai'i's unique history. History enriches our social, intellectual, aesthetic and economic lives with insights from the past. With the rapid change and development of our island state, our historical resources are at risk. The *Historic Preservation Functional Plan* attempts to preserve these resources by focusing on three main issue areas: (1) preservation of historic properties, (2) collection and preservation of historic records, artifacts and oral histories, and (3) provision of public information and education on the ethnic and cultural heritages and history of Hawai'i.

- No archaeological resources have been identified on the Kauhale Lani site, however, Maui Land & Pineapple Company, Inc., and its contractors will comply with all laws and rules regarding the preservation of archaeological, cultural, and historic sites should any sites be found during construction (see Section 3.2.1).
- Kauhale Lani is not expected to impact cultural resources as no cultural resources have been identified on the property; there is no evidence of past or present use for Hawaiian cultural practices, resources, or beliefs (see Section 3.2.2).

Housing

The State *Housing Functional Plan*, prepared by the State Housing Finance and Development Corporation (now Housing and Community Development Corporation of Hawaii), addresses six major areas of concern: 1) increasing home ownership; 2) expanding rental housing opportunities; 3) expanding rental housing opportunities for the elderly and other special need groups; 4) preserving housing stock; 5) designating and acquiring land that is suitable for residential development; and 6) establishing and maintaining a housing information system. The majority of the objectives, policies, and implementing actions of the State *Housing Functional Plan* apply to the government sector.

- Forecasts of housing demand project a need for approximately 4,600-plus homes (mid-point estimate) in the Upcountry area during the next 16 years (Hallstrom 2005). Approximately 94 percent, or more than 4,200 of the homes, would need to be single-family homes. Fewer than 500 home sites are currently proposed for the area.
- While the homes of the Kauhale Lani community will be priced at market rates, Maui Land & Pineapple Company Inc. will work with the County of Maui Department of Housing and Human Concerns to satisfy all County affordable housing requirements.

Recreation

The *Recreation Functional Plan* outlines the public and private sectors' roles in serving the recreation and open space needs of the public. It organizes objectives, policies, and actions into six major issue areas: (1) ocean and shoreline recreation, (2) mauka, urban, and other recreational opportunities, (3) public access to shoreline and upland recreation areas, (4) resource conservation and management, (5) management of recreation programs, facilities, and areas, and (6) wetlands protection and management.

- Recreational facilities of the community, such as an extensive trail system, will provide opportunities for increased physical fitness, contemplative views of Central Maui, and relief from daily stress. Further, the centralized neighborhood park and smaller "pocket parks" will provide gathering places for the community and family functions.

4.2.2 Hawai'i Coastal Zone Management Program

The Coastal Zone Management Area as defined in Chapter 205A, HRS, includes all the lands of the state. As such, the Kauhale Lani site is within the Coastal Zone Management Area; however, it is located on the slopes of Haleakalā, far from the shoreline.

The relevant objectives and policies of the Hawai‘i Coastal Zone Management (CZM) Program, along with a discussion of how Kauhale Lani conforms to these objectives and policies, is discussed below.

Recreational Resources

Objective: *Provide coastal recreational opportunities accessible to the public.*

Policies:

a. *Improve coordination and funding of coastal recreational planning and management; and*
b. *Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:*
   - *(i) 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 site, 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 adequate supply of shoreline parks and other recreational facilities suitable for public recreation;*
   - *(v) Ensuring public recreational uses 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 non-point 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 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, HRS.*

- The Kauhale Lani community site is not near the shoreline and will not impact coastal recreational opportunities or affect existing public access to the shoreline.
- While not on the shoreline, recreational facilities of the community, such as an extensive trail system, will provide opportunities for residents and the community in general for increased physical fitness, contemplative views of Central Maui, and relief from daily stress. Further, the centralized neighborhood park and "pocket parks" will provide gathering places for the community and family functions.

Historical/Cultural Resources

Objective:

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.*

- No archaeological resources have been identified on the Kauhale Lani site, however, Maui Land & Pineapple Company, Inc., and its contractors will comply with all laws and rules regarding the preservation of archaeological, cultural, and historic sites should any sites be found during construction (see Section 3.2.1).
- Kauhale Lani is not expected to impact cultural resources as no cultural resources have been identified on the property; there is no evidence of past or present use for Hawaiian cultural practices, resources, or beliefs (see Section 3.2.2).

Scenic and Open Space Resources

Objective:
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 that are not coastal dependent to locate in inland areas.*

- The Kauhale Lani community site is not near the shoreline and will not impact coastal scenic and open space resources.
- Although Kauhale Lani will be built at the entrance to Pukalani, the community is expected to enhance this gateway, as landscaping will be improved and maintained on a regular basis and design standards will provide for a unified streetscape planting theme in compliance with the Maui County Planting Plan.

Coastal Ecosystem

Objective:
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.*

- The Kauhale Lani community site is not near the shoreline and is not expected to impact coastal ecosystems adversely.
- The community's drainage system will be designed in accordance with applicable regulatory standards to assure that there are no adverse effects to adjacent or downstream properties.
- Appropriate erosion control measures will be implemented to minimize the effects of stormwater runoff during construction of the community to assure that coastal ecosystems are not adversely impacted.

Economic Use

Objective:
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 development 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 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.*

- The Kauhale Lani community site is not near the shoreline and is not a coastal dependent development.
- As represented by the "single-family" designation on *Makawao-Pukalani-Kula Community Plan,* residential uses on the site are appropriate and represent the carefully thought out expansion of Pukalani.

Coastal Hazards

Objective:
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;*
c. *Ensure that developments comply with requirements of the Federal Flood Insurance Program; and*

d. Prevent coastal flooding from inland projects.

- The community site is not on the shoreline and is not likely to be impacted from tsunamis or storm wave.
- The community site is reasonably free from danger of flood, unstable soil conditions and other adverse environmental effects.
- The Kauhale Lani drainage system will be designed in accordance with the Drainage Standards of the County of Maui to ensure that surface runoff from the site will not adversely affect downstream and adjoining properties.

Managing Development

Objective:
Improve the development review process, communication, and public participation in the management of coastal resources 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 of 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.

- Kauhale Lani will be developed in conformance with all applicable, laws, regulations, and requirements.
- Major permit processing for Kauhale Lani will include a State Land Use District Boundary Amendment, and a County Change in Zoning; these steps provide for agency review and public comments, as well as opportunities for the public and decision-makers to ask for more information.

Public Participation

Objective:
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

- As noted above, major permit processing for Kauhale Lani provides for agency review and public comments, as well as opportunities for the public and decision-makers to ask for more information.

Beach Protection

Objective:
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 Kauhale Lani community site is located a significant distance from the shoreline and therefore is not expected to have adverse impacts on beaches, natural shoreline processes, or existing recreational and waterline activities.

Marine Resources

Objective:
Promote the protection, use, and development of marine and coastal resources to assure their sustainability.

Policies:
a. Ensure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;
b. Coordinate the management of marine and coastal resources and activities to improve effectiveness and efficiency;
c. 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;
d. 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

- The Kauhale Lani community site is located a significant distance from the shoreline and will not involve the use or development of marine and coastal resources

4.3 COUNTY OF MAUI

County-specific land use plans and ordinances pertaining to the Kauhale Lani community include the *General Plan of the County of Maui 1990 Update*, the *Makawao-Pukalani-Kula Community Plan*, and the Maui County Code. The following subsections present relevant elements of these guidelines and regulations, accompanied with a description of how each will be addressed during the course of the proposed project.

4.3.1 General Plan

Kauhale Lani implements many of the objectives and policies of the *General Plan of the County of Maui 1990 Update*. As required by the County of Maui Charter, the *General Plan of the County of Maui* sets forth the desired sequence, patterns, and characteristics of future development. This is accomplished through long-range objectives focusing on the social, economic, and environmental effects of development coupled with specific policies designed to implement the objectives.

Specific general plan objectives and policies applicable to Kauhale Lani are discussed below.

Land Use

Objective 1: *To preserve for present and future generations existing geographic, cultural and traditional community lifestyles by limiting and managing growth through environmentally sensitive and effective use of land in accordance with the individual character of the various communities and regions of the County.*

- The Kauhale Lani community will provide a cohesive addition to Pukalani in character with the Upcountry region.

  Policy b: *Provide and maintain a range of land use districts sufficient to meet the social, physical, environmental and economic needs of the community.*

- Kauhale Lani community will meet the social, physical, environmental, and economic needs of the community by providing needed housing in conformance with in *Makawao-Pukalani-Kula Community Plan*.

Objective 2: *To use the land within the County for the social and economic benefit of all the County's residents.*

- In addition to providing needed housing, Kauhale Lani is expected to have a direct beneficial effect on the local economy
- Economic impacts associated with Kauhale Lani include:
  a. $81.7 million in direct, new capital investment and spending into the Maui economy during the planning and construction period;
  b. $8.5 million annually in net benefits (taxes minus costs) to the State and $1.5 million annually in net benefits to the County during the build out period; and
  c. $2.5 million annually in stabilized taxes for the State and approximately $864,000 annually for the County after the build out period.

  Policy a: *Mitigate environmental conflicts and enhance scenic amenities, without having a negative impact on natural resources.*

- Kauhale Lani is not expected to have a negative impact on natural resources. Impacts, such as site grading, increased runoff, and use of resources, will not be significant and can be mitigated with proper management techniques.
- Although Kauhale Lani will be built at the entrance to Pukalani, the community is expected to enhance this gateway, as landscaping will be improved and maintained on a regular basis and design standards will provide for a unified streetscape planting theme in compliance with the Maui County Planting Plan.

  Policy b: *Encourage land use patterns that foster a pedestrian oriented environment to include such amenities as bike paths, linear parks, landscaped buffer areas, and mini-parks.*

- Kauhale Lani will be a walkable community designed to enhance connectivity by way of pedestrian-friendly streets, alley ways, and a perimeter pedestrian/bike trail.

Objective 1: *To preserve lands that are well suited for agricultural pursuits.*

Policy a: *Protect prime agricultural lands from competing nonagricultural land uses.*

Policy b: *Discourage conversion, through zoning or other means, of productive or potentially productive agricultural lands to nonagricultural land uses, including but not limited to golf courses and residential subdivisions.*

- While the Kauhale Lani site is zoned agricultural, the *Makawao-Pukalani-Kula Community Plan* designates the site for residential uses.
- Agricultural uses on the both parcels of the site were discontinued in 2002. Both parcels are inefficient to farm as part of Maui Pineapple Company, Ltd., operations since the Pukalani Bypass separated these parcels from other contiguous, more suitable Maui Pineapple Company, Ltd., pineapple fields.

Environment

Objective 1: *To preserve and protect the County's unique and fragile environmental resources.*

- The design of the Kauhale Lani community will be sensitive to the site on which it is located, and will be constructed in such a way as to minimize the impacts to the environment.
- Design will take advantage of the natural topography of the land, and grading and contouring of the properties will be minimized.

Policy a: *Preserve for present and future generations the opportunity to experience the natural beauty of the islands.*

Policy b: *Preserve scenic vistas and natural features.*

- Kauhale Lani preserves and protects the County's unique and fragile environmental resources by providing residential uses in an appropriate area contiguous to existing urban uses and in conformance with the *Makawao-Pukalani-Kula Community Plan.*

Objective 2: *To use the County's land-based physical and ocean-related coastal resources in a manner consistent with sound environmental planning practice.*

- As represented by the "single-family" designation on *Makawao-Pukalani-Kula Community Plan,* residential uses on the site are appropriate and represent the carefully thought out expansion of Pukalani consistent with sound environmental planning practice.

Policy b: *Evaluate all land-based development relative to its impact on the County's land and ocean ecological resources.*

- Impacts from Kauhale Lani, such as site grading, increased runoff, and use of resources, are not expected to be significant and can be mitigated with proper management techniques. As such, the community is not anticipated to have any adverse effects on the County's land and ocean ecological resources.

Cultural Resources

Objective 1: *To preserve for present and future generations the opportunity to know and experience the arts, culture and history of Maui County.*

> ***Policy b:*** *Encourage the recordation and preservation of all cultural and historic resources, to include culturally significant natural resources.*
>
> ***Policy e:*** *Identify and maintain an inventory of significant and unique cultural resources for special protection.*

- Kauhale Lani is not expected to impact cultural resources as no cultural resources have been identified on the property; there is no evidence of past or present use for Hawaiian cultural practices, resources, or beliefs (see Section 3.2.2).
- No archaeological resources have been identified on the Kauhale Lani site, however, Maui Land & Pineapple Company, Inc., and its contractors will comply with all laws and rules regarding the preservation of archaeological, cultural, and historic sites should any sites be found during construction (see Section 3.2.1).

HOUSING AND URBAN DESIGN

Housing

Objective 1: *To provide a choice of attractive, sanitary and affordable homes for all of our residents.*

> ***Policy a:*** *Provide or require adequate physical infrastructure to meet the demands of present and planned future affordable housing needs.*

- Forecasts of housing demand project a need for approximately 4,600-plus homes (mid-point estimate) in the Upcountry area during the next 16 years (Hallstrom 2005). Approximately 94 percent, or more than 4,200 of the homes, would need to be single-family homes. Fewer than 500 home sites are currently proposed for the area.
- While the homes of the Kauhale Lani community will be priced at market rates, Maui Land & Pineapple Company Inc. will work with the County of Maui Department of Housing and Human Concerns to satisfy all County affordable housing requirements.

Urban Design

Objective 1: *To see that all developments are well designed and are in harmony with their surroundings.*

- Kauhale Lani is the logical expansion of Pukalani, as the site designated for residential uses (single-family) on the *Makawao-Pukalani-Kula Community Plan*, and is adjacent to the existing Lower Pukalani Terrace subdivision.

Policy a: *Require that appropriate principles of urban design be observed in the planning of all new developments.*

- Kauhale Lani will enrich the entrance to Pukalani by providing a community at the forefront of the town with architecture consistent with Upcountry Maui.

Objective 2: *To encourage developments which reflect the character and the culture of Maui County's people.*

Policy b: *Encourage community design that will establish a cohesive identity.*

- The Kauhale Lani community will provide a cohesive addition to Pukalani in character with the Upcountry region.

Policy c: *Encourage the establishment of continuous green areas, bike-paths, active and passive recreation areas and mini-parks in new subdivision development.*

- Kauhale Lani will include a pedestrian/bike trail along the New Hāmākua Ditch that wraps around the *makai* sides of the community, providing all residents with access to Central Maui views and an additional recreation area.
- The 39-acre parcel between Old Haleakalā Highway and Haleakalā Highway will include a pedestrian/bike trail running the length of the property from Old Haleakalā Highway to Makani Road with hopes to connect to the Upcountry Greenway Masterplan.

TRANSPORTATION

Water

Objective 1: *To provide an adequate supply of potable and irrigation water to meet the needs of Maui County's residents.*

Policy g: *Seek new sources of water by exploration in conjunction with other government agencies.*

Objective 2: *To make more efficient use of our ground, surface and recycled water sources.*

Policy a: *Reclaim and encourage the productive use of wastewater discharges in areas where such use will not threaten the integrity of ground water resources.*

- Maui Land & Pineapple Company, Inc. will drill a new well to obtain potable water for Kauhale Lani and dedicate the well to the County of Maui.
- Maui Land & Pineapple Company, Inc. is investigating the possibility of utilizing treated effluent to irrigate landscaped areas, the community park, and possibly the nearby Pukalani Golf Course.

Public Utilities and Facilities

Objective 2: *To improve the quality and availability of public facilities throughout Maui County.*

Policy a: *Encourage the design of multi-purposed public facilities accessible to all age groups and the handicapped.*

Policy b: *Continue the development of community centers throughout the County.*

- Recreational facilities of the community, such as an extensive trail system, will provide opportunities for increased physical fitness, contemplative views of Central Maui, and relief from daily stress. Further, the centralized neighborhood park may feature a community pavilion, play courts, and other recreational facilities that will provide a neighborhood center and gathering place for the community. Also, a few "pocket parks" dispersed throughout the community will provide additional gathering places. Kauhale Lani's parks and recreation areas will be accessible to people of all ages and ability and will be open to the public.

SOCIAL INFRASTRUCTURE

Recreation and Open Space

Objective 1: *To provide high-quality recreational facilities to meet the present and future needs of our residents of all ages and physical ability.*

Policy b: *Maintain recreational facilities for both active and passive pursuits.*

Policy c: *Maintain the natural beauty of recreational areas.*

Policy d: *Develop facilities that will meet the different recreational needs of the various communities.*

- Kauhale Lani will include pedestrian/bike trail along the New Hāmākua Ditch and wrapping around the *makai* sides of the community, providing all residents with access to Central Maui views and an additional recreation area.
- The 39-acre parcel between Old Haleakalā Highway and Haleakalā Highway will primarily be left in open space and will include a trail running the length of the property from Old Haleakalā Highway to Makani Road with future connectivity to the Upcountry Greenway Masterplan.
- A centralized neighborhood park may feature a community pavilion, play courts, and a few "pocket parks" dispersed throughout the community will provide additional recreational facilities.. Kauhale Lani's parks and recreation areas will be accessible to people of all ages and ability and will be open to the public.

4.3.2 Makawao-Pukalani-Kula Community Plan

The *Makawao-Pukalani-Kula Community Plan* is one of nine community plans for Maui County. It reflects current and anticipated conditions in the Upcountry region and advances planning goals, objectives, policies, and implementation considerations as a decision-making guide in the region through the year 2010 (see Figure 10). The *Makawao-Pukalani-Kula*

Community Plan provides specific recommendations addressing the goals, objectives, and policies contained in the General Plan, while still recognizing the values and unique attributes of the Upcountry region. The goals, objectives, policies, and implementing actions of the *Makawao-Pukalani-Kula Community Plan* applicable to the Kauhale Lani Community are discussed below.

LAND USE

Goal: *The maintenance and enhancement of Upcountry's unique and diverse rural land use character with sensitivity to existing land use patterns, natural resource values, and economic and social needs of the region's residents.*

Objective 1: *Recognize the value of open space, including agricultural lands and view planes to preserve the region's rural character.*

- Primary scenic views will not be significantly impacted by the Kauhale Lani community due to the topography of the site and an open space greenway path along the New Hāmākua Ditch. Portions of the community site will be preserved and enhanced as open space.

Objective 6: *Encourage new residential developments in areas which are contiguous extensions of, or infills within the established residential pattern, and which do not adversely affect agricultural uses.*

- While the Kauhale Lani site is zoned agricultural, the *Makawao-Pukalani-Kula Community Plan* designates the site for residential uses.
- The site is the logical expansion of Pukalani, as it is contiguous to residential uses of Pukalani.

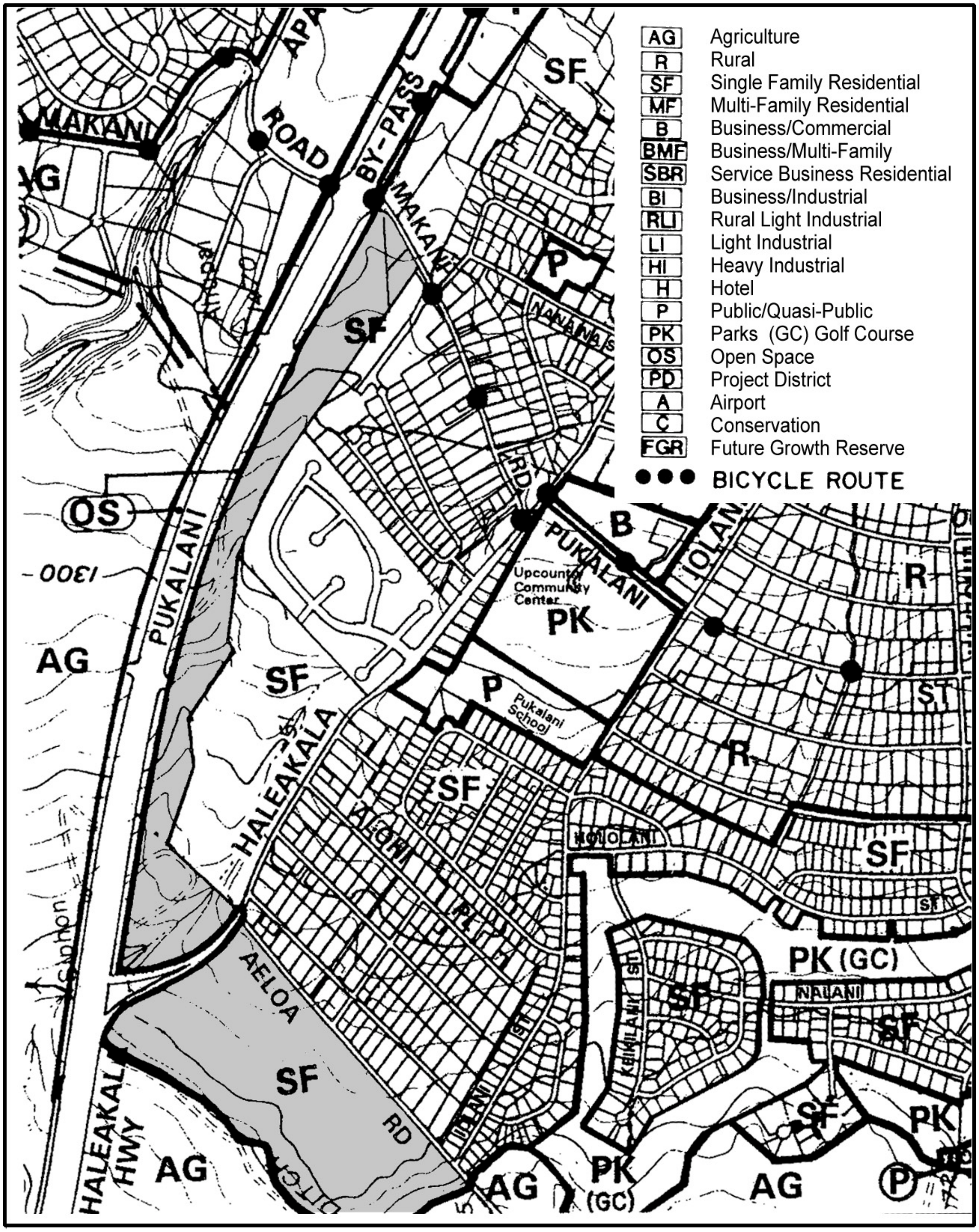
Objective 7: *Ensure that adequate lands are set aside for recreational and open space purposes.*

- Kauhale Lani will include extensive recreational open space, an extensive trail system, a centralized neighborhood park, and "pocket parks" which will provide opportunities for increased physical fitness, contemplative views of Central Maui, and relief from daily stress.

Objective 16: *Recognize the four (4) semi-urban centers of Makawao Town, Pukalani, Hāli'imaile, and Waiakoa Village. Within them, support the following land use and circulation patterns:*

b. Within Pukalani:
- *Single family expansion contiguous with existing residential uses.*
- *Parks and open spaces within and surrounding commercial and residential areas.*

- The site is the logical expansion of Pukalani, as it is contiguous to residential uses of Pukalani.
- A pedestrian/bike trail and greenway along the New Hāmākua Ditch as well as a centralized neighborhood park and smaller "pocket parks" will provide recreational benefits and a definite edge to the community. These open spaces will also provide a transition between the community and agricultural lands beyond.



LEGEND

Kauhale Lani Boundary

Source:
The County of Maui

Disclaimer:
This map has been prepared for general planning purposes only.

Figure 10
Makawao-Pukalani-Kula Community Plan

KAUHALE LANI

MAUI LAND & PINEAPPLE COMPANY, INC. ISLAND OF MAUI

NORTH

LINEAL SCALE (FEET)

0 1,000 2,000 4,000

PBR HAWAII

Objective 18: *Where appropriate, support the reclassification of State Land Use districts to ensure consistency between State Land Use designations and land use designations defined by the Makawao-Pukalani-Kula Community Plan land use map.*

- Kauhale Lani is in conformance with and implements the *Makawao-Pukalani-Kula Community Plan*. The entire area of Kauhale Lani is designated as "Single Family" on the *Makawao-Pukalani-Kula Community Plan* Land Use Map.

Objective 24: *Ensure an adequate supply of land designated for residential use to provide opportunity for residents to participate in housing market "trade ups."*

- The range of lot sizes within Kauhale Lani (from 6,000 square feet to approximately 12,000 square feet) will provide for a range of prices and allow for residents to participate in housing market "trade ups."

Objective 25: *Establish water resource availability as a major criteria in establishing land uses.*

- Maui Land & Pineapple Company, Inc., will drill a new well to obtain potable water for Kauhale Lani and dedicate the well to the County of Maui.

Implementing Action 8: *Utilize the land productivity inventory and assessment (i.e., Land Study Bureau "D" and "E" lands and ALISH) to identify low productivity lands which may be suitable for housing development.*

- The lands of the residential section of Kauhale Lani (49 acre parcel) are classified as "D" under the Land Study Bureau's classification system.

Implementing Action 11: *Determine the need for an additional school site(s) within the planning region at the time of LUC boundary amendments and/or zoning applications for additional housing projects. Special consideration should be given in this regard to additional housing in Hāliʻimaile Town.*

- The public schools that will service the Kauhale Lani community are currently under capacity and are anticipated to stay that way through the year 2009 according to projections provided by the State Department of Education. .The high end estimate of school-aged children (Grades K through 12) expected to reside in Kauhale Lani is 95. Private schools in the area such as the Kamehameha Schools Maui Campus, Seabury Hall and St. Joseph School provide additional school choices outside of the State system.

ENVIRONMENT

Goal: *Protection of Upcountry's natural resources and environment as a means of preserving and enhancing the region's unique beauty, serenity, ecology, and productivity, in order that future generations may enjoy and appreciate an environment of equal or higher quality.*

- The design of the Kauhale Lani community will be sensitive to the site on which it is located, and will be constructed in such a way as to minimize the impacts to the environment.

Objective 1: *Preserve environmental resources by maintaining important agricultural lands as an integral part of the open space setting in each community.*

- While the Kauhale Lani site is zoned agricultural, the University of Hawai‘i Land Study Bureau document titled *Detailed Land Classification, Islands of Kauai, Oahu, Maui, Molokai, and Lana"* classifies the land of Kauhale Lani as follows: approximately 21.6 acres as "fair" (C), 49 acres as "poor" (D), and 18 acres as "very poor" (F).
- Although the creation of Kauhale Lani will require that the approximately 89 acres of land previously used for pineapple cultivation be permanently withdrawn from agricultural use, this will only amount to about one percent of the approximately 5,800 acres currently in pineapple cultivation by Maui Pineapple Company, Ltd. Kauhale Lani will not lead to a decrease in Maui Land & Pineapple Company, Inc.'s agricultural viability.
- The *Makawao-Pukalani-Kula Community Plan* designates the site for single family residential uses, making the site a logical expansion of Pukalani.
- The proposed recreational facilities will provide open space in the community as well as a transition zone to the remaining agricultural lands adjacent to the community site.

Objective 3: *Recognize and protect rare, endangered and unique biological resources in the region.*

- There are no rare, threatened, or endangered flora, fauna, or avifauna species, or habitats for these species, on the Kauhale Lani community site.

Objective 9: *Promote landscaping which utilizes endemic and indigenous plant species.*

- Kauhale Lani landscaping will include non-invasive species and, where feasible, native and indigenous plants. Drought-tolerant, hardy plants and grasses will also be used where feasible to minimize the need for irrigation.

CULTURAL RESOURCES

Goal: *The identification, preservation and where appropriate, restoration and promotion of cultural resources and practices which reflect the rich and diverse heritage found in the Upcountry region.*

Objective 1: *Recognize the importance of historically and archaeologically sensitive sites, both known and undiscovered, and encourage their preservation and protection.*

Objective 2: *Support public and private efforts to inventory, evaluate, classify, register, and protect, as appropriate, cultural resources to increase public knowledge of the region's rich and diverse cultural character.*

- Kauhale Lani is not expected to impact cultural resources as no cultural resources have been identified on the property; there is no evidence of past or present use for Hawaiian cultural practices, resources, or beliefs (see Section 3.2.2).
- No archaeological resources have been identified on the Kauhale Lani site, however, Maui Land & Pineapple Company, Inc., and its contractors will comply with all laws and rules regarding the preservation of archaeological, cultural, and historic sites should any sites be found during construction (see Section 3.2.1).

URBAN DESIGN

Goal: *Recognition and preservation of the unique design characteristics of the Makawao, Pukalani and Kula communities in order to enhance Upcountry's man-made environment.*

Objectives 5: *Preserve the unique characteristics of all of the Upcountry towns by recognizing and respecting architectural styles as described in the Country Town Design Guidelines.*

Objectives 7: *Encourage the use of appropriate landscaping, with greenways where possible, along major roadways, parking areas and land use transition areas to establish and maintain landscape themes which are consistent with the character of each Upcountry community.*

- The architectural design for the homes of Kauhale Lani will be consistent with the Upcountry Maui architectural style.
- The 50-acre parcel will include a wide landscaped buffer area along Old Haleakalā Highway and design standards will include a unified streetscape planting theme and program to ensure the appropriate use of landscaping and compliance with the Maui County Planting Plan.

LIQUID AND SOLID WASTE DISPOSAL

Objectives 3: *Support wastewater reclamation and grey water alternatives as a means of reducing demands upon limited water resources in the Upcountry region.*

Implementing Action 2: *Construct a wastewater collection and treatment system for the Waiakoa, Makawao, Pukalani and all new urban developments.*

Implementing Action 3: *Utilize treated effluent for irrigation of farms, golf courses, parks and highway landscaping.*

- A wastewater collection, treatment and disposal system will be developed to service the new community.
- Maui Land & Pineapple Company Inc., is investigating the possibility of utilizing treated effluent to irrigate landscaped areas, the community park, and possibly the nearby Pukalani Golf Course.

Drainage

Objective *1: Respect and preserve natural drainageways as part of good land development practices and recognize their value as open-space corridors.*

- ML&P intends to develop a loop trail (approximately 25 feet wide), a portion of which will be located parallel to the New Hāmākua Ditch, for the residents of the Kauhale Lani community. The majority of the 39-acre parcel will also be preserved as an open space corridor; it is a natural drainage way and will consist of mature trees and native vegetation.

ENERGY

***Implementing Action** 1: Adopt standards and regulations for the use of solar water heating, low flush toilets and other conservation fixtures in new building construction.*

- Solar water heating, low flush toilets and other conservation fixtures will be required for Kauhale Lani homes.

***Implementing Action 3:** Use energy efficient street lights and develop appropriate street lighting standards for agricultural and rural areas.*

- It is anticipated that public street lighting will be "dark sky" compliant to minimize light pollution and interference with observatories at the summit of Haleakalā.

HOUSING

***Goal:** Housing opportunities for the residents of Makawao-Pukalani-Kula, to include all income and age groups, which are affordable, safe, and environmentally and culturally compatible.*

***Objective 2:** Provide increased opportunities for affordable housing through:*
***Policy i**: Provision of variable housing densities in areas designated for residential use.*

- The range of lot sizes within Kauhale Lani (from 6,000 square feet to approximately 12,000 square feet) will provide for a range of prices.
- While the homes of the Kauhale Lani community will be priced at market rates, Maui Land & Pineapple Company Inc., will work with the County of Maui Department of Housing and Human Concerns to satisfy all County affordable housing requirements.

SOCIAL INFRASTRUCTURE

***Goal:** An efficient and responsive system of people-oriented public services which enable residents to live a safe, healthy and enjoyable lifestyle, and offer the youth and adults of the region opportunities and choices for self and community improvement.*

Recreation

***Objective 4:** Pursue the development of equestrian trails, pathways, greenways and related facilities which will meet the recreational needs of runners, joggers, walkers, horseback riders and cyclists.*

- Kauhale Lani's extensive trail system will provide opportunities for increased physical fitness, contemplative views of Central Maui, and relief from daily stress.

GOVERNMENT

***Goal:** The provision of accessible, cost effective and responsive government services and programs which meet the needs of Upcountry residents.*

Planning Standards

The following planning standards are specific guidelines or measures for development and design. These standards are essential in clarifying the intent of the land use and urban design objectives and policies and the Land Use Map.

1. Land Use

b. *New residential subdivisions shall be reviewed for possible encroachment or other impacts to existing agricultural operations. Appropriate mitigative measures such as the provision of buffers and/or open spaces; larger building setbacks; significantly larger lot sizes; the incorporation of cluster housing to maintain overall allowable densities; or the use of other appropriate means to mitigate possible impacts shall be used. Possible uses for buffer spaces could be utilized for such uses such as bikepaths, equestrian trails and jogging.*

- Landscaped buffers and open spaces will be incorporated into the new community.
- A pedestrian/bike trail and greenway along the New Hāmākua Ditch will provide recreational benefits, a definite edge to the community, and a transition between the community and agricultural lands beyond.

5. Landscape Planting

a. Native plant species which are found in the region should be utilized for new public and quasi-public facilities. The use of native plants in landscaping should be encouraged in all new developments.

- Kauhale Lani landscaping will include non-invasive species and, where feasible, native and indigenous plants recommended by the County of Maui for the specific climate. Drought-tolerant, hardy plants and grasses will also be use where feasible to minimize the need for irrigation.
- Design standards for the community will include a unified streetscape planting theme and program to ensure the appropriate use of landscaping and compliance with the Maui County Planting Plan.

6. Subdivisions

Subdivision review for applications of four (4) lots or more shall include the following considerations:

a. Socio-Economic Considerations

The direct and cumulative impacts on agriculture and the socio-economic impacts on the community shall be assessed and considered.

- Section 3.2.6 contains discussion of Socio-economic considerations.
- Section 3.1.4 contains discussion of direct and cumulative impacts on agriculture.

c. Improvements

County urban subdivision standards shall not apply to rural and agricultural lands of the Upcountry Region. The following rural standards shall be considered:

- *Curbs and gutters shall not be required. Grassed shoulders and swales shall be allowed without curbs.*
- *Sidewalks shall be provided on one side of the street for County roads within a 3/4-mile radius of developed or proposed school sites.*
- *Street lighting shall not be required.*
- *Roadway pavement width shall provide for a minimum 4-ft. bikelane in each direction of travel.*
- *Highways and major roadways shall have a minimum pavement width of 20 feet (10 foot travel lanes), and shoulder width of 4 feet, to provide for the safe passage of two-way traffic, except in areas where natural landforms, historic structures and other environmental constraints preclude widening beyond existing roadway widths.*

- Roadways within the community will be built to County of Maui standards, while keeping in character with the Upcountry region. Interior block alleyways will provide access to some garages, which will be located toward the back of the homes. The typical street section design was based upon Chapter 18.16.050 "Minimum Right-of-Way and Pavement Widths", Subdivision Design Standards of the County Code for rural streets

4.3.3 Maui of County Zoning

The land of the Kauhale Lani site is currently within the County Agricultural District (Figure 11). Maui Land & Pineapple Company Inc. is seeking a Change in Zoning to change the zoning of the property to the Residential R-1 District.

The residential uses within the Kauhale Lani community will be in conformance with the Residential R-1 District. Lots will be at least 6,000 square feet with a minimum lot width of 60 feet, a minimum front yard of 15 feet, and minimum side and rear yards of six feet, or ten feet for two-story structures. Homes will not be over two stories or 30 feet.

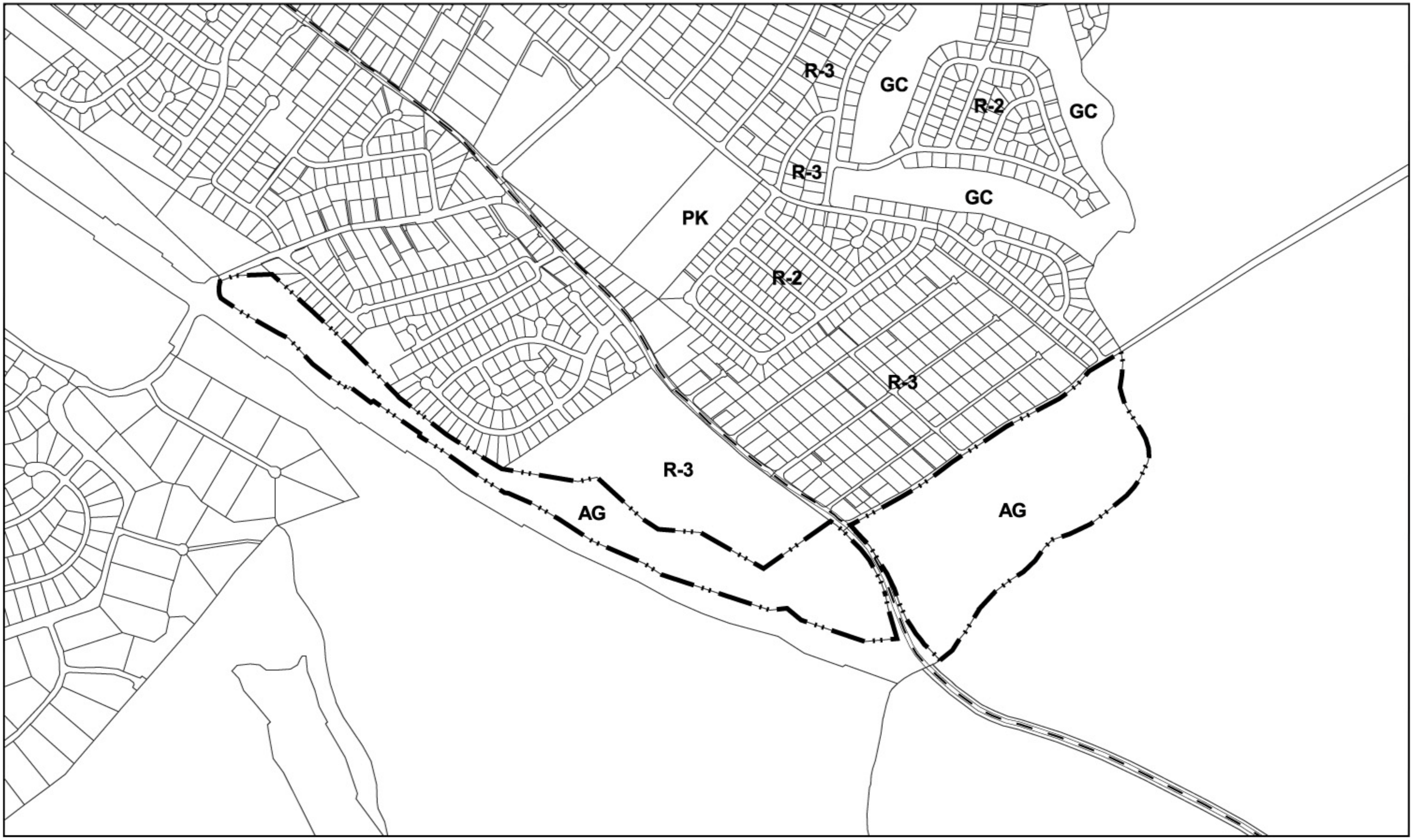
Section 19.30A.020 of the Maui County Zoning Ordinance states:

Agricultural lands that meet at least two of the following criteria should be given the highest priority for retention in the agricultural district:

A. *Agricultural Lands of Importance to the State of Hawai'i (ALISH);*
B. *Lands not classified by the ALISH system whose agricultural land suitability, based on soil, topographic, and climatic conditions, supports the production of agricultural commodities, including, but not limited to coffee, taro, watercress, ginger, orchard and flower crops and non-irrigated pineapple. In addition, these lands shall include lands used for intensive animal husbandry, and lands in agricultural cultivation in five of the ten years immediately preceding the date of approval of this chapter; and*
C. *Lands which have seventy-five percent or more of their boundaries contiguous to lands within the agricultural district.*

Although the lands of the Kauhale Lani community site meet two of the above criteria, the site should be rezoned to the Residential zone for the following reasons:

- The entire area of the Kauhale Lani site is designated as "Single Family" on the *Makawao-Pukalani-Kula Community Plan* Land Use Map. Changing the zoning to the



LEGEND

R-2	Residential	AG	Agricultural
R-3	Residential	GC	Golf Course
P-1	Public	PK	Park
RU-0.5	Rural 1/2 Acre		

Kauhale Lani Boundary

Source:
The State of Hawaii GIS Database

Disclaimer:
This map has been prepared for general planning purposes only.

Figure 11

Zoning Map

KAUHALE LANI

MAUI LAND & PINEAPPLE COMPANY, INC. ISLAND OF MAUI

NORTH

LINEAL SCALE (FEET)

0 500 1,000 2,000

Residential zone will bring the property into conformance with, and implement, the *Makawao-Pukalani-Kula Community Plan*. As represented by the "Single-Family" designation, residential uses on the site are appropriate and represent the carefully thought out expansion of Pukalani consistent with sound environmental planning practice.

- While the Kauhale Lani site is zoned Agricultural, the University of Hawai'i Land Study Bureau's *"Detailed Land Classification, Islands of Kauai, Oahu, Maui, Molokai, and Lanai"* classifies the land of the Kauhale Lani site as follows: approximately 21.6 acres as "fair" (C), 49 acres as "poor" (D), and 18 acres as "very poor" (F), indicating the poor suitbility of the soils for agriculture.
- According to the *United States Department of Agriculture Soil Conservation Service, Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, ,*the 50-acre parcel is dominated by Hāli'imaile Silty Clay (HhB), and (HhC) soils. In their natural state, these soils are not irrigated. The non-irrigated capability classification of the these soils have a subclass rating of IIIe, which indicates severe limitations and erosion potential when cultivated and not protected. Without irrigation, these lands are naturally unsuitable for agriculture.
- Approximately 30 percent of the boundaries of the 39-acre parcel are contiguous to Residential zoned, however this calculation does not include the boundary with Haleakalā Highway and Old Haleakalā Highway, which are both in the Agricultural zone but are a substantially urban use.
- Approximately 25 percent of the boundaries of the 50-acre are contiguous to Residential zoned, however this calculation does not include the boundary with Old Haleakalā Highway which is in the Agricultural zone but is a substantially urban use.
- Cultivation of both parcels was discontinued in 2002. Both parcels are inefficient to farm as part of Maui Pineapple Company, Ltd., operations since the Pukalani Bypass separated these parcels from other contiguous, more suitable Maui Pineapple Company, Ltd. pineapple fields.
- Kauhale Lani will not impact Maui Land & Pineapple Company, Inc.'s long-term goals for continuing agricultural operations on Maui (see Section 3.1.4). Maui Pineapple Company, Ltd. is keeping its best land in cultivation and exploring options to cultivate pineapple on other more suitable lands.

4.3.4 Special Management Area

The Kauhale Lani community site is not in the Special Management Area (SMA).

4.4 APPROVALS AND PERMITS

During the implementation stages of the project, the applicant will be working with the State and County review agencies for examination and approval of project plans and specifications.

Table 6. Required Permits and Approvals

Permit/Approval	Responsible Agency
Chapter 343, HRS compliance	State Land Use Commission DOH Office of Environmental Quality Control
State Land Use District Boundary Amendment (Agricultural to Urban)	State Land Use Commission
Change in Zoning (Agricultural to Residential R-1)	Maui County Planning Commission and Maui County Council
NPDES Permit	State Department of Health
Subdivision Approval	Maui County Planning Department
Wastewater System Approval	Maui County Department of Public Works & Environmental Management, Wastewater Administration & Engineering
Grading/Building Permits	Maui County Department of Public Works & Environmental Management, Development Services Administration

5.0 ALTERNATIVES

According to Title 11, Department of Health, Chapter 200, Environmental Impact Statement Rules, Section 11-200-10(F), an environmental assessment must discuss potential alternatives to the proposed action.

Three alternatives to the Kauhale Lani community were considered: 1) no action; 2) agricultural subdivision; and 3) the preferred alternative. These alternatives are discussed below.

5.1 NO ACTION ALTERNATIVE

Under the "no action" alternative, the Kauhale Lani community would not be built and the property would remain fallow pineapple fields. Under this alternative:

- The property would remain inconsistent with the *Makawao-Pukalani-Kula Community Plan*, which designates the entire area of the Kauhale Lani site as "Single-Family," and would not implement other State and County governmental policies as discussed in Chapter 4.
- No homes would be built on the property, despite housing demand forecasts for the need for approximately 4,600-plus homes (mid-point estimate) in the Upcountry area during the next 16 years (Hallstrom 2005).
- Economic benefits projected from Kauhale Lani would not be realized, including:
  - $81.7 million in direct, new capital investment and spending into the Maui economy during the planning and construction period
  - $20.1 million in total gross tax revenues for the State of Hawaiʻi and $6.1 million in taxes for the County of Maui during the build out period.
  - $2.5 million annually in stabilized taxes for the State and approximately $864,000 annually for the County after the build out period.
  - $8.5 million annually in net benefits (taxes minus costs) to the State and $1.5 million annually in net benefits to the County during the build out period.
  - $502,000 annually in stabilized net benefits (taxes minus costs) to the State and $62,000 annually in net benefits to the County.
  - 522 worker years (one worker/year is approximately equal to 2,000 hours) in construction related jobs during the build out period.
  - $33.6 million in total wages over the build out period.
  - 21 full-time equivalent jobs related to on-site activities, on a stabilized basis, after build-out.
  - $597,000 million in annual wages after build out.

5.2 AGRICULTURAL SUBDIVISION

The property is currently within the County Agricultural District (zone). Permitted uses in the Agricultural District include: agriculture, animal and livestock raising, and agricultural land conservation. One farm dwelling per lot is also allowed within the Agricultural District. In addition, one farm labor dwelling per every five acres is permitted provided the owner can provide proof of at least $35,000 of gross sales of agricultural products per year for each farm labor dwelling on the lot.

The County of Maui Zoning Ordinance lays out provisions for an agricultural subdivision. The formula that applies to the Kauhale Lani community is:

For properties at least 31 but less than 61 acres, the maximum number of permitted lots is:

- *Seven lots that have a two-acre minimum lot size; plus one additional lot for each 10 acres above 31 acres.*

Applying this formula to the Kauhale Lani parcels, the 50-acres parcel could be subdivided into eight lots and the 39-acre parcel could be subdivided into seven lots.

Under this alternative, the property would remain inconsistent with the *Makawao-Pukalani-Kula Community Plan*, which designates the entire area of the Kauhale Lani site as "Single-Family."

5.3 THE PREFERRED ALTERNATIVE

The preferred alternative is the Kauhale Lani community as described in Section 2.2 and throughout this environmental assessment. As proposed, the community will provide approximately 165 new homes in Pukalani on a site already designated for residential use on the *Makawao-Pukalani-Kula Community Plan*. The 50-acre parcel west of Old Haleakalā Highway will contain the residential neighborhood, while the 39-acre parcel between Old Haleakalā Highway and Haleakalā Highway will contain open space, community trails, and other community amenities (Figure 4).

The goal of the Kauhale Lani community is to provide a cohesive addition to Pukalani in character with the Upcountry region. The community will be a walkable neighborhood designed to enhance connectivity by way of pedestrian-friendly streets, alley ways, and a perimeter pedestrian/bike trail. A centralized neighborhood park may feature a community pavilion and play courts, providing a neighborhood center and gathering place for the community.

In addition to the central park, the community will include a wide greenway/pedestrian/bike trail along the New Hāmākua Ditch that wraps around the *makai* sides of the community, providing all residents with access to Central Maui views and an additional recreation area. The 39-acre parcel between Old Haleakalā Highway and Haleakalā Highway will include a pedestrian/bike trail running the length of the property from Old Haleakalā Highway to Makani Road with future connectivity to trails designated in the Upcountry Greenway Masterplan.

In addition, under the preferred alternative:

- The use of the land for residential uses will bring the property into conformance with, and implement, the *Makawao-Pukalani-Kula Community Plan*.
- The zoning of the property will be changed to Residential in conformance with the "Single Family" designation of the Community Plan.
- The new homes will help to satisfy a portion of the projected need for approximately 4,600-plus homes (mid-point estimate) in the Upcountry area over the next 16 years.

- The County of Maui will receive increased property tax revenues based on the higher tax rate of Residential zoned land (vs. the current Agricultural zoning) and the value of the homes.
- The State of Hawaiʻi and the County of Maui will benefit from increased excise tax receipts and income taxes from construction and other employment related benefits of the community.

(This page intentionally left blank.)

6.0 DETERMINATION, FINDINGS, AND REASONS FOR SUPPORTING THE DETERMINATION

To determine whether the proposed action may have a significant impact on the environment, every phase and expected consequences, both primary and secondary, and the cumulative as well as short and long-term effects have been evaluated. Based on the analyses performed and research evaluated, it is anticipated that the approving agency, the State Land Use Commission, will issue a Finding of No Significant Impact (FONSI) as summarized in this section.

6.1 SIGNIFICANCE CRITERIA

According to the Department of Health Rules (11-200-12), an applicant or agency must determine whether an action may have a significant impact on the environment, including all phases of the project, its expected consequences both primary and secondary, its cumulative impact with other projects, and its short and long-term effects. In making the determination, the Rules establish "Significance Criteria" to be used as a basis for identifying whether significant environmental impact will occur. According to the Rules, an action shall be determined to have a significant impact on the environment if it meets any one of the following criteria:

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

The Kauhale Lani community will not result in an irrevocable commitment to loss or destruction of any natural or cultural resources. There are no known archaeological or cultural properties, no evidence of past or present use for Hawaiian cultural practices, resources, or beliefs, and no known rare, threatened or endangered species of flora, fauna or avifauna located within the property.

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

The Kauhale Lani community will not curtail the range of beneficial uses of the environment. This community is intended to provide additional housing in the Upcountry region. Use of the land for housing is appropriate in the context of the *Makawao-Pukalani-Kula Community Plan* and the current need for new housing inventory.

(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 State's Environmental Policy and Guidelines are set forth in Chapter 344, Hawai'i Revised Statutes. The Kauhale Lani community is in accord with these policies and guidelines.

(4) Substantially affects the economic welfare, social welfare, and cultural practices of the community or state;

The Kauhale Lani community is expected to have a direct beneficial effect on the local economy. The addition of new housing units addresses the need for homes in the region. Analysis of projected tax revenues to the State of Hawaiʻi and Maui County (see Section 3.2.6.4) indicates the actual effect of governmental services relating to the population of Kauhale Lani would not create the need to expand additional County and State funding on Maui (Hallstrom 2005).

The State of Hawaiʻi and the County of Maui will both show a positive net revenue benefit from Kauhale Lani. Direct tax benefits to the State and County will primarily flow from the community and its operation over time from three major sources: real property taxes, gross excise tax receipts, and state income taxes. Should the County choose to allocate these additional tax revenues to fund more services to protect public health, welfare, and safety, any cost to the public that may result will be effectively minimized.

Kauhale Lani is not expected to impact cultural resources as no cultural resources have been identified on the property; there is no evidence of past or present use for Hawaiian cultural practices, resources, or beliefs.

(5) Substantially affects public health;

The Kauhale Lani community is not expected to substantially affect public health. Environmental impacts from the community, such as noise and air pollution, will be minimal. A clean source of water will be provided. Wastewater will be property handled. Additional drainage will be retained onsite. Solid waste will be disposed of properly.

In addition, recreational facilities of the community, such as an extensive trail system, will provide opportunities for increased physical fitness, contemplative views of Central Maui, and relief from daily stress. Further, the neighborhood park will provide a gathering place for the community and family functions.

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

The Kauhale Lani community does involve substantial secondary impacts. The 548 residents of Kauhale Lani represent a relatively insignificant population increase of approximately two percent compared to the projected 2005 Upcountry population of 23,369 people. Kauhale Lani residents are not expected to adversely impact public services such as police, fire, and emergency medical operations, nor are they anticipated to have an adverse effect upon educational and recreational facilities. State and county revenues generated by Kauhale Lani will offset any costs to public services that may occur as a result of the new community.

(7) Involves a substantial degradation of environmental quality;

Kauhale Lani does not involve a substantial degradation of environmental quality. During the construction phase, there will be short-term air quality and noise impacts. In the long-term, effects upon air quality and ambient noise levels will be minimal. Other impacts, such as site grading, increased runoff, and use of resources, are not expected to be significant and can be mitigated with proper management techniques. .

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

The Kauhale Lani community does not involve a commitment to larger actions. As represented by the "single-family" designation on *Makawao-Pukalani-Kula Community Plan,* residential uses on the site represent the carefully thought out expansion of Pukalani. While Kauhale Lani will add residents to the area, impacts from these new residents are not expected to be significant, and can be accommodated without substantially increasing public infrastructure or services.

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

There are no rare, threatened, or endangered flora, fauna, or avifauna species, or habitats for these species, on the Kauhale Lani community site.

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

Construction activities will result in short-term air quality and noise impacts. Dust control measures, such as regular watering and sprinkling, will be implemented to minimize wind-blown emissions. Noise impacts will occur primarily from construction-related activities. It is anticipated that construction will be limited to daylight working hours. Water quality is not expected to be affected.

In the long-term, the community is not anticipated to have a significant impact on air, water quality, or ambient noise levels.

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

The Kauhale Lani community is not located within, and will not affect, environmentally sensitive areas. The site is not subject to flooding or tsunami inundation. There are no geologically hazardous lands, estuaries, or coastal waters within or adjacent to the site.

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

The Kauhale Lani community site is not identified as a scenic vista or view plane nor will it affect identified scenic vistas or view planes. The community will not affect scenic corridors and coastal scenic and open space resources. Although Kauhale Lani will be built at the entrance to Pukalani, the community is expected to enhance this gateway, as landscaping will be improved and maintained on a regular basis and design standards will provide for a unified streetscape planting theme in compliance with the Maui County Planting Plan.

(13) Requires substantial energy consumption.

The Kauhale Lani community will involve the short-term commitment of fuel for equipment, vehicles, and machinery during construction activities. However, this use is not anticipated to result in a substantial consumption of energy resources. In the long-term, the community will create an additional demand for electricity. However, this demand is not deemed substantial or excessive within the context of the region's overall energy consumption.

Based on the foregoing findings, it is anticipated that the Kauhale Lani community will not result in any significant impacts.

6.2 ANTICIPATED DETERMINATION

On the basis of impacts and mitigative measures examined in this document and analyzed under the above criteria, it is anticipated that the Kauhale Lani community will not have a significant effect on the local, County, or Statewide physical or human environments. Pursuant to Chapter 343, HRS, it is anticipated that the Approving Agency, which in this case is the State Land Use Commission, will issue a Finding of No Significant Impact (FONSI).

7.0 REFERENCES

Baker, H.L. et al. (1967) *Detailed Land Classification, Island of Maui*. L.S. Land Study Bureau, University of Hawai'i. Honolulu, Hawai'i.

County of Maui. (1990) *General Plan of the County of Maui 1990 Update*. Wailuku, Hawai'i.

County of Maui. (1996) *Makawao-Pukalani-Kula Community Plan*. Wailuku, Hawai'i.

Federal Emergency Management Agency. (1988) *Flood Insurance Rate Map.*

Ferrell, Geoffrey, with Marcela Camblor and David Goodman. "Design Principles for Neighborhoods and Towns". Available at www.tndhomes.com (January 20, 2005).

Heliker, C. (1991). *Volcanic and Seismic Hazards on the Island of Maui*. U.S. Geological Survey.

Juvik, S. & J. Juvik, eds. (1998) *Atlas of Hawai'i*. 3rd edition. University of Hawai'i Press. Honolulu, Hawai'i.

Macdonald, Gordon A., Again T. Talbot, Frank L. Peterson. (1983) *Volcanoes Under the Sea: The Geology of Hawai'i*. University of Hawai'i Press, Honolulu.

R. M. Towill Corporation. (2002) *Public Facilities Assessment Update County of Maui*. Report prepared for County of Maui Department of Planning.

SMS. (2003) *Maui County Community Plan Update Program: Socio-Economic Forecast, Phase II Report*. Report prepared for County of Maui Planning Department.

State of Hawai'i, Department of Agriculture. (1977) *Agricultural Lands of Importance to the State of* Hawai'i. Honolulu, Hawai'i.

State of Hawai'i, Department of Business, Economic Development & Tourism. "Statistics and Economic Information". Available at: http://www3.hawaii.gov/dbedt/index.cfm?parent=statistics_and_economic_information (May 12, 2005).

State of Hawai'i, Department of Education, Facilities Division. *Maui Capacity and Enrollment*. Personal Communication, January 31, 2005 and April 19, 2005.

United States Department of Agriculture, Soil Conservation Service. (1972) *Island of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii.*

Wilson Okamoto Corporation. (2003) *County of Maui Infrastructure Assessment Update*. Report prepared for County of Maui Department of Planning. Honolulu, Hawai'i.

(This page intentionally left blank.)

A

Pre-consultation Comment & Response Letters

PRE-CONSULTATION COMMENTS AND RESPONSES

Letters requesting pre-consultation comments on the proposed project were sent to the following agencies and organizations on March 29, 2005. Where indicated, the agency or organization submitted written comments. These comments and response letters are included on the following pages.

	AGENCY	Comments
	County of Maui	
1	Department of Housing & Human Concerns	4/4/05
2	Department of Parks & Recreation	4/28/05
3	Department of Planning	4/25/05
4	Department of Public Works & Environmental Management	4/14/05
5	Department of Water Supply	
6	Fire Department	4/4/05
7	Police Department	
	State of Hawai'i	
8	Department of Agriculture – Maui Office	
9	Department of Agriculture – State Office	
10	Department of Business, Economic Development & Tourism – Office of Planning	5/4/05
11	Department of Education	4/13/05
12	Department of Health – Clean Water Branch	4/7/05
13	Department of Health – Maui District Health Office	4/14/05
14	Department of Health – Safe Drinking Water Branch	
15	Department of Health – Wastewater Branch	4/11/05
16	Department of Land & Natural Resources	
17	Department of Land & Natural Resources – State Historic Preservation Division	
18	Department of Transportation	
19	Office of Hawaiian Affairs	
	Private Companies, Organizations & Individuals	
20	Maui Electric Company, Ltd.	4/14/05
21	Verizon Hawaii, Inc.	4/21/05

March 29, 2005

Mr/Ms. XXXXXX, Title
Department of XXXXXXXX
XXXXXXXXX Street
XXXXXXXX, Hawaii 96XXX

SUBJECT: KAUHALE LANI DRAFT ENVIRONMENTAL ASSESSMENT

Dear Mr./Ms.XXXXX:

PBR Hawaii is currently preparing an environmental assessment for Maui Land & Pineapple Company, Inc.'s proposed Kauhale Lani community. As shown on the attached map, the Kauhale Lani community site is located on the slopes of Haleakalā at the entrance to Pukalani, where Old Haleakalā Highway branches off from Haleakalā Highway. Two parcels, identified by TMK 2-3-09:07 (50 acres) and TMK 2-3-09:64 (39 acres) comprise the community site. Old Haleakalā Highway bisects the parcels. The Makawao-Pukalani-Kula Community Plan designates both parcels for single-family residential uses.

Single family homes, parks, and a trail system are proposed on the 50-acre parcel (TMK 2-3-9: 7). Up to 165 single family homes may be included. Uses on the 39-acre property (TMK 2-3-09:064) are undetermined but could include a small wastewater treatment plant to serve the community and trails and open space.

Maui Land & Pineapple Company Inc., will seek a State Land Use District Boundary Amendment from the State Land Use Commission to change the designation of the properties from the Agricultural District to the Urban District. In addition, a Change in Zoning from Agricultural to Residential zoning (R-1) will be sought from the County of Maui.

As part of the scoping process, we are writing to consult with your agency. We seek your comments as to whether the proposed Kauhale Lani community may have an impact on any of your existing or proposed projects, plans, policies or programs. We would appreciate receiving your comments by April 20, 2005.

Please do not hesitate to contact me if you need any additional information or have any questions.

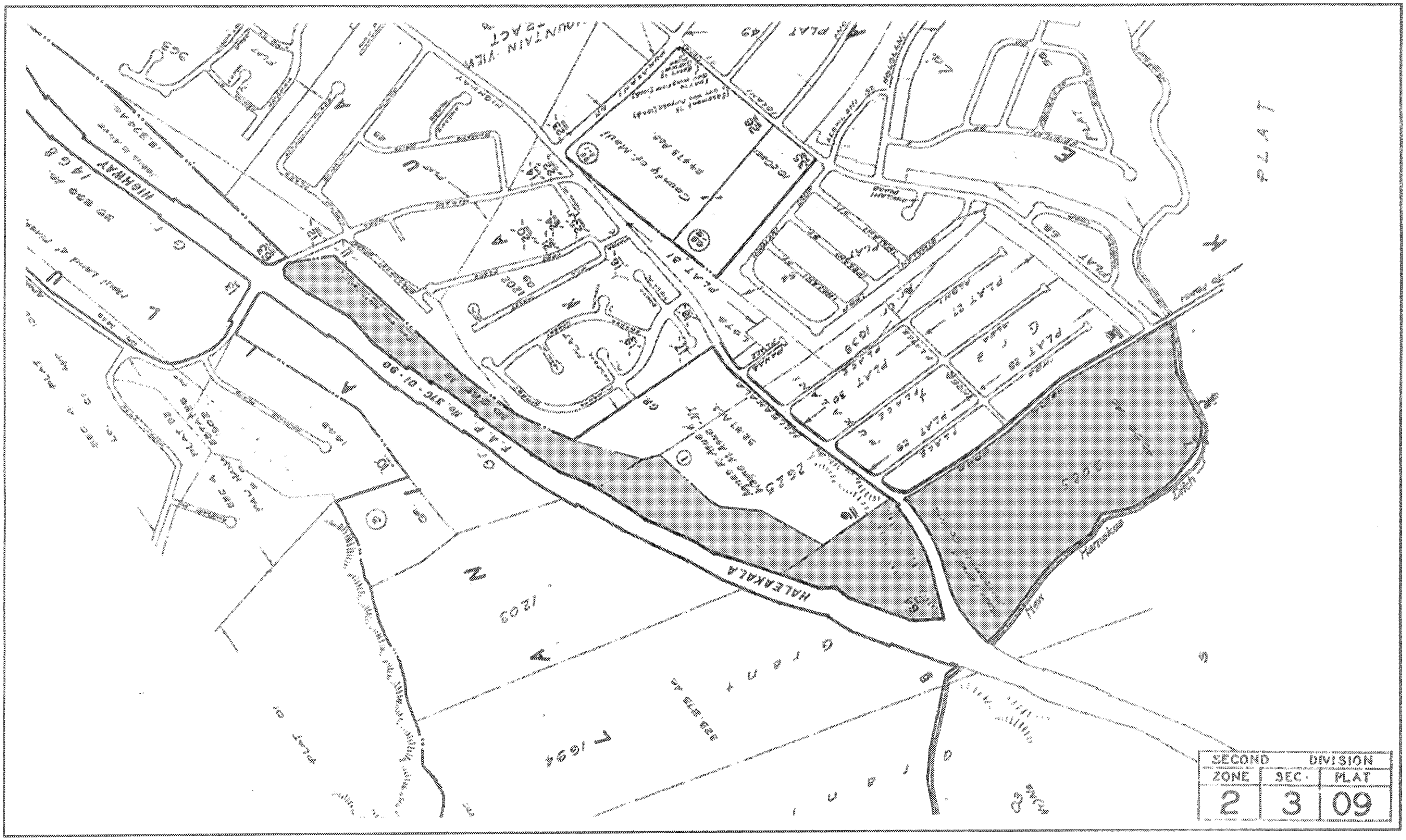
Sincerely,

PBR HAWAII

Tom Schnell, AICP
Associate

Enclosure

cc: Leilani Pulmano/Maui Land & Pineapple Company, Inc.



LEGEND

Kauhale Lani

Source:
County of Maui Tax Map Key

Disclaimer:
This map has been prepared for general planning purposes only.

Tax Map Key Map

KAUHALE LANI

MAUI LAND & PINEAPPLE COMPANY, INC.

ISLAND OF MAUI

NORTH

LINEAL SCALE (FEET)

0 500 1,000 2,000

PBR HAWAII

ALAN M. ARAKAWA
MAYOR

COUNTY OF MAUI
DEPARTMENT OF FIRE AND PUBLIC SAFETY

200 DAIRY ROAD
KAHULUI, MAUI, HAWAII 96732
(808) 270-7561
FAX (808) 270-7919

CARL M. KAUPALOLO
CHIEF

NEAL A. BAL
DEPUTY CHIEF

RECEIVED
APR 1 8 2005
PBR HAWAII

April 4, 2005

Tom Schnell, AICP
PBR Hawaii
2123 Kaohu Street
Wailuku, HI 96793

Subject: Kauhale Lani Draft Environmental Assessment

Dear Mr. Schnell,

At this time, our department does not have any concerns regarding the proposed project. I do imagine that we will be involved in the planning of this project and hope to make more detailed reviews as the project moves ahead.

Sincerely,

Valeriano F. Martin
Captain
Fire Prevention Bureau

PBR HAWAII

LAND PLANNING
LANDSCAPE ARCHITECTURE
ENVIRONMENTAL STUDIES

WM. FRANK BRANDT, FASLA
Chairman

THOMAS S. WITTEN, ASLA
President

R. STAN DUNCAN, ASLA
Executive Vice-President

RUSSELL Y.J. CHUNG, ASLA
Executive Vice-President

VINCENT SHIGEKUNI
Principal

JAMES LEONARD, AICP
Principal
Hilo Office

GRANT MURAKAMI, AICP
Senior Associate

TOM SCHNELL, AICP
Associate

RAYMOND T. HIGA, ASLA
Associate

KEVIN NISHIKAWA, ASLA
Associate

HONOLULU OFFICE
1001 BISHOP STREET
ASB TOWER, SUITE 650
HONOLULU, HAWAI'I 96813-3484
TEL: (808) 521-5631
FAX: (808) 523-1402
E-MAIL: sysadmin@pbrhawaii.com

HILO OFFICE
101 AUPUNI STREET
HILO LAGOON CENTER SUITE 310
HILO, HAWAI'I 96720-4262
TEL: (808) 961-3333
FAX: (808) 961-4989
E-MAIL: pbrhilo@ilhawaii.net

WAILUKU OFFICE
2123 KAOHU STREET
WAILUKU, HAWAI'I 96793-2204
TEL: (808) 242-2878
FAX: (808) 242-2902
E-MAIL: pbrmaui@[illegible]

May 12, 2005

Mr. Valeriano F. Martin, Captain
County of Maui
Department of Fire and Public Safety
200 Dairy Road
Kahului, Hawaii 96732

SUBJECT: KAUHALE LANI DRAFT ENVIRONMENTAL ASSESSMENT

Dear Captain Martin:

Thank you for your letter dated April 4, 2005. As the consultant for Maui Land & Pineapple Company, Inc., we acknowledge that you have no concerns regarding the project at this time. We will continue to consult with you throughout the planning of Kauhale Lani.

Thank you again for your participation in the preparation of the upcoming Environmental Assessment. If you have any questions regarding this project, please do not hesitate to contact me.

Sincerely,

PBR HAWAII

Tom Schnell, AICP
Associate

cc: Leilani Pulmano/Maui Land & Pineapple Company, Inc.

O:\JOB10-11\1116.07\EA\Preconsultation Letters\Responses\BL-05 Fire.doc

ALAN M. ARAKAWA
Mayor

MILTON M. ARAKAWA, A.I.C.P.
Director

MICHAEL M. MIYAMOTO
Deputy Director

Telephone: (808) 270-7845
Fax: (808) 270-7955

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS AND ENVIRONMENTAL MANAGEMENT
200 SOUTH HIGH STREET, ROOM 322
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.
Development Services Administration

TRACY TAKAMINE, P.E.
Wastewater Reclamation Division

CARY YAMASHITA, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

Solid Waste Division

April 14, 2005

Mr. Tom Schnell, A.I.C.P.
PBR HAWAII
1001 Bishop Street
ASB Tower, Suite 650
Honolulu, Hawaii 96813-3484

Dear Mr. Schnell:

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT
KAUHALE LANI
TMK: (2) 2-3-009:007

We reviewed the subject application and have the following comments:

1. Need to address solid waste/recycling.

2. The project is expected to have a major impact on two (2) adjacent County roads, Old Haleakala Highway and Aeloa Road. A more detailed roadway and lot layout needs to be submitted before we can comment on roadway sections, access restrictions, roadway widening, etc.

3. The Draft Environmental Assessment shall include a Traffic Impact Assessment Report (TIAR) and a detailed drainage report for the entire development. The TIAR shall address regional traffic impacts and include assessments from the local community police officer.

4. We note that there are several drainage ways within this property. Any drainage way that will be constructed outside of the right-of-way of any roads to be dedicated to the County shall remain under private ownership and maintenance. The makai

terminus of Iolani Street disposes drainage runoff into the current pineapple field. Accommodations shall be provided to handle this drainage runoff.

5. We would encourage the connection of Iolani Street, such that there would be an alternate path to Old Haleakala Highway. This would relieve some of the traffic that currently has to pass Pukalani School amidst the school's traffic congestion.

Please call Michael Miyamoto at 270-7845 if you have any questions regarding this letter.

Sincerely,

for MILTON M. ARAKAWA, A.I.C.P.
Director

MMA:MMM:da
S:\LUCA\CZM\Kauhale_Lani_draft_ea_23009007_da.wpd

May 12, 2005

Mr. Milton M. Arakawa, A.I.C.P., Director
County of Maui
Department of Public Works and Environmental Management
200 South High Street, Room 322
Wailuku, Hawaii 96793

SUBJECT: KAUHALE LANI DRAFT ENVIRONMENTAL ASSESSMENT

Dear Mr. Arakawa:

Thank you for your letter dated April 14, 2005. As the consultant for Maui Land & Pineapple Company, Inc., we are responding to your comments.

1. The Draft Environmental Assessment (DEA) will address the issues of solid waste and recycling.

2. We acknowledge your expectation that Kauhale Lani will have a major impact on two adjacent County roads, Old Haleakala Highway and Aeloa Road. The DEA will contain a conceptual subdivision plan which will include roadway and lot layouts. Please note that Aeloa Road is an unimproved County right-of-way. Current plans for Kauhale Lani do not include the improvement or use of Aeloa Road.

3. The DEA will include a Traffic Impact Assessment Report (TIAR) and detailed drainage report. The TIAR will address regional traffic impacts. Maui Land & Pineapple Company Inc., or its traffic consultant will consult the local community police officer.

4. We understand that any drainage ways constructed outside of the right-of-way of any County roads will remain under private ownership and maintenance. We also recognize that the makai terminus of Iolani Street disposes drainage runoff into the current pineapple field, and accommodations will be provided to handle this drainage runoff.

5. We acknowledge that you encourage the connection of Iolani Street to provide an alternate path to Old Haleakala Highway.

Thank you again for your participation in the preparation of the upcoming Environmental Assessment. If you have any questions regarding this project, please do not hesitate to contact me.

Sincerely,

PBR HAWAII

Tom Schnell, AICP
Associate

cc: Leilani Pulmano/Maui Land & Pineapple Company, Inc.

O:\JOB10-11\1116.07\EA\Preconsultation Letters\Responses\BL-06 DPWEM Maui Office.doc

---

ALAN M. ARAKAWA
Mayor

MICHAEL W. FOLEY
Director

WAYNE A. BOTEILHO
Deputy Director

RECEIVED
APR 28 2005
PBR HAWAII

COUNTY OF MAUI
DEPARTMENT OF PLANNING

April 25, 2005

Mr. Tom Schnell
PBR Hawaii
1001 Bishop Street
ASB Tower, Suite 650
Honolulu, Hawaii 96813-3484

Dear Mr. Schnell:

RE: Preconsultation for the Draft Environmental Assessment (EA) – Kauhale Lani Subdivision located at TMK: 2-3-009: 007 and 064, Pukalani, Island of Maui, Hawaii (LTR 2005/0954)

The Maui Planning Department (Department) is in receipt of your request for preconsultation comments on March 30, 2005, and our meeting on April 20, 2005. Based on information provided, the Department provides the following preconsultation comments on the above referenced project:

1. Clarify whether ohana units be allowed in the development.

2. Drainage

   a. Include a discussion of designing the proposed drainage system to manage more than the net increase in stormwater runoff.

   b. Does the proposed drainage plan intend to tie into the existing Hamakua Ditch.

3. Agricultural lands

   a. Discuss the loss of agricultural land.

   b. Discuss the impact of the agricultural operations adjacent to the proposed project area on the single family residential areas.

c. The project area was formerly in pineapple production, which historically used pesticides. Discuss any impacts of residual levels to the proposed action.

4. Discuss the impacts relating to the loss of open space as the entryway into Pukalani Town.

5. Discuss the proposed development plans for Parcel 64. The traffic patterns for the two (2) parcels should be coordinated if Parcel 64 is intended for development.

6. Parks, Street Treatments, and Pedestrian/Bikeway Trails

   a. Identify the responsible party for maintaining the proposed park areas and landscaped street treatments and pedestrian/bikeway trails.

   b. Identify the responsible party for constructing the proposed park areas and provide an anticipated timeframe for construction.

   c. Provide schematics illustrating the proposed landscaped buffer, street treatments, and pedestrian/bikeway trails.

   d. Will the pedestrian/bikeway trail be paved?

   e. The Department prefers the park layout depicted in the draft site plan dated November 2004.

7. Discuss the proposed sewer systems. Given the location, the Department recommends connecting to the existing Pukalani Sewer System.

8. Identify the potable water source.

9. The Department recommends planning for connectivity with the existing subdivision located north of Parcel 7, specifically connecting the proposed and existing roadways located at the midpoint and eastern most area of the northern property boundary.

10. The draft site plans appear to indicate back alleyways will service the lots, which should reduce the need for wide roadways. As such,

discuss the rationale for establishing 50 ft roadways in the site plan dated April 2005.

Thank you for the opportunity to comment. Please include the Department on the mailing list for the Draft EA. Should you require further clarification, please contact Ms. Kivette Caigoy, Environmental Planner, at 270-7735.

Sincerely,

MICHAEL W. FOLEY
Planning Director

MWF:KAC:lar
c: Wayne Boteilho, Deputy Planning Director
Clayton Yoshida, Planning Program Administrator
Kivette Caigoy, Environmental Planner
Colleen Suyama, Staff Planner
TMK File
General File
K:\WP_DOCS\PLANNING\EA\PreConComments\2005\0954_KauhaleLani.wpd

PBR HAWAII

LAND PLANNING
LANDSCAPE ARCHITECTURE
ENVIRONMENTAL STUDIES

W. FRANK BRANDT, FASLA
CHAIRMAN

THOMAS S. WITTEN, ASLA
PRESIDENT

R. STAN DUNCAN, ASLA
EXECUTIVE VICE-PRESIDENT

RUSSELL Y.J. CHUNG, ASLA
EXECUTIVE VICE-PRESIDENT

VINCENT SHIGEKUNI
PRINCIPAL

JAMES LEONARD, AICP
PRINCIPAL
HILO OFFICE

GRANT MURAKAMI, AICP
SENIOR ASSOCIATE

TOM SCHNELL, AICP
ASSOCIATE

RAYMOND T. HIGA, ASLA
ASSOCIATE

KEVIN NISHIKAWA, ASLA
ASSOCIATE

HONOLULU OFFICE
1001 Bishop Street
ASB Tower, Suite 650
Honolulu, Hawaii 96813-3484
Tel: (808) 521-5631
Fax: (808) 523-1402

HILO OFFICE
101 Aupuni Street
Hilo Lagoon Center, Suite 310
Hilo, Hawaii 96720-4262

WAILUKU OFFICE
2123 Kaohu Street
Wailuku, Hawaii 96793-2204

May 12, 2005

Mr. Michael Foley, Planning Director
County of Maui
Department of Planning
250 South High Street
Wailuku, Hawaii 96793

SUBJECT: KAUHALE LANI DRAFT ENVIRONMENTAL ASSESSMENT

Dear Mr. Foley:

Thank you for your letter dated April 25, 2005. As the consultant for Maui Land & Pineapple Company, Inc., we are responding to your comments.

1. Ohana units will not be allowed in Kauhale Lani.

2. The Draft Environmental Assessment (DEA) will include a preliminary drainage report. Currently a drainage swale adjacent to Old Haleakala Highway discharges into the New Hamakua Ditch. The existing drainage pattern from the site is generally for runoff to sheet flow from the south to the north toward and into the ditch.

   The increases in onsite runoff will be diverted and detained in on-site detention basins located within community open areas. No additional runoff will be released into the existing drainage ways or onto Old Haleakalā Highway. The net result of the proposed drainage improvements will be no increase in runoff from the community. All drainage improvements will be developed in accordance with applicable Department of Health and County of Maui drainage requirements and standards.

3. The DEA will discuss the loss of agricultural land and its impact to Maui Land & Pineapple Company's agricultural operations. Note that both parcels of the Kauhale Lani site are former pineapple fields. Maui Pineapple Company, Ltd. (a subsidiary of ML&P) ended pineapple cultivation on these parcels in 2002. The fields have been fallow since then, with the exception of a small section of the 39-acre parcel, on which Maui Pineapple Company cultivated organic pineapple until 2003.

   Both parcels are not well suited for pineapple cultivation and are inefficient to farm as part of Maui Pineapple Company (MPC) operations since the Pukalani Bypass separated these parcels from other contiguous MPC pineapple fields. As MPC downsizes its operations to focus on the fresh fruit market it is focusing on the best, most efficient land to farm.

   The DEA will discuss the impact of the neighboring agriculture operations on the proposed single-family homes.

   The DEA will include a section discussing chemicals and fertilizers used on the site.

4. The DEA will discuss the impacts relating to loss of open space at the entryway into Pukalani. Note that the Kauhale area is designated "SF" (single-family) on the

5. *Makawao-Pukalani-Kula Community Plan*, which is a reflection of the needs and desires of the community.

6. The DEA will discuss plans for Parcel 64. No homes are planned for this parcel. Current plans call for trails, open space, and other community amenities.

7. The DEA will identify the parties responsible for constructing and maintaining the proposed park areas and landscaped treatments and pedestrian/bikeway trails, as well as provide a timeframe for construction.

   The DEA will also include a preliminary subdivision plan showing parks, landscaped buffers and pedestrian/bike trails.

   We acknowledge that the Department prefers the park layout depicted in the November 2004 draft site plan. Since November 2004, the Kauhale Lani plan has been revised based on topography to reduce the amount of grading necessary, optimize drainage conditions, and provide retention basins in appropriate areas.

8. The DEA will discuss proposed sewer systems. We acknowledge the Department's recommendation to connect to the existing Pukalani sewer system.

9. The DEA will identify the potable water source for the Kauhale Lani community.

10. We acknowledge the Department's recommendation to plan for connectivity with the existing subdivision located north of Parcel 7, specifically connecting the proposed and existing roadways located at the midpoint and eastern most area of the northern property boundary.

11. Roadways within the community will be built to County of Maui standards, while keeping in character with the Upcountry region. This will be discussed in the DEA.

Thank you again for your participation in the preparation of the upcoming Environmental Assessment. We will provide a copy of the DEA to the Planning Department. If you have any questions regarding this project, please do not hesitate to contact me.

Sincerely,

PBR HAWAII

Tom Schnell, AICP
Associate

cc: Leilani Pulmano/Maui Land & Pineapple Company, Inc.

O:\JOB10-11\1116.07\EA\Preconsultation Letters\Responses\BL-10 Dept Planning.doc

ALAN M. ARAKAWA
Mayor

GLENN T. CORREA
Director

JOHN L. BUCK III
Deputy Director

(808) 270-7230
Fax (808) 270-7934

DEPARTMENT OF PARKS & RECREATION

700 Hali'a Nakoa Street, Unit 2, Wailuku, Hawaii 96793

April 28, 2005

Tom Schnell, Associate
PBR Hawaii
2123 Kaohu Street
Wailuku, Hawaii 96793

RE: Kauhale Lani Draft Environmental Assessment

Dear Mr. Schnell:

This is in response to your request for early comments regarding the Draft Environmental Assessment for the Kauhale Lani project.

Our department would like to work with the developer in establishing active ballfields within the planned project site. Should this arrangement not be amenable to the developer, our department would ask that the Parks Dedications Requirements be satisfied through a cash contribution.

Thank you for the opportunity to provide these comments. Should you have any questions or need of additional information or clarification, please call me, or Patrick Matsui, Chief of Parks Planning & Development at 808-270-7387.

Sincerely,

Glenn T. Correa
Director

c: Patrick Matsui, Chief of Parks Planning & Development
Willard Asato, East Maui District Supervisor

PBR HAWAII

LAND PLANNING
LANDSCAPE ARCHITECTURE
ENVIRONMENTAL STUDIES

WM. FRANK BRANDT, FASLA
Chairman

THOMAS S. WITTEN, ASLA
President

R. STAN DUNCAN, ASLA
Executive Vice-President

RUSSELL Y.J. CHUNG, ASLA
Executive Vice-President

VINCENT SHIGEKUNI
Principal

JAMES LEONARD, AICP
Principal
Hilo Office

GRANT MURAKAMI, AICP
Senior Associate

TOM SCHNELL, AICP
Associate

RAYMOND T. HIGA, ASLA
Associate

KEVIN NISHIKAWA, ASLA
Associate

HONOLULU OFFICE

HILO OFFICE

WAILUKU OFFICE

May 12, 2005

Mr. Glenn T. Correa, Director
County of Maui
Department of Parks & Recreation
700 Hali'a Nakoa Street, Unit 2
Wailuku, Hawaii 96793

SUBJECT: KAUHALE LANI DRAFT ENVIRONMENTAL ASSESSMENT

Dear Mr. Correa:

Thank you for your letter dated April 28, 2005. As the consultant for Maui Land & Pineapple Company, Inc., we are responding to your comments.

We acknowledge that the Department of Parks and Recreation would like active ballfields established within the Kauhale Lani. Due to the sloping topography of the site, large ballfields may not be feasible. However, other recreation-related facilities will be established within Kauhale Lani, including centralized neighborhood park featuring various play courts. Since a detailed program has not yet been determined for the park, the preliminary concepts may be modified with further planning and input from your department. Maui Land & Pineapple Company Inc., will work with the Department of Parks & Recreation to resolve all park requirement issues.

Thank you again for your participation in the preparation of the upcoming Environmental Assessment. If you have any questions regarding this project, please do not hesitate to contact me.

Sincerely,

PBR HAWAII

Tom Schnell, AICP
Associate

cc: Leilani Pulmano/Maui Land & Pineapple Company, Inc.

O:\JOB10-11\1116.07\EA\Preconsultation Letters\Responses\BL-09 Parks & Rec.doc

LINDA LINGLE
GOVERNOR OF HAWAII

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

CHIYOME L. FUKINO, M.D.
DIRECTOR OF HEALTH

In reply, please refer to:
EMD / CWB

04015PKP.05

April 7, 2005

Mr. Tom Schnell, AICP
Associate
PBR Hawaii
1001 Bishop Street, Suite 650
Honolulu, Hawaii 96813-3484

Dear Mr. Schnell:

Subject: Kauhale Lani Draft Environmental Assessment

The Department of Health (DOH), Clean Water Branch (CWB), has reviewed the subject document and offers the following comments:

1. The Army Corps of Engineers should be contacted at 438-9258 to identify whether a Federal license or permit (including a Department of Army permit) is required for this project. Pursuant to Section 401(a)(1) of the Federal Water Pollution Control Act (commonly known as the "Clean Water Act"), a Section 401 Water Quality Certification 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..."

2. A National Pollutant Discharge Elimination System (NPDES) general permit coverage is required for the following activities:

   a. Storm water associated with industrial activities, as defined in Title 40, Code of Federal Regulations, Sections 122.26(b)(14)(i) through 122.26(b)(14)(ix) and 122.26(b)(14)(xi).

   b. 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. **An NPDES permit is required before the commencement of the construction activities.**

   c. Discharges of treated effluent from leaking underground storage tank remedial activities.

   d. Discharges of once through cooling water less than one (1) million gallons per day.

   e. Discharges of hydrotesting water.

   f. Discharges of construction dewatering effluent.

   g. Discharges of treated effluent from petroleum bulk stations and terminals.

   h. Discharges of treated effluent from well drilling activities.

   i. Discharges of treated effluent from recycled water distribution systems.

   j. Discharges of storm water from a small municipal separate storm sewer system.

   k. Discharges of circulation water from decorative ponds or tanks.

   The CWB requires that a Notice of Intent (NOI) to be covered by an NPDES general permit for any of the above activities be submitted at least 30 days before the commencement of the respective 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/index.html

3. The applicant may be required to apply for an individual NPDES permit if there is any type of activity in which wastewater is discharged from the project into State waters and/or coverage of the discharge(s) under the NPDES general permit(s) is not permissible (i.e. NPDES general permits do not cover discharges into Class 1 or Class AA State waters). An application for the NPDES permit is to be submitted at least 180 days before the commencement of the respective activities. The NPDES application forms may also be picked up at our office or downloaded from our website at: http://www.hawaii.gov/health/environmental/water/cleanwater/index.html

4. Hawaii Administrative Rules, Section 11-55-38, also requires the applicant to either submit a copy of the new NOI or NPDES permit application to the State Department of Land and Natural Resources, State Historic Preservation Division (SHPD), or demonstrate to the satisfaction of the DOH that the project, activity, or site covered by the NOI or application has been or is being reviewed by SHPD.

If you have any questions, please contact Ms. Kris Poentis of the Engineering Section, CWB, at 586-4309.

Sincerely,

DENIS R. LAU, P.E., CHIEF
Clean Water Branch

KP:cu

PBR HAWAII

LAND PLANNING
LANDSCAPE ARCHITECTURE
ENVIRONMENTAL STUDIES

WM. FRANK BRANDT, FASLA
CHAIRMAN

THOMAS S. WITTEN, ASLA
PRESIDENT

R. STAN DUNCAN, ASLA
EXECUTIVE VICE-PRESIDENT

RUSSELL Y.J. CHUNG, ASLA
EXECUTIVE VICE-PRESIDENT

VINCENT SHIGEKUNI
PRINCIPAL

JAMES LEONARD, AICP
PRINCIPAL
HILO OFFICE

GRANT MURAKAMI, AICP
SENIOR ASSOCIATE

TOM SCHNELL, AICP
ASSOCIATE

RAYMOND T. HIGA, ASLA
ASSOCIATE

KEVIN NISHIKAWA, ASLA
ASSOCIATE

HONOLULU OFFICE
1001 BISHOP STREET
ASB TOWER, SUITE 650
HONOLULU, HAWAI'I 96813-3484
TEL: (808) 521-5631
FAX: (808) 523-1402

HILO OFFICE

WAILUKU OFFICE

May 12, 2005

Mr. Denis R. Lau, P.E., Chief
State of Hawai'i
Department of Health
Clean Water Branch
P.O. Box 3378
Honolulu, Hawaii 96801-3378

SUBJECT: KAUHALE LANI DRAFT ENVIRONMENTAL ASSESSMENT

Dear Mr. Lau:

Thank you for your letter dated April 7, 2005. As the consultant for Maui Land & Pineapple Company, Inc., we are responding to your comments.

1. The Army Corps of Engineers will be contacted to determine whether a Federal license or permit (including a Department of Army permit) is required. A Section 401 Water Quality Certification will be obtained if it is determined that the Kauhale Lani will involve any activity that may result in any discharge into navigable waters.

2. An NPDES permit will be obtained prior to construction to address non-point source discharges. In addition, a Notice of Intent (NOI) will be submitted, as required by the Clean Water Branch, at least 30 days before the commencement of construction activities such as clearing, grading, and excavation or any discharges.

3. While we presently do not foresee any instances in which the following may occur, we understand that an individual NPDES permit may be required if any activity discharges wastewater into State water and/or if the discharge(s) is not permissible under the NPDES general permit. If required, the application for the individual NPDES permit will be submitted at least 180 days before the commencement of such activities.

4. As required by Hawaii Administrative Rules, Section 11-55-38, a copy of the NOI or NPDES permit application will be submitted to the State Department of Land and Natural Resources, State Historic Preservation Division (SHPD), or the Department of Health to confirm that the project, activity, or site is being reviewed by the SHPD. Please note that an archaeological inventory survey for the Kauhale Lani site has been conducted and has been submitted to the State Historic Preservation Division for review.

Thank you again for your participation in the preparation of the upcoming Environmental Assessment. If you have any questions regarding this project, please do not hesitate to contact me.

Sincerely,

PBR HAWAII

Tom Schnell, AICP
Associate

cc: Leilani Pulmano/Maui Land & Pineapple Company, Inc.

O:\JOB10-11\1116.07\EA\Preconsultation Letters\Responses\BL-02 DOH Clean Water.doc

LINDA LINGLE
GOVERNOR OF HAWAII

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

CHIYOME LEINAALA FUKINO, M.D.
DIRECTOR OF HEALTH

In reply, please refer to:
File:

M2 3 009 007 & 064.wpd
W12 wb050189

April 11, 2005

Mr. Tom Schnell, AICP
PBR Hawaii
Honolulu Office
1001 Bishop Street
ASB Tower, Suite 650
Honolulu, Hawaii 96813-3484

Dear Mr. Schnell:

Subject: Kauhale Lani Draft Environmental Assessment
Maui Land & Pineapple Company, Inc.
Slopes of Haleakala at the Entrance to Pukalani
TMK: (2) 2-3-009: 007 and 064 50 acres and 39 acres

Thank you for allowing us the opportunity to provide pre-assessment comments to the subject project. Information provided indicates that the Kauhale Lani community project is proposing up to 165 single family homes, parks, and a trail system for the 50 acre parcel. Uses of the other 39 acre property are undetermined but could include a small wastewater treatment plant to serve the community and trails and open space. We have the following comments and information on the above subject property:

> Our primary concern is that domestic wastewater generated is treated and disposed property. Ultimately, we would want the development to connect to the County sewer system. However, as that is not possible, the development will be required to use a small wastewater treatment plant and disposal system. Use of onsite wastewater system is not permitted due to the size of the development.

All wastewater plans must conform to applicable provisions of the Department of Health's Administrative Rules, Chapter 11-62, "Wastewater Systems." We do reserve the right to review the detailed wastewater plans for conformance to applicable rules.

Should you have any questions, please contact the Planning & Design Section of the Wastewater Branch at telephone (808)586-4294.

Sincerely,

HAROLD K. YEE, P.E., CHIEF
Wastewater Branch

LNKM:mt

PBR HAWAII
LAND PLANNING
LANDSCAPE ARCHITECTURE
ENVIRONMENTAL STUDIES

WM. FRANK BRANDT, FASLA
Chairman

THOMAS S. WITTEN, ASLA
President

R. STAN DUNCAN, ASLA
Executive Vice-President

RUSSELL Y.J. CHUNG, ASLA
Executive Vice-President

VINCENT SHIGEKUNI
Principal

JAMES LEONARD, AICP
Principal
Hilo Office

GRANT MURAKAMI, AICP
Senior Associate

TOM SCHNELL, AICP
Associate

RAYMOND T. HIGA, ASLA
Associate

KEVIN NISHIKAWA, ASLA
Associate

HONOLULU OFFICE
1001 BISHOP STREET
ASB TOWER, SUITE 650

HILO OFFICE

WAILUKU OFFICE

May 12, 2005

Mr. Harold K. Yee, P.E., Chief
State of Hawai'i
Department of Health
Wastewater Branch
P.O. Box 3378
Honolulu, Hawaii 96801-3378

SUBJECT: KAUHALE LANI DRAFT ENVIRONMENTAL ASSESSMENT

Dear Mr. Yee:

Thank you for your letter dated April 11, 2005. As the consultant for Maui Land & Pineapple Company, Inc., we are responding to your comments.

1. We understand that the project will be required to use a small wastewater treatment plant and disposal system.

2. All wastewater plans will conform to applicable provisions of the DOH's Administrative Rules, Chapter 11-62, "Wastewater Systems," and the DOH has the right to review detailed wastewater plans for conformance to applicable rules.

Thank you again for your participation in the preparation of the upcoming Environmental Assessment. If you have any questions regarding this project, please do not hesitate to contact me.

Sincerely,

PBR HAWAII

Tom Schnell, AICP
Associate

cc: Leilani Pulmano/Maui Land & Pineapple Company, Inc.

O:\JOB10-11\1116.07\EA\Preconsultation Letters\Responses\BL-03 DOH Wastewater Branch.doc

LINDA LINGLE
GOVERNOR

STATE OF HAWAI'I
DEPARTMENT OF EDUCATION
P.O. BOX 2360
HONOLULU, HAWAI'I 96804

RECEIVED
APR 1 3 2005
PBR HAWAII

PATRICIA HAMAMOTO
SUPERINTENDENT

OFFICE OF THE SUPERINTENDENT

April 13, 2005

Mr. Tom Schnell, AICP
PBR Hawaii
1001 Bishop Street
ASB Tower, Suite 650
Honolulu, Hawaii 96813-3484

Dear Mr. Schnell:

Subject: Kauhale Lani
Early Consultation
Pukalani, Maui, Hawaii, TMK: 2-3-09:07

The Department of Education (DOE) has reviewed your March 29, 2005, letter requesting early consultation on the proposed plans of Maui Land & Pineapple Company, Inc. (MLPC) to develop up to 165 single-family homes near the intersection of Haleakala Highway and the Old Haleakala Highway at the entrance to Pukalani.

The DOE estimates that the residential project could generate a total of 95 school students who would most likely attend the following schools: Pukalani Elementary, Kalama Intermediate, and King Kekaulike High schools.

The DOE will request that the State Land Use Commission impose a school fair-share contribution as a condition of changing the designation of the land from agricultural to urban. We will ask that an agreement be reached between MLPC and the DOE prior to the project obtaining county rezoning.

We appreciate the opportunity to provide preliminary comment. If you have any questions, please call Rae Loui, Assistant Superintendent of the Office of Business Services, at 586-3444 or Heidi Meeker of the Facilities and Support Services Branch at 733-4862.

Very truly yours,

Patricia Hamamoto
Superintendent

PH:hy

c: Rae Loui, Asst. Supt., OBS
Kenneth Nomura, CAS, Baldwin/Kekaulike/Maui

AN AFFIRMATIVE ACTION AND EQUAL OPPORTUNITY EMPLOYER

PBR HAWAII

LAND PLANNING
LANDSCAPE ARCHITECTURE
ENVIRONMENTAL STUDIES

WM. FRANK BRANDT, FASLA
CHAIRMAN

THOMAS S. WITTEN, ASLA
PRESIDENT

R. STAN DUNCAN, ASLA
EXECUTIVE VICE-PRESIDENT

RUSSELL Y.J. CHUNG, ASLA
EXECUTIVE VICE-PRESIDENT

VINCENT SHIGEKUNI
PRINCIPAL

JAMES LEONARD, AICP
PRINCIPAL
HILO OFFICE

GRANT MURAKAMI, AICP
SENIOR ASSOCIATE

TOM SCHNELL, AICP
ASSOCIATE

RAYMOND T. HIGA, ASLA
ASSOCIATE

KEVIN NISHIKAWA, ASLA
ASSOCIATE

HONOLULU OFFICE
1001 BISHOP STREET
ASB TOWER, SUITE 650
HONOLULU, HAWAI'I 96813-3484
TEL: (808) 521-5631
FAX: (808) 523-1402
E-MAIL: sysadmin@pbrhawaii.com

HILO OFFICE
101 AUPUNI STREET
HILO LAGOON CENTER, SUITE 310
HILO, HAWAI'I 96720-4262
TEL: (808) 961-3333
FAX: (808) 961-4989
E-MAIL: pbrhilo@lava.net

WAILUKU OFFICE
[illegible] STREET
WAILUKU, HAWAI'I [illegible]
TEL: [illegible]
FAX: [illegible]
E-MAIL: [illegible]

May 12, 2005

Ms. Patricia Hamamoto, Superintendent
State of Hawai'i
Department of Education
P.O. Box 2360
Honolulu, Hawaii 96804

SUBJECT: KAUHALE LANI DRAFT ENVIRONMENTAL ASSESSMENT

Dear Ms. Hamamoto:

Thank you for your letter dated April 13, 2005. As the consultant for Maui Land & Pineapple Company, Inc., we are responding to your comments.

1. We acknowledge your estimates that the Kauhale Lani community could generate a total of 95 school students who would most likely attend Pukalani Elementary, Kalama Intermediate, and King Kekaulike High schools.

2. We understand that the DOE will request that the Land Use Commission impose a school fair-share contribution as a condition of changing the land use designation. Maui Land & Pineapple Company, Inc. will work with the DOE to reach a school fair-share contribution agreement.

Thank you again for your participation in the preparation of the upcoming Environmental Assessment. If you have any questions regarding this project, please do not hesitate to contact me.

Sincerely,

PBR HAWAII

Tom Schnell, AICP
Associate

cc: Leilani Pulmano/Maui Land & Pineapple Company, Inc.

O:\JOB10-11\1116.07\EA\Preconsultation Letters\Responses\BL-01 DOE.doc

LINDA LINGLE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF HEALTH
MAUI DISTRICT HEALTH OFFICE
54 HIGH STREET
WAILUKU, MAUI, HAWAII 96793-2102

CHIYOME L. FUKINO, M. D.
DIRECTOR OF HEALTH

LORRIN W. PANG, M. D., M. P. H.
DISTRICT HEALTH OFFICER

RECEIVED
APR 18 2005

April 14, 2005

Mr. Tom Schnell, AICP
PBR Hawaii
ASB Tower, Suite 650
1001 Bishop Street
Honolulu, Hawai`i 96813-3484

Dear Mr. Schnell:

Subject: **Kauhale Lani Draft Environmental Assessment**
TMK: (2) 2-3-09:07 & 2-3-09: 64

Your letter of March 29, 2005, regarding the environmental assessment for the proposed Kauhale Lani project was forwarded to this office. We have the following comments to offer.

1. The property may be harboring rodents that will be dispersed to the surrounding areas when the site is cleared. The applicant is required by Hawaii Administrative Rules (HAR), Chapter 11-26, "Vector Control" to eradicate any rodents prior to demolition or site clearing activities and to notify the Department of Health by submitting Form VC-12 to the Maui Vector Control program when such action is taken. Rodent traps and/or rodenticides should be set out on the project site for at least a week or until the rodent activity ceases. The Maui Vector Control program telephone number is 808 873-3560.

2. National Pollutant Discharge Elimination System (NPDES) permit coverage is required for this project. The Clean Water Branch should be contacted at 808 586-4309.

3. Due to the nature and location of the project, there is a significant potential for fugitive dust emissions during site work preparations. It is recommended that a dust control management plan be developed. Implementation of adequate dust control measures during all phases of the project is warranted. Construction activities must comply with the provisions of HAR, Chapter 11-60.

4. The noise created during the construction phase of the project may exceed the maximum allowable levels as set forth in Hawaii Administrative Rules, Chapter 11-46 "Community Noise Control". A noise permit may be required and should be obtained before the commencement of work.

5. Plan approval for all new wastewater disposal systems will be required prior to construction of the systems. The wastewater plans must conform to applicable provisions of the Department of Health's Administrative Rules, Chapter 11-62, "Wastewater Systems".

Should you have any questions, please call me at 984-8230.

Sincerely,

Herbert S. Matsubayashi
District Environmental Health Program Chief

PBR HAWAII

LAND PLANNING
LANDSCAPE ARCHITECTURE
ENVIRONMENTAL STUDIES

WM. FRANK BRANDT, FASLA
CHAIRMAN

THOMAS S. WITTEN, ASLA
PRESIDENT

R. STAN DUNCAN, ASLA
EXECUTIVE VICE-PRESIDENT

RUSSELL Y.J. CHUNG, ASLA
EXECUTIVE VICE-PRESIDENT

VINCENT SHIGEKUNI
PRINCIPAL

JAMES LEONARD, AICP
PRINCIPAL
HILO OFFICE

GRANT MURAKAMI, AICP
SENIOR ASSOCIATE

TOM SCHNELL, AICP
ASSOCIATE

RAYMOND T. HIGA, ASLA
ASSOCIATE

KEVIN NISHIKAWA, ASLA
ASSOCIATE

May 12, 2005

Mr. Herbert S. Matsubayashi
District Environmental Health Program Chief
State of Hawaii, Department of Health
Maui District Health Office
54 High Street
Wailuku, Hawaii 96793-2102

SUBJECT: KAUHALE LANI DRAFT ENVIRONMENTAL ASSESSMENT

Dear Mr. Matsubayashi:

Thank you for your letter dated April 14, 2005. As the consultant for Maui Land & Pineapple Company, Inc., we are responding to your comments.

1. We understand that the property may need to undergo rodent eradication prior to demolition or site clearing activities. Maui Land Pineapple Company Inc., will notify the Department of Health if such measures are taken by submitting Form VC-12 to the Maui Vector Control program as required by the Hawaii Administrative Rules (HAR), Chapter 11-26, "Vector Control".
2. An NPDES Permit will be obtained through the Clean Water Branch.
3. We acknowledge your concern about the potential for fugitive dust emissions during site work preparations. A dust control management plan will be developed and implemented in compliance with the provisions of HAR, Chapter 11-60.
4. A noise permit will be obtained before work commences, should noise levels during construction phase exceed the maximum allowable levels set forth in the HAR, Chapter 11-46, "Community Noise Control".
5. All wastewater plans will conform to applicable provisions of the Department of Health's Administrative Rules, Chapter 11-62, "Wastewater Systems."

Thank you again for your participation in the preparation of the upcoming Environmental Assessment. If you have any questions regarding this project, please do not hesitate to contact me.

Sincerely,

PBR HAWAII

Tom Schnell, AICP
Associate

cc: Leilani Pulmano/Maui Land & Pineapple Company, Inc.

O:\JOB10-11\1116.07\EA\Preconsultation Letters\Responses\BL-04 DOH Maui District Office.doc

---

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

OFFICE OF PLANNING
235 South Beretania Street, 6th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

LINDA LINGLE
GOVERNOR
THEODORE E. LIU
DIRECTOR
MARK K. ANDERSON
ACTING DEPUTY DIRECTOR
LAURA H. THIELEN
DIRECTOR
OFFICE OF PLANNING

Telephone: (808) 587-2846
Fax: (808) 587-2824

Ref. No. P-10916

May 4, 2005

Mr. Tom Schnell, AICP
PBR Hawaii
1001 Bishop Street
ASB Tower, Suite 650
Honolulu, Hawaii 96813-3484

Dear Mr. Schnell:

Subject: Pre-Consultation for Draft Environmental Assessment
Kauhale Lani Community Project, TMK: (2) 2-3-09: 07, 64

The Office of Planning has reviewed the materials transmitted as part of the Pre-Consultation Notice for the above Draft Environmental Assessment for the Maui Land and Pineapple's proposed Kauhale Lani community site at the entrance to Pukalani Town.

The proposed low-density residential community is planned for two lots currently in the State Agricultural District that are designated for single-family development in the County Community Plan.

The Draft Environmental Assessment (DEA) should address the impacts on natural and cultural resources and state and county services and facilities. Please address the impact of the additional development on the limited groundwater supply in the East Maui watershed and storm water runoff and wastewater treatment.

Please also address the potential impacts on education and traffic in conjunction with other developments in the Pukalani and Lower Kula communities. Please also indicate how the developer plans to protect any cultural finds and access for traditional and customary practices.

We look forward to the opportunity to review and comment on the DEA. If you should have any questions, please call Mary Alice Evans of my staff at 587-2802.

Sincerely,

Laura H. Thielen
Director

PBR HAWAII

LAND PLANNING
LANDSCAPE ARCHITECTURE
ENVIRONMENTAL STUDIES

W. FRANK BRANDT, FASLA
Chairman

THOMAS S. WITTEN, ASLA
President

R. STAN DUNCAN, ASLA
Executive Vice-President

RUSSELL Y.J. CHUNG, ASLA
Executive Vice-President

VINCENT SHIGEKUNI
Principal

JAMES LEONARD, AICP
Principal
Hilo Office

GRANT MURAKAMI, AICP
Senior Associate

TOM SCHNELL, AICP
Associate

RAYMOND T. HIGA, ASLA
Associate

KEVIN NISHIKAWA, ASLA
Associate

HONOLULU OFFICE

HILO OFFICE

WAILUKU OFFICE

May 12, 2005

Ms. Laura Thielen, Director
State of Hawai'i
Department of Business, Economic Development & Tourism
Office of Planning
P.O. Box 2369
Honolulu, Hawaii 96804

SUBJECT: KAUHALE LANI DRAFT ENVIRONMENTAL ASSESSMENT

Dear Ms. Thielen:

Thank you for your letter dated May 4, 2005 (Ref. No. P10916). As the consultant for Maui Land & Pineapple Company, Inc., we are responding to your comments.

The Draft Environmental Assessment (DEA) will address impacts related to:

1. Natural and cultural resources;
2. State and County services and facilities;
3. Water sources for the Kauhale Lani community;
4. Stormwater runoff;
5. Wastewater treatment;
6. Education facilities;
7. Traffic; and
8. Cultural finds and access

Thank you again for your participation in the preparation of the upcoming Environmental Assessment. If you have any questions regarding this project, please do not hesitate to contact me.

Sincerely,

PBR HAWAII

Tom Schnell, AICP
Associate

cc: Leilani Pulmano/Maui Land & Pineapple Company, Inc.

O:\JOB10-11\1116.07\EA\Preconsultation Letters\Responses\BL-11 OP.doc

---

DEPARTMENT OF
HOUSING AND HUMAN CONCERNS
COUNTY OF MAUI

ALAN M. ARAKAWA
Mayor

ALICE L. LEE
Director

HERMAN T. ANDAYA
Deputy Director

200 SOUTH HIGH STREET • WAILUKU, HAWAII 96793 • PHONE (808) 270-7805 • FAX (808) 270-7165

April 4, 2005

Mr. Tom Schnell, AICP
Associate
PBR Hawaii
1001 Bishop Street
ASB Tower, Suite 650
Honolulu, Hawaii 96813-3484

Dear Mr. Schnell:

Subject: Kauhale Lani Draft Environmental Assessment

We have reviewed the information contained in your March 29, 2005 letter and enclosure and would like to provide the following comments:

1. Please indicate in the draft EA as to whether the LUC District Boundary Amendment and Change-In-Zoning will be requested through the regular process or some other process (please specify).

2. Please indicate if affordable housing units will be provided in the project, and if so, how many and affordable to what income group.

3. Please specify whether the units in the project will be lots only or house & lot packages. If the units will consist of house and lot packages, please provide floor plans and exterior elevations for the houses.

4. Will the sale of the units be subject to owner-occupancy requirements, buy-back option restrictions, shared-appreciation restrictions, or any other types of restrictions? If so, please specify what they will be.

Thank you for the opportunity to comment.

Very truly yours,

ALICE L. LEE
Director

ETO:hs
c: Housing Administrator

PBR HAWAII
LAND PLANNING
LANDSCAPE ARCHITECTURE
ENVIRONMENTAL STUDIES

WM. FRANK BRANDT, FASLA
CHAIRMAN

THOMAS S. WITTEN, ASLA
PRESIDENT

R. STAN DUNCAN, ASLA
EXECUTIVE VICE-PRESIDENT

RUSSELL Y.J. CHUNG, ASLA
EXECUTIVE VICE-PRESIDENT

VINCENT SHIGEKUNI
PRINCIPAL

JAMES LEONARD, AICP
PRINCIPAL
HILO OFFICE

GRANT MURAKAMI, AICP
SENIOR ASSOCIATE

TOM SCHNELL, AICP
ASSOCIATE

RAYMOND T. HIGA, ASLA
ASSOCIATE

KEVIN NISHIKAWA, ASLA
ASSOCIATE

HONOLULU OFFICE
1001 BISHOP STREET
ASB TOWER, SUITE 650

HILO OFFICE

WAILUKU OFFICE

May 12, 2005

Ms. Alice L. Lee, Director
County of Maui
Department of Housing and Human Concerns
200 South High Street
Wailuku, Maui, Hawaii 96793
Honolulu, Hawaii 96804

SUBJECT: KAUHALE LANI DRAFT ENVIRONMENTAL ASSESSMENT

Dear Ms. Lee:

Thank you for your letter dated April 4, 2005. As the consultant for Maui Land & Pineapple Company, Inc., we are responding to your comments.

1. Maui Land & Pineapple Company Inc., will request the LUC District Boundary Amendment and County Change in Zoning through the regular process.

2. At this time the Kauhale Lani community is targeted toward market-priced buyers. Maui Land & Pineapple Company, Inc., will work with your office to satisfy all County affordable housing requirements.

3. Currently plans for Kauhale Lani are preliminary. Maui Land & Pineapple Company Inc., has not determined if only lots will be provided or if house and lot packages will be available. As such, floor plans and exterior elevations of homes have not been prepared.

4. As the homes of Kauhale Lani are planned to be market rate, it is not currently envisioned that there will be buy-back options, shared-appreciation, or any other restrictions on sales or resales.

Thank you again for your participation in the preparation of the upcoming Environmental Assessment. If you have any questions regarding this project, please do not hesitate to contact me.

Sincerely,

PBR HAWAII

Tom Schnell, AICP
Associate

cc: Leilani Pulmano/Maui Land & Pineapple Company, Inc.

O:\JOB10-11\1116.07\EA\Preconsultation Letters\Responses\BL-12 HHC.doc

---

Maui Electric Company, Ltd. • 210 West Kamehameha Avenue • PO Box 398 • Kahului, Maui, HI 96733-6898 • (808) 871-8461

RECEIVED
APR 1 8 2005
PBR HAWAII

April 14, 2005

Mr. Tom Schnell
PBR Hawaii
ASB Tower, Suite 650
1001 Bishop Street
Honolulu, Hawaii 96813-3484

Dear Mr. Schnell,

Subject: Kauhale Lani - Draft Envirionmental Assessment –
Old Haleakala Highway and Haleakala Highway, Pukalani, Maui, Hawaii
TMK: (2) 2-3-09:07 and (2) 2-3-09:64

Thank you for allowing us to comment on the Draft Environmental Assessment (EA) notice and map for the subject project, which was received on March 31, 2005.

In reviewing our records and the information received, Maui Electric Company (MECO) may require access and electrical easements for our facilities to serve the subject project site. Since State of Hawaii and the County of Maui permits may be required prior to MECO's installation, we highly encourage the customer's electrical consultant to submit the electrical demand requirements and project time schedule. In addition, we recommend that the consultant schedule a meeting with us as soon as practical to verify and indicate the desired service location so that service can be provided on a timely basis.

Should you have any questions or concerns, please call Ray Okazaki at 871-2340.

Sincerely,

Neal Shinyama
Manager, Engineering

NS/ro:lkh

PBR HAWAII

LAND PLANNING
LANDSCAPE ARCHITECTURE
ENVIRONMENTAL STUDIES

W. FRANK BRANDT, FASLA
CHAIRMAN

THOMAS S. WITTEN, ASLA
PRESIDENT

R. STAN DUNCAN, ASLA
EXECUTIVE VICE-PRESIDENT

RUSSELL Y.J. CHUNG, ASLA
EXECUTIVE VICE-PRESIDENT

VINCENT SHIGEKUNI
PRINCIPAL

JAMES LEONARD, AICP
PRINCIPAL
HILO OFFICE

GRANT MURAKAMI, AICP
SENIOR ASSOCIATE

TOM SCHNELL, AICP
ASSOCIATE

RAYMOND T. HIGA, ASLA
ASSOCIATE

KEVIN NISHIKAWA, ASLA
ASSOCIATE

HONOLULU OFFICE
1001 BISHOP STREET
ASB TOWER, SUITE 650
HONOLULU, HAWAII 96813-3484
TEL: (808) 521-5631
FAX: (808) 523-1402

May 12, 2005

Mr. Neal Shinyama, Manager, Engineering
Maui Electric Company, Ltd.
210 West Kamehameha Avenue
P.O. Box 398
Kahului, Hawaii 96733-6898

SUBJECT: KAUHALE LANI DRAFT ENVIRONMENTAL ASSESSMENT

Dear Mr. Shinyama:

Thank you for your letter dated April 14, 2005. As the consultant for Maui Land & Pineapple Company, Inc., we are responding to your comments.

1. We recognize that MECO may require access and electrical easements to serve the Kauhale Lani community. Maui Land & Pineapple Company Inc., will work with MECO to resolve any access and electrical easement issues.

2. Electrical demand requirements and project time schedule will be submitted to MECO. In addition, Maui Land & Pineapple Company Inc., has scheduled a meeting on May 18, 2004 with MECO to verify and indicate the desired service location so that service can be provided on a timely basis.

Thank you again for your participation in the preparation of the upcoming Environmental Assessment. If you have any questions regarding this project, please do not hesitate to contact me.

Sincerely,

PBR HAWAII

Tom Schnell, AICP
Associate

cc: Leilani Pulmano/Maui Land & Pineapple Company, Inc.

O:\JOB10-11\1116.07\EA\Preconsultation Letters\Responses\BL-07 MECO.doc

---

verizon

Verizon Hawaii Inc.
P.O. Box 2200
Honolulu, HI 96841

RECEIVED
APR 25 2005
PBR HAWAII

April 21, 2005

PBR Hawaii
Bishop Street
ASB Tower, Suite 650
Honolulu, Hawaii 96813

ATTN: Mr. Tom Schnell

SUBJECT: Kauhale Lani Community
DRAFT ENVIRONMENTAL ASSESSMENT

Dear Mr. Schnell:

Thank you for providing Verizon Hawaii Incorporated, the opportunity to comment on the Draft Environmental Assessment for the Kauhale Lani Community Project.

Verizon Hawaii's existing infrastructure providing telecommunication services to this area is nearly filled to capacity and unable to serve a project of this magnitude. In order to provide telecommunication services for this project, an easement area of 30' X 30' will be required for Verizon Hawaii to install a pair gain. Fiber cable and power lines will energize the pair gain to provide telecommunication services for the Kauhale Lani Community Project.

If there are any questions, please call Sheri Tihada at (808) 242-5258 or Jerry Imai at (808) 242-5110.

Sincerely,

Lynette Yoshida
Section Manager – Network Engineering & Planning
Verizon Hawaii

C: File (3050-MKWO)
S. Tihada

PBR HAWAII

LAND PLANNING
LANDSCAPE ARCHITECTURE
ENVIRONMENTAL STUDIES

WM. FRANK BRANDT, FASLA
CHAIRMAN

THOMAS S. WITTEN, ASLA
PRESIDENT

R. STAN DUNCAN, ASLA
EXECUTIVE VICE-PRESIDENT

RUSSELL Y.J. CHUNG, ASLA
EXECUTIVE VICE-PRESIDENT

VINCENT SHIGEKUNI
PRINCIPAL

JAMES LEONARD, AICP
PRINCIPAL
HILO OFFICE

GRANT MURAKAMI, AICP
SENIOR ASSOCIATE

TOM SCHNELL, AICP
ASSOCIATE

RAYMOND T. HIGA, ASLA
ASSOCIATE

KEVIN NISHIKAWA, ASLA
ASSOCIATE

HONOLULU OFFICE
1001 BISHOP STREET
ASB TOWER, SUITE 650
HONOLULU, HAWAI'I 96813-3484
TEL: (808) 521-5631
FAX: (808) 523-1402
E-MAIL: [illegible]

HILO OFFICE
101 AUPUNI STREET
HILO LAGOON CENTER, SUITE 310
HILO, HAWAI'I 96720-4262
TEL: [illegible]
FAX: [illegible]
E-MAIL: [illegible]

WAILUKU OFFICE
[illegible]
WAILUKU, HAWAI'I [illegible]
TEL: [illegible]
FAX: [illegible]
E-MAIL: [illegible]

May 12, 2005

Ms. Lynette Yoshida
Section Manager--Network Engineering & Planning
Verizon Hawaii Inc.
P.O. Box 2200
Honolulu, Hawaii 96841

SUBJECT: KAUHALE LANI DRAFT ENVIRONMENTAL ASSESSMENT

Dear Ms. Yoshida:

Thank you for your letter dated April 21, 2005. As the consultant for Maui Land & Pineapple Company, Inc., we are responding to your comments.

We acknowledge that Verizon Hawaii's existing infrastructure for this area is nearly filled to capacity and unable to serve a project of the magnitude of Kauhale Lani. To provide telecommunication services for the Kauhale Lani community, Verizon Hawaii will require an easement area of 30' x 30' to install a pair gain. Fiber optic cable and power lines will energize the pair gain to provide telecommunication services for Kauhale Lani. Maui Land & Pineapple Company Inc., will work with Verizon to resolve any easement issues.

Thank you again for your participation in the preparation of the upcoming Environmental Assessment. If you have any questions regarding this project, please do not hesitate to contact me.

Sincerely,

PBR HAWAII

Tom Schnell, AICP
Associate

cc: Leilani Pulmano/Maui Land & Pineapple Company, Inc.

O:\JOB10-11\1116.07\EA\Preconsultation Letters\Responses\BL-08 Verizon.doc

B

Flora Survey

BOTANICAL RESOURCES ASSESSMENT STUDY
PUKALANI MAKAI
MAKAWAO DISTRICT, MAUI

by

Winona P. Char

CHAR & ASSOCIATES
Botanical Consultants
Honolulu, Hawai'i

Prepared for: **MAUI LAND & PINEAPPLE COMPANY, INC.**

May 2004

BOTANICAL RESOURCES ASSESSMENT STUDY
PUKALANI MAKAI
MAKAWAO DISTRICT, MAUI

INTRODUCTION

The proposed Pukalani Makai project site is comprised of two parcels totaling approximately 89 acres. The larger, rectangular-shaped, ±50-acre parcel (TMK: 2-3-09: 7) is bound by Haleakala Highway to the north, sugar cane fields and the Hamakua Ditch to the west and south, and a residential development to the east. This parcel is under active pineapple cultivation and is identified as "Field 280". The second parcel (TMK: 2-9-09: 64), about 39 acres in size, is an elongated piece that borders Pukalani Bypass Highway. The vegetation consists primarily of overgrown pineapple fields. Where it borders Haleakala Highway, there is a large planting of *Eucalyptus* trees and a small gully.

The soils on the majority of the project site belong to the Hali'imaile series (Foote *et al*. 1972). These are well-drained, dark reddish brown, silty clay soils found on the uplands of Maui. The actively cultivated pineapple field as well as the overgrown fields occur on this soil type. The area with the *Eucalyptus* planting and small gully is mapped as "rRR", rough broken land, on the soil maps (Foote *et al*. 1972).

Field studies to assess the botanical resources on the Pukalani Makai project site were conducted on 22 April 2004 by a team of two botanists. The primary objectives of the field studies were to:

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

SURVEY METHODS

Prior to undertaking the field studies, a search was made of the pertinent literature to familiarize the principal investigator with other botanical studies conducted in the general area. The TMK map as well as aerial photos were examined to determine vegetation cover patterns, terrain characteristics, access, boundaries, and reference points. The ±50-acre parcel was recently plowed and the perimeter road graded; this perimeter road provided the primary access. The smaller ±39-acre parcel can be accessed from Haleakala Highway and a dirt road follows along the lower boundary of the overgrown pineapple fields.

A walk-through survey method was used. Notes were made on plant associations and distribution, disturbances, substrate types, topography, drainage, exposure, etc. The less disturbed area with the *Eucalyptus* plantings and small gully were more intensively surveyed as this portion of the project site was more likely to harbor native plants.

DESCRIPTION OF THE VEGETATION

The plant names used in this report follow Wagner *et al*. (1990) and Wagner and Herbst (1999). The few recent name changes are those reported in the Hawaii Biological Survey series (Evenhuis and Eldredge, eds. 1999-2002).

A description of the vegetation types found on each of the parcels is presented below.

±50-Acre Parcel

This parcel, identified as "Field 280", was recently plowed and will be planted (T. Shepard, pers. comm., Maui Pineapple Company, Ltd.). A few rock piles are scattered through the plowed field; these support a cover of green panicgrass (*Panicum maximum* var. *trichoglume*) and sourgrass (*Digitaria insularis*).

A band of weedy vegetation, 3 to 4 ft. tall, is found along the perimeter of the parcel. Along Haleakala Highway, green panicgrass and Natal redtop grass (*Melinis repens*) are abundant. Other weedy species which occur here in smaller numbers include Spanish needle (*Bidens pilosa*), fireweed (*Senecio madagascariensis*), spiny amaranth (*Amaranthus spinosus*), pualele (*Emilia fosbergii*), *Crassocephalum crepidioides*, and Cuba jute (*Sida rhombifolia*). Smaller, scattered patches of goosegrass (*Eleusine indica*), sourgrass, swollen fingergrass (*Chloris barbata*), *Brachiaria subquadripara*, and crabgrass (*Digitaria* sp.) are common. Two native species, popolo (*Solanum americanum*) and 'uhaloa (*Waltheria indica*), are found here. A row of oleander shrubs (*Nerium oleander*) is planted alongside the highway.

Along the ditch, the weedy vegetation is periodically treated with herbicide and so in most places it is low, 1 to 2 ft. tall, and open. Spanish needle and sowthistle (*Sonchus oleraceus*) are abundant in some places, while crabgrass and spiny amaranth are abundant in other places. A pile of large boulders is found along the ditch. In this area, there is a small thicket of koa haole shrubs (*Leucaena leucocephala*) and dense mats of California grass (*Brachiaria mutica*). Semi-woody shrubs and subshrubs found here are castor bean (*Ricinus communis*), hairy abutilon (*Abutilon grandifolium*), and 'ilima (*Sida fallax*). Besides 'ilima, the other native species observed in this area is koali 'awa (*Ipomoea indica*), a member of the morning glory family.

The band of weedy vegetation adjacent to the residential area is similar to that found along the highway, but also includes cheeseweed (*Malva parviflora*), apple of Peru (*Nicandra physalodes*), Jimson weed (*Datura stramonium*), California grass, lion's ear (*Leonotis nepetifolia*), prickly lettuce (*Lactuca serriola*), and a yellow-flowered morning glory (*Ipomoea ochracea*). A few landscape plantings from the adjacent yards spill over onto the parcel; these include New Zealand spinach (*Tetragonia tetragonioides*), aloe (*Aloe vera*), guava (*Psidium guajava*), etc.

±39-Acre Parcel

Most of the vegetation on this parcel consists of overgrown pineapple fields. The pineapple fields on the eastern half of the parcel appear to have been abandoned fairly recently so the rows of pineapple plants are not as overgrown and the weedy assemblage of species, mostly Natal redtop grass and sourgrass, occur along the edge of the fields and on the dirt roads. On the western half of the parcel, the old fields are open and grassy with sourgrass, Natal redtop, Guinea grass (Panicum maximum), and green panicgrass abundant. Sourbush shrubs (Pluchea carolinensis), 5 to 7 ft. tall, are scattered throughout the old fields. Other weedy species found here include spiny amaranth, golden crown-beard (Verbesina encelioides), castor bean, lion's ear, pualele, Spanish needle, and Cuba jute. Fireweed is locally abundant on the old roads. A few remnant clumps of pineapple plants occur here and there among the old field vegetation. In some places along the highway, there is a narrow band of Guinea grass and a few koa haole shrubs with koali 'awa vines growing on them.

The planting of various Eucalyptus species, 40 to 70 ft. tall, bordering Haleakala Highway also contains a few trees of silk oak (Grevillea robusta) and Chinaberry (Melia azedarach). Koa haole and Christmas berry (Schinus terebinthifolius) shrubs form scattered, small thickets under the tree canopy. Ground cover consists of scattered clumps of Guinea grass, along with a few weedy plants of maile hohono (Ageratum conyzoides), Spanish needle, burbush (Triumfetta sp.), and Jamaica vervain (Stachytarpheta jamaicensis). However, areas with bare soil and leaf and branch litter are common. Axis deer tracks and scats are occasionally encountered.

A few native species are quite common in this forested area. Shrubs of 'a'ali'i (Dodonaea viscosa) and 'akia (Wikstroemia oahuensis), 3 to 8 ft. tall, are common to occasional. 'Uhaloa and 'ilima are found along the edge of the tree planting. Vines of Sicyos hispidus, a member of the cucumber or squash family, are found on the edge of the tree planting facing the highway. This species of Sicyos is easily identified by its fuzzy fruits.

The small gully found between the Eucalyptus planting and the overgrown pineapple fields supports abundant patches of Napier or elephant grass (Pennisetum purpureum) as well as dense clumps of Guinea grass. Neonotonia wightii, a member of the pea family, is locally abundant in some places, forming tangled mats over the grasses and scattered koa haole shrubs.

DISCUSSION AND RECOMMENDATIONS

Pineapple fields (actively cultivated, overgrown, or recently abandoned) cover the majority of the two parcels which make up the project site. Weedy species commonly associated with agricultural lands are usually found as a narrow band along the edges of the fields where they border roads, ditches, and other uncultivated areas. A botanical survey of the nearby pineapple fields for the proposed Upcountry Maui Town Center project (Char 2001) recorded similar findings.

A large planting of various Eucalyptus species as well as a few trees of silk oak and Chinaberry borders Haleakala Highway on the ±39-acre parcel. The native 'a'ali'i and 'akia shrubs and Sicyos hispidus vine are commonly encountered in this forested area. The small gully supports abundant patches of Napier grass and Guinea grass.

None of the plants found during the field studies is a threatened and endangered species or a species of concern (U.S. Fish and Wildlife Service 1999a, 1999b; Wagner et al. 1999). Seven native species were observed on the project site. Five are indigenous, that is, they are native to the Hawaiian Islands and elsewhere. These are popolo (Solanum americanum), 'uhaloa (Waltheria indica), koali 'awa (Ipomoea indica), 'ilima (Sida fallax), and 'a'ali'i (Dodonaea viscosa). The 'akia (Wikstroemia oahuensis) and Sicyos are endemic, that is, they are native only to the Hawaiian Islands.

Given these findings, the proposed development of the project site is not expected to have a significant negative impact on the botanical resources. However, it is recommended that the area with the Eucalyptus planting and small gully be kept in open space as the topography is rough and broken, and the erosion hazard is of some concern.

LITERATURE CITED

Char, W.P. (Char & Associates). 2001. Botanical Survey, MLP Upcountry Maui Project, Pukalani, Makawao District, Maui. Prepared for Group 70 International. February 2001.

Evenhuis, N.L. and L.G. Eldredge, editors. 1999-2002. Records of the Hawaii Biological Survey. Bishop Museum Occasional Papers Nos. 58-70.

Foote, D.E., E.L. Hill, S. Nakamura, and F. Stephens. 1972. Soil survey of the islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii. Soil Conservation Service, U.S. Department of Agriculture, Washington, D.C.

U.S. Fish and Wildlife Service. 1999a. U.S. Fish and Wildlife Service species list, plants. March 23, 1999. Pacific Islands Office, Honolulu, HI.

U.S. Fish and Wildlife Service. 1999b. Endangered and threatened wildlife and plants. 50 CFR 17.11 and 17.12. December 31, 1999.

Wagner, W.L., M.M. Bruegmann, D.R. Herbst, and J. Q.C. Lau. 1999. Hawaiian vascular plants at risk: 1999. Bishop Museum Occasional Papers No. 60.

Wagner, W.L., D.R. Herbst, and S.H. Sohmer. 1990. Manual of the flowering plants of Hawai'i. 2 vols. University of Hawai'i Press and Bishop Museum Press, Honolulu. Bishop Museum Special Publication 83.

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 Hawai'i Press and Bishop Museum Press, Honolulu.

C

Faunal Survey

AVIFAUNAL AND FERAL MAMMAL FIELD SURVEY OF PUKALANI MAKAI TMK 2-3-09:7 and TMK 2-9-09:64, MAUI

Prepared for:
PBR Hawaii
And
Kapalua Land Company, Ltd.

Prepared by:

Phillip L. Bruner
Environmental Consultant
Faunal (Bird and Mammal) Surveys
 # 1775 BYUH
55-220 Kulanui St.
Laie, Hawaii 96762

Revised
18 May 2004

INTRODUCTION

This report presents the findings of a two day (1,2, May 2004) field survey of Pukalani Makai property TMK 2-3-09:7 (50 acres) and TMK 2-9-09:64 (39 acres) in Maui. In addition to the field data this report also gives pertinent published and unpublished sources of birds and mammals to provide a broader view of the potential species known in this region of Maui. The two objectives of the field survey were to:

1- Document the birds and mammals presently found on or near the property.

2- Examine all habitats on the site and nearby lands.

SITE DESCRIPTION

This site contained a variety of habitats. A portion of the land was recently plowed and contained no vegetation. Old pineapple fields along with grass, brush and scattered eucalyptus trees cover the remaining area. No wetland habitat or native forest occurs on the property. Agricultural fields and residential property surround this site.

METHODS OF THE FIELD SURVEY

The survey was conducted by walking the site. Observations were made during early morning, late afternoon and early evening hours. All habitats on the property were investigated. All birds seen and heard were tallied. Data on mammals were obtained by visual observations only. No trapping of mammals was conducted. The duration and nature of the field survey did not warrant trapping. One evening (1 May was devoted to searching for the presence of owls and the endangered Hawaiian Hoary Bat (*Lasiurus cinereus semotus*). A Pettersson Elecktronik AB Ultrasound Detector D-100 was used to listen for echolocating bats. The weather during the survey was generally fair with some cloud cover late in the day. The winds were variable.

RESULTS OF THE FIELD SURVEY

Native Land Birds:

No native land birds were recorded on the survey. The only likely species that might be expected to forage in this area is the Hawaiian Owl or Pueo (*Asio flammeus sandwichensis*). This species is listed by the State of Hawaii as endangered on Oahu but not elsewhere in the state. They forage in grassland, agricultural fields and forests (Pratt et al. 1987, Hawaii Audubon Society 1993).

Native Waterbirds:

No native waterbirds were seen and none were expected due to the absence of wetland habitat.

Seabirds:

No seabirds were recorded on the survey. None would be expected at this site due to the presence of ground predators and human disturbance. Some species may fly over the property between their mountain nesting areas and the sea.

Migratory Birds:

No migratory birds were observed on the survey. At this time of year the majority of the migrants have departed for their arctic breeding grounds. A few may "over-summer" in Hawaii if they fail to gain sufficient weight to migrate or they are injured. The most common migratory shorebird in Hawaii is the Pacific Golden-Plover (*Pluvialis fulva*). They forage on lawns and in cleared agricultural fields. It is possible that between August and the end of April plover may occur on or near this area in the appropriate habitat. These birds are not endangered. They have been extensively studied both here in Hawaii and on their breeding grounds in western Alaska (Johnson et al. 1981, 1989, 1993, 2001a, 2001b).

Introduced (Alien) Birds:

Fourteen species of alien birds were tallied on the survey. Table One gives the names of these species. None of the alien birds are listed as endangered. The array of birds at this location is typical of this region on Maui (Bruner 1991, 1993, 1994, 1998, 2003).

Mammals:

Two cats (*Felis catus*) were seen on the survey. Given the proximity of nearby homes it is possible these cats were pets. No other mammals were recorded. It is likely that rats (*Rattus spp.*), Small Indian Mongoose (*Herpestes auropunctatus*), and Mice (*Mus musculus*) occur in this area. No endangered Hawaiian Hoary Bats (*Lasiurus cinereus semotus*) were detected on the night survey conducted on 1 May using the ultrasound detector. This finding was not unexpected given the low numbers of bats reported to occur on Maui (Tomich 1986, Kepler and Scott 1990, Duval and Duvall 1991). This species forages in a wide variety of habitats including: forests, agricultural lands, and urban areas. They are most abundant on Kauai and the Big Island. Jacobs (1991, 1993) and Reynolds et al. (1998) give information on the occurrence of this species on the Big Island.

CONCLUSIONS

The purpose of this report was to present the findings of a bird and feral mammal survey at this site. The absence of native land birds, native waterbirds, migratory birds, and seabirds was not totally unexpected given the location of the property, the available habitats, and the time of year. The array of alien birds was typical of this region. Mammal observations were also not unusual although mongoose and rats are typically recorded on a survey of this type. The absence of the Hawaiian Hoary Bat was likewise not unexpected given the low numbers of bats reported to occur on Maui.

TABLE ONE

Introduced (alien) birds recorded on the survey of Pukalani Makai TMK 2-3-09:7 and TMK 2-9-09:64, Maui.

COMMON NAME	SCIENTIFIC NAME
Cattle Egret	*Bulbucus ibis*
Gray Francolin	*Francolinus pondicerianus*
Black Francolin	*Francolinus francolinus*
Red Junglefowl	*Gallus fallus*
Spotted Dove	*Streptopelia chinensis*
Zebra Dove	*Geopelia striata*
Japanese White-eye	*Zosterops japonicus*
Northern Mockingbird	*Mimus polyglottos*
Common Myna	*Acridotheres tristis*
Red-crested Cardinal	*Paroaria coronata*
Northern Cardinal	*Cardinalis cardinalis*
House Finch	*Carpodacus mexicanus*
Nutmeg Mannikin	*Lonchura punctulata*
Chestnut Mannikin	*Lonchura atricapilla*

SOURCES CITED

Bruner, P.L. 1991. Survey of the avifauna and feral mammals at Paia, Maui. Prepared for A & B Properties, Inc.

__________ 1993. Avifaunal and feral mammal survey of lands involved in the east Maui Water Development Project, Maui. Prepared for Norman Saito Engineering Consultants, Inc.

__________ 1994. Survey of the avifauna and feral mammals at Department of Hawaiian Homelands Kula residentials Lots, Unit I, Kula, Maui. Prep. for Munekiyo and Arakawa, Inc.

__________ 1998. Survey of the avifauna and feral mammals at Department of Hawaiian Homelands – Keokea Agricultural Lots, Unit 1, Kula, Makawao, Maui. prepared for SSFM Engineers, Inc.

__________ 2003. Avifaunal and feral mammal field survey of Alexander and Baldwin's Maui Business Park-phase II. Prep. for PBR-Hawaii.

DLNR (Department of Land and Natural Resources) 2001-2002. Survey of the Nene Population on Maui, Hawaii Non-game Surveys. Grant No.: W-23-NG-7. Project No.: W-35-NGS. Gov. Doc. State of Hawaii.

Duvall, F. and R.G. Duvall. 1991. No bats on Maui? Look again. 'Elepaio 51(3):1-2.

Hawaii Audubon Society. 1993. Hawaii's Birds. Fourth Edition. Hawaii Audubon Society, Honolulu. 112 pp.

Honacki, J.H., Kinman and J.W. Koeppl eds. 1982. Mammal species of the world: A taxonomic and geographic reference. Allen Press, Inc. and the Association of Systematic Collections. Lawrence, Kansas. 694 pp.

Jacobs, D.S. 1991. The distribution and abundance of the endangered Hawaiian Hoary Bat (*Lasiurus cinereus semotus*), on the island of Hawaii. Unpubl. report submitted to University of Hawaii, Department of Zoology.

__________ 1993. Foraging behavior of the endangered Hawaiian Hoary Bat (*Lasiurus cinereus semotus*). Final report to U.S. Fish and Wildllife Service. Grant No. 14-48-0001-92570. Unpubl. ms.

Johnson, O.W., P.M. Johnson and P.L. Bruner. 1981. Wintering behavior and site-faithfulness of Golden-Plovers on Oahu. 'Elepaio 41(12):123-130.

Johnson, O.W., M.L. Morton, P.L. Bruner and P.M. Johnson. 1989. Fat cyclicity, flight ranges and features of wintering behavior in Pacific Golden-Plovers. Condor 91:156-177.

Johnson, O.W., P.G. Connors, P.L. Bruner, and J.L. Maron. 1993. Breeding ground fidelity and mate retention in the Pacific Golden-Plover. Wilson Bull. 105:60-67.

Jophnson, O.W., P.L. Bruner, J.J. Rotella, P.M. Johnson, and A.E. Bruner. 2001a. Long term study of apparent survival in Pacific Golden-Plovers at a wintering ground on Oahu, Hawaiian Islands. The Auk 118(2):342-351.

Johnson. O.W., P.L. Bruner, A.E. Bruner, P.M. Johnson, R.J. Kienholz, and P.A. Brusseau. 2001b. Features of breeding biology in Pacific Golden-Plovers nesting on the Seward Peninsula, Alaska. Wader Study Group Bulletin 25:59-65.

Kepler, C.B. and J.M. Scott. 1990. Notes on the distribution and behavior of the endangered Hawaiian Hoary Bat (*Lasiurus cinereus semotus*). 'Elepaio 50(7):59 64.

Pratt, H.D., P.L. Bruner and D.G. Berrett. 1987. A field guide to the birds of Hawaii and the tropical Pacific. Princeton University Press. Princeton, New Jersey. 409 pp.

Pyle, R.L. 2002. Checklist of the birds of Hawaii – 2002. 'Elepaio 62(6):137-148.

Reynolds, M.H., B.M.B. Nielsen, and J.D. Jacobi. 1998. Surveys on the Hawaiian Hoary Bat in the district of Puna, Hawaii Island. 'Elepaio 57(9):153-157.

Tomich, P.Q. 1986. Mammals in Hawaii. Bishop Museum Press. Honolulu. 375 pp.

D

Archaeological Inventory Survey

ARCHAEOLOGICAL ASSESSMENT OF THE KAUHALE LANI COMMUNITY KAILUA *AHUPUA'A*, MAKAWAO DISTRICT ISLAND OF MAUI TMK 2-3-09:7 and 64

for
Maui Land and Pineapple, Inc.

by
Jeffrey Pantaleo, M.A.

FEBRUARY 2005

ARCHAEOLOGICAL SERVICES HAWAII, LLC
16 S. Market St., Suite G
Wailuku, HI 96793

ABSTRACT

Archaeological Service Hawaii, LLC (ASH), of Wailuku, conducted an archaeological assessment at the request of Maui Land and Pineapple, Inc., of the proposed Kauhale Lani Community (TMK 2-3-09:7 and 64). The project area consists of two parcels of land situated in Pukalani, Kailua *ahupua'a*, Makawao District, Maui Island. Parcel 7 is comprised of 49.99 acres, and Parcel 64 is comprised of 38.629 acres. The purpose of this investigation was to determine presence/absence, extent, and significance of cultural remains in the project area.

Historical and archaeological background research was conducted to enhance site predictability and interpretation. Following the surface survey of the parcels, which resulted in no findings, subsurface testing using backhoe trenching was conducted in selected localities. A total of 15 trenches were excavated in Parcel 7, and ten trenches were excavated in Parcel 64. No cultural remains were encountered in any of the trenches. Two to four stratigraphic layers were revealed during trenching, indicating the extent of previous ground disturbance from commercial agricultural activities. Layer I was the till zone from pineapple cultivation, consisting of silt with roots and rootlets and black sheeting and irrigation lines. Underlying the till zone was Layer II, silty clay to clay with minimal rocks and rootlets. Underlying Layer II was Layer III, silty clay to clay. Basalt outcrop was exposed in T5, 7, 8, 9, and 10 in Parcel 7, and T10 in Parcel 64.

Based on the negative results of subsurface testing in both parcels, no further archaeological procedures appear to be warranted prior to commencing construction activities. However, due to the presence of significant sites in the vicinity, archaeological monitoring is recommended during initial construction activities to ensure that any subsurface cultural remains or deposits underlying the till zone are properly documented. Prior to commencing any construction activities, an archaeological monitoring plan shall be prepared for approval by the State Historic Preservation Division (SHPD).

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

At the request of the landowner, Maui Land & Pineapple, Inc., Archaeological Services Hawaii, LLC (ASH), of Wailuku, conducted an archaeological assessment of the proposed Kauhale Lani Community in Kailua *ahupua'a*, Makawao District, Maui Island. The purpose of this investigation was to determine presence/absence, extent, and significance of cultural remains in the project area. Paul Titchenal, M.A., and Jeffrey Pantaleo, M.A., conducted the fieldwork on November 30, 2004.

PROJECT AREA

The project area consists of two parcels of land (TMK 2-3-09:7 and 64) situated in Pukalani, Kailua *ahupua`a*, Makawao District, Maui Island (Fig. 1). Parcel 7, comprised of 49.99 acres, is bounded by Old Haleakala Highway to the north, a residential subdivision to the east, and the New Hamakua Ditch to the west and south. Parcel 64, comprised of 38.629 acres, is bounded by Haleakala Highway to the north, Makani Road to the east, and Old Haleakala Highway to the south and west (Fig. 2).

ENVIRONMENT

The project area is situated on the northwestern slope of Haleakala. Topography of Parcel 7, artificially altered by pineapple cultivation, is relatively level with isolated rock clearing mounds (Fig. 3). Topography of Parcel 64, also artificially altered by pineapple cultivation, includes level areas and low ridges (Fig. 4). Extensive modifications including a concrete culvert and channel and access roads were located in the western portion of the Parcel 64 (Fig. 4). Elevation of Parcel 7 ranges from c. 1080 to 1160 feet above mean sea level, and elevation of Parcel 64 ranges from c. 1080 to 1450 feet above mean sea level. Rainfall averages between 20 to 50 inches annually, with most occurring during the months of October to April. Vegetation in Parcel 7 was limited to various grasses and weeds, and Parcel 64 included fallow pineapple (*Ananas comosus*), isolated stands of eucalyptus trees (*E. globulus*), and various grasses and shrubs.

Soils in Parcel 7 included Haliimaile silty clay, 3-7% slopes, and 7-15% slopes. These soils, developed in material weathered from basic igneous rocks, are well-drained and located on gently to strongly sloping terrain. Haliimaile silty clay, 3-7% slopes, occur on smooth uplands. The surface layer is dark reddish-brown silty clay overlying dark reddish-brown silty clay and very dark grayish-brown clay. Permeability is moderately rapid, runoff is slow, and the erosion hazard

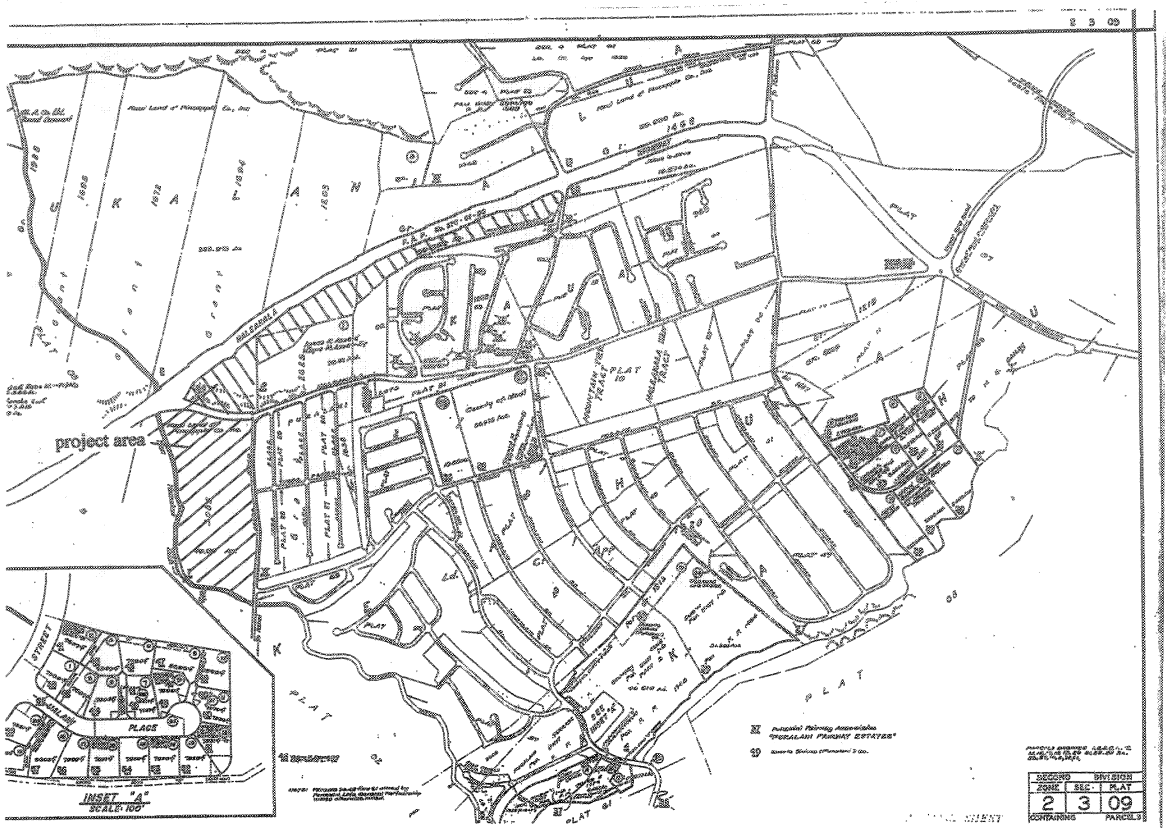


Figure 2. Project Area on Tax Map Key

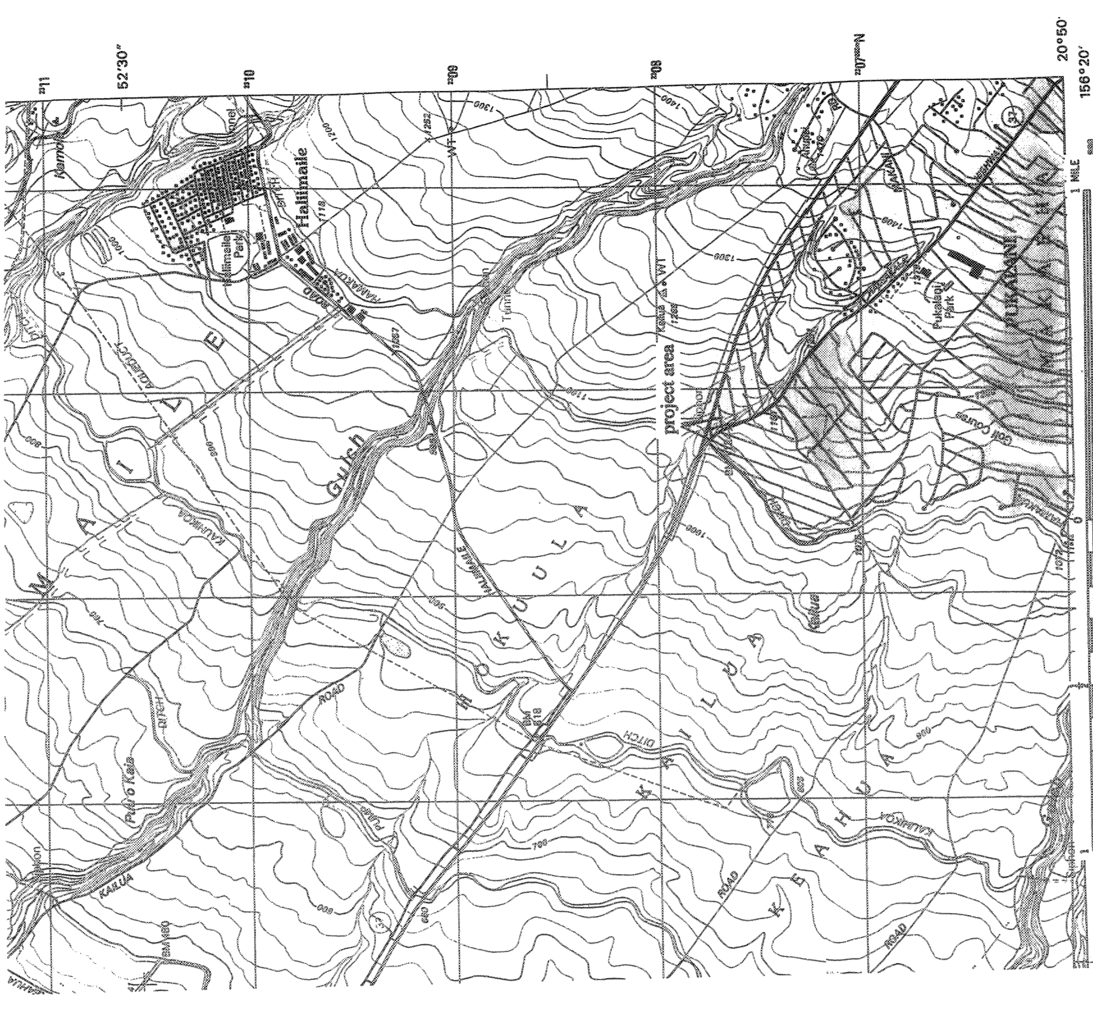


Figure 1. Location of Project Area on U.S.G.S. Kilohana Quad

Figure 3. Top: Overview of Parcel 7, View to Southwest. Bottom: Parcel 7, View to Northwest

Figure 4. Top: Overview of Parcel 64, View to North. Bottom: Concrete Culvert, View to North.

is slight. This soil is used for sugarcane, pineapple, and homesites (Foote et al. 1972:35-36). Haliimaile silty clay, 7-15% slopes, included small, cobbly areas and small, moderately steep areas. Runoff is medium, and the erosion hazard is moderate. This soil is used for sugarcane, pineapple, and homesites.

Soils in Parcel 64 include Haliimaile silty clay, 7-15% slopes, and Haliimaile gravelly silty clay, 7-15% slopes, eroded. Haliimaile gravelly silty clay, 7-15% slopes, eroded, is similar to Haliimaile silty clay, 7-15% slopes, except that in most places about 50% of the original surface and occasionally the subsoil has been lost from erosion. Runoff is medium to rapid, and the erosion hazard is severe. This soil is used for pineapple and pasture.

HISTORY

Historical research of Kailua *ahupua'a* and the Makawao District was summarized in Wong Smith (Appendix A, in Donham 1990) and Sinoto and Pantaleo (2001). The reader is referred to these studies for detailed information. A brief summary of the history and land use of the subject project area is included here.

The *ahupua`a* of Kailua, the name literally meaning "two seas," was once part of the old district of Kula (Pukui 1974:69). Kailua is not a typical *ahupua`a* encompassing the uplands to the coast, but is cut off from the sea by Wailuku *ahupua`a* and modern district (Wong Smith 1990). However, since Pukui and Elbert (1986:115) define "kai" as an area near the sea, Kailua *ahupua'a* may have once extended to the ocean (Wong Smith 1990).

According to Wong Smith (1990), not much is known regarding the pre-contact occupation and use of this specific region. Legendary and mythological references are scarce. Seasonal resource exploitation involving the gathering and harvesting of hardwoods like *koa* (*Acacia koa*), other plants, and animals most likely took place.

Background information regarding the individual land divisions are practically non-existent, thus references to Makawao and Kula will be briefly summarized here. For a more detailed historical summary, the reader is directed to Wong Smith (Appendix A in Donham 1990).

Early historic land-use patterns can be considered to reflect that of the late historic period. During the late prehistoric periods, dry land agriculture, including yam and sweet potato, probably flourished. While prehistoric permanent settlements, such as those to the east and south, have not been clearly indicated in the region of the current project area, the Kula region, more to the southeast, is said to have sustained a relatively large pre-contact permanent population. As discussed by Handy and Handy in *Native Planters in Old Hawaii*:

> All the country below the west and south slopes of Haleakala, specifically Kula, Honua`ula, Kahikinui, and Kaupo, in old Hawaiian times depended on the sweet potato. The leeward flanks of Haleakala were not as favorable for dry or upland taro culture...however, some upland taro was grown up to an altitude of 3000 feet (1972:276).

Kula was always an arid region, throughout its long, low seashore, vast stony *Kula* lands, and broad uplands. Both on the coast, where fishing was good, and on the lower westward slopes of Haleakala, a considerable population existed. Hawaiian taro was probably not cultivated in Kula, so the fishermen in this section must have depended for vegetable food mainly on *poi* brought from the wetlands of Waikapu and Wailuku to westward across the plain to supplement their usual sweet-potato diet. In recent times, however, Chinese taro has been raised at a considerable elevation. Kula was widely famous for its sweet-potato plantations. *`Uala* was the staple of life here (1972:510-511).

Makawao literally means "forest beginning" (Pukui et al. 1974:142). Early accounts of Makawao consist of descriptions of the area or accounts of notable events that took place. The rain of Makawao is mentioned often in poetical sayings as well as in journals of early visitors (Wong Smith in Donham 1990:A-1). The Hawaiian historian Kamakau mentioned the following event that he estimated to have taken place around 1785:

> When Kekaulike heard that Alapa`i, the ruling chief of Hawaii was at Kohala on his way to war against Maui, he was afraid and fled to Wailuku in his double war canoe named Ke-aka-milo...and the fleet landed at Kapa`ahu at the pit of `Aihako`ko in Kula [old name for Makawao]. Here on the shore the chiefs prepared a litter for Kekaulike and bore him upland to Haleki`i in Kukahua (1961:69)

By around the 1800s, agriculture in the Kula area underwent a transformation from subsistence to commercial. The arrival of whalers created a demand for fresh produce including vegetables, meat, and fruit. The increase in the number of whaling ships after 1840 caused an increase in demand for fresh produce. Although, at first only sweet potatoes were available, but by the mid-1830s, Irish potatoes were being cultivated. Since they were so well suited to be raised in Kula, it was soon called the "potato district" (Kuykendall 1965:313).

The Irish potato blight and the California gold rush of 1849 started a potato "boom" and an annual yield of 20,000 barrels of commercial Irish potatoes was estimated in the years between 1847 and 1854. The gold rush also created a market for potatoes, other vegetables, and sugar and molasses. The potato boom was short-lived, but sugar cane and pineapple would have a profound effect upon land-use and tenure over a large part of Maui.

Prior to the Mahele of 1848, Makawao was involved in an experimental program of land awards created by King Kamehameha III (Wong Smith 1990). In 1845 and 1846, land in the Makawao District was sold for $1 per acre with the transactions being registered as grants. About 900-acres, in parcels ranging from 5 to 10 acres, were purchased by native Hawaiians. The homesteaders gained title to their lands. Much of the remaining government lands were leased to *haole* ranchers. Around this time, immigrant Chinese farmers began leasing lands in Kula, either from the Hawaiian homesteaders or from the ranchers. A sizeable Chinese population flourished in Kula by the mid-1850s.

A portion of Grant 3085 was awarded within Parcel 7. This Grant, consisting of 182.16-acres, was awarded to Mark Preevere and Kamakele on March 18, 1871, for $182.16. Portions of Grants 1088, 1202, 1203, and 2625 were awarded in Parcel 64. Grant 1088, consisting of 53.20-acres, was awarded to Kalawe on December 24, 1852, for $106.80. Grant 1202, consisting of 76-acres, was awarded to Kawahalama on August 31, 1853, for $76.00. Grant 1203, consisting of 60-acres, was awarded to Nuole on August 31, 1853, for $60.00. Grant 2625, consisting of 82-acres, was awarded to Kahili on September 9, 1859, for $82.00. No land use was indicated in these grants.

Several other grants were awarded in the vicinity, but not directly associated with the project area. Grant 1672, located adjacent to the east of Grant 1694, was awarded to Thomas B. Cummings on April 3, 1853, consisting of 100-acres, for $100.00. Grant 1695, located adjacent to the east of Grant 1672, was awarded to Robert Bracy on April 17, 1853, consisting of 56.44-acres, for $56.44. Grant 1988, located adjacent to the east of Grant 1695, was awarded to Charles Barston on April 2, 1856, consisting of 100-acres, for $100.00.

Maui Land & Pineapple Company has been continuously cultivating pineapple in the area for nearly 70 years. Currently, Parcel 7 includes open land previously cultivated in pineapple, and Parcel 64 includes fallow pineapple fields.

PREVIOUS ARCHAEOLOGY

Donham (1990) previously investigated a portion of Parcel 7 in conjunction with an archaeological inventory survey of five potential upcountry Maui high school sites in Haliimaile, Hokuula, Kailua, and Makaeha *ahupua`a*, Makawao District (Fig. 5). School Sites 1 through 5 each measured approximately 35 acres and were cultivated in pineapple. School Site 1 included a portion of the current project area (Parcel 7). A total of four ceramic sherds were identified on the surface of School Site 1. Donham noted that these sherds may be associated with a house formerly located along Haleakala Highway; however, no remains of this house currently exists. Four lithic artifacts, including a basalt flake, an *ulu maika* fragment, a complete basalt adz, an adz fragment, and a ceramic sherd were collected from the surface of School Site 4. A small piece of waterworn coral and Cellana shells were observed on the surface of School Site 3, a horseshoe and metal were found in School Site 2, and a complete small adz was identified in School Site 5. No further work was recommended for School Sites 1-3, and 5; however, additional work including land tenure and cartographic sources was recommended for School Site 4.

Pertinent archaeological work conducted in the immediate vicinity of the current project area included Bordner (1980), Connelly (1973), Donham (1992), Fredericksen and Fredericksen (1995, 1999), Kennedy (1991), Pantaleo (2003), Pickett et al. (2003), Sinoto (2001), and Sinoto and Pantaleo (2001)(Fig. 5).

Environmental Impact Statement Corporation (Bordner 1980) conducted a reconnaissance survey of the proposed Makawao Subdivision, located between Apana Road and Kailua Gulch. No surface archaeological sites were identified during this investigation. The project area was formerly used as a plantation camp; however, no remains of this camp were observed. No further work was recommended.

Donham (1992) conducted a field inspection of petroglyphs located near the Kula 200 Subdivision in Makaeha, Makawao District. These petroglyphs, on a vertical rock face along the northern bank of a gulch, were reported to the State Historic Preservation Division by a resident of the Kula 200 Subdivision. A total of 32 separate glyphs, including canoes and paddlers, long canoes with no sails, human figures, and possible lizard figures, were observed on an approximately 20 m long section of the cliff. These petroglyphs were assigned State Site Number 50-50-11-2920. Site 1062, consisting of 87 petroglyphs on the northern rock face in Kaluapulani Gulch, was recorded by Bishop Museum (Connelly 1973).

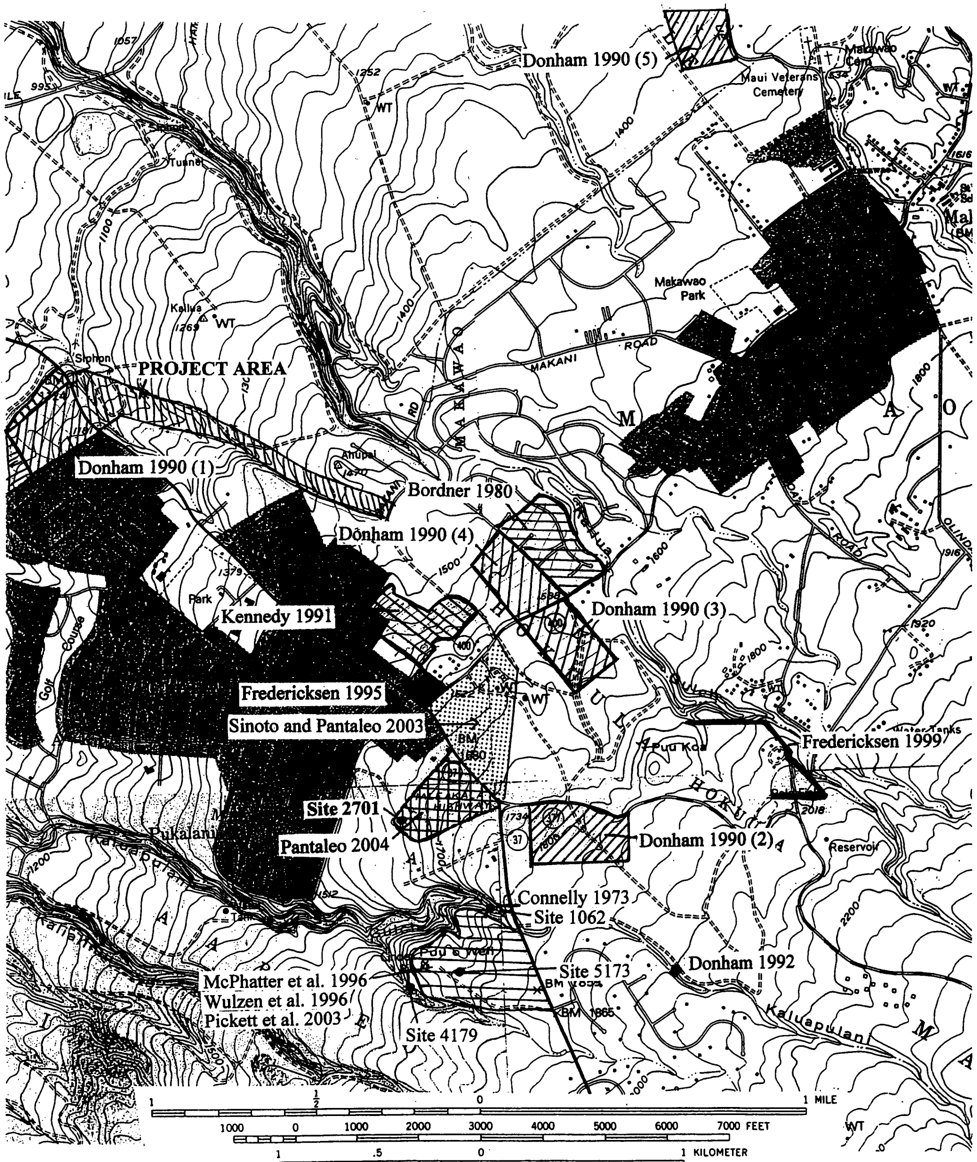


Figure 5. Previous Archaeological Work

Xamanek Researches conducted an inventory survey on a 1.78-acre parcel of land located in the *ahupua'a* of Hokuula, Makawao District (Fredericksen and Fredericksen 1995). State Site 50-50-05-3929, a rock aggregation, was recorded during the survey. Two manually excavated units and one backhoe trench were excavated at this site. Historic material including metal, bottle glass, plastic and black mulch sheeting, sawn bovine bone, ceramics, kukui nut, water-worn pebbles, and marine shell were recovered from Trench #1 and Test Unit #1. Backhoe Trench #9 was excavated across the rock pile to obtain a stratigraphic profile. A three-layer stratigraphic sequence was revealed during trenching. Layers I and II were mixed with historic material, and Layer III was the basal layer absent of cultural material. A total of 22 backhoe trenches were excavated throughout the parcel. No subsurface cultural remains were encountered in these trenches, and no further archaeological work was recommended at Site 3929.

Xamanek Researches conducted an archaeological inventory survey for the Kulamalu water tank and waterline improvements in Hokuula *ahupua'a*, Makawao District (Fredericksen and Fredericksen 1999). State Sites 50-50-10-4677 through 4681 were recorded during the investigation. Sites 4677 and 4680 were historic retaining walls; Site 4678 was an excavated cave shelter; Site 4679 was a rock shelter; and Site 4681 is a probable historic grave. All of these sites are located beyond the waterline corridor, and will not be impacted during construction of the waterline and tank. Since these sites will not be impacted by the proposed development, no further work was recommended.

Archaeological Consultants of Hawaii, Inc., conducted an archaeological inventory survey and test results for the proposed Pukalani Highlands property located at Pukalani, *ahupua'a* of Kailua, Maui Island (Kennedy 1991). Sites 2497 through 2499 were recorded during the survey. Site 2497 was a platform, 2498 was a possible *heiau* based on recovered artifacts and coral, and Site 2499 was a rock mound. However, testing was limited to outside these structures to minimize disturbance and preserve its integrity.

Archaeological Services Hawaii, LLC, conducted an archaeological inventory survey of the proposed Kualono residential subdivision in Pukalani, Makawao District, Maui Island (Pantaleo 2003). No archaeological sites were identified during the surface survey. Due to extensive previous disturbances from pineapple cultivation, a total of 26 backhoe trenches were excavated in selected areas throughout the parcel. No subsurface cultural remains or deposits were encountered during testing, and no further work was recommended. However, due to the presence of Site 2770 adjacent to the proposed development, archaeological monitoring during construction activities was recommended to ensure protection of the site and document any subsurface cultural remains or deposits underlying the till zone.

Archaeological Services Hawaii, LLC (Pickett et al. 2003) conducted monitoring of the Kulamalu Commercial Subdivision in Aapueo *ahupua'a*, Kula, Maui. Site 5173, a Chinese Cemetery consisting of coffin and pit burials, 5 burning episodes, and an animal burial, was recorded.

Aki Sinoto Consulting (Sinoto 2001) conducted a cultural impact assessment for the proposed phased development of the Pukalani Triangle in Makaeha *ahupua'a*, Makawao, Maui (TMK 2-3-07:08). No continuing cultural practices are currently occurring within the project area based on the findings of the archaeological inventory survey (Sinoto and Pantaleo 2001) and oral testimonies; however, five intact structures associated with the Corn Mill Camp (Site 50-50-06-5169) are still present within the project area. It was recommended that landscaping and planting in the project area should use native plants for lei-making and medicinal use, and a museum or interpretive space should be dedicated within one of the buildings associated with Site 5169.

SETTLEMENT PATTERN AND SITE EXPECTABILITY

The atypical configuration of Kailua, as well as some of the surrounding *ahupua`a,* in being truncated from access to the sea, would certainly have influenced the types of sites and their distribution. No extensive permanent settlements were indicated within this specific region until the historic period. Until that time, the prevailing land-use pattern was most likely associated with the seasonal exploitation of upland forest resources in the form of assorted plants and animals. Thus, the sites associated with such endeavors would consist of rock-shelters, small temporary habitation structures such as C-shapes, and trails. Although, the *Kula* areas further east and south were known for extensive dry-land agricultural pursuits, the current project area, in terms of elevation appeared to have been peripheral or marginal in productivity for prehistoric agricultural activities. Thus, features related to such activity would be limited in extent and consist of small plots and gardens in selected areas in the vicinity of gulches and drainages, where the terrain was more suitable. The places for religious and ceremonial activities such as *heiau* are found in neighboring *ahupua`a* such as Omaopio, but none have been recorded in Kailua *ahupua'a*. The paucity of prehistoric period sites may also be attributable to the extensive terrain alteration that took place with the advent of large-scale commercial agricultural ventures during the historic period.

By the mid-1800s, much of the upland forests had been cleared for agriculture, both cultivation and cattle grazing. The current project area is devoid of forest trees and consists of secondary growth following large-scale clearing. Thus, the most likely cultural remains to be encountered in the study area would be historic features and artifacts associated with agricultural pursuits. Some 900 acres of homestead grants were awarded in the Makawao District in a pre-Mahele experimental program and some remains associated with such homesteads could be encountered.

METHODS

Archaeological and historical literature and documents research was undertaken, not only to gain some insight into the prehistoric and historic background of the project area, but also to enhance the predictability of the nature and extent of potential cultural resources in the subject area. This research was conducted at the State Historic Preservation Division (SHPD) library of the Department of Land and Natural Resources (DLNR) in Kapolei, the Bureau of Conveyances and Land Management Branch of DLNR, the Hawaii State Library in Honolulu.

The surface survey of Parcels 7 and 64 was conducted by walking systematic transects spaced at 5-10 meter intervals when feasible throughout the project area. Results of the surface survey revealed no significant surface cultural manifestations. The ensuing subsurface testing employed a wheeled backhoe with a 24" bucket. Fifteen backhoe trenches were placed in selected localities in Parcel 7 and ten backhoe trenches were placed in Parcel 64 to allow representative sampling of the entire project area.

The location of each trench was plotted onto the project area map. A stratigraphic profile of a representative column on a trench sidewall was recorded for each trench. A color photographic record on APS format was obtained for each trench and soil colors were described in reference to Munsell color designations. Project area overviews were also photographically recorded.

All procedures followed generally accepted archaeological methods and standards. All field notes, maps, and photographs generated in connection with the current project will be curated at Archaeological Services Hawaii, LLC, in Wailuku, Maui.

RESULTS OF SURVEY

No surface cultural remains were encountered during the surface survey of Parcels 7 and 64. Both parcels exhibited extensive previous disturbances from pineapple cultivation, and recent modifications in Parcel 64 included construction of a concrete culvert and channel and access roads. The New Hamakua Ditch defines the western and southern boundaries of Parcel 7 (Fig. 6). This ditch, constructed of concrete, runs on surplus water from other ditches or for delivery to the fields (Wilcox 1996:121). Localities were selected for backhoe testing for the purpose of sampling the subsurface conditions within the parcels. A total of 15 trenches were excavated in Parcel 7 (Fig. 7), and 10 trenches were excavated in Parcel 64 (Fig. 8). No cultural remains, either prehistoric or historic, were encountered in any of the trenches.

Table 1 presents the dimensions and stratigraphic information for each of the 15 trenches in Parcel 7 and 10 trenches in Parcel 64. Representative stratigraphic columns for T1 through T15 in Parcel 7 are depicted on Figure 9, and T1 through T10 in Parcel 64 are depicted in Figure 10. Figures 11-18 presents photographic overviews of selected trenches.

No subsurface cultural remains or deposits were encountered in any of the trenches. Generally, two to four stratigraphic layers were exposed during trenching in Parcel 7. Layer I was the till zone from pineapple cultivation, consisting of silt with black sheeting and irrigation lines. Underlying the till zone was Layer II, silty clay to clay with minimal rocks and rootlets. Underlying Layer II was Layer III, clay. Basalt outcrop was exposed in T7 and 9.

Two to four stratigraphic layers were also exposed in Parcel 64. Layer I was the till zone from pineapple cultivation, consisting of silt with black sheeting and irrigation lines. The till zone was absent in T9. Layers II and III consisted of clay to silty clay, and basalt outcrop was exposed in T10.

The stratigraphic components of T1-T15 in Parcel 7 are as follows:

Layer I (T1-15): till zone consisting of dark brown to very dark brown (10YR 2/2 – 3/3; 7.5YR 2.5/2, 2.5/3, 3/2, 3/3) silt with black sheeting and irrigation lines from pineapple cultivation; abundant roots/rootlets; fine, moist, sticky, non-plastic, non-cultural.

Figure 6. Top: Overview of the New Hamakua Ditch, View to West.
Bottom: New Hamakua Ditch, View to North.

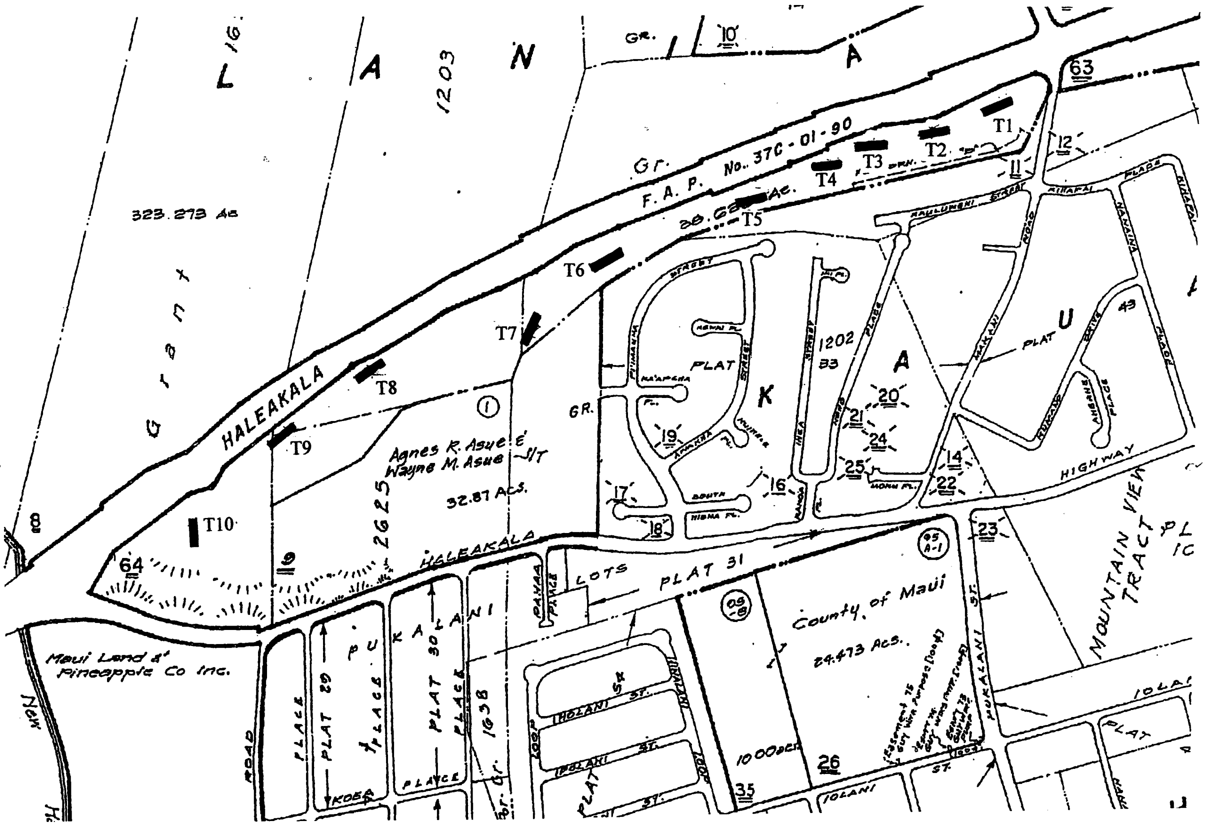


Figure 8. Location of Trenches 1-10 in Parcel 64

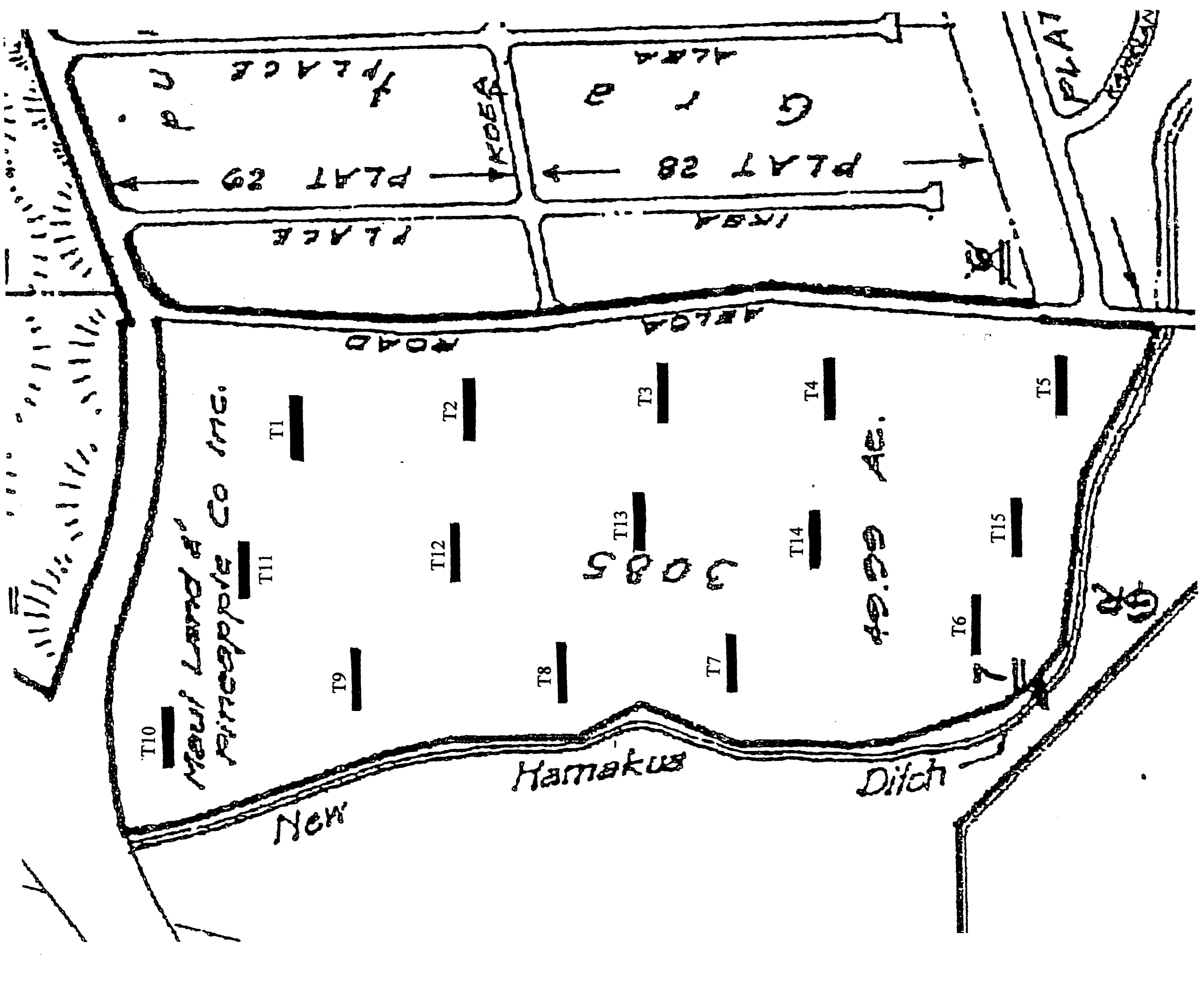


Figure 7. Location of Trenches 1-15 in Parcel 7

Table 1. Dimensions and Stratigraphic Information for T1-15 in Parcel 7 and T1-10 in Parcel 64

PARCEL 7								
T-	Length	Width	Depth	Orient.	Layer I	Layer II	Layer III	Layer IV
1	5.0m	0.8m	2.0m	140/320	till zone	silty clay		
2	6.0m	0.8m	1.8m	140/320	till zone	silty clay		
3	5.0m	0.8m	1.9m	140/320	till zone	silty clay		
4	5.5m	0.8m	1.8m	140/320	till zone	silty clay	clay	
5	5.5m	0.8m	1.7m	140/320	till zone	silty clay	outcrop	
6	5.5m	0.8m	2.0m	130/310	till zone	clay		
7	5.5m	0.8m	1.9m	140/320	till zone	silty clay	clay	outcrop
8	6.0m	0.8m	1.7m	140/320	till zone	clay	outcrop	
9	6.0m	0.8m	1.9m	120/300	till zone	silty clay	clay	outcrop
10	6.0m	0.8m	1.8m	130/310	till zone	clay	outcrop	
11	5.5m	0.8m	1.9m	140/320	till zone	silty clay	clay	
12	5.0m	0.8m	1.8m	120/300	till zone	silty clay		
13	6.0m	0.8m	2.0m	140/320	till zone	silty clay		
14	6.0m	0.8m	1.9m	140/320	till zone	silty clay	clay	
15	6.0m	0.8m	1.8m	140/320	till zone	silty clay		

PARCEL 64								
T-	Length	Width	Depth	Orient.	Layer I	Layer II	Layer III	Layer IV
1	5.0m	0.8m	1.8m	120/300	till zone	silty clay		
2	5.2m	0.8m	1.7m	130/310	till zone	silty clay		
3	5.3m	0.8m	1.8m	130/310	till zone	silty clay	clay	
4	5.0m	0.8m	1.8m	120/300	till zone	silty clay		
5	5.0m	0.8m	1.8m	130/310	till zone	silty clay		
6	5.0m	0.8m	2.0m	100/280	till zone	silty clay		
7	5.0m	0.8m	1.6m	110/290	till zone	outcrop	silty clay	
8	5.5m	0.8m	1.8m	90/270	till zone	clay	silty clay	
9	5.5m	0.8m	2.0m	70/250	silt	clay		
10	5.0m	0.8m	1.8m	40/220	till zone	silty clay	clay	outcrop

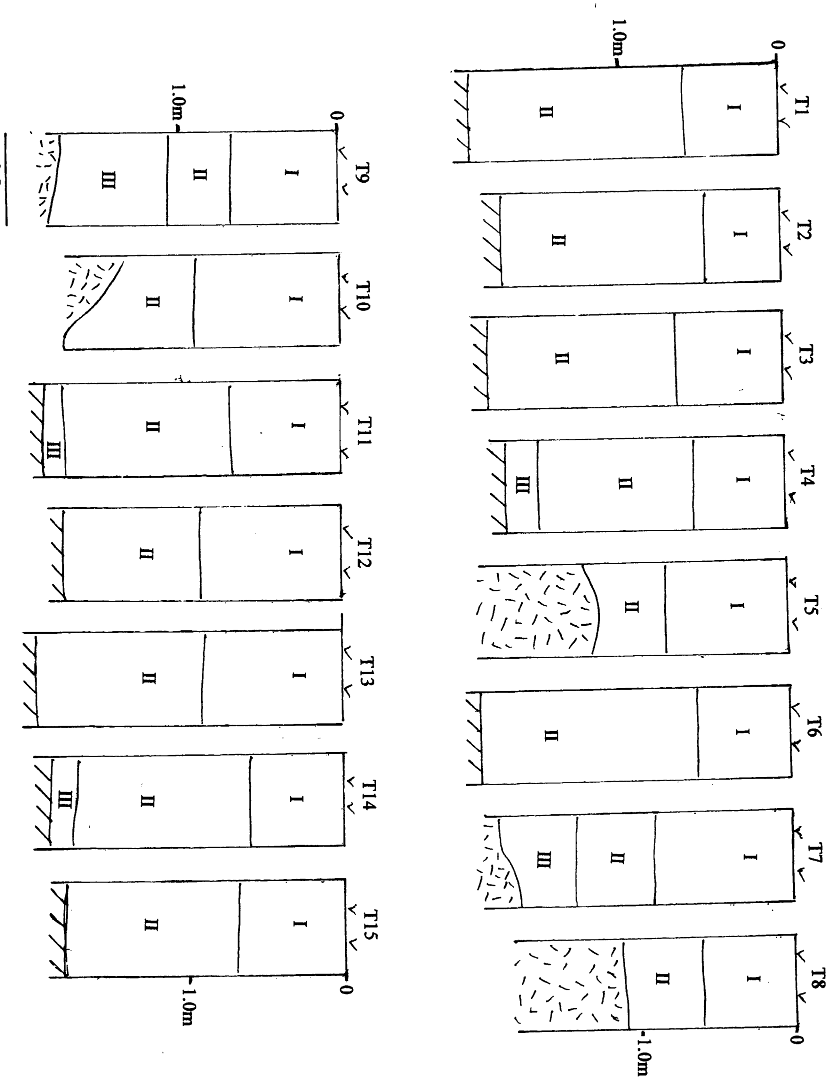


Figure 9. Representative Stratigraphic Columns for T1-15 in Parcel 7

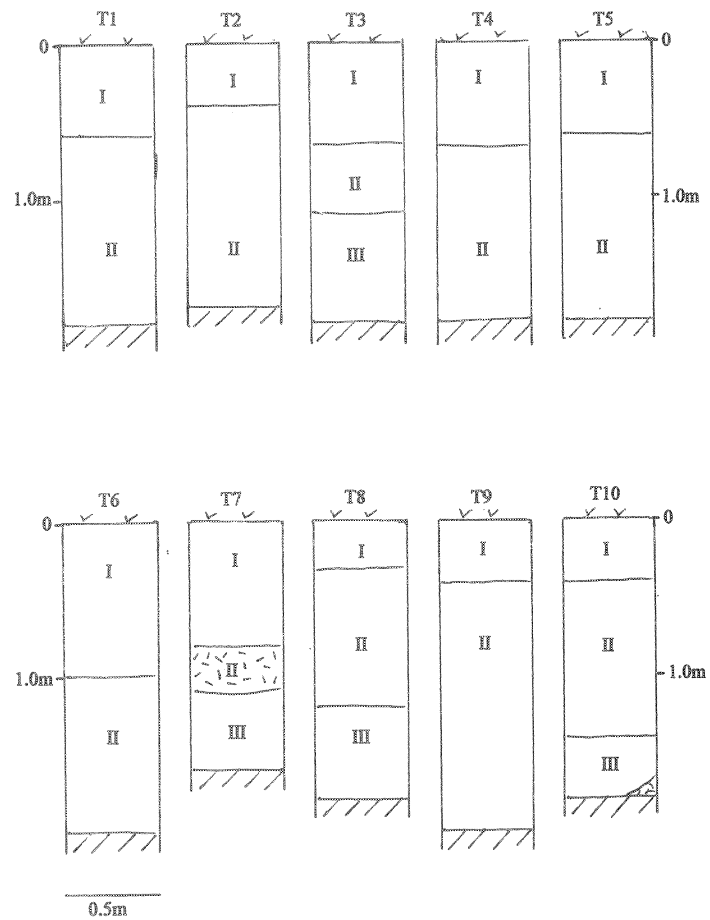


Figure 10. Representative Stratigraphic Columns for T1-10 in Parcel 64

Figure 11. Overview of T5 in Parcel 7, View to Southeast

Figure 12. Overview of T7 in Parcel 7, View to Southeast

Figure 13. Overview of T12 in Parcel 7, View to Southeast

Figure 14. Overview of T2 in Parcel 64, View to Northwest

Figure 15. Overview of T3 in Parcel 64, View to Northwest

Figure 16. Overview of T5 in Parcel 64, View to Northwest

Figure 17. Overview of T8 in Parcel 64, View to West

Figure 18. Overview of T10 in Parcel 64, View to Northeast

Layer II (T1-7, 10-15): dark brown to very dark grayish-brown (7.5YR 2.5/2 – 2.5/3 – 3/2 – 3/3) silty clay with moderate amounts of rocks and rootlets; compact, fine, sticky, slightly, plastic; non-cultural.

Layer II in T8 was dark gray (10YR 4/1) clay with pockets of dark yellowish-brown (10YR 4/4) silty clay; fine, compact, sticky, plastic to slightly plastic; non-cultural. Layer II in T9 was very dark gray (10YR 3/1) silty clay with minimal amounts of rocks and rootlets; fine, slightly sticky, slightly plastic; non-cultural.

Layer III (T4, 7, 9, 11, 14): brown to very dark brown to dark gray to very dark gray (10YR 3/1, 10YR 4/1, 10YR 4/3) clay; compact, fine, sticky, slightly plastic to plastic, with some rocks; non-cultural.

Layer III in T5, 8, and 10, and Layer IV in T7 and 9 was basalt outcrop.

The stratigraphic components of T1-T10 in Parcel 64 are as follows:

Layer I (T1-8, 10): till zone consisting of dark brown to very dark brown (10YR 2/2 – 3/2 – 3/3; 7.5YR 2.5/2 – 3/3) silt with black sheeting and irrigation lines from pineapple cultivation; abundant roots/rootlets; fine, moist, non-sticky, non-plastic, non-cultural.

Layer I in T9 was dark brown (10YR 3/3) silt; crumbly, dry, non-sticky, non-plastic, with abundant roots/rootlets and rocks.

Layer II (T1-6, 10): dark brown to very dark brown to very dark gray to very dark grayish-brown (10YR 3/2 – 10YR 3/3; 7.5YR 2.5/2 – 3/1 – 3/2) silty clay with few rocks and rootlets; compact, fine, sticky, slightly plastic, non-cultural.

Layer II in T7 was basalt outcrop. Layer II in T8 was dark brown (7.5YR 3/2) clay with rootlets; sticky, slightly plastic, non-cultural. Layer II in T9 was very dark grayish-brown (10YR 3/2) clay; compact, homogenous, fine, sticky, slightly plastic, non-cultural.

Layer III in T3 was very dark brown (7.5YR 2.5/3) clay with few roots; compact, fine, sticky, plastic, non-cultural. Layer III in T7 and 8 was very dark grayish-brown (10YR 3/2) silty clay with few roots; fine, slightly sticky, slightly plastic, slightly compact, non-cultural. Layer III in T10 was dark gray (10YR 4/1) clay; moist, very fine, sticky, slightly plastic, non-cultural.

Layer IV in T10 was basalt outcrop.

DISCUSSION

No surface or subsurface cultural remains were encountered in both Parcels 7 and 64. The results of the current investigation produced no evidence for sedentary cultural activities during the prehistoric and early historic periods in the subject project area, and the background data search also supported this conclusion.

Fifteen trenches were excavated in Parcel 7, and ten trenches were excavated in Parcel 64. The results of backhoe testing showed that subsurface cultural remains were absent in all exposed stratigraphic layers. Stratigraphic analysis revealed a two to four layer stratigraphic sequence. The surface of both parcels consisted of Layer I, the till zone. Underlying the till zone were several layers of silty clay to compact clay. Basalt outcrop was encountered in T5, 7, 8, 9, and 10 in Parcel 7, and T10 in Parcel 64.

RECOMMENDATIONS

Based on the negative results of subsurface testing in both parcels, together with evidence for previous disturbances in the subject project area from pineapple cultivation, no further archaeological inventory work is recommended. However, due to the presence of significant sites in the vicinity, archaeological monitoring is recommended during initial construction activities to ensure that any subsurface cultural remains or deposits underlying the till zone are properly documented. Prior to commencing any construction activities, an archaeological monitoring plan shall be prepared for approval by SHPD.

REFERENCES

Bordner, Richard
1980 *Archaeological Reconnaissance, Makawao Subdivision (TMK 2-3-07:por 8)* Environmental Impact Statement Corporation, Maui

Connelly, R.A., III
1973 *Site 50-50-1-1062, Kaluapulani Petroglyphs, Makawao, Maui.* Hawaii State Archaeological Survey Form on file, Department of Land and Natural Resources. Ms. in Dept. Anthropology. Bishop Museum, Honolulu

Donham, Theresa
1990 *Archaeological Inventory Survey, Potential Upcountry Maui High School Sites, Lands of Haliimaile, Hokuula, Kailua, and Makaeha; Makawao District, Island of Maui.* For the State of Hawaii Department of Accounting and General Services. PHRI, Inc., Hilo

1992 *Field Inspection of Petroglyphs near the Kula 200 Subdivision, Makaeha, Makawao, Maui (TMK 2-3-07:15).* Inter-Divisional Memorandum. State Historic Preservation Division, DLNR, Maui

1992b *Surface survey of the Koyonagi Subdivision, Omaopio, Kula, Maui (TMK 2-3-03:129).* State Historic Preservation Division, DLNR, Maui

Foote, Donald et al.
1972 *Soil Survey of Islands of Kauai, Oahu, Molokai, and Lanai, State of Hawaii.* U.S. Department of Agriculture, Soil Conservation Service. U.S. Government Printing Office, Washington D.C.

Fredericksen, Demaris L. and Erik M. Fredericksen
1995 *An Inventory Survey of a 1.78-acre Parcel Located in Hoku'ula ahupua`a, Makawao District, Maui Island (TMK 2-3-44:31).* For Plantation Properties II. Xamanek Researches, Pukalani

1999 *Archaeological Inventory Survey for the Kulamalu Watertank and Waterline Improvements, Hoku`ula ahupua`a, Makawao District, Maui Island (TMK 2-3-07:por 10 & 11).* Xamanek Researches, Pukalani

Fredericksen, Demaris L., Walter Fredericksen, and Erik M. Fredericksen
1991 *Preliminary Report on Additional Archaeological Data Collection of Problematical Features on a Parcel in Pukalani, Maui, Hawaii (TMK 2-3-44:20).* For Hawaiian Estates Reality, Inc. Xamanek Researches, Pukalani

Handy, E.S. Craighill
1940 *The Hawaiian Planter.* Bishop Museum Bulletin No. 161. Bishop Museum Press, Honolulu

Handy, E.S. Craighill and Elizabeth Green Handy
1972 *Native Planters in Old Hawaii: Their Life, Lore, and Environment.* Bishop Museum Bulletin No. 233. Bishop Museum Press, Honolulu

Kamakau, Samuel M.
1961 *Ruling Chiefs of Hawaii.* Revised Edition. Kamehameha Schools Press, Honolulu

Kennedy, J.
1990 *Archaeological Investigations at a Suspected Heiau Site Located Near Pukalani, District of Kula, Maui (TMK 2-3-11).* For Ainalani Associates. Archaeological Consultants of Hawaii, Inc.

1991 *Survey and Test Results for the Proposed Pukalani Highlands Property TMK 2-3-44, Located at Pukalani, Island of Maui.* Archaeological Consultants of Hawaii, Inc.

1991 *Archaeological Inventory Survey and Test Results for the Proposed Pukalani Highlands Property Located at Pukalani, Ahupua'a of Kailau, District of Makawao, Island of Maui (TMK 2-3-44).* Archaeological Consultants of Hawaii, Inc.

Kuykendall, R.S.
1965 *The Hawaiian Kingdom, 1778-1854.* University of Hawaii Press, Honolulu

McPhatter, B., and P.H. Rosendahl
1996 *Archaeological Reconnaissance Survey, 250-Acre Pukalani Terrace Subdivision III, Land of A'apueo, Makawao District, Island of Maui (TMK 2-3-08: por. 5).* PHRI Report 1700-021696. Prepared for Dowling Company, Inc., Wailuku

Maxwell, Charles Sr.
1996 *Archaeological Investigation of Heiau Site, Land of Maka'eha, Pukalani District, Island of Maui (TMK 2-3-11:1; 2-3-9:30, 31, 32).* For the Malama Group. CKM Cultural Resources, Pukalani

2003 *Kualono Subdivision, Consolidation of TMK 2-3-11: 1 and 2, 28.695 Acres and Resubdivision into Lots 1 to 48, Inclusive, Old Haleakala Highway, Pukalani, Maui, Hawaii.* For Hanohano LLC. CKM Cultural Resources, Pukalani.

Neal, Marie C.
1965 *In Gardens of Hawaii.* Bishop Museum Special Publication No.50. Bishop Museum Press, Honolulu

Pantaleo, Jeffrey
2003 *Archaeological and Cultural Assessment of the Proposed Piiholo Road Well Site, Hali'imaile Ahupua'a, Makawao, Maui Island (TMK 2-4-12:por.6).* For Maui Land and Pineapple Company. Jeffrey Pantaleo Consultants, LLC, Honolulu

Pickett, J., L. Hazuka-Rotunno, and J. Pantaleo
2003 *Archaeological Monitoring Report for the Kulamalu Commercial Subdivision, A'apueo Ahupua'a, Kula District, Island of Maui (TMK 2-3-08:39, por. 39).* Archaeological Services Hawaii, LLC, Wailuku

Pukui, Mary K.
1983 *'Olelo No'eau.* Bishop Museum Special Publication 71. Bishop Museum Press, Honolulu

Pukui, Mary K., S.H. Elbert
1986 *Hawaiian Dictionary.* University of Hawaii Press, Honolulu

Pukui, Mary K., S.H. Elbert, and E.T. Mookini
1974 *Place Names of Hawaii.* University of Hawaii Press, Honolulu

Sinoto, A.
2001 *Cultural Impact Assessment for the Proposed Phased Development of the Pukalani Triangle, Makaeha Ahupua'a, Makawao, Maui.* Aki Sinoto Consulting, Honolulu

Sinoto, A. and Jeffrey Pantaleo
2002 *An Archaeological Inventory Survey of the Pukalani Triangle, Makaeha Ahupua'a, Makawao, Maui (TMK 2-3-07:08).* Aki Sinoto Consulting, Honolulu

Sterling, Elspeth P.
1998 *Sites of Maui.* BPBM Press, Honolulu

Wulzen, W., P.H. Rosendahl, and H. Wong Smith
1996 *Archaeological Inventory Survey, 44-Acre Pukalani Terrace Subdivision III, Land of A'apueo, Makawao District, Island of Maui (TMK 2-3-08: por. 5).* PHRI, Hilo. Prepared for Dowling Company, Inc., Wailuku

Walker, Winslow
1931 *Archaeology of Maui.* Ms. in Dept. Anthropology. Bishop Museum, Honolulu

E

Cultural Impact Assessment

KAUHALE LANI

(Heavenly Village)

Sunset at Kauhale Lani, project site. Photo by C. K. Maxwell

TMK 2-3-09:7, 49.99 acres, single-family homes in lower Pukalani & TMK 2-3-09:64, 38.623 acres, open space with walking path alongside the Haleakalā Bypass Highway. Pukalani, Maui, Hawaiʻi 96768

MITIGATING MEASURES

"Archaeological monitoring during initial grading"

NO IMPACT

F I N A L   R E P O R T

Prepared for:	*Prepared by*:
KAPALUA LAND COMPANY, LTD.	CKM Cultural Resources, L.L.C.
1000 Kapalua Drive	C. K. Maxwell Sr.
Kapalua, Hawaiʻi	157 Alea Place
	Pukalani, Maui, Hawaiʻi

KAUHALE LANI

(Heavenly Village)

TITLE PAGE

TMK 2-3-09:7, 49.99 acres, single-family homes in lower Pukalani & TMK 2-3-09:64, 38.623 acres, open space with walking path alongside the Haleakalā Bypass Highway, Pukalani, Maui, Hawaiʻi

MITIGATING MEASURES

"Archaeological monitoring during initial grading"

NO IMPACT

F I N A L   R E P O R T

February 2005

Prepared for:	*Prepared by*:
KAPALUA LAND COMPANY, LTD.	CKM Cultural Resources, L.L.C.
1000 Kapalua Drive	C. K. Maxwell Sr.
Kapalua, Hawaiʻi	157 Alea Place
	Pukalani, Maui, Hawaiʻi

KAUHALE LANI

(Heavenly Village)

TMK 2-3-09:7, 49.99 acres, single-family homes in lower Pukalani & TMK 2-3-09:64, 38.623 acres, open space with walking path alongside the Haleakalā Bypass Highway, Pukalani, Maui, Hawai'i

TABLE OF CONTENTS

KAUHALE LANI

(Heavenly Village)

TMK 2-3-09:7, 49.99 acres, single-family homes in lower Pukalani & TMK 2-3-09:64, 38.623 acres, open space with walking path alongside the Haleakalā Bypass Highway, Pukalani, Maui, Hawai'i

ABSTRACT

This study, in accordance with the guidelines of Office of Environmental Quality Control, describes resources having Hawaiian Cultural Value. It will describe potential impacts from further development, along with measures that could possibly be employed to mitigate those impacts. If any historic and/or prehistoric resources are identified during an archaeological survey, the study will evaluate the resources and assist in the development of a general preservation plan. It will also address the requirements of the Office of Hawaiian Affairs, in regards to cultural impacts. Specifically, the document will address potential effects on the Hawaiian Cultural and Traditional Customary Rights, as described in the legislation known as Act 50, Sessions Laws of Hawai'i, 2002, and meet the requirements of the HRS Chapter 343, which also requires an environmental assessment of cultural resources, in determining the significance of a proposed project. Also, Articles IX and XII of the State Constitution, other state laws, and the courts of the state, require government agencies to promote and preserve cultural beliefs, practices, and resources of Native Hawaiians and other ethnic groups. Furthermore, this study will address whether the development will impede access to any cultural or spiritual sites and how this could be mitigated, if cultural resources are found.

A Hawaiian cultural resource evaluation revealed the locations of the project (named Kauhale Lani – meaning *Heavenly Village*) areas as follows: The first site (TMK 2-3-09:7) is located on the Old Haleakalā[1] Highway, in the Kīhei direction. The makai[2] side (Kahului side) of the project is bordered by the New Hāmākua[3] Ditch, which separates this project from the HC&S Co. cane field. The mauka[4] side of the project runs parallel to Aeloa[5] Rd., which ends in a dead-end street. However, the project boundary continues in the Kīhei[6] direction bordering the homes on Ikea[7] Place and ends just after the beginning of Iolani[8] Street, in Lower Pukalani Terrace. According to information received from a resident who lives mauka of this project site, the area was once a ranch established by the Enos family. After being used for ranch land, pineapple was planted on this project area up until the present time.

The second site in this project is TMK 2-3-09:64, with a total of 38.623 acres. It begins at the intersection of the Haleakalā Highway (new bypass) and the Old Haleakalā Highway intersection, then goes in the mauka direction parallel to the Haleakalā Highway bypass, and ends at Makani[9] Road. It then runs along Makani Road in the Kīhei direction for a hundred yards and stops at Munoz[10] Road. The project site then continues in the makai direction along the back of the housing area, which follows a 10 foot gulley that is unnamed. The developers are planning to leave this area in open space and create a walking path with indigenous and endemic trees and plants.

---

[1] Haleakalā – "The House of the Sun", Mt. Haleakalā, 10,025 feet elevation, approximately 31 miles from this project.
[2] makai – Towards the sea.
[3] Hāmākua –Lit. means "long corner".
[4] mauka - Towards the mountain: upper side.
[5] A'e Loa – Name for the trade wind.
[6] Kīhei – (cloak), district in South Maui.
[7] 'ikea – To bring forth life.
[8] Iolani – The high flight of the hawk – referring to royalty.
[9] makani – Wind.
[10] Munoz Road – Named after Frank Munoz who developed this area.

No known Hawaiian cultural or spiritual practices were performed on either of the two properties.

The project area in Maka'eha[11] is located in and around very culturally important areas. It borders the ancient 'ili of 'A'apueo[12], which is separated by the Kaluapulani gulch. This gulch is located several hundred yards (in the Kīhei direction) from the project that is being assessed. Numerous petroglyphs have been recorded in Kaluapulani gulch, and they are considered to be the best in the State Of Hawai'i. Members of the Polynesian Voyaging Society took rubbings from a petroglyph of a double hulled sailing canoe and used it to fashion the sails for the Hōkule'a, the modern sailing canoe that traveled all over the Polynesian Triangle.

I have been through these gulches on many occasions and have found a lot of evidence that the ancient Hawaiian people came to these gulches to make adzes, shape stone implements, pound herbs, and many other reasons that are too numerous to mention. Also, a lot of the native flora still exists in these gulches. In 1963, Mr. John Tavares "discovered" in a cave a ki'i (or image) of the Kamapua'a family in either the Kaluapulani gulch, which is adjacent to Kauhale Lani, or the gulch of Kalialinui, which is located about a mile from this property in the Kīhei direction. This image is the only known wooden image from Maui and is presently kept at the Bishop Museum on O'ahu. A replica of this ki'i is on display at the Hale Ho'iki'iki Museum Bailey House in Wailuku.

Note: As much as possible, throughout this report, the spellings of Hawaiian vocabulary and place names have been standardized to present orthography.

---

[11] Maka'eha - translation is "sore eyes".
[12] 'A'apueo - Land of the female owl goddess Pueo.

KAUHALE LANI

(Heavenly Village)

TMK 2-3-09:7, 49.99 acres, single-family homes in lower Pukalani & TMK 2-3-09:64, 38.623 acres, open space with walking path alongside the Haleakalā Bypass Highway, Pukalani, Maui, Hawaiʻi

OUTLINE

KAUHALE LANI

(Heavenly Village)

TMK 2-3-09:7, 49.99 acres, single-family homes in lower Pukalani & TMK 2-3-09:64, 38.623 acres, open space with walking path alongside the Haleakalā Bypass Highway, Pukalani, Maui, Hawaiʻi

INTRODUCTION

Scope:

The scope of this report will be to compile various historical, cultural, and topographical accounts and facts of Makaʻeha (Pukalani as it is now called) and its adjacent ʻili[1]. Unfortunately, with only a few exceptions, direct references to Makaʻeha are meager. Therefore, the following description of the project area is derived from topographical, cultural, and usage descriptions of the more general areas of Kula. The report will be:

(1) In accordance with O.E.Q.C. guidelines, the study will describe resources having cultural value, and will describe potential impacts from further development along with measures that could be employed to mitigate those impacts. The contractor will coordinate with the archaeologist characterizing the site to evaluate the cultural significance of historic and prehistoric resources identified during an archaeological inventory, and will assist in the development of a general preservation plan for those resources.

[1] ʻili - Land section within a specific land division.

(2) It will also include a Traditional Practices Assessment that will meet the assessment requirements of O.E.Q.C. and O.H.A. for cultural impacts. Specifically, the document will address potential effects on Hawai'i's culture, and traditional and customary rights, as described in the legislation known as Act 50, 2000.

Specific Area of Research:

This project site shall be identified as: (1) TMK 2-3-09:7, 49.99 acres containing single-family homes and a park, and (2) TMK 2-3-09:64, 38.623 acres kept in open space, containing a walking path, planted with indigenous plants and trees. These project areas are located in the ahupua'a of Kula and in the 'ili of Maka'eha (Pukalani).

Surrounding 'Ili within Kula:

There are many 'ili within the ahupua'a[2] of Kula, which stretches from the shoreline to the peak of the mountain. Maka'eha is located on a high elevated plain of this ahupua'a. And, many other 'ili are either adjacent or perpendicular to Maka'eha, such as 'A'apueo[3] (separated by Kalialinui gulch), Ōma'opio, Keahua, Kailua, and many other 'ili'ili[4].

Maka'eha: (Lit. sore eyes) Maka'eha is rich with heritage. Much of the upper plains of the Kula region were dry and arid. This had left only a few options for the types of plants that could be cultivated here, and it was the home to one of the best plants that could handle such

[2] ahupua'a – Ancient land division and its boundaries would contain a pile of rocks with a pigs head on it.
[3] 'A'apueo – An owl god that lived in this land division.
[4] 'ili'ili - Smaller land sections within a specific land division and land section.

arid conditions. This area was the home to King Kihapi'ilani's mala 'uala (Sweet Potato Garden). Maka'eha is now called "Pukalani". It takes its name from a hill in the Makulekailua[5] area, which is called "Pu'ukalani (lit. meaning - "hill to heaven"). Maka'eha or Maka'ehu[6] has a unique position in all of Maui. From its location, there is a panoramic view of much of the island. Like most of its surroundings, Maka'eha is nestled on a ridge and encompassed by gulches and plateaus.

'A'apueo: The 'ili of 'A'apueo has a distinct topographical position. 'A'apueo is situated on a ridge, and therefore, it is largely protected by the two gulches that are on both of its sides. This important feature was the reason why 'A'apueo was a place of great refuge and home to many kahuna who guarded a special heiau with reverence.

A kahuna once lived in 'A'apueo, and his sole responsibility was to protect a heiau that was built on Pu'upane hill, in the Kula ahupua'a. While Kihapi'ilani and his wife stayed at 'A'apueo, they came in contact with this kahuna, who then gave the King and Queen a tour of the ahupua'a.

Pu'upane: (Lit. hill of answers) Pu'upane resides within the district of Kula. This hill was decreed by a ruling chief of Maui to be sacred. No commoner ascended this hill, for it was a heiau[7] for the high chiefs of Maui, stretching from ancient times until Kihapi'ilani's arrival upon the hill of Pu'upane. A certain kahuna[8] lived at 'A'apueo to make certain that no commoner ascended

[5] Makulekailua(old Kailua), located below what is now Pukalani, above Keahua.
[6] Maka'eha may be called Maka'ehu as those who are kama'āina or local to this area may once have called it so.
[7] heiau - Sacred place of worship of various gods.
[8] kahuna - Spiritual priest. (Lit. keeper of the secret)

Pu'upane, and allowed only those who were sanctified to do so.

Ōma'opio: (Lit. whistling thrush) Ōma'opio has four registered heiau and numerous ahu[9]. Located at Ōma'opio is a heiau named Mo'omuku[10]. This extensive heiau measured some ninety feet by one hundred and eight feet. Another registered heiau is Mahia heiau, located more to the north than Mo'omuku. This heiau is also smaller than Mo'omuku, at thirty-two feet by forty-one feet. Po'ohinahale heiau is located on the opposite side of Mahia heiau. This may also be the same heiau that is called Kaunuopahu, however the only living informant gave the name Po'ohinahale.

Kauhale Lani consists of two parcels. The first parcel will include single-family homes and a park. It is located at the bottom of Pukalani, on the Kīhei side of the Old Haleakalā Highway, heading in the mauka direction. The other parcel is located on the Kīhei side of the Haleakalā Bypass, and starts at the intersection of the Old Haleakalā Highway. This parcel will be kept in open space with a walking path planted with native plants.

The intent of the developer is not to "clutter" Pukalani with wall to wall houses, which stays in tune with the Upcountry Community Plan asking for open space areas wherever possible. As a member of the last C.A.C, we made this a point for developers to follow. Both areas are surrounded by significant ancient Hawaiian archaeological sites, however no known archaeological sites exist on the parcels in question. Also, no evidence was found through research that indicated any Hawaiian cultural practices were performed on either of the parcels.

[9] ahu - Personal platforms of which commoners and royalty alike created to heed offerings to various gods and guardians.
[10] When translated Mo'omuku means "dissected lizard".

'A'apueo: The female deity:

The completion of this report cannot be achieved without the mention of 'A'apueo. In various translations, the term 'A'apueo could mean "the owl's wail". The place name could also reflect the topography of the area, which is encompassed by the 'a'a rock. However, most sources believe the place was named after the female deity, 'A'apueo, who once resided in this area.

Lifestyle:

The word Kula in Hawaiian translates to "plain". While this may barely describe some of the topographical features of this ahupua'a, much of its landscape is dry and arid. Therefore, farming was limited to plants that were tolerable to cold evenings and hot tempered days. Although the landscape of Kula has changed considerably over the past two to three hundred years, the climate has remained constant. The scene for most of the landscape was farming families.

It was often documented that the people of Kula were incompetent. This was due to the fact that the people of Kula were not accustomed to the ways of the ocean. Families that lived near the ocean, and those who frequented the shores, mocked the people of Kula who lacked experience in the ocean lifestyle. Therefore, those who lacked the experience needed to master the familiarities of the ocean were deemed incompetent.

Today, Kula is a rapidly changing community, being very different from its scene ten years ago. The area is still largely agriculturally zoned. However, the demand for the suburban lifestyle shows its price, at nearly one million dollars for a choice lot. Its hillsides are abundant with wild deer that were introduced within the last 3 decades, and which is the cause of mass erosion and crop damage to the surrounding areas and farms of Kula.

Many of the culturally significant sights, such as heiau and ahu, are no longer in existence primarily due to the "paniolo" age[11]. During this era, much of the land was cleared for the industrially driven use of cattle ranching. Heiau and ahu were plundered without regard for their significance to the area. As mentioned earlier, the ahupuaʻa of Kula had many heiau and ahu located in ʻili such as Ōmaʻopio. During the late 1950's and 1960's, the conceptualized "suburbia" became the dream place to live, and thus began the influx of homes and population to Kula. This left little recovery of what had already been destroyed by the paniolo era. Fifty years ago, a Cultural Impact Statement was not an issue, and neither was the significance of documenting Hawaiian antiquities. This is the reason for the lack of information of such items.

[11] paniolo age - The era of cowboy influx into the Kula region.

Native Plant Growth:

The vegetation in the Kula and Makaʻeha area do not flourish as generously as other ahupua'a on Maui.

Every aspect of the traditional lifestyle was closely interconnected with the life forms of these islands. The saying, *"He Hawaiʻi Au"* – I am Hawaiʻi - reveals this basic truth: the people and their environment are one in the same. All of the needs of the population (which numbered nearly as many as those who inhabit Hawaiʻi today) were provided for abundantly from the life of the land and ocean, which passed on the stored energy of the sun in multitudes of useful and beautiful forms.

Due to its geographic location, as the most isolated land in the world (5,000 miles from the nearest continent), the Hawaiian archipelago evolved incredibly diverse and unique ecosystems, with myriad species of flora and fauna found nowhere else on the planet.

A well-known tree is the sandalwood (Santalum freyecinetianum), known in Hawaiian as ʻiliahi. The wood was traditionally used to scent kapa[12] cloth. It was sometimes used to make ʻukeke, a musical bow, the only traditional Hawaiian stringed instrument. The leaves and wood of the sandalwood trees were also used for medicinal purposes, often in combination with ʻawa[13] and other woods. One type of sandalwood, of the lanaiense variety, occurs near the peak of Kula's boundaries. Recognizable by its red flowers, it is an endangered species. Found only on East Maui and Lānaʻi, there are about 100 plants surviving today, with a population found on the southern slope of Kula.

[12] kapa - bark cloth made from wauke (Broussonetia papyrifera) or māmaki bark; formerly clothes of any kind or bedclothes; quilt.

[13] ʻawa - the kava (Piper methysticum), a shrub, native to the Pacific Islands, the root being the source of a narcotic drink of the same name used in ceremonies, and also used medicinally.

Other medicinal plants from this area include the ‘ahina kuahiwi (Gunnera petaloidea), also known as the ka‘ape‘ape or ‘ape‘ape, and the mau‘u la‘ili (Sisyrinchium acre), a crawling grass (native iris) found on Kula’s highest point. The mau‘u la‘ili is used to treat skin disorders.

The durable wood of the golden-flowered lacy mamane (Sophora chrysophylla) and the kolomona tree were utilized to make o‘o (digging sticks), house poles, and hōlua[14] sleds.

Most of Kula’s landscape is in a fairly dry and arid state, and thus, most plants do not do well in a place like this. However, Kula is gifted with well-balanced dirt, as it is known today for producing the famous "Maui onion".

Due to the dry conditions, kalo (taro) was not a suitable crop to plant. To supplement the need for wet land kalo, the ‘uala (sweet potato) was grown as an alternative. Many sources point to the example of Kihapi‘ilani’s potato patch in Maka‘eha. Sweet potato was just as stable and healthy as kalo, yet required less water to fruit, whereas the kalo grew best in fields of fresh running water.

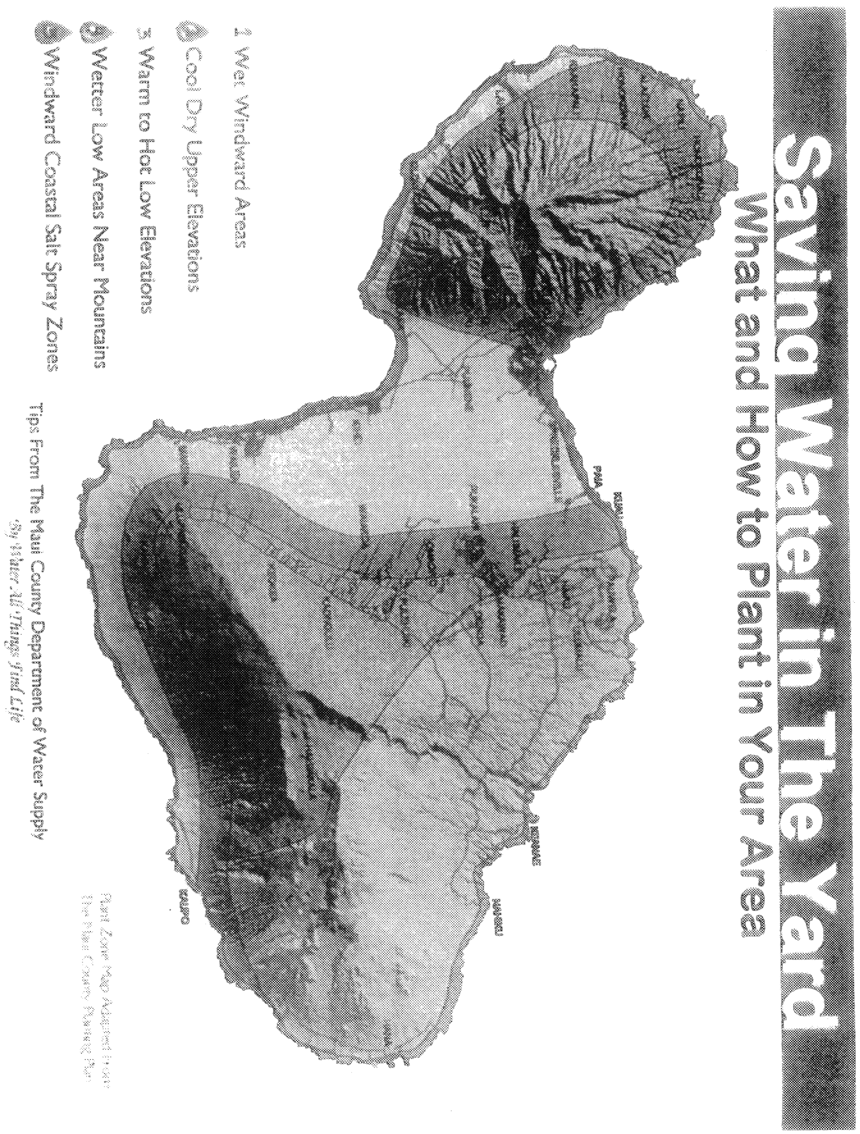
Another plant that may have grown in this area, to supplement the need for kalo, was ‘ulu (Artocarpus incisus – breadfruit). According to "Native Planters in Old Hawai‘i: Their life, lore, and environment," written by E.S. Handy et al. explicates, "…early voyagers noted extensive planting of breadfruit along the southern and leeward coast…" Although this statement singles out the southern and leeward coasts, which are the dryer areas of the island, Kula still made a perfect place for ‘ulu to flourish because of its arid plains.

[14] hōlua - sled, especially the ancient sled used on grassy slopes.

Another blossoming plant that has resided in this area is the ‘a‘ali‘i (Dodonaea viscosa) bush. This hard wood native shrub is indigenous to the islands. This plant also grows well in dryer climates. Ranging in height from one to thirty feet, this shrub/tree is found growing at elevations of up to 8,000 feet, and in wind-swept open country. It is found today in the gulches and surrounding area of this site.

One essential plant used to construct thatched homes was the pili grass (Heteropogon contortus). The Hawaiian people would line the exteriors of their homes with dried clumps of this grass for waterproofing. Pili grass liked to grow in arid and dusty conditions, and thus, was quite common in this area.

Plant Zone Map of Maui



ZONES

The Maui County Planting Plan has compiled a system of 5 zones of plant growth for Maui County. The descriptions of zones and maps for these zones are as follows:

Zone 1:
Wet areas on the windward side of the island. More than 40 inches of rain per year. Higher than 3,000 feet.

Zone 2:
Cool, dry areas in higher elevations (above 1,000 feet). 20 to 40 inches of rain per year.

Zone 3:
Low, drier areas, warm to hot. Less than 20 inches of rain per year. Sea level to 1,000 feet.

Zone 4:
Lower elevations which are wetter due to proximity of mountains. 1,000 to 3,000 feet.

Zone 5:
Salt spray zones in coastal areas on the windward side.

These zones are to be used as a general guide to planting for Maui County. In addition to looking at the maps, read the descriptions of the zones and decide which zone best fits your area. Plants can be listed in more than one zone and can be planted in a variety of conditions. For best results, take notes on the rainfall, wind, sun and salt conditions of your site. Use the zones as a general guide for selection and read about the plants to decide which best fits your needs as far as care and or function.

Explanation of Plant Zone Map

Zone-specific Native and Polynesian plants for Maui County

Zone 2

Type	Scientific Name	Common Name	Height	Spread	Elevation	Water req.
Tr	Nestegis sandwicensis	olopua	15'	15'	1,000' to 3,000'	Dry to Medium
Tr	Pleomele auwahiensis	halapepe	20'			
Tr	Rauvolfia sandwicensis	hao	20'	15'	sea to 3,000'	Dry to Medium
Tr	Santalum ellipticum	coastal sandalwood, 'ili-ahi	8'	8'	sea to 3,000'	Dry to Medium
Tr	Sophora chrysophylla	mamane	15'	15'	1,000' to 3,000'	Medium
V	Alyxia oliviformis	maile	Vine		sea to 6,000'	Medium to Wet

Zone-specific Native and Polynesian plants for Maui County

Zone 2

TYPE: **F** Fern **G** Grass **Gr** Ground Cover **Sh** Shrub **P** Palm **S** Sedge **Tr** Tree **V** Vine

Type	Scientific Name	Common Name	Height	Spread	Elevation	Water req.
F	Psilotum nudum	moa, moa kula	1'	1'	sea to 3,000'	Dry to Wet
F	Sadleria cyatheoides	'ama'u, ama'uma'u				
G	Eragrostis monticola	kalamalo	1'	2'	sea to 3,000'	Dry to Medium
Gr	Ipomoea tuboides	Hawaiian moon flower, 'uala	1'	10'	sea to 3,000'	Dry to Medium
Gr	Peperomia leptostachya	'ala'ala-wai-nui	1'	1'	sea to 3,000'	Dry to Medium
Gr	Plumbago zeylanica	'ilie'e	1'			
Gr - Sh	Hibiscus calyphyllus	ma'o hau hele, Rock's hibiscus	3'	2'	sea to 3,000'	Dry to Medium
Gr - Sh	Lipochaeta rockii	nehe	2'	2'	sea to 3,000'	Dry to Medium
Sh	Argemone glauca var. decipiens	pua kala	3'	2'	sea to 3,000'	Dry to Medium
Sh	Artemisia mauiensis var. diffusa	Maui wormwood, 'ahinahina	2'	3'	1,000' to higher	Dry to Medium
Sh	Chenopodium oahuense	'aheahea, 'aweoweo	6'		sea to higher	Dry to Medium
Sh	Dianella sandwicensis	'uki	2'	2'	1,000' to higher	Dry to Medium
Sh	Lipochaeta lavarum	nehe	3'	3'	sea to 3,000'	Dry to Medium
Sh	Osteomeles anthyllidifolia	'ulei, eluehe	4'	6'	sea to 3,000'	Dry to Medium
Sh	Senna gaudichaudii	kolomana	5'	5'	sea to 3,000'	Dry to Medium
Sh	Styphelia tameiameiae	pukiawe	6'	6'	1,000' to higher	Dry to Medium
Sh	Vitex rotundifolia	pohinahina	3'	4'	sea to 1,000'	Dry to Medium
Sh - Tr	Myoporum sandwicense	naio, false sandalwood	10'	10'	sea to higher	Dry to Medium
Sh - Tr	Nototrichium sandwicense	kulu'i	8'	8'	sea to 3,000'	Dry to Medium
Sh-Tr	Dodonaea viscosa	'a'ali'i	6'	8'	sea to higher	Dry to Medium
Tr	Acacia koa	koa	50' - 100'	40' - 80'	1,500' to 4,000'	Dry to Medium
Tr	Charpentiera obovata		15'			
Tr	Erythrina sandwicensis	wiliwili	20'	20'	sea to 1,000'	Dry
Tr	Metrosideros polymorpha var. macrophylla	ohi'a lehua	25'	25'	sea to 1,000'	Dry to Wet

PLACES TO BUY NATIVES ON:

Maui:

1. Hoolawa Farms — 575-5099
   P O Box 731
   Haiku HI 96708
   The largest and best collection of natives in the state. They will deliver, but it's worth the drive to go and see!
   Will propagate upon request

2. Kula True Value Nursery — 878-2551
   Many natives in stock
   Get most of their plants from Hoolawa Farms
   They take special requests

3. Kihei Garden and Landscape — 244-3804

4. Kihana Nursery, Kihei — 879-1165

5. The Hawaiian Collection — 878-1701
   Specialize in Sandalwood propagation
   Will propagate special requests

Places to Buy Native Plants

Wildlife:

There is little recorded information about the wildlife in the Kula/Maka'eha region. However, today the area is infested with foreign plants, wild feral, and fowl. This has left much of Kula's natural habitat destroyed.

In Maka'eha, seldom does the native owl take flight. It is the common barn owl, native to North America, which primarily inhabits the region. The common barn owls tend to be more aggressive in nature, which has caused depletion to other native birds and native plant species.

INTERVIEWS OF INFORMANTS

STATEMENT OF:

Albert "Ape" Fernandez, Adult/Port./Hawn.
Retired – Hawaiian Telephone
2840 Koea Place, Pukalani, Maui, Hawai'i 96768
(Property overlooks Kauhale Lani)

Interviewed at his residence on November 8, 2004, at 5:30 p.m.
He related that he moved to his present residence around the mid-1950's. At the time, there were no homes in the area and he was told by his neighbors that there was an old Hawaiian church on the property that he bought. He stated that the only thing he could remember was a large stone pile and didn't know if it was left by the old church. He also remembered that the property in question (Kauhale Lani) was used for ranching by the Enos family. After the ranching, the property was planted with pineapple until the present time. He did not remember any Hawaiian services being conducted on the property.

STATEMENT OF:

Robert Bonacorsi, Adult/Cau.
Fireman – Maui Fire Department
39 Munoz Road, Pukalani, Maui, Hawai'i 96768

Interviewed at his residence on November 9, 2004, at 11:00 a.m.
He stated that his residence is located adjacent to the "open space" parcel and he was very happy to hear that it will be kept in open space. After hearing that the property would also include a walking path, he felt that there shouldn't be any problems as long as the people using the path do not come onto his property because he has animals. He suggested that a fence could possibly be placed in the gully to keep people from coming onto his property. He was very favorable to the idea.

STATEMENT OF:

Lionel "Rachi" Santos, Adult/Port.
Retired – Haleakalā Ranch
32 A'ala Road, Makawao, Maui, Hawai'i

Interviewed on November 5, 2004, at 11:15 a.m.
He stated that Mr. Bonacorsi is his son-in-law and he spends a lot of time at their residence. He is a life-long resident of Upcountry Maui, and more so of the Pukalani area. He recalled that when he was a young child all of the property in the Pukalani area was owned by the Ma'alo Estate. He related that one of the great grand children of the Ma'alo Estate, Wayne Asuē, was still living on the property. As far as he could remember, there was always pineapple grown on the open space area. Also, he thought that it was a good idea to keep this area in open space. He could not recall any Hawaiian ceremonies being performed on the properties in question.

STATEMENT OF:

James Francis DeRego, Adult/Port.
Retired – County Sanitation Div.
133 Ikea Place, Pukalani, Maui, Hawai'i 96768

Interviewed at his home on November 5, 2004, at 11:30 a.m.
He related that he has lived in Pukalani for the past 40 years. As far as he could recall, the open space parcel has been planted in pineapple. He thought that it was a good idea to make it open space with a walking path, but felt that some measures must be taken to keep the people from crossing over to his property. He did not know of any Hawaiian ceremonies that might have taken place on this property or at Kauhale Lani.

STATEMENT OF:

Jeff Tarpey, Adult/Cau.
Management - United Airlines
145 Piimauna St., Pukalani, Maui, Hawaiʻi 96768

Interviewed at his home on November 9, 2004, at 11:05 a.m.

He stated that he moved into the Kua Lono Subdivision about two years ago. His home overlooks the open space parcel and the By-pass Haleakalā Highway. He thought that it would be a great idea to have the subject parcel in open space. Being a new resident to this area, he did not know much of the subject area.

STATEMENT OF:

Wayne Manuel Asuē, Adult/Cau./Hawn.
Fireman - State Of Hawaiʻi
2605-A Old Haleakalā Highway, Pukalani, Maui, Hawaiʻi 96768

Interviewed at his home on November 5, 2004, at 2:00 p.m.

He related that his grandfather, Manuel Asuē, owned his property and many of the other properties around the Pukalani area. His property, which is a little over 5 acres, is bordering the parcel slated for open space. He felt that the open space parcel was a good idea. There is an un-named 12 foot gully which separates his property from the parcel. He did not know of any Hawaiian cultural ceremonies that might have been held on the parcel in question and did not remember his father telling him of any.

STATEMENT OF:

James T. Sato, Adult/Jap.
Retired Owner – Maui Recapping Center
132 Ikea Place, Pukalani, Maui, Hawaiʻi 96768

Interviewed at his residence on December 30, 2004, at 10:30 a.m.

He related that he moved to his present residence in 1950. His property borders Kauhale Lani on the mauka side. He remembered that there was an old Hawaiian church where "Ape" Fernandez's home is and recalled that there were burials towards the Kīhei side of his home. He personally did not see the burials, but was told by others about their existence. He was not happy with the fact that there is going to be a subdivision fronting his home and preferred that the property remained in pineapple farming. He had nothing further to add.

STATEMENT OF:

Eleanor Bell, Adult/Hawn./Chi.
Retired – Maui Pineapple Cannery
39 Aeloa Place, Pukalani, Maui, Hawaiʻi 96768
(will soon be moving to 280 Pueo Dr., Kula, Maui)

Interviewed at her home on December 30, 2004, at 11:30 a.m.

She related that she had sold her home on Ikea St. in anticipation of their moving to the Hawaiian Homes Community in Kula. Their lot is not ready, so they are renting at their present residence. She stated that Kauhale Lani was always planted in pineapple, and she felt that the project was a good thing for the community, especially with the "open space" parcel.

CKM CULTURAL RESOURCES, L.L.C.

Specializing in Cultural Impact Statements
(using State of Hawaii O.E.Q.C. methods),
Blessings, Weddings, Lectures
and Ho'oponopono

IMINA I KA NA'AUAO E PAHU IA MAKOU IMUA
(Seeking the knowledge to push us forward)

INTERVIEW SUMMARY AND CONSENT FORM

JOB NAME: Kauhale Lani

PERSON INTERVIEWED: Albert "Ape" Fernandez

DATE & TIME OF INTERVIEW: ______________

INTERVIEWER: **CKM CULTURAL RESOURCE L.L.C. - C. K. Maxwell**

PURPOSE OF INTERVIEWE: **CULTURAL IMPACT ASSESSMENT**

I HEREBY GIVE PERMISSION TO CKM CULTURAL RESOURCES L.L.C., TO USE, THE INFORMATION FROMTHIS INTERVIEW IN PREPARING A CULTURAL IMPACT ASSESSESMENT REPORT FOR THE SUBJECT PROJECT. I FURTHERE UNDERSTAND THAT I WILL BE GIVEN A COPY OF MY COMMENTS.

Person Interviewed Print name: ALBERT FERNANDEZ
Signature: Albert Fernandez
Date: 11-9-04

Kahu Charles Kauluwehi Maxwell, Sr.
157 Alea Place · Pukalani, Maui, HI 96768
Phone: (808) 572-8038 · Fax (808) 572-0602 · Cell: 870-3345
Email: kale@moolelo.com Website: www.moolelo.com

Albert "Ape" Fernandez's Consent Form

CKM CULTURAL RESOURCES, L.L.C.

Specializing in Cultural Impact Statements
(using State of Hawaii O.E.Q.C. methods),
Blessings, Weddings, Lectures
and Ho'oponopono

IMINA I KA NA'AUAO E PAHU IA MAKOU IMUA
(Seeking the knowledge to push us forward)

INTERVIEW SUMMARY AND CONSENT FORM

JOB NAME: Kauhale Lani

PERSON INTERVIEWED: Robert Bonacorsi

DATE & TIME OF INTERVIEW: Nov 9, 2004 11:00am

INTERVIEWER: **CKM CULTURAL RESOURCE L.L.C. - C. K. Maxwell**

PURPOSE OF INTERVIEWE: **CULTURAL IMPACT ASSESSMENT**

I HEREBY GIVE PERMISSION TO CKM CULTURAL RESOURCES L.L.C., TO USE, THE INFORMATION FROMTHIS INTERVIEW IN PREPARING A CULTURAL IMPACT ASSESSESMENT REPORT FOR THE SUBJECT PROJECT. I FURTHERE UNDERSTAND THAT I WILL BE GIVEN A COPY OF MY COMMENTS.

Person Interviewed Print name: Robert Bonacorsi
Signature: Robert Bonacorsi
Date: 11.9.2004

Kahu Charles Kauluwehi Maxwell, Sr.
157 Alea Place · Pukalani, Maui, HI 96768
Phone: (808) 572-8038 · Fax (808) 572-0602 · Cell: 870-3345
Email: kale@moolelo.com Website: www.moolelo.com

Robert Bonacorsi's Consent Form

CKM CULTURAL RESOURCES, L.L.C.

Specializing in Cultural Impact Statements
(using State of Hawaii O.E.Q.C. methods),
Blessings, Weddings, Lectures
and Ho'oponopono

IMI NA I KA NA'AUAO E PAHU IA MAKOU IMUA
(Seeking the knowledge to push us forward)

INTERVIEW SUMMARY AND CONSENT FORM

JOB NAME: Kauhale Lani

PERSON INTERVIEWED: Lionel "Rachi" Santos

DATE & TIME OF INTERVIEW: 11-9-04 1045 Am.

INTERVIEWER: **CKM CULTURAL RESOURCE L.L.C. - C. K. Maxwell**

PURPOSE OF INTERVIEWE: **CULTURAL IMPACT ASSESSMENT**

I HEREBY GIVE PERMISSION TO CKM CULTURAL RESOURCES L.L.C., TO USE, THE INFORMATION FROMTHIS INTERVIEW IN PREPARING A CULTURAL IMPACT ASSESESMENT REPORT FOR THE SUBJECT PROJECT. I FURTHERE UNDERSTAND THAT I WILL BE GIVEN A COPY OF MY COMMENTS.

Person Interviewed Print name: Lionel Santos
Signature: Lionel Santos
Date: 11-9-04

Kahu Charles Kauluwehi Maxwell Sr.
157 Alea Place Pukalani, Maui, HI 96768
Phone (808) 572-8038 Fax (808) 572-0602 · Cell: 870-3345
Email: kale@moolelo.com · Website: www.moolelo.com

Lionel "Rachi" Santos' Consent Form

CKM CULTURAL RESOURCES, L.L.C.

Specializing in Cultural Impact Statements
(using State of Hawaii O.E.Q.C. methods),
Blessings, Weddings, Lectures
and Ho'oponopono

IMI NA I KA NA'AUAO E PAHU IA MAKOU IMUA
(Seeking the knowledge to push us forward)

INTERVIEW SUMMARY AND CONSENT FORM

JOB NAME: Kauhale Lani

PERSON INTERVIEWED: James DeRego

DATE & TIME OF INTERVIEW: 11:30 11-11-04

INTERVIEWER: **CKM CULTURAL RESOURCE L.L.C. - C. K. Maxwell**

PURPOSE OF INTERVIEWE: **CULTURAL IMPACT ASSESSMENT**

I HEREBY GIVE PERMISSION TO CKM CULTURAL RESOURCES L.L.C., TO USE, THE INFORMATION FROMTHIS INTERVIEW IN PREPARING A CULTURAL IMPACT ASSESESMENT REPORT FOR THE SUBJECT PROJECT. I FURTHERE UNDERSTAND THAT I WILL BE GIVEN A COPY OF MY COMMENTS.

Person Interviewed Print name:
Signature: James DeRego
Date: 11-11-04

Kahu Charles Kauluwehi Maxwell Sr.
157 Alea Place Pukalani, Maui, HI 96768
Phone (808) 572-8038 Fax (808) 572-0602 · Cell: 870-3345
Email: kale@moolelo.com · Website: www.moolelo.com

James DeRego's Consent Form

CKM CULTURAL RESOURCES, L.L.C.

Specializing in Cultural Impact Statements
(using State of Hawaii O.E.Q.C. methods),
Blessings, Weddings, Lectures
and Ho'oponopono

IMINA I KA NA'AUAO E PAHU IA MAKOU IMUA
(Seeking the knowledge to push us forward)

INTERVIEW SUMMARY AND CONSENT FORM

JOB NAME: Kauhale Lani

PERSON INTERVIEWED: Jeff Tarpey

DATE & TIME OF INTERVIEW: 11-13-04

INTERVIEWER: CKM CULTURAL RESOURCE L.L.C. - C. K. Maxwell

PURPOSE OF INTERVIEWE: CULTURAL IMPACT ASSESSMENT

I HEREBY GIVE PERMISSION TO CKM CULTURAL RESOURCES L.L.C., TO USE, THE INFORMATION FROMTHIS INTERVIEW IN PREPARING A CULTURAL IMPACT ASSESSESMENT REPORT FOR THE SUBJECT PROJECT. I FURTHERE UNDERSTAND THAT I WILL BE GIVEN A COPY OF MY COMMENTS.

Person Interviewed Print name: Jeff Tarpey
Signature: [signature]
Date: 11-13-04

Kahu Charles Kauluwehi Maxwell, Sr.
157 Alea Place · Pukalani, Maui, HI 96768
Phone: (808) 572-8038 · Fax: (808) 572-0602 · Cell: 870-3345
Email: kale@moolelo.com · Website: www.moolelo.com

Jeff Tarpey's Consent Form

CKM CULTURAL RESOURCES, L.L.C.

Specializing in Cultural Impact Statements
(using State of Hawaii O.E.Q.C. methods),
Blessings, Weddings, Lectures
and Ho'oponopono

IMINA I KA NA'AUAO E PAHU IA MAKOU IMUA
(Seeking the knowledge to push us forward)

INTERVIEW SUMMARY AND CONSENT FORM

JOB NAME: Kauhale Lani

PERSON INTERVIEWED: Wayne Manuel Asuē

DATE & TIME OF INTERVIEW: 11/13/04 10:30 AM

INTERVIEWER: CKM CULTURAL RESOURCE L.L.C. - C. K. Maxwell

PURPOSE OF INTERVIEWE: CULTURAL IMPACT ASSESSMENT

I HEREBY GIVE PERMISSION TO CKM CULTURAL RESOURCES L.L.C., TO USE, THE INFORMATION FROMTHIS INTERVIEW IN PREPARING A CULTURAL IMPACT ASSESSESMENT REPORT FOR THE SUBJECT PROJECT. I FURTHERE UNDERSTAND THAT I WILL BE GIVEN A COPY OF MY COMMENTS.

Person Interviewed Print name: WAYNE M. ASUĒ
Signature: [signature]
Date: Nov. 13, 2004

Kahu Charles Kauluwehi Maxwell, Sr.
157 Alea Place · Pukalani, Maui, HI 96768
Phone: (808) 572-8038 · Fax: (808) 572-0602 · Cell: 870-3345
Email: kale@moolelo.com · Website: www.moolelo.com

Wayne Manuel Asuē's Consent Form

CKM CULTURAL RESOURCES, L.L.C.

Specializing in Cultural Impact Statements
(using State of Hawaii O.E.Q.C. methods),
Blessings, Weddings, Lectures
and Ho'oponopono

IMINA I KA NA'AUAO E PAHU IA MAKOU IMUA
(Seeking the knowledge to push us forward)

INTERVIEW SUMMARY AND CONSENT FORM

JOB NAME: Kauhale Lani

PERSON INTERVIEWED: James T. Sato

DATE & TIME OF INTERVIEW: 12-30-04 – 1030 AM

INTERVIEWER: CKM CULTURAL RESOURCE L.L.C. - C. K. Maxwell

PURPOSE OF INTERVIEWE: CULTURAL IMPACT ASSESSMENT

I HEREBY GIVE PERMISSION TO CKM CULTURAL RESOURCES L.L.C., TO USE, THE INFORMATION FROMTHIS INTERVIEW IN PREPARING A CULTURAL IMPACT ASSESESEMENT REPORT FOR THE SUBJECT PROJECT. I FURTHERE UNDERSTAND THAT I WILL BE GIVEN A COPY OF MY COMMENTS.

Person Interviewed Print name: JAMES T. SATO
Signature: James T. Sato
Date: 12-30-2004

Kahu Charles Kauluwehi Maxwell, Sr.
157 Alea Place · Pukalani, Maui, HI 96768
Phone: (808) 572-8038 Fax. (808) 572-0602 · Cell: 870-3345
Email: kale@moolelo.com Website: www.moolelo.com

James T. Sato's Consent Form

CKM CULTURAL RESOURCES, L.L.C.

Specializing in Cultural Impact Statements
(using State of Hawaii O.E.Q.C. methods),
Blessings, Weddings, Lectures
and Ho'oponopono

IMINA I KA NA'AUAO E PAHU IA MAKOU IMUA
(Seeking the knowledge to push us forward)

INTERVIEW SUMMARY AND CONSENT FORM

JOB NAME: Kauhale 'Lani

PERSON INTERVIEWED: Eleanor Bell

DATE & TIME OF INTERVIEW: 12/30/04 – 1130 pm.

INTERVIEWER: CKM CULTURAL RESOURCE L.L.C. - C. K. Maxwell

PURPOSE OF INTERVIEWE: CULTURAL IMPACT ASSESSMENT

I HEREBY GIVE PERMISSION TO CKM CULTURAL RESOURCES L.L.C., TO USE, THE INFORMATION FROMTHIS INTERVIEW IN PREPARING A CULTURAL IMPACT ASSESESEMENT REPORT FOR THE SUBJECT PROJECT. I FURTHERE UNDERSTAND THAT I WILL BE GIVEN A COPY OF MY COMMENTS.

Person Interviewed Print name: Eleanor BeLL
Signature: Eleanor Bell
Date: 12/30/04

Kahu Charles Kauluwehi Maxwell, Sr.
157 Alea Place Pukalani, Maui, HI 96768
Phone: (808) 572-8038 Fax: (808) 572-0602 · Cell: 870-3345
Email: kale@moolelo.com · Website: www.moolelo.com

Eleanor Bell's Consent Form

KAUHALE LANI

(Heavenly Village)

<u>TMK 2-3-09:7</u>, 49.99 acres, single-family homes in lower Pukalani & <u>TMK 2-3-09:64</u>, 38.623 acres, open space with walking path alongside the Haleakalā Bypass Highway, Pukalani, Maui, Hawaiʻi

CONCLUSION

Much of the history of Makaʻeha, which includes this project area, lacks in quantitative measures. Thus, it is extremely difficult to extract the details of a lifestyle unfamiliar to those of today. The natural habitat is inundated with foreign forest shrubbery and various other plants brought in to "beautify" certain landscapes, such as the cactus (pānini) which thrives in this region today.

Much of Kula's natural and indigenous landscape barely exists. The thinking then, should be to reverse the impact on the land, such as planting shrubs native to the area, desecrate the land as little as possible, and to stop the use of tactics such as those of the "paniolo era". More cautious approaches to certain areas are solutions to the vitality of our Hawaiʻi.

From all indications, this project will not affect the fauna, flora, or endangered species, because they were already impacted by prior agricultural disturbances which occurred on this project area many years ago.

Because of the prior disturbance, no cultural or archaeological properties were found for preservation on this project site. In the project area, no evidence of past or present use for Hawaiian cultural practices, resources, or beliefs were found in the study area.

That does not mean that this area is free of Hawaiian cultural association. The property is in close proximity to the Kalialinui gulch, which happens to contain the best petroglyphs in the State Of Hawaiʻi. Members of the Polynesian Voyaging Society took rubbings from a petroglyph of a canoe and used it to fashion the sail for the Hōkuleʻa (a Hawaiian double-hulled sailing canoe).

An archaeological survey was conducted by Archaeological Services Hawaii L.L.C. Lisa Rotunno Hazuka related that they found nothing in their test trenches to indicate any archaeological findings of Hawaiian habitation or burials. She suggested monitoring during initial grading, and if finds are negative, determination can be made by Dr. Melissa Kirkendall of the Maui Historic Preservation Department of the State Land and Natural Resources Division.

There are no areas of impact from the proposed construction on this site, so mitigation measures are not necessary.

I would declare at this time that, based on my personal knowledge of the property, extensive research conducted of the property, site visits to the property from October thru November 2004, interviews with several long-time residents of the area, and review of the archaeological inventory survey conducted by Archaeological Services Hawaii L.L.C., it is my professional opinion that the proposed development will not have any significant adverse effects to native Hawaiian traditional and customary rights which would require protection under Article XII, Section 7 of the Hawaii State Constitution.

Refer to archaeological report by Archaeological Services Hawaii L.L.C.

INTEPRETATION OF PROJECT'S NAME

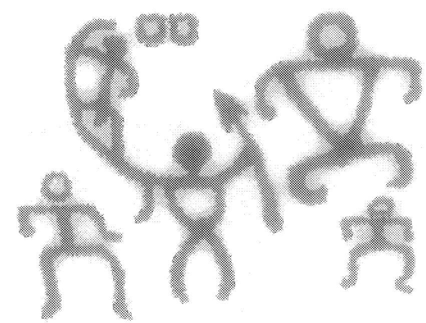
KAUHALE LANI

The name "Kauhale" was chosen because its meaning, in a poetic sense, refers to a "village". The homes that will be built represent a "village", with its own park where people could gather as friends and neighbors.

"Lani" was used because it represents part of the chosen area name of Pukalani, which means "pathway to heaven". "Lani" means heaven. Together it is translated to mean "Heavenly Village".

State Historic Preservation Division

PROTECTING NATIVE HAWAIIAN BURIALS



For at least two thousand years, native Hawaiians have placed the earthly remains and spirits of their "kupuna," or ancestors, within the landscapes of Hawai'i.

When a departing kupuna was laid to rest there was never a doubt that their remains would empower their descendants until they themselves were reduced to earth. Some kupuna were covered by stacked stones while others were buried with no surface markers at all, frequently in sand dunes.

Remains of high chiefs or those kupuna of high honor often were interred at night to conceal their location from jealous rivals who might steal and degrade or otherwise use the spiritual power of the remains for personal gain.

Because of these cultural practices, ancestral bones can be found almost anywhere in Hawai'i today. Burial sites are often accidentally disturbed either by nature (high surf or erosion) or by human activity through projects that involve excavation.

If you discover a burial site: stop activity in the immediate area; leave remains in place; contact the State Department of Land and Natural Resources, Historic Preservation Division and your County Police Department. Reporting a burial site disturbance is required by law (Hawai'i Revised Statutes, Chapter 6E) and severe penalties could result when SHPD is not notified of such disturbance.

Let us all continue to give these ancestors the dignity and respect they deserve. Become a partner in preserving and protecting Hawaiian burial sites.

BIBLIOGRAPHY

Pūku'i, Mary Kawena, et al. Place Names of Hawai'i. Honolulu, HI: University of Hawai'i Press, 1976.

United States. United States Map of Census 2000. U.S. Census 2000. Washington: GPO, 2000.

United States Geological Survey GNIS Database (November 20).

Buck, Peter H., Arts and Crafts of Hawai'i. Honolulu: Bishop Museum Special Publication No. 45, 1957.

Emerson, Nathaniel B., Pele and Hi'iaka. A myth from Hawai'i. Rutland, VT and Japan: C.E. Tuttle, 1978.

Handy, E.S. Craighill, et al. Native Plants in Old Hawai'i. Honolulu, HI: 1991

Kamakau, Samuel Mānaiakalani. Ka Po'e Kāhiko: The people of old. Bishop Museum Press. Honolulu, HI, 2000.

Malo, David. Ch. 35-37 in Hawaiian Antiquities. 1898. Honolulu: Bishop Museum Special Publication No. 2, 1976.

Mitchell Ph.D., D. Kilolani. Resource Units in Hawaiian Culture: Revised Edition. Honolulu, HI: Kamehameha Schools Press, 2001.

Elspeth P. Sterling, Sites of Maui. Bishop Museum Press. 1998.

View of the project from the Old Haleakalā Highway, looking in the makai direction.

View from the bottom of the property, looking towards the Kīhei direction (note Hāmākua ditch)

Photograph of the New Hāmākua Ditch, taken from the bottom of the property.

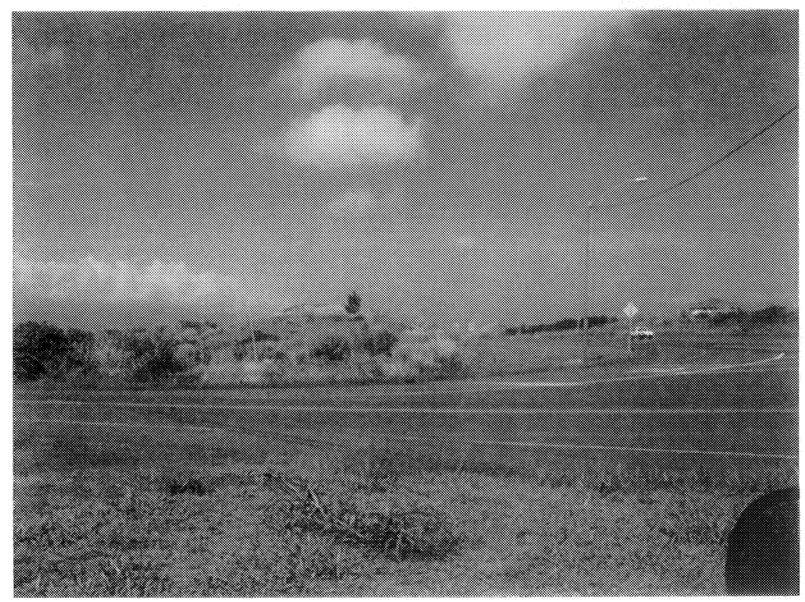
Looking mauka towards a resident's home on Aeloa Rd.

View from property looking towards the intersection of the Old Haleakalā Highway and Haleakalā Highway Bypass.

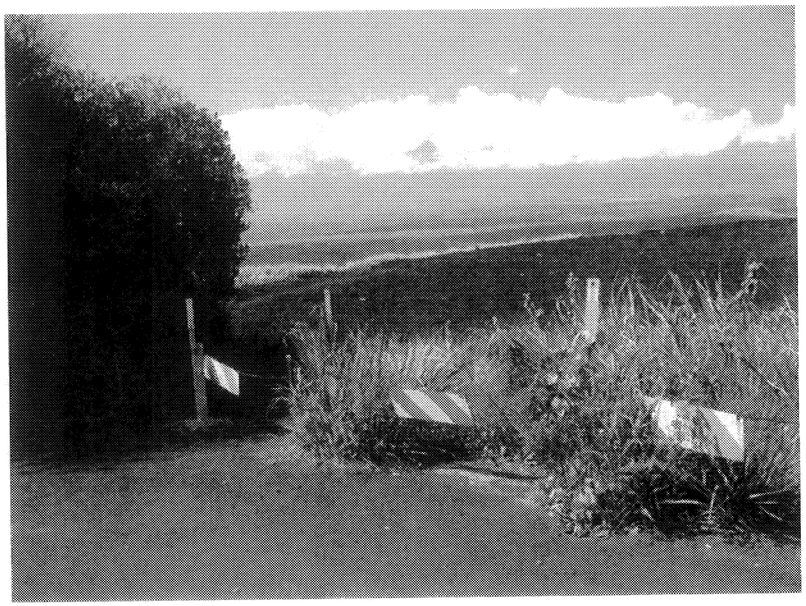
Entrance to the 38.623 acre "open space" parcel from the Old Haleakalā Highway.

View of the bottom of the "open space" parcel from the intersection of the Old Haleakalā Highway and new Haleakalā Highway.

Photograph taken from the middle of the "open space" parcel, facing the Kīhei direction.

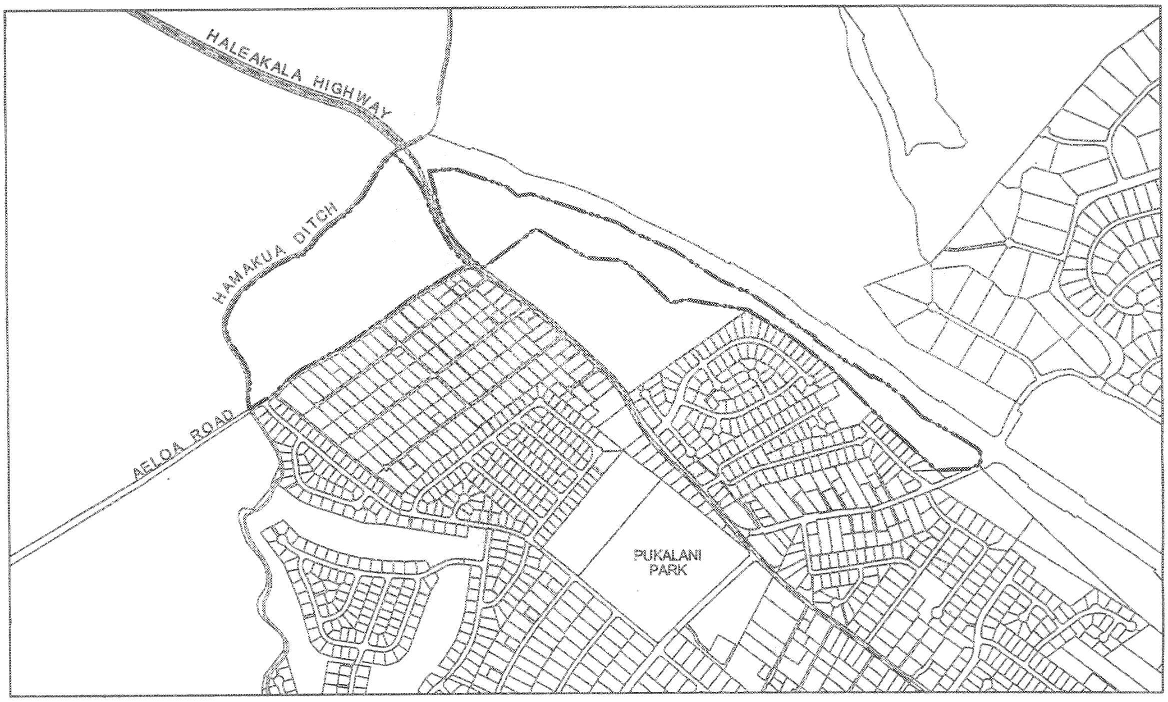


The top of the "open space" parcel, at the intersection of Makani Road and Haleakalā Highway.



The makai dead-end of Iolani St., on the Haleakalā\Kīhei end of Kauhale Lani.

Sunset from Kauhale Lani.



PUKALANI MAKAI

MAUI LAND & PINEAPPLE COMPANY, INC. ISLAND OF MAUI

NORTH LINEAL SCALE (FEET) 0 500 1,000 2,000

Source:
Federal Emergency Management Agency
The State of Hawaii GIS Database

Disclaimer:
This map has been prepared for general planning purposes only.

Ancient and Modern Districts of Maui

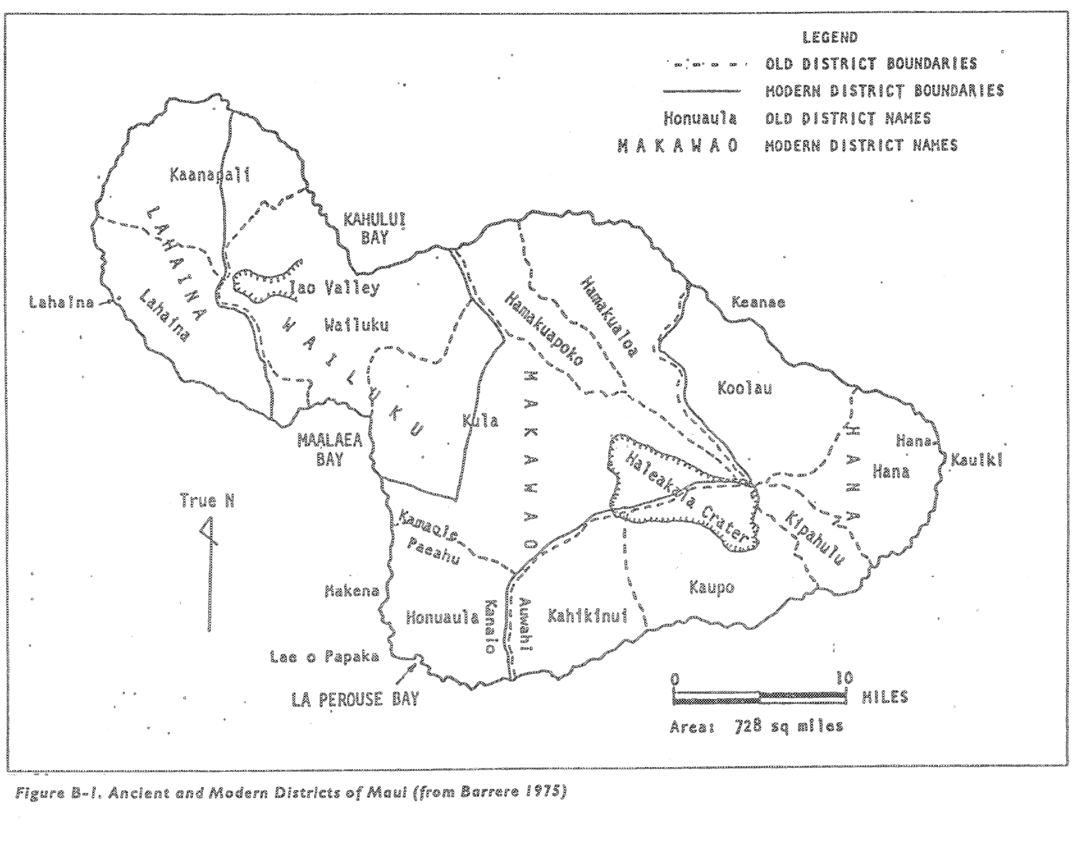
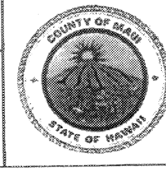
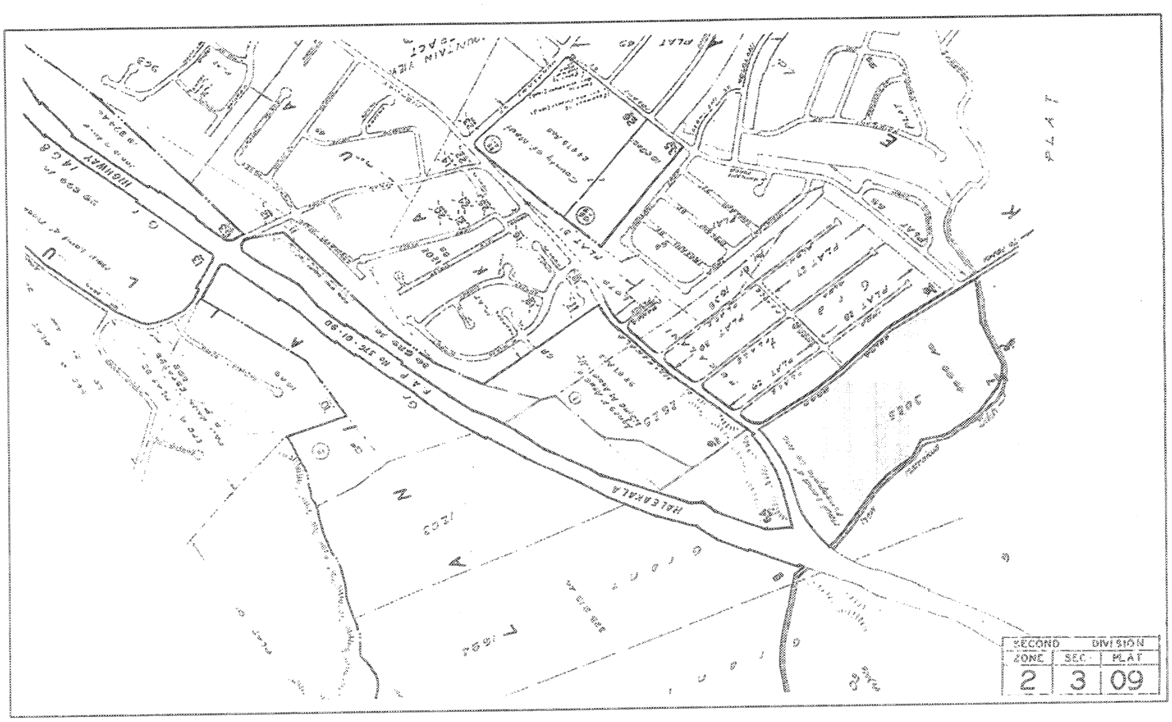


Figure B-1. Ancient and Modern Districts of Maui (from Barrere 1975)

Kauhale Lani



http://accelagis.co.maui.hi.us:8080/agis_5_2/map/printMap.jsp?MapTitle=Kauhale+Lani&Notes=&Orientation=Landscape&P... 12/27/2004



LEGEND

Kauhale Lani

Source:
County of Maui Tax Map Key

Disclaimer:
This map has been prepared for general planning purposes only.

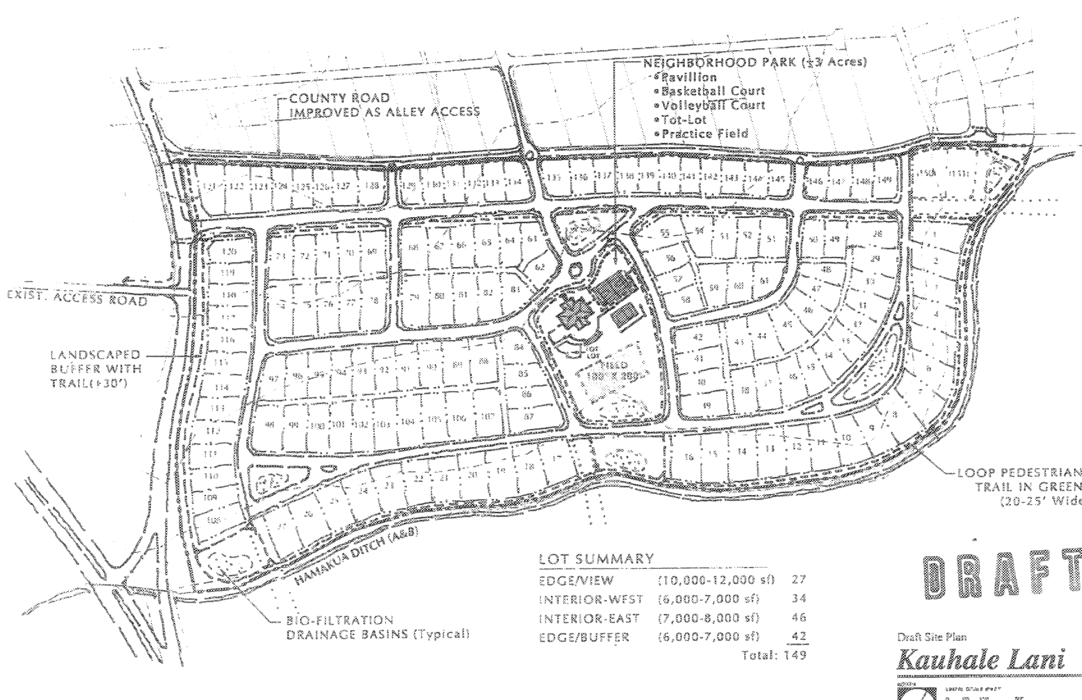
Tax Map Key Map

KAUHALE LANI

MAUI LAND & PINEAPPLE COMPANY, INC. ISLAND OF MAUI

NORTH LINEAL SCALE (FEET) 0 500 1,000 2,000

PBR



LOT SUMMARY

EDGE/VIEW	(10,000-12,000 sf)	27
INTERIOR-WEST	(6,000-7,000 sf)	34
INTERIOR-EAST	(7,000-8,000 sf)	46
EDGE/BUFFER	(6,000-7,000 sf)	42
	Total:	149

DRAFT

Draft Site Plan

Kauhale Lani

PBR

F

TRAFFIC IMPACT ANALYSIS REPORT

TRAFFIC IMPACT ANALYSIS REPORT FOR

THE KAUHALE LANI COMMUNITY

IN PUKALANI, MAUI, HAWAII

Prepared For

PBR Hawaii
1001 Bishop Street
Pacific Tower, Suite 650
Honolulu, HI 96813

Phillip Rowell and Associates
47-273 'D' Hui Iwa Street
Kaneohe, Hawai'i 96744
Tel: 808-239-8206 Fax: 808-239-4175
Email: prowell@gte.net

May 6, 2004

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

Phillip Rowell and Associates prepared this Traffic Impact Analysis Report for the proposed Kauhale Lani Community in Pukalani, Maui, Hawaii. This introductory chapter describes the proposed project, purposes of the traffic study, study methodology and order of presentation.

Project Location and Description

1. Kauhale Lani will be located along the south side of Old Haleakala Highway and east of Haleakala Highway. The general location on Maui is shown in Figure 1.

2. Kauhale Lani will be a 165 unit single-family residential community. No ohana units will be allowed.

3. Primary access and egress will be provided by two driveways along the south side of Old Haleakala Highway. These driveways are referred to as Drive A and Drive B in this report and are shown on Figure 2, which is a preliminary site plan of Kauhale Lani. Both driveways will be unsignalized. This TIAR will determine the need for separate left or right turn lanes.

   Drive A is the closest to Haleakala Highway. Use of Drive A will be restricted to right in and right out only. Drive B is approximately 300 feet east (mauka) of Drive A. All movements will be allowed at Drive B.

4. There will be a connection between Kauhale Lani and the subdivision east of the project via Koea Place. This connection is not intended to be an access and egress point of Kauhale Lani but is intended to provide a connection between the subdivisions without having to use Old Haleakala Highway.

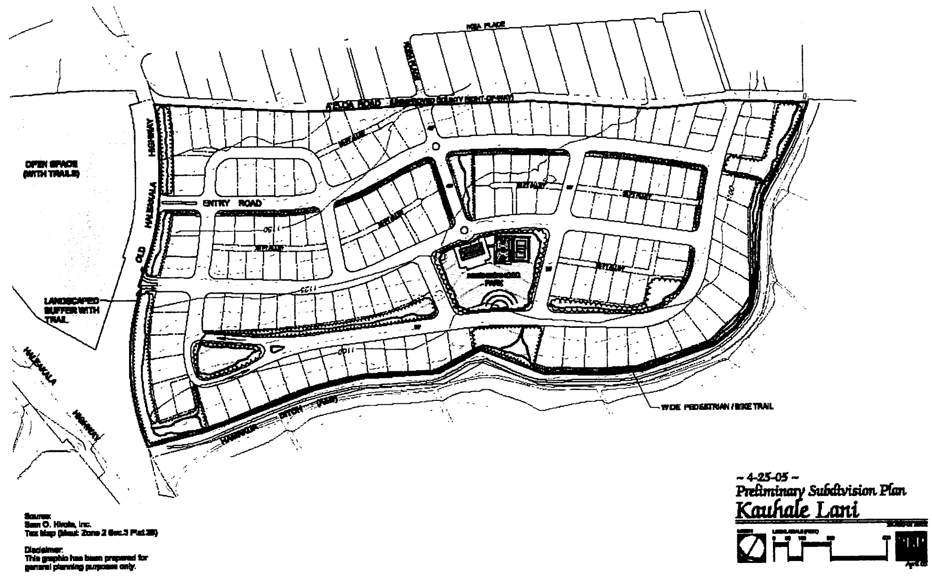


Figure 2
PRELIMINARY SITE PLAN

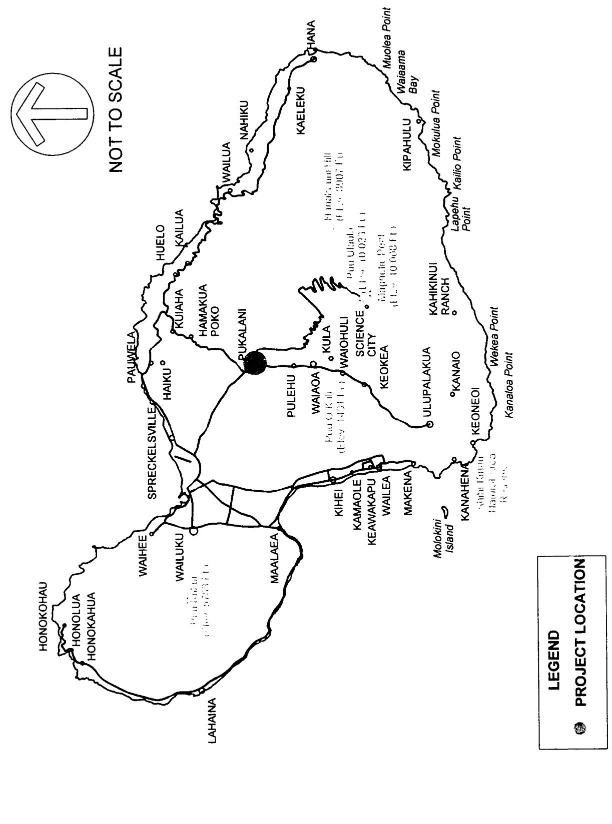


Figure 1
PROJECT LOCATION MAP

Purpose and Objectives of Study

1. Determine and describe the traffic characteristics of Kauhale Lani.
2. Quantify and document the traffic related impacts of Kauhale Lani.
3. Identify and evaluate traffic related improvements required to provide adequate access to and egress from Kauhale Lani and to mitigate the project's traffic impacts.

Study Area

The study area is shown in Figure 3. The study area includes the following intersections, which are also shown in the figure:

1. Haleakala Highway at Kula Highway/Old Haleakala Highway
2. Haleakala Highway at Makawao Avenue
3. Haleakala Highway at Makani Road
4. Haleakala Highway at Old Haleakala Highway
5. Haleakala Highway at Hana Highway
6. Old Haleakala Highway at Makawao Avenue
7. Old Haleakala Highway at Pukalani Street
8. Old Haleakala Highway at Makani Road/Loha Street
9. Old Haleakala Highway at Drive A
10. Old Haleakala Highway at Drive B

Design Year

The design, or horizon, year of a project is the future year for which background traffic conditions are estimated. For the projects comparable to Kauhale Lani, the Institute of Transportation Engineers recommends that the anticipated opening or completion year be used as the design year[1]. It is anticipated that the project will be completed within 24 months. Using this standard, the design year for the traffic study, should be 2007.

However, there are a number of other development projects within and adjacent to the study area that will probably not be completed within this time frame. In order to consider the traffic generated by these projects and to be consistent with the traffic forecasts in the traffic studies for these projects, it was decided to use 2010 as the design year rather than 2007 noted above.

[1] Institute of Transportation Engineers, *Transportation and Land Development*, 2nd Edition, Washington, D.C., 2002, p. 3-13.

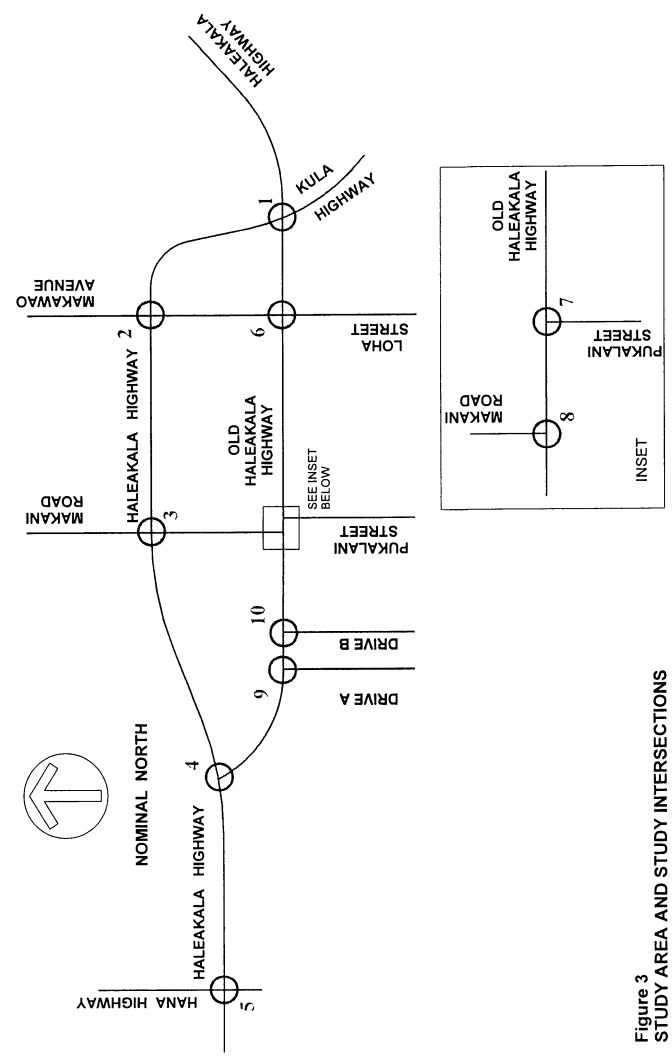


Figure 3
STUDY AREA AND STUDY INTERSECTIONS

Study Methodology

The following is a summary list of the tasks performed:

1. A site reconnaissance was performed to identify existing roadway cross-sections, intersection lane configurations, traffic control devices, and surrounding land uses.
2. Existing peak-hour traffic volumes for the study intersections were obtained and summarized.
3. Existing levels-of-service of the study intersections were determined using the methodology described in the *Highway Capacity Manual*.
4. A list of related development projects within and adjacent to the study area that will impact traffic conditions at the study intersections was compiled. This list included both development projects and anticipated roadway improvement projects.
5. Future background traffic volumes at the study intersections without traffic generated by Kauhale Lani were estimated.
6. Peak hour traffic that Kauhale Lani will generate was estimated using trip generation analysis procedures recommended by the Institute of Transportation Engineers.
7. A level-of-service analysis for future traffic conditions with traffic generated by Kauhale Lani was performed.
8. The impacts of traffic generated by Kauhale Lani at the study intersections were quantified and summarized.
9. Locations where Kauhale Lani generated traffic significantly impacts traffic operating conditions were identified.
10. Recommendations, improvements or modifications necessary to mitigate the traffic impacts of Kauhale Lani and to provide adequate access to and egress from the site were formulated.
11. A report documenting the conclusions of the analyses performed and recommendations was prepared.

Order of Presentation

Chapter 2 describes existing traffic conditions, the Level-of-Service (LOS) concept and the results of the LOS analysis of existing conditions.

Chapter 3 describes the process used to estimate 2010 background traffic volumes and the resulting background traffic projections. Background conditions are defined as future background traffic conditions without traffic generation by Kauhale Lani.

Chapter 4 describes the methodology used to estimate the traffic characteristics of the proposed project, including 2010 background plus Kauhale Lani traffic projections.

Chapter 5 describes the traffic impacts of Kauhale Lani, identifies potential mitigation measures and summarizes the traffic impact study.

2. EXISTING CONDITIONS

This chapter presents the existing traffic conditions on the roadways adjacent to Kauhale Lani. The Level-of-Service (LOS) concept and the results of the LOS analysis for existing conditions are also presented. The purpose of this analysis is to establish the base conditions for the determination of the impacts of the project which are described in a subsequent chapter.

Existing Roadway and Traffic Conditions

The traffic characteristics of the roadways serving the project are summarized in Table 1.

A schematic of the existing roadway network serving the project is shown in Figure 5. Shown are the existing lane configurations and right-of-way controls of the study intersections.

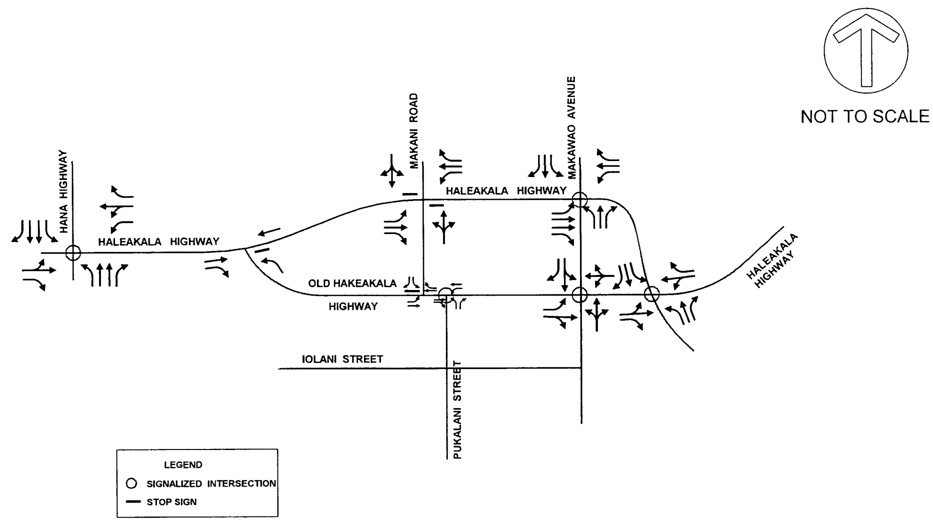


Figure 4
EXISTING ROADWAY NETWORK AND INTERSECTION CONFIGURATIONS

Table 1 Summary of Existing Roadways

Roadway	Section	Jurisdiction	Number of Lanes	Divided	Approximate ADT	Posted Speed Limit
Hana Highway	South of Haleakala Highway	State	2	Yes	29,100	55
	North of Haleakala Highway	State	4	No	5,700	55
Haleakala Highway	Hana Highway to Old Haleakala Highway	State	3	No	26,000	55
	Old Haleakala Highway to Makani Road		4	Yes	14,400	45
	Makani Road to Makawao Avenue	State	4	Yes	10,000	45
	Makawao Avenue to Kula Highway		3	Yes	10,700	45
Kula Highway	East of Haleakala Highway	State	2	No	14,400	45
Old Haleakala Highway	Haleakala Highway to Makani Road		2	No	13,000	35
	Makani Road to Makawao Avenue	County	2	No	12,000	35
	Makawao Avenue to Kula Highway		2	No	4,300	35
Pukalani Street	South of Old Haleakala Highway	County	4	No	16,800	20
Makani Road	Haleakala Highway to Haleakala Highway	County	2	No	2,000	30
Makawao Avenue	Old Haleakala Highway to Haleakala Highway	County	2	No	6,700	30

Existing Peak Hour Traffic Volumes

Existing peak hourly traffic volumes of the study intersections were obtained from field surveys conducted during September and October, 2004. The traffic count schedule is shown in Table 2.

Table 2 Traffic Count Schedule

Intersection	AM Counts			PM Counts		
	Day	Date	Hours	Day	Date	Hours
Haleakala Hwy at Kula Highway	Friday	24 Sept 04	0630 to 0900	Friday	24 Sept 04	1530 to 1800
Haleakala Hwy at Makawao Av	Friday	10 Oct 04	0630 to 0900	Friday	10 Oct 04	1530 to 1800
Haleakala Hwy at Makani Rd	Friday	17 Sept 04	0630 to 0900	Friday	17 Sept 04	1530 to 1800
Haleakala Hwy at Old Haleakala Hwy	Monday	13 Sept 04	0630 to 0900	Monday	13 Sept 04	1530 to 1800
Haleakala Highway at Hana Hwy	Friday	17 Sept 04	0630 to 0900	Friday	17 Sept 04	1530 to 1800
Old Haleakala Hwy at Makawao Av	Friday	24 Sept 04	0630 to 0900	Friday	24 Sept 04	1530 to 1800
Old Haleakala Highway at Pukalani St	Friday	24 Sept 04	0630 to 0900	Friday	24 Sept 04	1530 to 1800
Old Haleakala Hwy at Makani Rd	Friday	24 Sept 04	0630 to 0900	Friday	24 Sept 04	1530 to 1800

The morning and afternoon peak hourly traffic volumes are shown in Figures 5 and 6, respectively.

1. The traffic volumes include large trucks, buses and motorcycles.
2. The traffic volumes of one intersection may not match those of the adjacent intersection. This is because adjacent intersections may have different peak hours and there may be driveways or minor streets between the intersections.

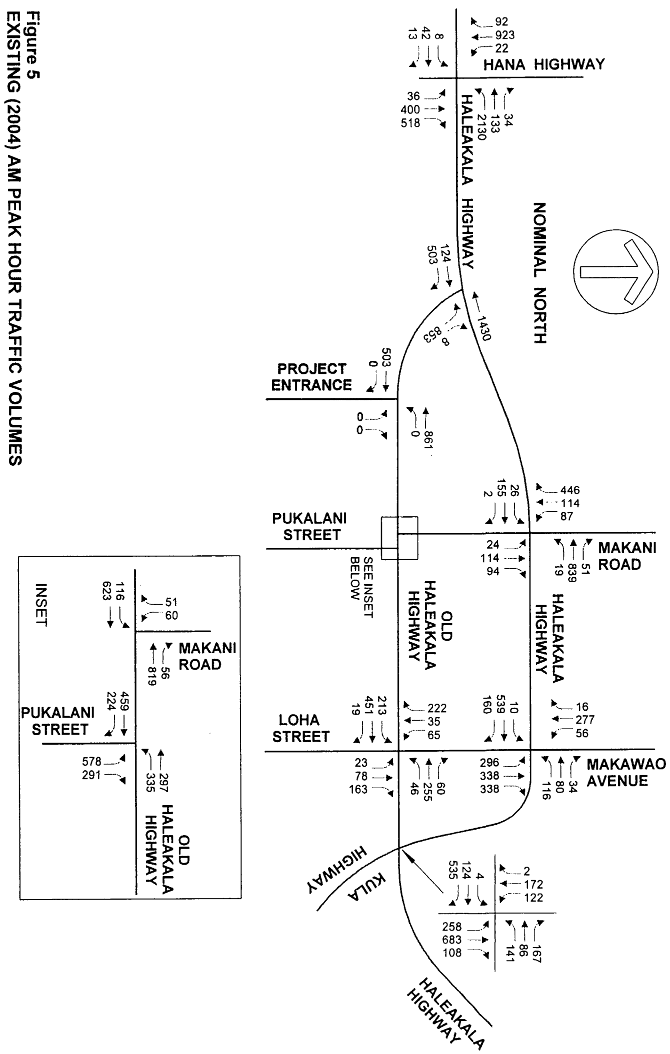


Figure 5
EXISTING (2004) AM PEAK HOUR TRAFFIC VOLUMES

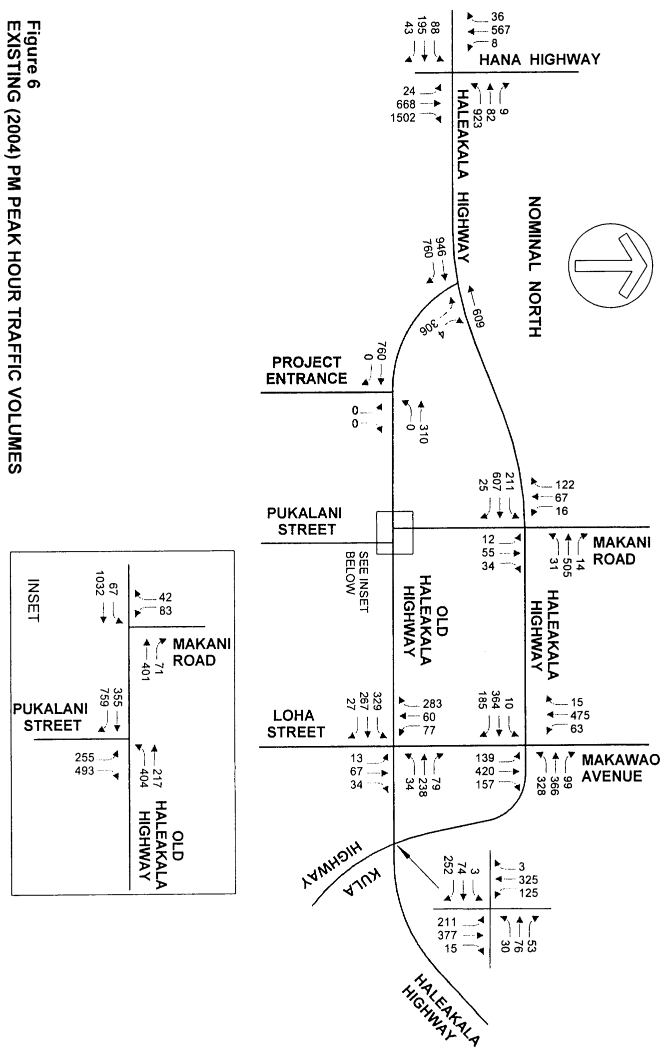


Figure 6
EXISTING (2004) PM PEAK HOUR TRAFFIC VOLUMES

Level-of-Service Concept

Signalized Intersections

"Level-of-Service" is a term which denotes any of an infinite number of combinations of traffic operating conditions that may occur on a given lane or roadway when it is subjected to various traffic volumes. Level-of-Service (LOS) is a qualitative measure of the effect of a number of factors which include space, speed, travel time, traffic interruptions, freedom to maneuver, safety, driving comfort and convenience.

There are six levels-of-service, A through F, which relate to the driving conditions from best to worst, respectively. The characteristics of traffic operations for each Level-of-Service are summarized in Table 3. In general, LOS A represents free-flow conditions with no congestion. LOS F, on the other hand, represents severe congestion with stop-and-go conditions. Level-of-Service D is typically considered acceptable for peak hour conditions in urban areas.

Corresponding to each Level-of-Service shown in the table is a volume/capacity ratio. This is the ratio of either existing or projected traffic volumes to the capacity of the intersection. Capacity is defined as the maximum number of vehicles that can be accommodated by the roadway during a specified period of time. The capacity of a particular roadway is dependent upon its physical characteristics such as the number of lanes, the operational characteristics of the roadway (one-way, two-way, turn prohibitions, bus stops, etc.), the type of traffic using the roadway (trucks, buses, etc.) and turning movements.

Table 3 Level-of-Service Definitions for Signalized Intersections[1]

Level of Service	Interpretation	Volume-to-Capacity Ratio[2]	Control Delay (Seconds)
A, B	Uncongested operations; all vehicles clear in a single cycle.	0.000-0.700	<10.0
C	Light congestion; occasional backups on critical approaches	0.701-0.800	10.1-20.0
D	Congestion on critical approaches but intersection functional. Vehicles must wait through more than one cycle during short periods. No long standing lines formed.	0.801-0.900	20.1-35.0
E	Severe congestion with some standing lines on critical approaches. Blockage of intersection may occur if signal does not provide protected turning movements.	0.901-1.000	35.1-80.0
F	Total breakdown with stop-and-go operation	>1.001	>80.0

Notes:
(1) Source: *Highway Capacity Manual*, 2000.
(2) This is the ratio of the calculated critical volume to Level-of-Service E Capacity.

Unsignalized Intersections

Like signalized intersections, the operating conditions of intersections controlled by stop signs can be classified by a Level-of-Service from A to F. However, the method for determining Level-of-Service for unsignalized intersections is based on the use of gaps in traffic on the major street by vehicles crossing or turning through that stream. Specifically, the capacity of the controlled legs of an intersection is based on two factors: 1) the distribution of gaps in the major street traffic stream, and 2) driver judgement in selecting gaps through which to execute a desired maneuver. The criteria for Level-of-Service at an unsignalized intersection is therefore based on delay of each turning movement. Table 4 summarizes the definitions for Level-of-Service and the corresponding delay.

Table 4 Level-of-Service Definitions for Unsignalized Intersections[(1)]

Level-of-Service	Expected Delay to Minor Street Traffic	Control Delay (Seconds)
A	Little or no delay	>10
B	Short traffic delays	10.1 to 15.0
C	Average traffic delays	15.1 to 25.0
D	Long traffic delays	25.1 to 35.0
E	Very long traffic delays	35.1 to 50.0
F	See note (2) below	>50.1

Notes:
(1) Source: *Highway Capacity Manual*, 2000.
(2) When demand volume exceeds the capacity of the lane, extreme delays will be encountered with queuing which may cause severe congestion affecting other traffic movements in the intersection. This condition usually warrants improvement of the intersection.

Level-of-Service Analysis of Existing Conditions

The results of the Level-of-Service analysis for the signalized intersections are shown in Table 5. Shown in the table are the volume-to-capacity ratios, average control delays and the levels-of-service for each lane group and the overall intersection.

The results of the Level-of-Service analysis for unsignalized intersections are also shown in Table 5. The average control delays and levels-of-service are shown for controlled movements only. Volume-to-capacity ratios are not shown for unsignalized intersections. Overall intersection volume-to-capacity ratios, delays and levels-of-service are not calculated for unsignalized intersections.

Table 5 Existing (2004) Levels-of-Service

	AM Peak Hour			PM Peak Hour		
Intersection, Approach and Movement	V/C	Delay [1]	LOS [2]	V/C	Delay	LOS
1. Old Haleakala Highway at Haleakala Highway	***0.93***	***74.6***	***E***	***0.72***	***48.5***	***D***
Eastbound Left	0.05	69.0	E	0.03	66.6	E
Eastbound Thru	1.07	172.2	F	0.53	81.8	F
Eastbound Right	0.00	67.8	E	0.02	66.3	E
Westbound Left	0.84	98.6	F	0.33	72.7	E
Westbound Thru	0.35	64.6	E	0.41	71.3	E
Westbound Right	0.68	101.6	F	0.19	70.4	E
Northbound Left & Thru	1.00	65.1	E	0.71	38.2	D
Northbound Right	0.05	17.8	B	0.00	22.2	C
Southbound Left & Thru	0.64	57.7	E	0.71	49.6	D
Southbound Right	0.00	42.7	D	0.00	32.3	C
2. Haleakala Highway at Makawao Avenue	***0.94***	***157.3***	***E***	***0.79***	***115.0***	***F***
Eastbound Left	0.03	29.8	C	0.11	44.6	D
Eastbound Thru & Right	0.61	38.6	D	0.76	56.3	E
Westbound Left	0.76	81.1	F	2.27	647.1	F
Westbound Thru	0.12	23.6	C	0.77	53.1	D
Westbound Right	0.00	22.2	C	0.06	34.3	C
Northbound Left & Thru	1.15	114.3	F	0.63	13.7	B
Northbound Right	0.33	15.9	B	0.09	6.5	A
Southbound Left & Thru	0.46	18.2	B	0.48	10.4	B
Southbound Right	0.01	12.2	B	0.00	6.0	A
3. Haleakala Highway at Makani Road						
Eastbound Left		10.0	B		9.5	A
Westbound Left		7.6	A		9	A
Northbound Left & Thru		288.4	F		>999.9	F
Northbound Right		9.1	A		10.7	B
Southbound Left & Thru		553.8	F		491.8	F
Southbound Right		27.9	D		10.9	B
4. Haleakala Highway at Old Haleakala Highway						
Northbound Left		See Note (3)			67.3	F
Northbound Right					17.2	C
5. Haleakala Highway at Hana Highway	***1.07***	***88.8***	***F***	***0.70***	***58.6***	***E***
Eastbound Left & Thru	0.74	135.2	F	0.71	74.1	E
Eastbound Right	0.05	85.0	F	0.05	55.1	E
Westbound Left	1.07	81.0	F	0.67	45.2	D
Westbound Left & Thru	0.99	56.3	E	0.65	44.2	D
Westbound Right	0.00	11.5	B	0.00	28.7	C
Northbound Left	0.95	216.1	F	0.50	117.6	F
Northbound Thru	0.50	61.4	E	0.75	67.1	E
Northbound Right	0.33	59.1	E	0.00	49.7	D
Southbound Left	0.57	136.0	F	0.16	91.9	F
Southbound Thru	1.14	146.4	F	0.64	62.7	E
Southbound Right	0.16	55.3	E	0.04	50.4	D

Table 5 (Continued) Existing (2004) Levels-of-Service

Intersection, Approach and Movement	AM Peak Hour V/C	AM Peak Hour Delay [1]	AM Peak Hour LOS [2]	PM Peak Hour V/C	PM Peak Hour Delay	PM Peak Hour LOS
6. Old Haleakala Highway at Makawao Avenue and Loha Street	***0.63***	***17.2***	***B***	***0.60***	***15.3***	***B***
Eastbound Left & Thru	0.37	9.1	A	0.48	7.7	A
Eastbound Right	0.43	8.4	A	0.24	4.4	A
Westbound Left, Thru & Right	0.52	17.8	B	0.46	15.36	B
Northbound Left, Thru & Right	0.63	31.8	C	0.36	30.4	C
Southbound Left & Thru	0.35	26.3	C	0.54	36.0	D
Southbound Right	0.31	24.7	C	0.28	29.4	C
7. Old Haleakala Highway at Pukalani Street	***0.92***	***35.2***	***D***	***0.73***	***16.6***	***B***
Eastbound Thru	0.77	31.4	C	0.61	26.6	C
Eastbound Right	0.09	3.0	A	0.67	13.3	B
Westbound Left	0.84	33.4	C	0.64	13.5	B
Westbound Thru	0.31	10.0+	B	0.19	5.4	A
Northbound Left	1.02	65.8	E	0.64	34.9	C
Northbound Right	0.19	7.4	A	0.33	8.5	A
8. Old Haleakala Highway at Makani Road						
Eastbound Left		10.7	B		8.6	A
Southbound Left		140.8	F		125.4	F
Southbound Right		16.8	C		11.1	B

NOTES:
(1) Delay in seconds per vehicle.
(2) LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. Level-of-Service is based on delay.
(3) Delay calculations for the AM peak hour could not be calculated as all movements are free-flowing except the northbound to eastbound right turn, which is a negligible number of vehicles during the AM peak hour.

The conclusions of the Level-of-Service analysis are:

1. *Haleakala Highway at Old Haleakala Highway and Kula Highway*

This intersection operates a Level-of-Service E during the morning peak hour. All traffic movements operate at Level-of-Service E or F except the northbound right and the southbound right, which operate at Level-of-Service B and D, respectively. The counts were performed during the peak commute hour and included traffic associated with King Kaukelike Highway, Kamehameha School and the morning commuter traffic. The calculated levels-of-service are consistent with conditions observed during the traffic counts.

During the afternoon peak hour, the overall intersection operates at Level-of-Service D. Only the northbound and southbound approaches operate at acceptable levels-of-service (C or D). All the remaining movements operate at Level-of-Service E or F.

2. *Haleakala Highway at Makawao Avenue*

During the morning peak hour, the overall intersection operates at Level-of-Service E. However, only the westbound left and the northbound left & through operate at Level-of-Service F. All the remaining movements operate at Level-of-Service D, or better.

During the afternoon peak hour, the overall intersection operates at Level-of-Service F. Only the eastbound through and right operates at Level-of-Service E and the westbound left operates at Level-of-Service F. The remaining movements operate at Level-of-Service D, or better.

3. *Haleakala Highway at Makani Road*

Traffic from the side streets operate a Level-of-Service F during both peak periods. The *Maui Long Range Transportation Plan* recommended that this intersection be signalized, which would mitigate this deficiency. We were informed during the review of the traffic study for Kulamalu, that signalization of this intersection is a priority. We have not been able to determine when the traffic signals will be installed.

4. *Haleakala Highway at Old Haleakala Highway*

During the morning peak hour, eastbound through movement is prohibited. All eastbound traffic must turn right onto Old Haleakala Highway. The northbound to westbound left turn is a free right turn onto Haleakala Highway. The result is that during the morning peak hour all movements are free flow and the Level-of-Service is A.

During the afternoon peak hour, the northbound to westbound left turn must use the STOP sign with a resulting delay that results in Level-of-Service F. The provision of an acceleration and merge lane for these left turns mitigates some of the delay.

5. *Haleakala Highway at Hana Highway*

This intersection operates at Level-of-Service F during the morning and Level-of-Service E during the afternoon peak hour. During the morning peak hour, all movements except the westbound right operate at Level-of-Service E or F.

During the afternoon peak hour, the westbound approach, the northbound right and the southbound right turns operate at Level-of-Service D. All the remaining movements operate at Level-of-Service E or F.

6. *Old Haleakala Highway at Makawao Avenue and Loha Street*

The overall intersection operates at Level-of-Service B during both peak periods. All movements operate at Level-of-Service C, or better, with the exception of the southbound left and through movement which operates at Level-of-Service D during the afternoon peak hour.

7. *Old Haleakala Highway at Pukalani Street*

This intersection operates at Level-of-Service D during the morning peak hour and Level-of-Service B during the afternoon peak hour. During the morning peak hour, all movements operate at Level-of-Service C, or better, except the northbound left, which operates at Level-of-Service E. During the afternoon peak hour, all movements operate at Level-of-Service C, or better.

8. *Old Haleakala Highway at Makani Road*

The southbound left turn operates at Level-of-Service F during both peak periods. The remaining movements operate at Level-of-Service C, or better.

3. BACKGROUND TRAFFIC CONDITIONS

The purpose of this chapter is to discuss the assumptions and data used to estimate 2010 background traffic conditions. Background traffic conditions are defined as future traffic volumes without the proposed project.

Future traffic growth consists of two components. The first is ambient background growth that is a result of regional growth and cannot be attributed to a specific project. The second component is estimated traffic that will be generated by other development projects in the vicinity of the proposed project.

Background Traffic Growth

The *Maui Long Range Transportation Plan*[2] concluded that traffic in Maui would increase an average of 1.6% per year from 1990 to 2020. This growth rate was used to estimate the background growth between 2004 and 2010, which is the design year for this project. The growth factor was calculated to be 1.10 using the following formula:

$$F = (1 + i)^n$$

where F = Growth Factor
i = Average annual growth rate, or 0.016
n = Growth period, or 6 years

This growth factor was applied to all traffic movements at the study intersections.

[2] Kaku Associates, October 1996

Related Projects

The second component in estimating background traffic volumes is traffic resulting from other proposed projects in the vicinity. Related projects are defined as those projects that are under construction, have been approved for construction or have been the subject of a traffic study and would significantly impact traffic in the study area. Related projects may be development projects or roadway improvements.

It was determined that there are two projects that will generate additional traffic within the study area. The locations of these projects are shown on Figure 7.

The first is the proposed Upcountry Town Center, which will be in the triangle bordered by Old Haleakala Highway, Makawao Avenue and Haleakala Highway. The traffic study for this project was obtained. The trip generation analysis of the Upcountry Town Center is summarized in Table 6.

The traffic study analyzed three intersections adjacent to the Upcountry Town Center (Haleakala Highway at Makawao Avenue, Old Haleakala Highway at Makawao Avenue and Old Haleakala Highway at Kula Highway). The traffic generated by the Upcountry Town Center was assigned to the other intersections within the study area and added to the background traffic previously estimated.

The second project is the expansion of Kamehameha School and includes Kulamalu and other development associated with the Kulamalu Development. The traffic study for this project was also obtained and the traffic assignments used to develop the traffic forecasts. It should be noted that the traffic assignments include traffic generated by grades 7 through 12, some of which have been added since the traffic study was completed. Therefore, the traffic for the grades added since has been double counted as it is included in the existing counts and forecasts.

Table 6 Trip Generation Summary of the Related Projects

	AM Peak Hour			PM Peak Hour		
Related Project	Total	In	Out	Total	In	Out
Upcountry Town Center[(1)]	486	320	163	1017	444	573
Kamehameha School (Additional Grades) and Kulamalu[(2)]	852	524	328	736	378	358
TOTAL	1338	844	491	1753	822	931

Notes:
(1) Parsons Brinckerhoff Quade & Douglas, *Traffic Impact Assessment Study Upcountry Town Center*, March 2002
(2) Phillip Rowell and Associates, *Traffic Impact Study for Kamehameha School, Maui Campus*, August 15, 2002.

The traffic study for the Upcountry Town Center[3] recommended the following roadway improvements at the study intersections:

a. Exclusive right turn lanes from Haleakala Highway at Makawao Avenue.

b. Exclusive right turn lane along the southbound approach of Makawao Avenue at Haleakala Highway.

c. Exclusive left turn signal phase for Makawao Avenue movements at Haleakala Highway.

During review of the traffic study for Kamehameha Schools, it was learned that State of Hawaii Department of Transportation plans to signalize the intersection of Haleakala Highway at Makani Road. A scheduled completion date was not provided, but it was assumed that construction would be completed within the design year of the project (2010).

2010 Background Traffic Projections

2010 background traffic projections were calculated by expanding existing traffic volumes by the appropriate growth rates and then superimposing traffic generated by the related project. The resulting 2010 background weekday morning and afternoon peak hour ly traffic volumes are shown in Figures 8 and 9, respectively.

[3] Parsons Brinckerhoff Quade & Douglas, Traffic Impact Assessment Study, Upcountry Town Center, March 2002, page 18.

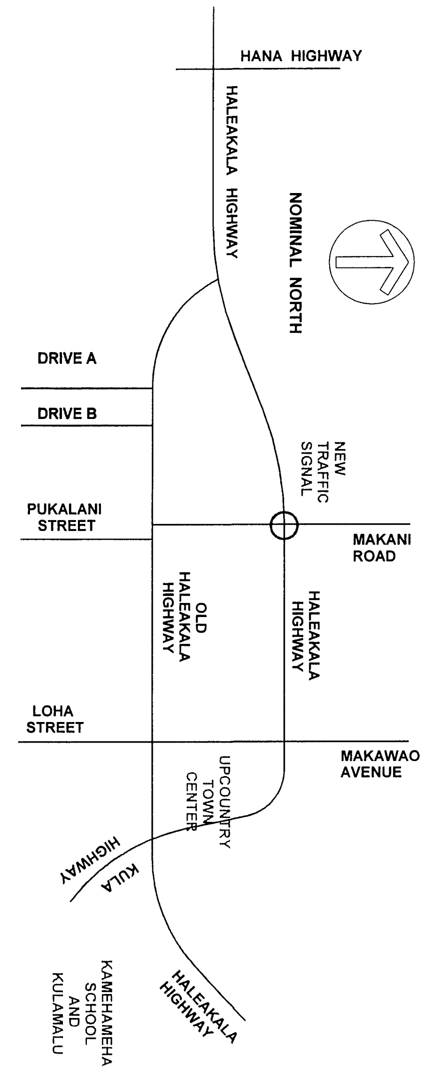


Figure 7
LOCATIONS OF RELATED PROJECTS

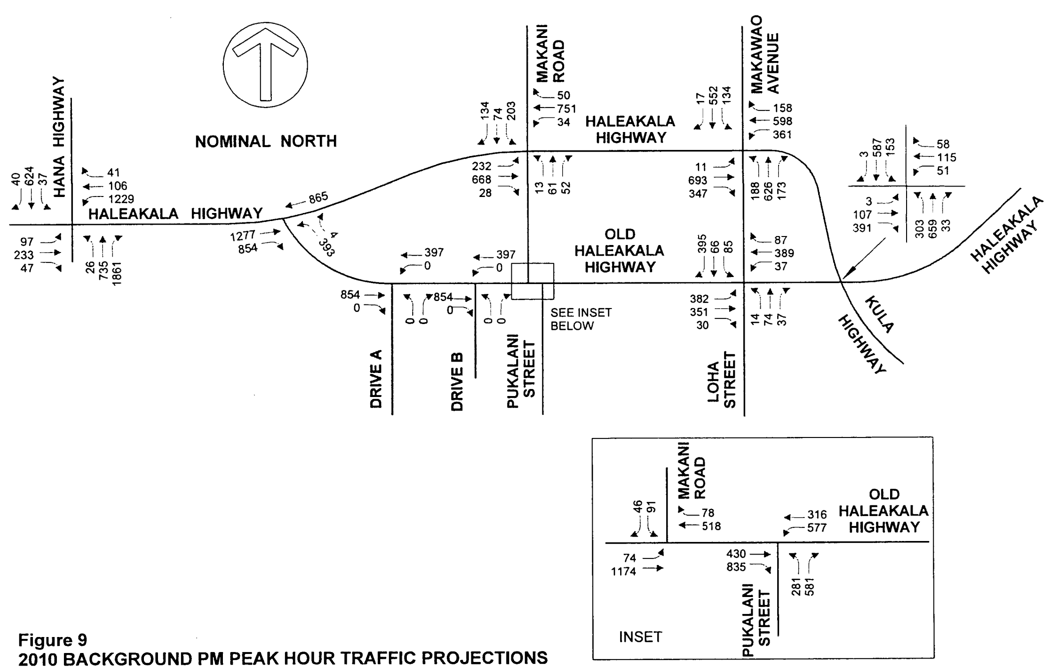


Figure 9
2010 BACKGROUND PM PEAK HOUR TRAFFIC PROJECTIONS

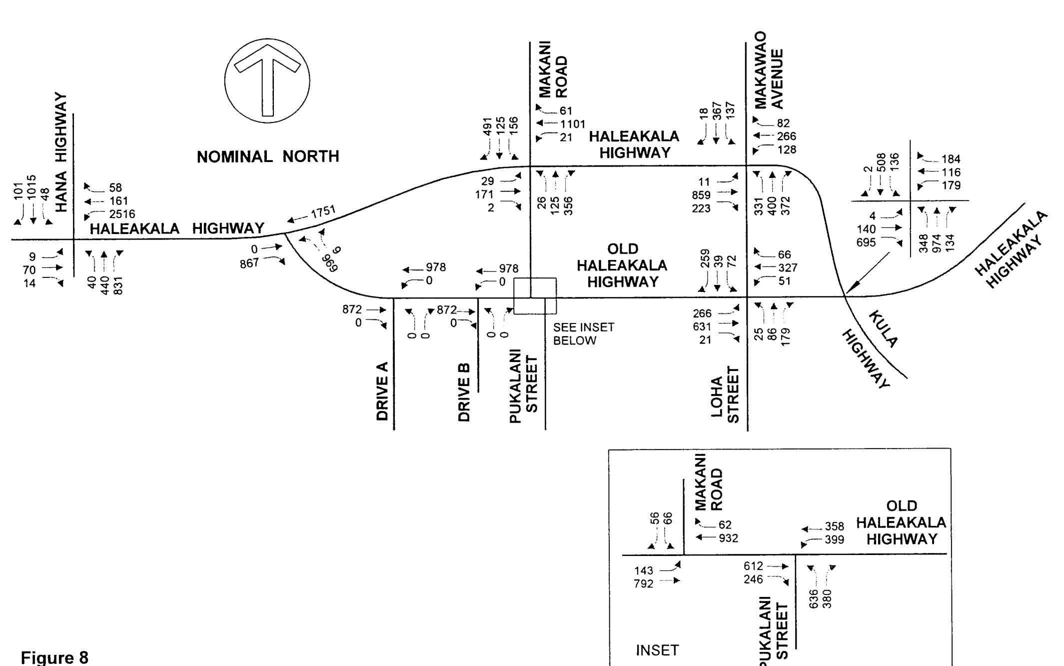


Figure 8
2010 BACKGROUND AM PEAK HOUR TRAFFIC PROJECTIONS

4. PROJECT-RELATED TRAFFIC CHARACTERISTICS

This chapter discusses the methodology used to identify the traffic-related characteristics of the proposed project. Generally, the process involves the determination of peak-hour trips that would be generated by the proposed project, distribution and assignment of these trips on the approach and departure routes, and finally, determination of the levels-of-service at affected intersections and driveways subsequent to implementation of the project. This chapter presents the generation, distribution and assignment of project generated traffic and the background plus project traffic projections. The results of the Level-of-Service analysis of background plus project conditions is presented in the following chapter.

Project Trip Generation

Future traffic volumes generated by the project were estimated using the procedures described in the *Trip Generation Handbook*[4] and data provided in *Trip Generation*[5]. This method used trip generation rates to estimate the number of trips that the project will generate during the peak hours of the project and along the adjacent street.

The project will consist of 165 single-family units. Single-family detached housing is defined by the Institute of Transportation Engineers as follows:

[4] Institute of Transportation Engineers, *Trip Generation Handbook*, Washington, D.C., 1998, p. 7-12

[5] *Trip Generation*, Institute of Transportation Engineers, Washington, D.C., 2003

Single-family detached housing includes all single-family detached homes on individual lots. A typical site surveyed is a suburban subdivision.[6]

The trip generation analysis is summarized in Table 7.

Table 7 Trip Generation Analysis

Period & Direction		Single Family Units: Trips per Unit or Percent	Units	Trips
AM Peak Hour	Total	0.77	165	127
	Inbound	25%		32
	Outbound	75%		95
PM Peak Hour	Total	1.02		168
	Inbound	64%		108
	Outbound	36%		60

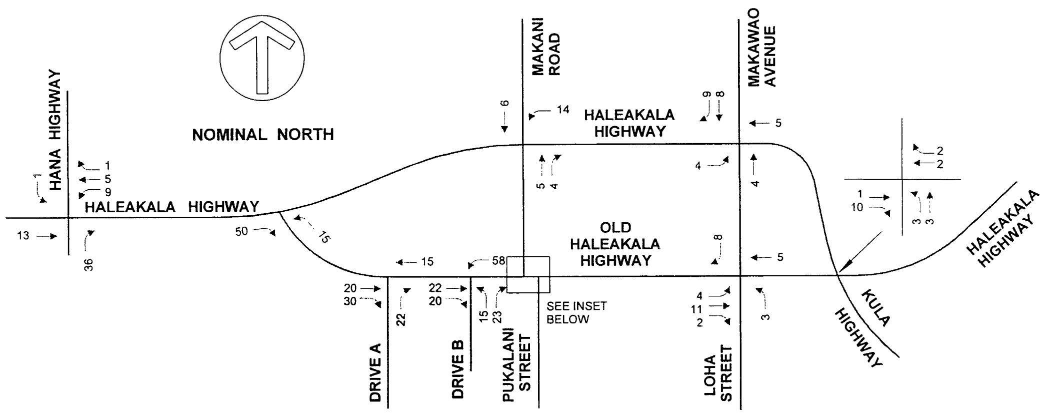
As shown the proposed project will generate 32 inbound and 95 outbound trips during the morning peak hour. During the afternoon peak hour, the project will generate 108 inbound and 60 outbound trips.

2010 Background Plus Project Projections

Background plus project traffic conditions are defined as 2010 background traffic conditions plus project generated traffic. The project generated traffic was distributed and assigned based on the existing approach and departure pattern of traffic along the pertinent sections of Haleakala and Old Haleakala Highways. The morning and afternoon peak hour traffic assignments are shown in Figures 10 and 11, respectively.

2010 background plus project traffic projections were estimated by superimposing the peak hourly traffic generated by the proposed project on the 2010 background (without project) peak hour traffic projections. This assumes that the peak hourly trips generated by the project coincide with the peak hour of the adjacent street. This represents a worse-case condition. The resulting 2010 background plus project peak hour traffic projections are shown in Figures 12 and 13, respectively.

[6] Institute of Transportation Engineers, *Trip Generation*, Washington, D.C., 1997, p. 262



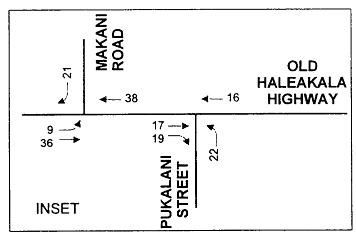
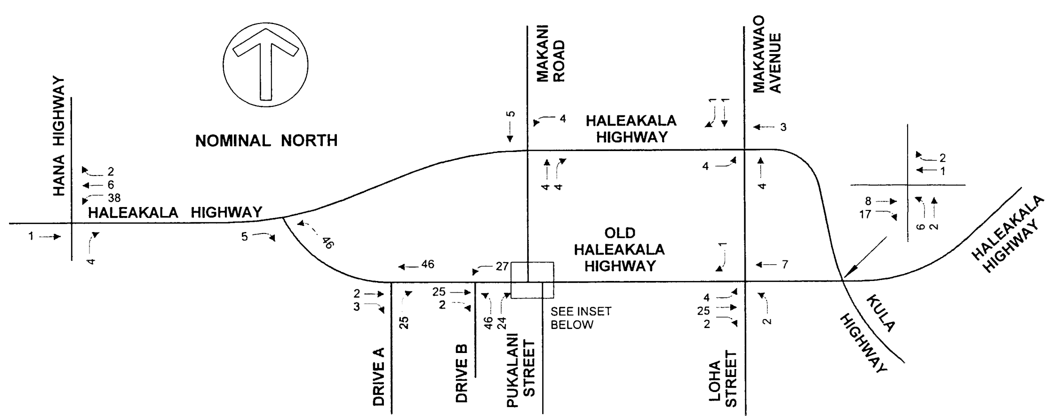


Figure 11
PM PEAK HOUR PROJECT TRIP ASSIGNMENTS



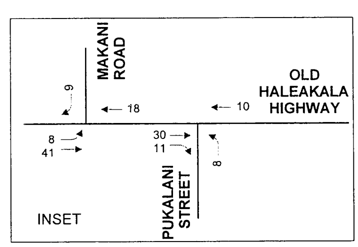


Figure 10
AM PEAK HOUR PROJECT TRIP ASSIGNMENTS

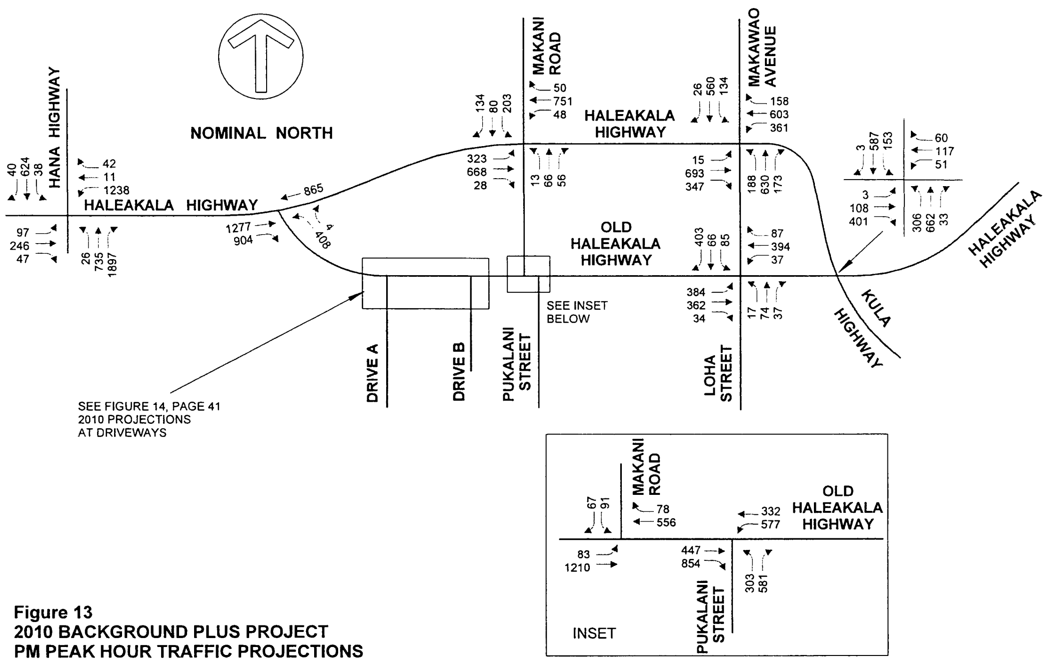


Figure 13
2010 BACKGROUND PLUS PROJECT
PM PEAK HOUR TRAFFIC PROJECTIONS

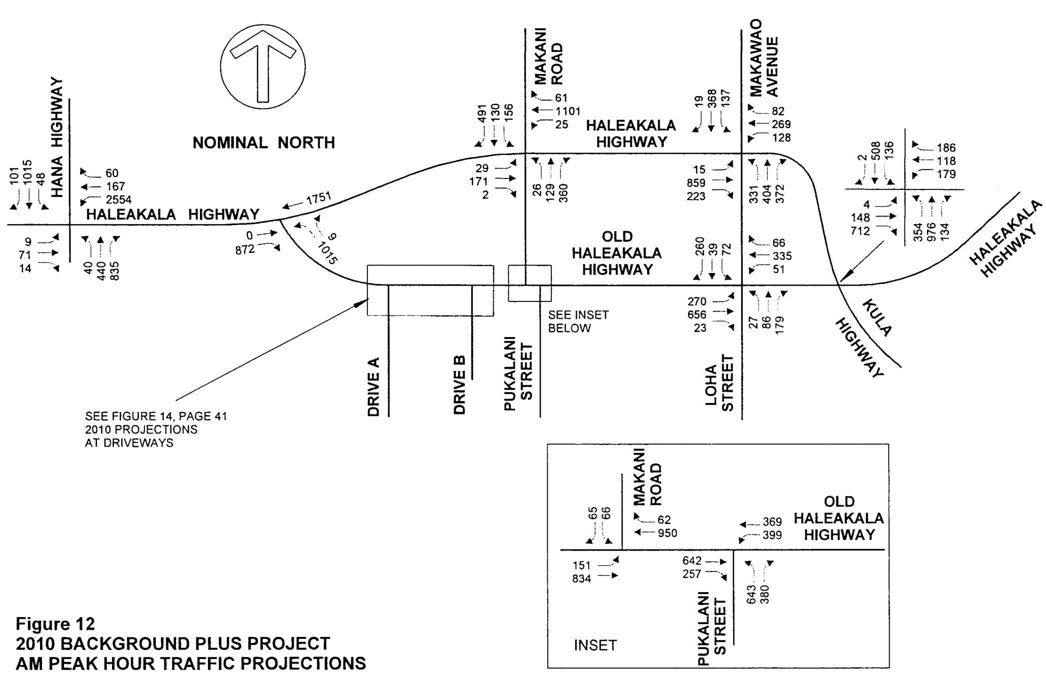


Figure 12
2010 BACKGROUND PLUS PROJECT
AM PEAK HOUR TRAFFIC PROJECTIONS

5. TRAFFIC IMPACT ANALYSIS

The purpose of this chapter is to summarize the results of the Level-of-Service analysis of future conditions with traffic generated by Kauhale Lani. This analysis identifies any potential traffic operational deficiencies. If deficiencies are anticipated, mitigation measures are identified and assessed.

Traffic Impact Analysis

The impact of traffic generated by Kauhale Lani was analyzed by analyzing the changes in peak hourly traffic volumes at the study intersections and the volume-to-capacity ratios of the overall intersection and each controlled lane group. These analyses are discussed in the following two sections.

Volume Change Analysis

An analysis of the changes in the peak hourly traffic volumes at the study intersections is summarized in Table 8. Shown are the existing (2004), 2010 background and 2010 background plus project peak hour traffic projections. Also shown are the estimated traffic volumes added by background growth, related project traffic and project generated traffic. There is no established criteria for the impact to be considered significant. However, it is generally accepted that an increase of 5%, or more, should trigger assessment of viable mitigation measures.

Table 8 Analysis of Traffic Growth at Study Intersections

	Intersection and Peak Period		Existing Trips (2004)	Background Growth	Related[1] Project Trips	2010 Background Trips	Project Trips		2010 Background Plus Project
							Trips	%	
1	Haleakala Highway at Kula Highway	AM	2402	240	778	3420	37	1.08%	3457
		PM	1544	155	764	2463	21	0.85%	2484
2	Haleakala Highway at Makawao Avenue	AM	2260	228	706	3194	13	0.41%	3207
		PM	2621	264	973	3858	30	0.78%	3888
3	Haleakala Highway at Makani Road	AM	1971	197	496	2664	17	0.64%	2681
		PM	1699	171	430	2300	29	1.26%	2329
4	Haleakala Highway at Old Haleakala Highway	AM	2794	279	523	3596	51	1.42%	3647
		PM	2625	263	505	3393	65	1.92%	3458
5	Haleakala Highway at Hana Highway	AM	4351	434	518	5303	51	0.96%	5354
		PM	4145	415	516	5076	65	1.28%	5141
6	Old Haleakala Highway at Makawao Avenue & Laho Street	AM	1630	164	228	2022	42	2.08%	2064
		PM	1508	151	288	1947	33	1.69%	1980
7	Old Haleakala Highway at Pukalani Street	AM	2184	219	228	2631	59	2.24%	2690
		PM	2483	249	288	3020	74	2.45%	3094
8	Old Haleakala Highway at Makani Road	AM	1725	173	153	2051	77	3.75%	2128
		PM	1696	169	116	1981	104	5.25%	2085

Notes:
(1) Related projects are other development projects in the vicinity that will generate additional traffic at the study intersections. See Table 6 on page 19 for a list of related projects.

As shown in the table, the increases in peak hour traffic volumes at the intersections along Haleakala Highway are all less than 2%. This implies a minor increase in traffic at these intersections as a result of project generated traffic. However, because the traffic volumes using these intersections are large and the levels-of-service are generally low, mitigation may be considered at locations where the increase is less than 5% standard noted in the previous paragraph.

At the intersections along Old Haleakala Highway, the increases in traffic volumes are naturally a greater percentage because these intersections are closer to the project and generally have lower background traffic volumes. The increases in traffic volumes at these intersections range between 1.69% and 5.25%.

Overall, the increases in peak hourly traffic volumes as a result of project generated traffic are significantly less than the increases as a result of ambient background traffic growth and traffic generated by related projects.

Volume-to-Capacity and Level-of-Service Impact Analysis

The Level-of-Service analysis was performed for 2010 background and 2010 background plus project conditions to identify the impacts of the project and locations where mitigation measures should be investigated. The Level-of-Service analysis calculates the volume-to-capacity ratio of each movement. The change in the volume-to-capacity ratio quantifies the impact of the project. As previously noted in Chapter 2, Level-of-Service D is generally considered an acceptable level-of-service.

The results of the Level-of-Service analysis is presented separately for each of the study intersections.

1. Haleakala Highway at Kula Highway/Old Haleakala Highway

The Level-of-Service analysis of this intersection for existing right-of-way control conditions is summarized in Table 9. Overall, the intersection will operate at Level-of-Service F during both peak periods, without and with project generated traffic.

Table 9 Level-of-Service Analysis - Haleakala Highway at Kula Highway/Old Haleakala Highway

	2010 Background			2010 Background Plus Project			Changes	
Peak Hour, Approach and Movement	V/C(2)	Delay(3)	LOS(4)	V/C	Delay	LOS	V/C	Delay
AM Peak Hour	1.360	206.1	F	1.310	209.2	F	-0.050	3.1
Eastbound Left	0.048	69.1	E	0.048	69.1	E	0.000	0.0
Eastbound Thru	1.195	215.4	F	1.268	242.4	F	0.073	27.0
Eastbound Right	0.452	83.4	F	0.625	95.8	F	0.173	12.4
Westbound Left	1.062	150.6	F	1.062	150.6	F	0.000	0.0
Westbound Thru	0.475	68.1	E	0.482	68.3	E	0.007	0.2
Westbound Right	0.846	125.4	F	0.875	131.0	F	0.029	5.6
Northbound Left & Thru	1.402	223.6	F	1.411	227.6	F	0.009	4.0
Northbound Right	0.085	18.2	B	0.085	18.2	B	0.000	0.0
Southbound Left & Thru	1.398	248.8	F	1.398	248.8	F	0.000	0.0
Southbound Right	0.002	42.7	D	0.002	42.7	D	0.000	0.0
PM Peak Hour	1.200	131.4	F	1.210	135.2	F	0.010	3.8
Eastbound Left	0.036	67.0	E	0.037	67.0	E	0.001	0.0
Eastbound Thru	0.769	101.4	F	0.776	102.3	F	0.007	0.9
Eastbound Right	1.184	209.8	F	1.272	242.2	F	0.088	32.4
Westbound Left	0.563	86.5	F	0.563	86.5	F	0.000	0.0
Westbound Thru	0.617	80.3	F	0.628	80.9	F	0.011	0.6
Westbound Right	0.232	71.5	E	0.256	72.2	E	0.024	0.7
Northbound Left & Thru	1.166	128.6	F	1.173	131.3	F	0.007	2.7
Northbound Right	0.025	22.5	C	0.025	22.5	C	0.000	0.0
Southbound Left & Thru	1.168	141.1	F	1.168	141.1	F	0.000	0.0
Southbound Right	0.003	32.3	C	0.003	32.3	C	0.000	0.0

NOTES:
1. Peak hour conditions analyzed are "worst-case" conditions, which is the sum of the peak hour of the adjacent street plus the peak hour of the generator.
2. V/C denotes ratio of volume to capacity. V/C ratio is not calculated for unsignalized intersections.
3. Delay is in seconds per vehicle.
4. LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. LOS is based on delay.

During the morning peak hour, all movements will operate at Level-of-Service E or F, except the northbound right turn, which will operate at Level-of-Service B and the southbound right which will operate at Level-of-Service D. There is no change as a result of project generated traffic as the proposed project adds no traffic to these movements. During then afternoon peak hour, all movements will operate at level-of-service E or F, except the northbound and southbound right turns, which will operate at Level-of-Service C without and with the project. These low levels-of-service are the result of regional traffic. Less than 1.1% of the peak hourly traffic volumes are project generated traffic. This is a clear indication that the low levels-of-service at this intersection is a regional issue that must be addressed on a regional basis. Improvements as identified in the *Maui Long-Range Land Transportation Plan* should be implemented. The applicant should be responsible for no more than the project's pro rata share of the total traffic using the intersection.

2. Haleakala Highway at Makawao Avenue

The results of the Level-of-Service analysis for the intersection of Haleakala Highway at Makawao Avenue are summarized in Table 10. Overall the intersection will operate at Level-of-Service F during both peak periods, without and with the project. As with the previous intersection, the low levels-of-service are the result of regional traffic growth and traffic generated by other development projects, specifically the Upcountry Town Center for this particular intersection. Less than 0.8% of the peak hourly traffic volumes are project generated traffic. This is a clear indication that the low levels-of-service at this intersection is a regional issue that must be addressed on a regional basis. Improvements as identified in the *Maui Long-Range Land Transportation Plan* should be implemented. The applicant should be responsible for no more than the project's pro rata share of the total traffic using the intersection.

Table 10 Level-of-Service Analysis - Haleakala Highway at Makawao Avenue

	2010 Background			2010 Background Plus Project			Changes	
Peak Hour, Approach and Movement	V/C(2)	Delay(3)	LOS(4)	V/C	Delay	LOS	V/C	Delay
AM Peak Hour	1.360	129.8	F	1.370	130.6	F	0.010	0.8
Eastbound Left	0.036	29.9	C	0.048	30.1	C	0.012	0.2
Eastbound Thru & Right	1.005	70.7	E	1.005	70.7	E	0.000	0.0
Westbound Left	0.842	91.6	F	0.842	91.6	F	0.000	0.0
Westbound Thru	0.388	27.7	C	0.392	27.8	C	0.004	0.1
Westbound Right	0.073	23.1	C	0.073	23.1	C	0.000	0.0
Northbound Left & Thru	1.643	325.4	F	1.647	327.5	F	0.004	2.1
Northbound Right	0.376	16.5	B	0.376	16.5	B	0.000	0.0
Southbound Left & Thru	1.125	106.8	F	1.130	108.4	F	0.005	1.6
Southbound Right	0.010	12.2	B	0.011	12.2	B	0.001	0.0
PM Peak Hour	1.280	211.7	F	1.310	214.0	F	0.030	2.3
Eastbound Left	0.175	48.6	D	0.238	51.8	D	0.063	3.2
Eastbound Thru & Right	1.610	332.0	F	1.610	332.0	F	0.000	0.0
Westbound Left	2.497	748.6	F	2.497	748.6	F	0.000	0.0
Westbound Thru	1.265	179.8	F	1.277	184.9	F	0.012	5.1
Westbound Right	0.208	36.5	D	0.208	36.5	D	0.000	0.0
Northbound Left & Thru	1.045	63.1	E	1.093	78.9	E	0.048	15.8
Northbound Right	0.100	6.6	A	0.100	6.6	A	0.000	0.0
Southbound Left & Thru	0.853	25.2	C	0.884	28.6	C	0.031	3.4
Southbound Right	0.002	6.0	A	0.010	6.0	A	0.008	0.0

NOTES:
1. Peak hour conditions analyzed are "worst-case" conditions, which is the sum of the peak hour of the adjacent street plus the peak hour of the generator.
2. V/C denotes ratio of volume to capacity. V/C ratio is not calculated for unsignalized intersections.
3. Delay is in seconds per vehicle.
4. LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. LOS is based on delay.

3. *Haleakala Highway at Makani Road*

The results of the Level-of-Service analysis for the intersection of Haleakala Highway at Makani Road is summarized in Table 11. As it is anticipated that the intersection will be signalized before 2010, as discussed in Chapter 3, the methodology for signalized intersection was used to analyze this intersection. Overall, the intersection will operate at Level-of-Service C during both peak periods, without and with the proposed project.

During the morning peak hour, the eastbound left turn and the westbound left turn will operate at Level-of-Service E as defined by delay. However, the volume-to-capacity ratios imply Level-of-Service A or B. This situation implies that the poor level-of-service is a function of the traffic signal timing, rather than insufficient intersection capacity, as these vehicles must wait for the traffic signal to cycle through the other phases before receiving a green light. All the remaining traffic movements will operate at Level-of-Service D, or better, without and with project generated traffic.

During the afternoon peak hour, all traffic movements will operate at Level-of-Service D, or better, without and with project generated traffic.

Table 11 Level-of-Service Analysis - Haleakala Highway at Makani Road

	2010 Background			2010 Background Plus Project			Changes	
Peak Hour, Approach and Movement	V/C(2)	Delay(3)	LOS(4)	V/C	Delay	LOS	V/C	Delay
AM Peak Hour	0.690	30.8	C	0.690	30.9	C	0.000	0.1
Eastbound Left	0.559	56.2	E	0.640	56.2	E	0.081	0.0
Eastbound Thru & Right	0.559	17.5	B	0.640	17.5	B	0.081	0.0
Westbound Left	0.559	54.6	D	0.559	55.4	E	0.000	0.8
Westbound Thru	0.348	26.7	C	0.348	26.7	C	0.000	0.0
Westbound Right	0.078	17.0	B	0.136	17.0	B	0.058	0.0
Northbound Left & Thru	0.207	25.3	C	0.236	25.4	C	0.029	0.1
Northbound Right	0.042	31.9	C	0.042	32.1	C	0.000	0.2
Southbound Left & Thru	0.461	35.7	D	0.529	36.3	D	0.068	0.6
Southbound Right	0.110	41.4	D	0.207	41.4	D	0.097	0.0
PM Peak Hour	0.620	34.3	C	0.630	34.5	C	0.010	0.2
Eastbound Left	0.559	48.4	D	0.640	48.4	D	0.081	0.0
Eastbound Thru & Right	0.559	31.0	C	0.640	31.0	C	0.081	0.0
Westbound Left	0.559	37.2	D	0.559	37.7	D	0.000	0.5
Westbound Thru	0.348	32.0	C	0.348	32.0	C	0.000	0.0
Westbound Right	0.078	24.0	C	0.136	24.0	C	0.058	0.0
Northbound Left & Thru	0.207	27.7	C	0.236	27.8	C	0.029	0.1
Northbound Right	0.042	26.5	C	0.042	26.6	C	0.000	0.1
Southbound Left & Thru	0.461	41.6	D	0.529	42.6	D	0.068	1.0
Southbound Right	0.110	27.7	C	0.207	27.7	C	0.097	0.0

NOTES:
1. Peak hour conditions analyzed are "worst-case" conditions, which is the sum of the peak hour of the adjacent street plus the peak hour of the generator.
2. V/C denotes ratio of volume to capacity. V/C ratio is not calculated for unsignalized intersections.
3. Delay is in seconds per vehicle.
4. LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. LOS is based on delay.

4. *Haleakala Highway at Old Haleakala Highway*

The results of the Level-of-Service analysis for the intersection of Haleakala Highway at Old Haleakala Highway are summarized in Table 12. As discussed in Chapter 2 - Existing Conditions, all movements are free flowing during the morning peak hour and, therefore, operate at Level-of-Service A. A look at morning peak hourly traffic volume along Haleakala Highway shows that there is no increase in the peak hourly traffic volumes as a result of project generated traffic. However, the volume is approximately 1750 vehicles per hour. The maximum theoretical capacity of a free flowing traffic lane, with no adjustments for lane width, heavy vehicles, shoulders, gradient, etc., is 2000 vehicles per hour. This implies a volume-to-capacity ratio of 0.875, or Level-of-Service D, for the westbound through lane and very few gaps in the traffic stream. The proposed project adds no traffic to this movement, but does add traffic to the northbound left turn.

During the afternoon peak hour, the northbound left will operate at Level-of-Service E without the project and Level-of-Service F with the project. The increased delay is the result of the increased eastbound through traffic and therefore fewer acceptable gaps for the northbound to westbound left turns.

A preliminary review of the peak hour warrants for traffic signals indicates that the minimum peak hour volumes will satisfy the warrants for traffic signals during both peak hours. This issue should be discussed with State of Hawaii Department of Transportation.

Table 12 Level-of-Service Analysis - Haleakala Highway at Old Haleakala Highway

	2010 Background		2010 Background Plus Project		Changes
Peak Hour, Approach and Movement	Delay(3)	LOS(4)	Delay	LOS	Delay
AM Peak Hour					
Northbound Left	See Report		See Report		
PM Peak Hour					
Northbound Left	43.9	E	116.4	F	72.5

NOTES:
1. Peak hour conditions analyzed are "worst-case" conditions, which is the sum of the peak hour of the adjacent street plus the peak hour of the generator.
2. V/C denotes ratio of volume to capacity. V/C ratio is not calculated for unsignalized intersections.
3. Delay is in seconds per vehicle.
4. LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. LOS is based on delay.

5. *Haleakala Highway at Hana Highway*

The results of the Level-of-Service analysis for the intersection of Hana Highway at Haleakala Highway is summarized in Table 13. Overall, the intersection will operate at Level-of-Service F during the morning peak hour and Level-of-Service E during the peak hour, without and with the project.

Table 13 Level-of-Service Analysis - Haleakala Highway at Hana Highway

Peak Hour, Approach and Movement	2010 Background			2010 Background Plus Project			Changes	
	V/C(2)	Delay(3)	LOS(4)	V/C	Delay	LOS	V/C	Delay
AM Peak Hour	1.260	150.5	F	1.270	155.7	F	0.010	5.2
Eastbound Left & Thru	1.151	238.6	F	1.178	248.0	F	0.027	9.4
Eastbound Right	0.063	85.5	F	0.063	85.5	F	0.000	0.0
Westbound Left	1.269	160.2	F	1.288	168.4	F	0.019	8.2
Westbound Left & Thru	1.176	120.7	F	1.197	129.6	F	0.021	8.9
Westbound Right	0.013	11.6	B	0.015	11.7	B	0.002	0.1
Northbound Left	1.075	253.6	F	1.075	235.6	F	0.000	-18.0
Northbound Thru	0.544	62.2	E	0.544	62.6	E	0.000	0.4
Northbound Right	1.192	178.2	F	1.203	182.2	F	0.011	4.0
Southbound Left	1.275	322.3	F	1.275	322.3	F	0.000	0.0
Southbound Thru	1.256	193.4	F	1.256	193.4	F	0.000	0.0
Southbound Right	0.265	57.6	E	0.265	57.6	E	0.000	0.0
PM Peak Hour	0.880	70.1	E	0.920	73.4	E	0.040	3.3
Eastbound Left & Thru	0.825	83.2	F	0.856	86.7	F	0.031	3.5
Eastbound Right	0.064	55.3	E	0.064	55.3	E	0.000	0.0
Westbound Left	0.898	62.2	E	0.906	63.3	E	0.008	1.1
Westbound Left & Thru	0.866	58.2	E	0.878	59.5	E	0.012	1.3
Westbound Right	0.016	28.9	C	0.019	29.0	C	0.003	0.1
Northbound Left	0.540	122.1	F	0.540	122.1	F	0.000	0.0
Northbound Thru	0.828	71.5	E	0.828	71.5	E	0.000	0.0
Northbound Right	0.908	91.0	F	1.000	111.0	F	0.092	20.0
Southbound Left	0.780	160.0	F	0.800	164.2	F	0.020	4.2
Southbound Thru	0.703	65.0	E	0.703	65.0	E	0.000	0.0
Southbound Right	0.051	50.5	D	0.051	50.5	D	0.000	0.0

NOTES:
1. Peak hour conditions analyzed are "worst-case" conditions, which is the sum of the peak hour of the adjacent street plus the peak hour of the generator.
2. V/C denotes ratio of volume to capacity. V/C ratio is not calculated for unsignalized intersections.
3. Delay is in seconds per vehicle.
4. LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. LOS is based on delay.

During the morning peak hour, all movements will operate at Level-of-Service E or F, except the westbound right turn, which is the right turn from Haleakala Highway toward Paia. During then afternoon peak hour, all movements will operate at level-of-service E or F, except the westbound right turn and the southbound right turn. These low levels-of-service are the result of regional traffic. Less than 1.5% of the peak hourly traffic volumes are project generated traffic. This is a clear indication that the low levels-of-service at this intersection is a regional issue that must be addressed on a regional basis. Improvements as identified in the Maui Long-Range Land Transportation Plan should be implemented. The applicant should be responsible for no more than the project's pro rata share of the total traffic using the intersection.

6. *Old Haleakala Highway at Makawao Avenue/Loha Street*

The results of the Level-of-Service analysis of the intersection of Old Haleakala Highway at Makawao Avenue is tabulated in Table 14. During the morning peak hour, all volume-to-capacity ratios are 0.700, or less, and all movements operate at Level-of-Service C, or better. During the afternoon peak hour, all volume-to-capacity ratios are 0.734, or less, and all movements will operate at Level-of-Service D, or better.

Table 14 Level-of-Service Analysis - Old Haleakala Highway at Makawao Avenue

Peak Hour, Approach and Movement	2010 Background			2010 Background Plus Project			Changes	
	V/C(2)	Delay(3)	LOS(4)	V/C	Delay	LOS	V/C	Delay
AM Peak Hour	0.730	19.1	B	0.740	19.3	B	0.010	0.2
Eastbound Left	0.497	11.4	B	0.508	11.6	B	0.011	0.2
Eastbound Thru & Right	0.600	10.7	B	0.627	11.2	B	0.027	0.5
Westbound Left, Thru & Right	0.659	21.1	C	0.673	21.6	C	0.014	0.5
Northbound Left, Thru & Right	0.695	34.3	C	0.700	34.6	C	0.005	0.3
Southbound Left & Thru	0.427	28.4	C	0.427	28.4	C	0.000	0.0
Southbound Right	0.399	26.3	C	0.401	26.3	C	0.002	0.0
PM Peak Hour	0.740	19.6	B	0.750	21.7	C	0.010	2.1
Eastbound Left	0.634	11.8	B	0.641	12.1	B	0.007	0.3
Eastbound Thru & Right	0.316	4.9	A	0.329	5.0	A	0.013	0.1
Westbound Left, Thru & Right	0.663	19.5	B	0.670	19.7	B	0.007	0.2
Northbound Left, Thru & Right	0.406	31.4	C	0.734	48.2	D	0.328	16.8
Southbound Left & Thru	0.628	40.0	D	0.657	42.1	D	0.029	2.1
Southbound Right	0.672	40.2	D	0.700	41.7	D	0.028	1.5

NOTES:
1. Peak hour conditions analyzed are "worst-case" conditions, which is the sum of the peak hour of the adjacent street plus the peak hour of the generator.
2. V/C denotes ratio of volume to capacity. V/C ratio is not calculated for unsignalized intersections.
3. Delay is in seconds per vehicle.
4. LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. LOS is based on delay.

7. . *Old Haleakala Highway at Pukalani Street*

The results of the Level-of-Service analysis of the intersection of Old Haleakala Highway at Pukalani Street is summarized in Table 15. Overall the intersection will operate at Level-of-Service E during the morning peak hour and Level-of-Service C during the afternoon peak hour.

During the morning peak hour, only the eastbound right turn , the westbound through movement and the northbound right turn operate at acceptable levels-of-service . The remaining movements operate at Level-of-Service E or F.

During the afternoon peak hour, all movements except the eastbound right will operate at Level-of-Service D, or better, even thought the volume-to-capacity ratio of the eastbound right is greater than 0.900. The project adds no traffic to this movement.

Table 15 Level-of-Service Analysis - Old Haleakala Highway at Pukalani Street

	2010 Background			2010 Background Plus Project			Changes	
Peak Hour, Approach and Movement	V/C(2)	Delay(3)	LOS(4)	V/C	Delay	LOS	V/C	Delay
AM Peak Hour	1.190	61.2	E	1.190	66.0	E	0.000	4.8
Eastbound Thru	1.023	66.7	E	1.072	81.9	F	0.049	15.2
Eastbound Right	0.112	3.1	A	0.122	3.1	A	0.010	0.0
Westbound Left	1.078	89.4	F	1.078	89.5	F	0.000	0.1
Westbound Thru	0.372	10.7	B	0.384	10.8	B	0.012	0.1
Northbound Left	1.119	99.0	F	1.130	103.2	F	0.011	4.2
Northbound Right	0.289	8.3	A	0.289	8.3	A	0.000	0.0
PM Peak Hour	0.870	25.7	C	0.910	27.3	C	0.040	1.6
Eastbound Thru	0.737	31.1	C	0.766	32.5	C	0.029	1.4
Eastbound Right	0.750	15.8	B	0.771	16.7	B	0.021	0.9
Westbound Left	0.974	49.0	D	0.988	52.9	D	0.014	3.9
Westbound Thru	0.276	6.0	A	0.290	6.1	A	0.014	0.1
Northbound Left	0.709	37.7	D	0.766	40.8	D	0.057	3.1
Northbound Right	0.425	9.5	A	0.425	9.5	A	0.000	0.0

NOTES:
1. Peak hour conditions analyzed are "worst-case" conditions, which is the sum of the peak hour of the adjacent street plus the peak hour of the generator.
2. V/C denotes ratio of volume to capacity. V/C ratio is not calculated for unsignalized intersections.
3. Delay is in seconds per vehicle.
4. LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. LOS is based on delay.

8. *Old Haleakala Highway at Makani Road*

The results of the Level-of-Service analysis of the intersection of Old Haleakala Highway at Makani Road is summarized in Table 16. All movements will operate at Level-of-Service C, or better, except the southbound left turn, which will operate at Level-of-Service F during both peak periods, without and with the project. Even though the proposed project adds no traffic to this movement, the delays increase because of the additional traffic added to the eastbound and westbound through traffic, which translates into fewer acceptable gaps for the left turns and therefore a longer delay and lower level-of-service.

Table 16 Level-of-Service Analysis - Old Haleakala Highway at Makani Road

	2010 Background		2010 Background Plus Project		Changes
Peak Hour, Approach and Movement	Delay(3)	LOS(4)	Delay	LOS	Delay
AM Peak Hour					
Eastbound Left	11.9	B	12.1	B	0.2
Southbound Left	468.8	F	616.6	F	147.8
Southbound Right	19.6	C	20.0	C	0.4
PM Peak Hour					
Eastbound Left	9.1	A	9.3	A	0.2
Southbound Left	360.4	F	468.2	F	107.8
Southbound Right	12.3	B	13.1	B	0.8

NOTES:
1. Peak hour conditions analyzed are "worst-case" conditions, which is the sum of the peak hour of the adjacent street plus the peak hour of the generator.
2. V/C denotes ratio of volume to capacity. V/C ratio is not calculated for unsignalized intersections.
3. Delay is in seconds per vehicle.
4. LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. LOS is based on delay.

Project Driveways

A level-of-service analysis was performed to determine the access and egress requirements at the project driveways along Old Haleakala Highway. Figure 14 is a schematic drawing indicating the locations of the driveways and the peak hour traffic projections. The schematic drawing also indicates the lane configurations used for the level-of-service analysis.

The level-of-service analysis of the driveways was performed assuming that only right turns in and right turns out will be allowed at Drive A, that all traffic movements will be allowed at Drive B and that there are no separate turn lanes into or out of the project at either Drive A and Drive B.

The results are summarized in Table 17. As shown, left turns from Drive A, which is the main driveway of the project, will operate at Level-of-Service C during the both peak hours without improvement.

Table 17 Level-of-Service Analysis for Project Driveways

	2010 AM Peak Hour				2010 PM Peak Hour			
	Without Mitigation		With Mitigation [3]		Without Mitigation		With Mitigation [3]	
Intersection and Movement	Delay [1]	LOS [2]	Delay	LOS	Delay	LOS	Delay	LOS
Project Driveway A at Old Haleakala Highway								
Northbound Left and Right	17.8	C			17.9	C		
Project Driveway B at Old Haleakala Highway								
Southbound Left & Thru	10.4	B	10.4	B	10.6	B	10.6	B
Westbound Left & Right	224.5	F	26.8	D	29.9	C	18.7	C

NOTES:
(1) Delay in seconds per vehicle.
(2) LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. Level-of-Service is based on delay.
(3) Mitigation is a separate left turn lane into the project from Old Haleakala Highway and a refuge lane along Old Haleakala Highway for left turns out of the project.

The left turns from Drive B will operate at Level-of-Service F during the morning peak hour and Level-of-Service C during the afternoon peak hour. Mitigation is required. An analysis was performed to determine if provision of a left turn refuge lane would improve the levels-of-service to an acceptable level. As shown in the table, the left turns will operate at Level-of-Service D during the morning peak hour and Level-of-Service C during the afternoon peak hour with a left turn refuge lane. Level-of-Service D is considered an acceptable level-of-service for peak hour conditions.

An assessment of the need for a separate left turn lane along Old Haleakala Highway at Drive B was also performed. This assessment was performed using guidelines provided by the Transportation Research Board. This guideline is reproduced as Appendix . The conclusion of the assessment is that a left turn storage lane should be provided at Drive B. The additional width required for this left turn storage lane will also provide the additional width required for the left turn refuge lane discussed previously.

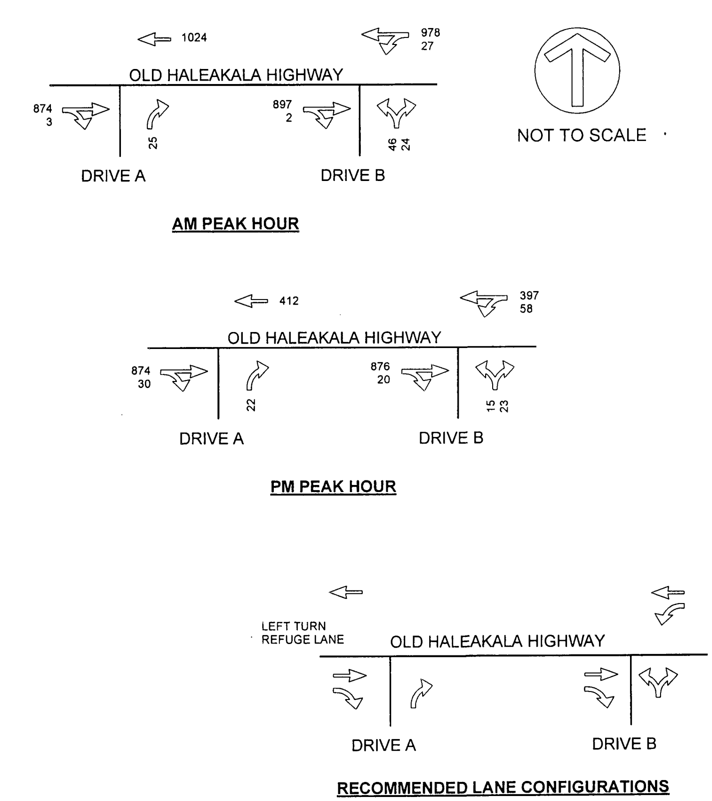


Figure 14
2010 TRAFFIC PROJECTIONS AT DRIVEWAYS

Part 2.1

Trip Assignment Worksheet

Pukalani Makai TIAR
March 2005

INTERSECTION NO 1
INTERSECTION OF Old Haleakala Highway at Pukalani Bypass

		Case 1						Case 2														Case 3	
	Approach	Existing		Background Growth		Related Project Traffic		Cumulative		AM Distribution		AM Assignment		PM Distribution		PM Assignment		Project Trips		Cumulative Plus Project	
No	& Mvt	AM	PM	AM	PM	AM	PM	AM	PM	% In	% Out	In	Out	% In	% Out	In	Out	AM	PM	AM	PM
1	N- RT	2	3	0	0			2	3			0	0			0	0	0	0	2	3
2	TH	172	325	17	33	319	229	508	587			0	0			0	0	0	0	508	587
3	LT	122	125	12	13	2	15	136	153			0	0			0	0	0	0	136	153
4	E- RT	167	53	17	5			184	58	5%		2	0	2%		2	0	2	2	186	60
5	TH	86	76	9	8	21	31	116	115	5%		2	0	2%		2	0	2	2	118	117
6	LT	141	30	14	3	24	18	179	51			0	0			0	0	0	0	179	51
7	S- RT	108	15	11	2	15	16	134	33			0	0			0	0	0	0	134	33
8	TH	683	377	68	38	223	244	974	659	5%		2	0	3%		3	0	2	3	976	662
9	LT	258	211	26	21	64	71	348	303	20%		6	0	3%		3	0	6	3	354	306
10	W- RT	535	252	54	25	106	114	695	391		18%	0	17		16%	0	10	17	10	712	401
11	TH	124	74	12	7	4	26	140	107		8%	0	8		2%	0	1	8	1	148	108
12	LT	4	3	0	0			4	3			0	0			0	0	0	0	4	3
TOTAL		2402	1544	240	155	778	764	3420	2463			12	25			10	11	37	21	3457	2484
Approach Totals																					
From North		296	453	29	46	321	244	646	743			0	0			0	0	0	0	646	743
From East		394	159	40	16	45	49	479	224			4	0			4	0	4	4	483	228
From South		1049	603	105	61	302	331	1456	995			8	0			6	0	8	6	1464	1001
From West		663	329	66	32	110	140	839	501			0	25			0	11	25	11	864	512
Total		2402	1544	240	155	778	764	3420	2463			12	25			10	11	37	21	3457	2484
Departure Totals																					
To North		854	433	85	43	223	244	1162	720			4	0			5	0	4	5	1166	725
To East		354	214	35	22	21	57	410	293			0	8			0	1	8	1	418	294
To South		848	607	85	61	449	361	1382	1029			0	17			0	10	17	10	1399	1039
To West		346	290	35	29	85	102	466	421			8	0			5	0	8	5	474	426
Total		2402	1544	240	155	778	764	3420	2463			12	25			10	11	37	21	3457	2484
Leg Totals																					
North		1150	886	114	89	544	488	1808	1463			4	0			5	0	4	5	1812	1468
East		748	373	75	38	66	106	889	517			4	8			4	1	12	5	901	522
South		1897	1210	190	122	751	692	2838	2024			8	17			6	10	25	16	2863	2040
West		1009	619	101	61	195	242	1305	922			8	25			5	11	33	16	1338	938
Total		4804	3088	480	310	1556	1528	6840	4926			24	50			20	22	74	42	6914	4968

Phillip Rowell and Associates 10-May-05 Pukalani Makai.Traffic.qpw

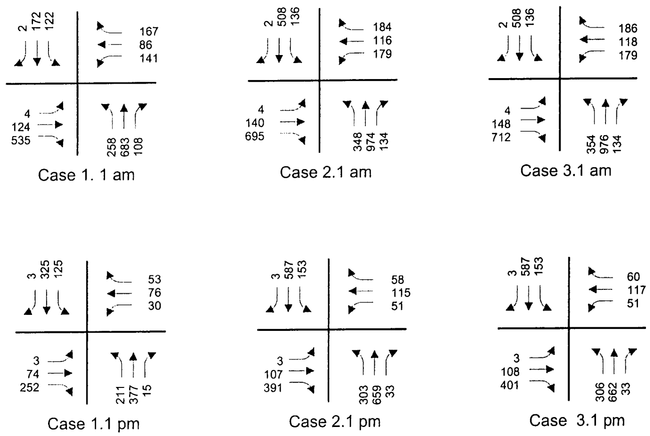
Conclusions of the Level-of-Service Analysis

The conclusion of the level-of-service analysis is that traffic generated by the Kauhale Lane project will have an impact on the levels-of-service of the key intersections in the study area. However, there are no significant changes in the level-of-service of any of the study intersections as a result of traffic generated by the Kauhale Lane project. However, the background levels-of-service of several intersections will be below acceptable conditions whether Kauhale Lani is constructed or not because of the heavy background traffic volumes. These intersections are Haleakala Highway at Kula Highway, Haleakala Highway at Makawao Avenue and Haleakala Highway at Hana Highway.

The low levels-of-service at these intersections are the result of regional traffic. Traffic generated by the Kauhale Lane project comprises a small percentage (1.28% or less) of the total traffic projected to use these intersections during the peak hours. This is a clear indication that the low levels-of-service at these intersections are a regional issue that must be addressed on a regional basis. Improvements as identified in the *Maui Long-Range Land Transportation Plan* should be implemented. The applicant should be responsible for no more than the project's pro rata share of the total traffic using the intersections.

The conclusion of the level-of-service analysis of the driveways is that a separate left lane for traffic turning into the project and a left turn refuge lane should be installed along Old Haleakala Highway at Drive B. Only right turns should be allowed at Drive A.

#1 OLD HALEAKALA HIGHWAY AT PUKALANI BY PASS (EAST)

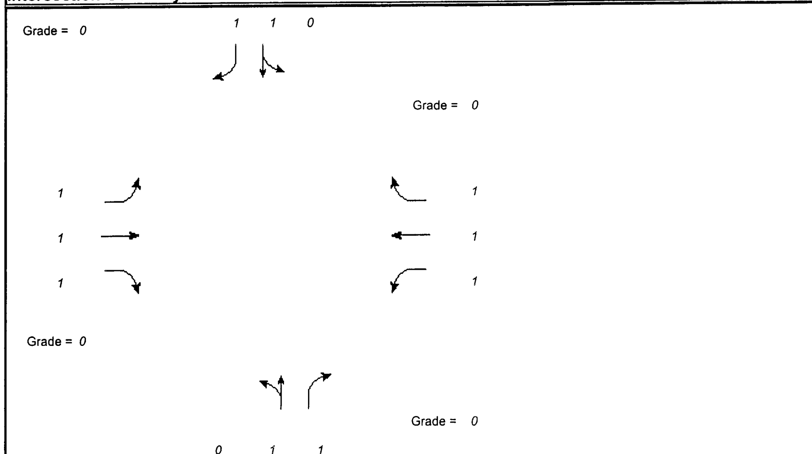


INPUT WORKSHEET

General Information		Site Information	
Analyst	PJR	Intersection	Case1.1am
Agency or Co.	PRA	Area Type	All other areas
Date Performed	4/5/2005	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case1.1am*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	4	124	535	141	86	167	258	683	108	122	172	2
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
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
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0		2.0	2.0
Ext. eff. green	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0		2.0	2.0
Arrival type	3	3	3	3	3	3		3	3		3	3
Unit Extension	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Ped/Bike/RTOR Volume	0		0	0		100	0		65	0		1
Lane Width	12.0	12.0	12.0	12.0	12.0	12.0		12.0	12.0		12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0	0	0	0	0		0	0		0	0

	WB Only	EW Perm	03	04	NB Only	SB Only	07	08
Timing	G = 11.0	G = 10.0	G =	G =	G = 82.0	G = 40.0	G =	G =
	Y = 0	Y = 4	Y =	Y =	Y = 4	Y = 4	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 155.0		

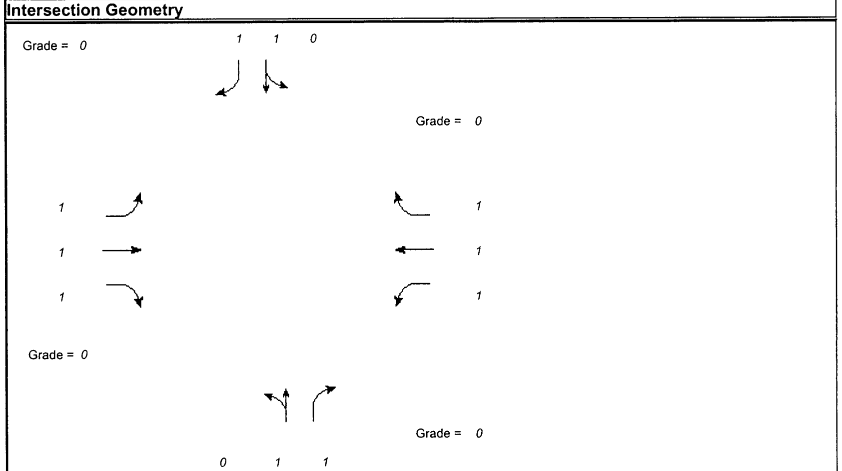
HCS2000™ Version 4.1c

INPUT WORKSHEET

General Information		Site Information	
Analyst	*PJR*	Intersection	*Case1.1pm*
Agency or Co.	*PRA*	Area Type	*All other areas*
Date Performed	*4/5/2005*	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case1.1pm*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	3	74	252	30	76	53	211	377	15	125	325	3
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
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
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0		2.0	2.0
Ext. eff. green	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0		2.0	2.0
Arrival type	3	3	3	3	3	3		3	3		3	3
Unit Extension	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Ped/Bike/RTOR Volume	0		250	0		30	0		15	0		1
Lane Width	12.0	12.0	12.0	12.0	12.0	12.0		12.0	12.0		12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0	0	0	0	0		0	0		0	0

	WB Only	EW Perm	03	04	NB Only	SB Only	07	08
Timing	G = 4.0	G = 12.0	G =	G =	G = 72.0	G = 55.0	G =	G =
	Y = 0	Y = 4	Y =	Y =	Y = 4	Y = 4	Y =	Y =

Duration of Analysis (hrs) = 0.25 | Cycle Length C = 155.0

HCS2000™ Version 4.1c

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case1.1am*

Capacity Analysis

	EB			WB			NB		SB	
Lane group	L	T	R	L	T	R	LT	R	LT	R
Adj. flow rate	4	131	563	148	91	71	991	45	309	1
Satflow rate	1326	1900	1615	1805	1900	1615	1874	1615	1861	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.06	0.06	0.06	0.14	0.14	0.06	0.53	0.53	0.26	0.26
Lane group cap.	86	123	104	177	257	104	991	854	480	417
v/c ratio	0.05	1.07	5.41	0.84	0.35	0.68	1.00	0.05	0.64	0.00
Flow ratio	0.00	0.07	0.35		0.05	0.04	0.53	0.03	0.17	0.00
Crit. lane group	N	N	Y	N	N	N	Y	N	Y	N
Sum flow ratios	1.11									
Lost time/cycle	16.00									
Critical v/c ratio	1.24									

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB		SB	
Lane group	L	T	R	L	T	R	LT	R	LT	R
Adj. flow rate	4	131	563	148	91	71	991	45	309	1
Lane group cap.	86	123	104	177	257	104	991	854	480	417
v/c ratio	0.05	1.07	5.41	0.84	0.35	0.68	1.00	0.05	0.64	0.00
Green ratio	0.06	0.06	0.06	0.14	0.14	0.06	0.53	0.53	0.26	0.26
Unif. delay d1	68.0	72.5	72.5	63.5	60.8	70.9	36.5	17.7	51.2	42.7
Delay factor k	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Increm. delay d2	1.0	99.7	2007	35.1	3.8	30.7	28.6	0.1	6.5	0.0
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	69.0	172.2	2079	98.6	64.6	101.6	65.1	17.8	57.7	42.7
Lane group LOS	E	F	F	F	E	F	E	B	E	D
Apprch. delay	1710			89.3			63.0		57.6	
Approach LOS	F			F			E		E	
Intersec. delay	554.2			Intersection LOS					F	

HCS2000™ Version 4.1c

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case1.1pm*

Capacity Analysis

	EB			WB			NB		SB	
Lane group	L	T	R	L	T	R	LT	R	LT	R
Adj. flow rate	3	78	2	32	80	24	619	0	474	2
Satflow rate	1339	1900	1615	1805	1900	1615	1867	1615	1874	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.08	0.08	0.08	0.10	0.10	0.08	0.46	0.46	0.35	0.35
Lane group cap.	104	147	125	96	196	125	867	750	665	573
v/c ratio	0.03	0.53	0.02	0.33	0.41	0.19	0.71	0.00	0.71	0.00
Flow ratio	0.00	0.04	0.00		0.04	0.01	0.33	0.00	0.25	0.00
Crit. lane group	N	Y	N	N	N	N	Y	N	Y	N
Sum flow ratios	0.64									
Lost time/cycle	16.00									
Critical v/c ratio	0.72									

Lane Group Capacity, Control Delay, and LOS Determination

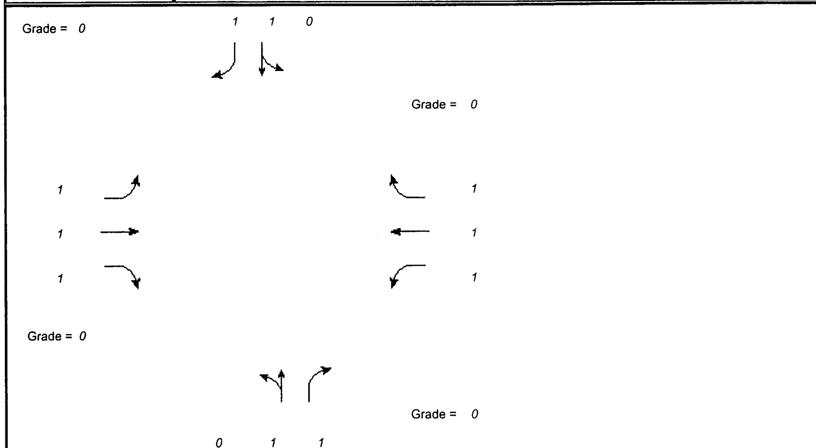
	EB			WB			NB		SB	
Lane group	L	T	R	L	T	R	LT	R	LT	R
Adj. flow rate	3	78	2	32	80	24	619	0	474	2
Lane group cap.	104	147	125	96	196	125	867	750	665	573
v/c ratio	0.03	0.53	0.02	0.33	0.41	0.19	0.71	0.00	0.71	0.00
Green ratio	0.08	0.08	0.08	0.10	0.10	0.08	0.46	0.46	0.35	0.35
Unif. delay d1	66.1	68.8	66.0	63.6	65.1	67.0	33.2	22.2	43.2	32.3
Delay factor k	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Increm. delay d2	0.5	13.0	0.2	9.1	6.2	3.4	5.0	0.0	6.4	0.0
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	66.6	81.8	66.3	72.7	71.3	70.4	38.2	22.2	49.6	32.3
Lane group LOS	E	F	E	E	E	E	D	C	D	C
Apprch. delay	80.9			71.4			38.2		49.5	
Approach LOS	F			E			D		D	
Intersec. delay	48.5			Intersection LOS					D	

INPUT WORKSHEET

General Information		Site Information	
Analyst	PJR	Intersection	Case2.1am
Agency or Co.	PRA	Area Type	All other areas
Date Performed	4/5/2005	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case2.1am*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	4	140	695	179	116	184	348	974	134	136	508	2
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
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
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0		2.0	2.0
Ext. eff. green	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0		2.0	2.0
Arrival type	3	3	3	3	3	3		3	3		3	3
Unit Extension	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Ped/Bike/RTOR Volume	0		650	0		100	0		65	0		1
Lane Width	12.0	12.0	12.0	12.0	12.0	12.0		12.0	12.0		12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0	0	0	0	0		0	0		0	0

	WB Only	EW Perm	03	04	NB Only	SB Only	07	08
Timing	G = 11.0	G = 10.0	G =	G =	G = 82.0	G = 40.0	G =	G =
	Y = 0	Y = 4	Y =	Y =	Y = 4	Y = 4	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 155.0		

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case2.1am*

Capacity Analysis

	EB			WB			NB		SB	
Lane group	L	T	R	L	T	R	LT	R	LT	R
Adj. flow rate	4	147	47	188	122	88	1391	73	678	1
Satflow rate	1289	1900	1615	1805	1900	1615	1875	1615	1880	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.06	0.06	0.06	0.14	0.14	0.06	0.53	0.53	0.26	0.26
Lane group cap.	83	123	104	177	257	104	992	854	485	417
v/c ratio	0.05	1.20	0.45	1.06	0.47	0.85	1.40	0.09	1.40	0.00
Flow ratio	0.00	0.08	0.03		0.06	0.05	0.74	0.05	0.36	0.00
Crit. lane group	N	N	N	N	N	N	Y	N	Y	N
Sum flow ratios	1.25									
Lost time/cycle	12.00									
Critical v/c ratio	1.36									

Lane Group Capacity, Control Delay, and LOS Determination

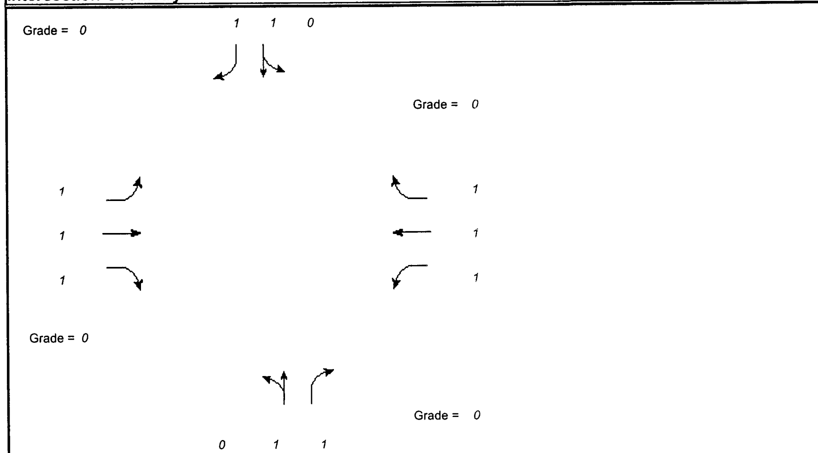
	EB			WB			NB		SB	
Lane group	L	T	R	L	T	R	LT	R	LT	R
Adj. flow rate	4	147	47	188	122	88	1391	73	678	1
Lane group cap.	83	123	104	177	257	104	992	854	485	417
v/c ratio	0.05	1.20	0.45	1.06	0.47	0.85	1.40	0.09	1.40	0.00
Green ratio	0.06	0.06	0.06	0.14	0.14	0.06	0.53	0.53	0.26	0.26
Unif. delay d1	68.0	72.5	69.9	65.5	61.9	71.7	36.5	18.0	57.5	42.7
Delay factor k	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Increm. delay d2	1.1	142.9	13.5	85.1	6.2	53.6	187.1	0.2	191.3	0.0
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	69.1	215.4	83.4	150.6	68.1	125.4	223.6	18.2	248.8	42.7
Lane group LOS	E	F	F	F	E	F	F	B	F	D
Apprch. delay	181.1			119.7			213.4		248.5	
Approach LOS	F			F			F		F	
Intersec. delay	206.1			Intersection LOS					F	

INPUT WORKSHEET

General Information		Site Information	
Analyst	*PJR*	Intersection	*Case2.1pm*
Agency or Co.	*PRA*	Area Type	*All other areas*
Date Performed	*4/5/2005*	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case2.1pm*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	3	107	391	51	115	58	303	659	33	153	587	3
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
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
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0		2.0	2.0
Ext. eff. green	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0		2.0	2.0
Arrival type	3	3	3	3	3	3		3	3		3	3
Unit Extension	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Ped/Bike/RTOR Volume	0		250	0		30	0		15	0		1
Lane Width	12.0	12.0	12.0	12.0	12.0	12.0		12.0	12.0		12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0	0	0	0	0		0	0		0	0

	WB Only	EW Perm	03	04	NB Only	SB Only	07	08
Timing	G = 4.0	G = 12.0	G =	G =	G = 72.0	G = 55.0	G =	G =
	Y = 0	Y = 4	Y =	Y =	Y = 4	Y = 4	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 155.0		

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case2.1pm*

Capacity Analysis

	EB			WB			NB		SB	
Lane group	L	T	R	L	T	R	LT	R	LT	R
Adj. flow rate	3	113	148	54	121	29	1013	19	779	2
Satflow rate	1074	1900	1615	1805	1900	1615	1871	1615	1881	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.08	0.08	0.08	0.10	0.10	0.08	0.46	0.46	0.35	0.35
Lane group cap.	83	147	125	96	196	125	869	750	667	573
v/c ratio	0.04	0.77	1.18	0.56	0.62	0.23	1.17	0.03	1.17	0.00
Flow ratio	0.00	0.06	0.09		0.06	0.02	0.54	0.01	0.41	0.00
Crit. lane group	N	N	Y	N	N	N	Y	N	Y	N
Sum flow ratios	1.07									
Lost time/cycle	16.00									
Critical v/c ratio	1.20									

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB		SB	
Lane group	L	T	R	L	T	R	LT	R	LT	R
Adj. flow rate	3	113	148	54	121	29	1013	19	779	2
Lane group cap.	83	147	125	96	196	125	869	750	667	573
v/c ratio	0.04	0.77	1.18	0.56	0.62	0.23	1.17	0.03	1.17	0.00
Green ratio	0.08	0.08	0.08	0.10	0.10	0.08	0.46	0.46	0.35	0.35
Unif. delay d1	66.1	70.1	71.5	64.8	66.6	67.2	41.5	22.5	50.0	32.3
Delay factor k	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Increm. delay d2	0.8	31.3	138.3	21.7	13.7	4.3	87.1	0.1	91.1	0.0
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	67.0	101.4	209.8	86.5	80.3	71.5	128.6	22.5	141.1	32.3
Lane group LOS	E	F	F	F	F	E	F	C	F	C
Apprch. delay	161.8			80.7			126.6		140.8	
Approach LOS	F			F			F		F	
Intersec. delay	131.4			Intersection LOS					F	

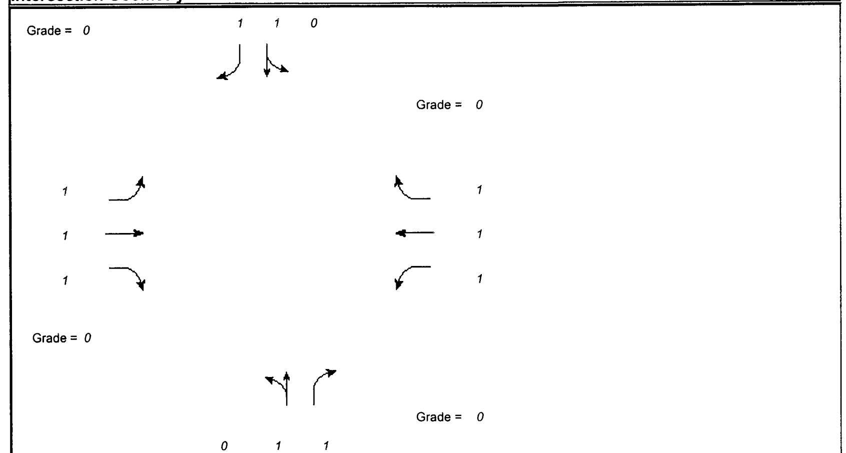
HCS2000™ Version 4.1c

INPUT WORKSHEET

General Information		Site Information	
Analyst	PJR	Intersection	Case3.1am
Agency or Co.	PRA	Area Type	All other areas
Date Performed	4/5/2005	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case3.1am*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	4	148	712	179	118	186	354	976	134	136	508	2
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
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
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0		2.0	2.0
Ext. eff. green	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0		2.0	2.0
Arrival type	3	3	3	3	3	3		3	3		3	3
Unit Extension	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Ped/Bike/RTOR Volume	0		650	0		100	0		65	0		1
Lane Width	12.0	12.0	12.0	12.0	12.0	12.0		12.0	12.0		12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0	0	0	0	0		0	0		0	0

	WB Only	EW Perm	03	04	NB Only	SB Only	07	08
Timing	G = 11.0	G = 10.0	G =	G =	G = 82.0	G = 40.0	G =	G =
	Y = 0	Y = 4	Y =	Y =	Y = 4	Y = 4	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 155.0		

HCS2000™ Version 4.1c

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case3.1am*

Capacity Analysis

	EB			WB			NB		SB	
Lane group	L	T	R	L	T	R	LT	R	LT	R
Adj. flow rate	4	156	65	188	124	91	1400	73	678	1
Satflow rate	1287	1900	1615	1805	1900	1615	1875	1615	1880	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.06	0.06	0.06	0.14	0.14	0.06	0.53	0.53	0.26	0.26
Lane group cap.	83	123	104	177	257	104	992	854	485	417
v/c ratio	0.05	1.27	0.63	1.06	0.48	0.88	1.41	0.09	1.40	0.00
Flow ratio	0.00	0.08	0.04		0.07	0.06	0.75	0.05	0.36	0.00
Crit. lane group	N	Y	N	N	N	N	Y	N	Y	N
Sum flow ratios	1.26									
Lost time/cycle	16.00									
Critical v/c ratio	1.41									

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB		SB	
Lane group	L	T	R	L	T	R	LT	R	LT	R
Adj. flow rate	4	156	65	188	124	91	1400	73	678	1
Lane group cap.	83	123	104	177	257	104	992	854	485	417
v/c ratio	0.05	1.27	0.63	1.06	0.48	0.88	1.41	0.09	1.40	0.00
Green ratio	0.06	0.06	0.06	0.14	0.14	0.06	0.53	0.53	0.26	0.26
Unif. delay d1	68.0	72.5	70.7	65.5	62.0	71.9	36.5	18.0	57.5	42.7
Delay factor k	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Increm. delay d2	1.1	169.9	25.1	85.1	6.4	59.1	191.1	0.2	191.3	0.0
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	69.1	242.4	95.8	150.6	68.3	131.0	227.6	18.2	248.8	42.7
Lane group LOS	E	F	F	F	E	F	F	B	F	D
Apprch. delay	197.0			120.8			217.2		248.5	
Approach LOS	F			F			F		F	
Intersec. delay	209.2			Intersection LOS					F	

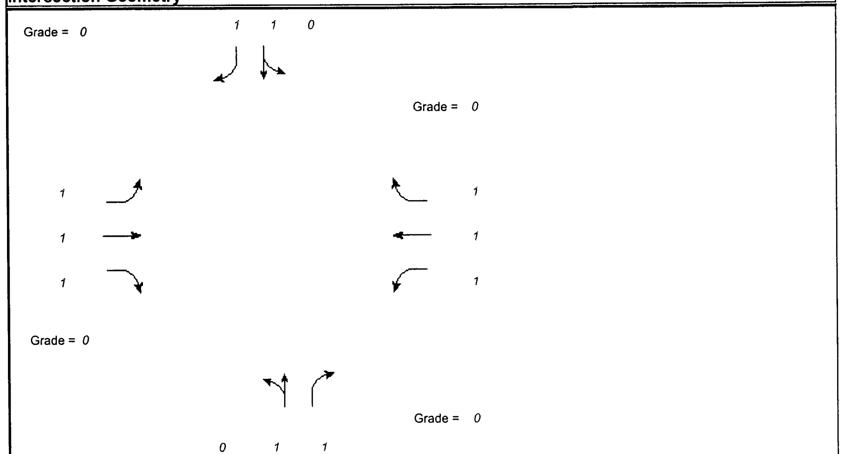
HCS2000™ Version 4.1c

INPUT WORKSHEET

General Information		Site Information	
Analyst	PJR	Intersection	Case3.1pm
Agency or Co.	PRA	Area Type	All other areas
Date Performed	4/5/2005	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case3.1pm*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	3	108	401	51	117	60	306	662	33	153	587	3
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
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
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0		2.0	2.0
Ext. eff. green	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0		2.0	2.0
Arrival type	3	3	3	3	3	3		3	3		3	3
Unit Extension	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Ped/Bike/RTOR Volume	0		250	0		30	0		15	0		1
Lane Width	12.0	12.0	12.0	12.0	12.0	12.0		12.0	12.0		12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0	0	0	0	0		0	0		0	0

	WB Only	EW Perm	03	04	NB Only	SB Only	07	08
Timing	G = 4.0	G = 12.0	G =	G =	G = 72.0	G = 55.0	G =	G =
	Y = 0	Y = 4	Y =	Y =	Y = 4	Y = 4	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 155.0		

HCS2000™ Version 4.1c

Part 2.1

Trip Assignment Worksheet

Pukalani Makai TIAR
March 2005

INTERSECTION NO 2
INTERSECTION OF Makawao Road at Pukalani Bypass

No	Approach & Mvt	Case 1 Existing AM	Existing PM	Background Growth AM	Background Growth PM	Related Project Traffic AM	Related Project Traffic PM	Case 2 Cumulative AM	Cumulative PM	AM Distribution % In	AM Distribution % Out	AM Assignment In	AM Assignment Out	PM Distribution % In	PM Distribution % Out	PM Assignment In	PM Assignment Out	Project Trips AM	Project Trips PM	Case 3 Cumulative Plus Project AM	Cumulative Plus Project PM
1	N- RT	16	15	2	2			18	17	4%		1	0	8%		9	0	1	9	19	26
2	TH	277	475	28	48	62	29	367	552	4%		1	0	7%		8	0	1	8	368	560
3	LT	56	63	6	6	75	65	137	134			0	0			0	0	0	0	137	134
4	E- RT	34	99	3	10	45	49	82	158			0	0			0	0	0	0	82	158
5	TH	80	366	8	37	178	195	266	598	10%		3	0	5%		5	0	3	5	269	603
6	LT	116	328	12	33			128	361			0	0			0	0	0	0	128	361
7	S- RT	338	157	34	16			372	173			0	0			0	0	0	0	372	173
8	TH	338	420	34	42	28	164	400	626		4%	0	4		7%	0	4	4	4	404	630
9	LT	296	139	30	14	5	35	331	188			0	0			0	0	0	0	331	188
10	W- RT	160	185	16	19	47	143	223	347			0	0			0	0	0	0	223	347
11	TH	539	364	54	36	266	293	859	693			0	0			0	0	0	0	859	693
12	LT	10	10	1	1			11	11		4%	0	4		7%	0	4	4	4	15	15
TOTAL		2260	2621	228	264	706	973	3194	3858			5	8			22	8	13	30	3207	3888
Approach Totals																					
From North		349	553	36	56	137	94	522	703			2	0			17	0	2	17	524	720
From East		230	793	23	80	223	244	476	1117			3	0			5	0	3	5	479	1122
From South		972	716	98	72	33	199	1103	987			0	4			0	4	4	4	1107	991
From West		709	559	71	56	313	436	1093	1051			0	4			0	4	4	4	1097	1055
Total		2260	2621	228	264	706	973	3194	3858			5	8			22	8	13	30	3207	3888
Departure Totals																					
To North		382	529	38	53	73	213	493	795			0	8			0	8	8	8	501	803
To East		933	584	94	58	341	358	1368	1000			0	0			0	0	0	0	1368	1000
To South		553	988	56	100	109	172	718	1260			1	0			8	0	1	8	719	1268
To West		392	520	40	53	183	230	615	803			4	0			14	0	4	14	619	817
Total		2260	2621	228	264	706	973	3194	3858			5	8			22	8	13	30	3207	3888
Leg Totals																					
North		731	1082	74	109	210	307	1015	1498			2	8			17	8	10	25	1025	1523
East		1163	1377	117	138	564	602	1844	2117			3	0			5	0	3	5	1847	2122
South		1525	1704	154	172	142	371	1821	2247			1	4			8	4	5	12	1826	2259
West		1101	1079	111	109	496	666	1708	1854			4	4			14	4	8	18	1716	1872
Total		4520	5242	456	528	1412	1946	6388	7716			10	16			44	16	26	60	6414	7776

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case3.1pm*

Capacity Analysis

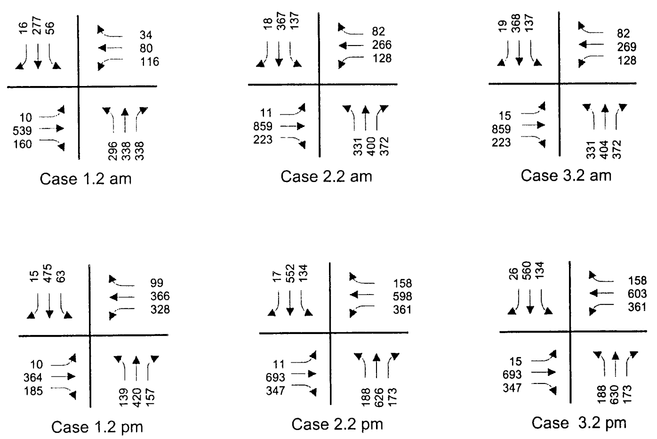
	EB			WB			NB		SB	
Lane group	L	T	R	L	T	R	LT	R	LT	R
Adj. flow rate	3	114	159	54	123	32	1019	19	779	2
Satflow rate	1053	1900	1615	1805	1900	1615	1870	1615	1881	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.08	0.08	0.08	0.10	0.10	0.08	0.46	0.46	0.35	0.35
Lane group cap.	82	147	125	96	196	125	869	750	667	573
v/c ratio	0.04	0.78	1.27	0.56	0.63	0.26	1.17	0.03	1.17	0.00
Flow ratio	0.00	0.06	0.10		0.06	0.02	0.54	0.01	0.41	0.00
Crit. lane group	N	N	Y	N	N	N	Y	N	Y	N
Sum flow ratios	1.08									
Lost time/cycle	16.00									
Critical v/c ratio	1.21									

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB		SB	
Lane group	L	T	R	L	T	R	LT	R	LT	R
Adj. flow rate	3	114	159	54	123	32	1019	19	779	2
Lane group cap.	82	147	125	96	196	125	869	750	667	573
v/c ratio	0.04	0.78	1.27	0.56	0.63	0.26	1.17	0.03	1.17	0.00
Green ratio	0.08	0.08	0.08	0.10	0.10	0.08	0.46	0.46	0.35	0.35
Unif. delay d1	66.2	70.2	71.5	64.8	66.6	67.3	41.5	22.5	50.0	32.3
Delay factor k	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Increm. delay d2	0.8	32.1	170.7	21.7	14.3	4.9	89.8	0.1	91.1	0.0
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	67.0	102.3	242.2	86.5	80.9	72.2	131.3	22.5	141.1	32.3
Lane group LOS	E	F	F	F	F	E	F	C	F	C
Apprch. delay	182.5			81.0			129.3		140.8	
Approach LOS	F			F			F		F	
Intersec. delay	135.2			Intersection LOS					F	

HCS2000™ Version 4.1c

#2 PUKALANI BY PASS AT MAKAWAO ROAD

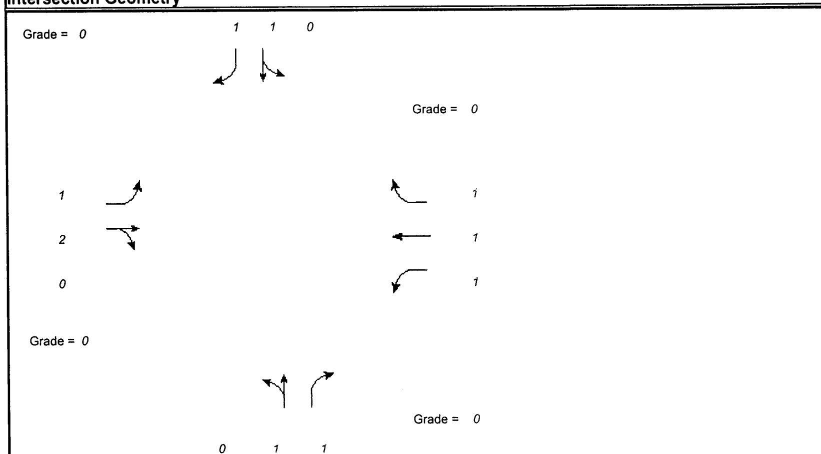


INPUT WORKSHEET

General Information		Site Information	
Analyst	*PJR*	Intersection	*Case1.2am*
Agency or Co.	*PRA*	Area Type	*All other areas*
Date Performed	*4/14/2005*	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case1.2am*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	10	539	160	116	80	34	296	338	338	56	277	16
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time	2.0	2.0		2.0	2.0	2.0		2.0	2.0		2.0	2.0
Ext. eff. green	2.0	2.0		2.0	2.0	2.0		2.0	2.0		2.0	2.0
Arrival type	3	3		3	3	3		3	3		3	3
Unit Extension	3.0	3.0		3.0	3.0	3.0		3.0	3.0		3.0	3.0
Ped/Bike/RTOR Volume	0		100	0		0	0		65	0		10
Lane Width	12.0	12.0		12.0	12.0	12.0		12.0	12.0		12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0	0		0	0		0	0

	WB Only	EW Perm	03	04	NS Perm	06	07	08
Timing	G = 11.0	G = 36.0	G =	G =	G = 66.0	G =	G =	G =
	Y =	Y = 3.5	Y =	Y =	Y = 3.5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 120.0		

HCS2000™ Version 4.1c

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case1.2am*

Capacity Analysis

	EB		WB			NB		SB	
Lane group	L	TR	L	T	R	LT	R	LT	R
Adj. flow rate	11	651	126	87	37	689	297	362	7
Satflow rate	1331	3556	1805	1900	1615	1085	1615	1425	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.30	0.30	0.09	0.39	0.39	0.55	0.55	0.55	0.55
Lane group cap.	399	1067	165	744	633	597	888	784	888
v/c ratio	0.03	0.61	0.76	0.12	0.06	1.15	0.33	0.46	0.01
Flow ratio	0.01	0.18	0.07	0.05	0.02	0.64	0.18	0.25	0.00
Crit. lane group	N	Y	Y	N	N	Y	N	N	N
Sum flow ratios	0.89								
Lost time/cycle	7.00								
Critical v/c ratio	0.94								

Lane Group Capacity, Control Delay, and LOS Determination

	EB		WB			NB		SB	
Lane group	L	TR	L	T	R	LT	R	LT	R
Adj. flow rate	11	651	126	87	37	689	297	362	7
Lane group cap.	399	1067	165	744	633	597	888	784	888
v/c ratio	0.03	0.61	0.76	0.12	0.06	1.15	0.33	0.46	0.01
Green ratio	0.30	0.30	0.09	0.39	0.39	0.55	0.55	0.55	0.55
Unif. delay d1	29.6	36.0	53.2	23.3	22.7	27.0	14.9	16.3	12.2
Delay factor k	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Increm. delay d2	0.1	2.6	27.9	0.3	0.2	87.3	1.0	2.0	0.0
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	29.8	38.6	81.1	23.6	22.9	114.3	15.9	18.2	12.2
Lane group LOS	C	D	F	C	C	F	B	B	B
Apprch. delay	38.4		52.5			84.7		18.1	
Approach LOS	D		D			F		B	
Intersec. delay	56.8		Intersection LOS					E	

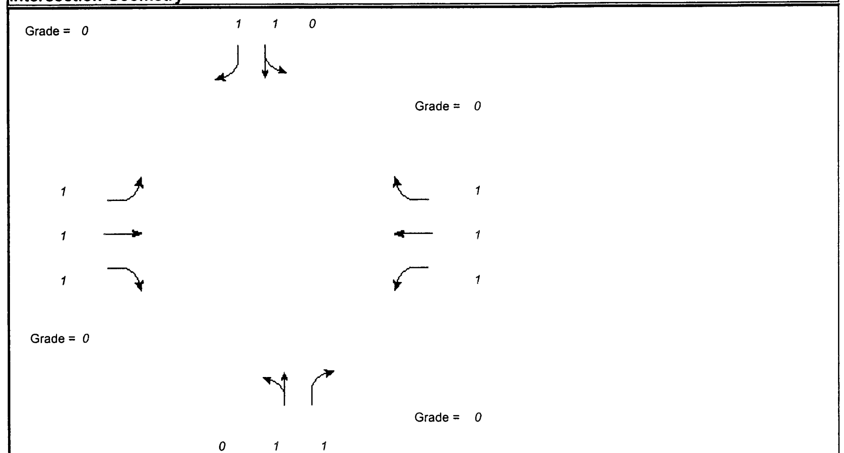
HCS2000™ Version 4.1c

INPUT WORKSHEET

General Information		Site Information	
Analyst	PJR	Intersection	Case1.1pm
Agency or Co.	PRA	Area Type	All other areas
Date Performed	4/5/2005	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case1.1pm*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	3	74	252	30	76	53	211	377	15	125	325	3
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
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
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0		2.0	2.0
Ext. eff. green	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0		2.0	2.0
Arrival type	3	3	3	3	3	3		3	3		3	3
Unit Extension	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0
Ped/Bike/RTOR Volume	0		250	0		30	0		15	0		1
Lane Width	12.0	12.0	12.0	12.0	12.0	12.0		12.0	12.0		12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0	0	0	0	0		0	0		0	0

	WB Only	EW Perm	03	04	NB Only	SB Only	07	08
Timing	G = 4.0	G = 12.0	G =	G =	G = 72.0	G = 55.0	G =	G =
	Y = 0	Y = 4	Y =	Y =	Y = 4	Y = 4	Y =	Y =
Duration of Analysis (hrs) = 0.25					Cycle Length C = 155.0			

HCS2000™ Version 4.1c

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case1.1pm*

Capacity Analysis

	EB			WB			NB		SB	
Lane group	L	T	R	L	T	R	LT	R	LT	R
Adj. flow rate	3	78	2	32	80	24	619	0	474	2
Satflow rate	1339	1900	1615	1805	1900	1615	1867	1615	1874	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.08	0.08	0.08	0.10	0.10	0.08	0.46	0.46	0.35	0.35
Lane group cap.	104	147	125	96	196	125	867	750	665	573
v/c ratio	0.03	0.53	0.02	0.33	0.41	0.19	0.71	0.00	0.71	0.00
Flow ratio	0.00	0.04	0.00		0.04	0.01	0.33	0.00	0.25	0.00
Crit. lane group	N	Y	N	N	N	N	Y	N	Y	N
Sum flow ratios	0.64									
Lost time/cycle	16.00									
Critical v/c ratio	0.72									

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB		SB	
Lane group	L	T	R	L	T	R	LT	R	LT	R
Adj. flow rate	3	78	2	32	80	24	619	0	474	2
Lane group cap.	104	147	125	96	196	125	867	750	665	573
v/c ratio	0.03	0.53	0.02	0.33	0.41	0.19	0.71	0.00	0.71	0.00
Green ratio	0.08	0.08	0.08	0.10	0.10	0.08	0.46	0.46	0.35	0.35
Unif. delay d1	66.1	68.8	66.0	63.6	65.1	67.0	33.2	22.2	43.2	32.3
Delay factor k	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Increm. delay d2	0.5	13.0	0.2	9.1	6.2	3.4	5.0	0.0	6.4	0.0
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	66.6	81.8	66.3	72.7	71.3	70.4	38.2	22.2	49.6	32.3
Lane group LOS	E	F	E	E	E	E	D	C	D	C
Apprch. delay	80.9			71.4			38.2		49.5	
Approach LOS	F			E			D		D	
Intersec. delay	48.5			Intersection LOS					D	

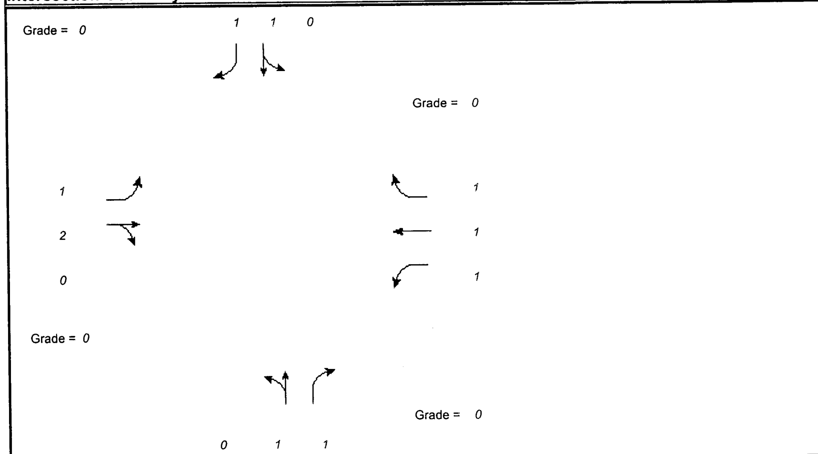
HCS2000™ Version 4.1c

INPUT WORKSHEET

General Information		Site Information	
Analyst	*PJR*	Intersection	*Case2.2am*
Agency or Co.	*PRA*	Area Type	*All other areas*
Date Performed	*4/14/2005*	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case2.2am*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	11	859	223	128	266	82	331	400	372	137	367	18
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time	2.0	2.0		2.0	2.0	2.0		2.0	2.0		2.0	2.0
Ext. eff. green	2.0	2.0		2.0	2.0	2.0		2.0	2.0		2.0	2.0
Arrival type	3	3		3	3	3		3	3		3	3
Unit Extension	3.0	3.0		3.0	3.0	3.0		3.0	3.0		3.0	3.0
Ped/Bike/RTOR Volume	0		100	0		40	0		65	0		10
Lane Width	12.0	12.0		12.0	12.0	12.0		12.0	12.0		12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0	0		0	0		0	0

	WB Only	EW Perm	03	04	NS Perm	06	07	08
Timing	G = 11.0	G = 36.0	G =	G =	G = 66.0	G =	G =	G =
	Y =	Y = 3.5	Y =	Y =	Y = 3.5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 120.0		

HCS2000™ Version 4.1c

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case2.2am*

Capacity Analysis

	EB		WB			NB		SB	
Lane group	L	TR	L	T	R	LT	R	LT	R
Adj. flow rate	12	1068	139	289	46	795	334	548	9
Satflow rate	1107	3542	1805	1900	1615	880	1615	886	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.30	0.30	0.09	0.39	0.39	0.55	0.55	0.55	0.55
Lane group cap.	332	1063	165	744	633	484	888	487	888
v/c ratio	0.04	1.00	0.84	0.39	0.07	1.64	0.38	1.13	0.01
Flow ratio	0.01	0.30	0.08	0.15	0.03	0.90	0.21	0.62	0.01
Crit. lane group	N	Y	Y	N	N	Y	N	N	N
Sum flow ratios	1.28								
Lost time/cycle	7.00								
Critical v/c ratio	1.36								

Lane Group Capacity, Control Delay, and LOS Determination

	EB		WB			NB		SB	
Lane group	L	TR	L	T	R	LT	R	LT	R
Adj. flow rate	12	1068	139	289	46	795	334	548	9
Lane group cap.	332	1063	165	744	633	484	888	487	888
v/c ratio	0.04	1.00	0.84	0.39	0.07	1.64	0.38	1.13	0.01
Green ratio	0.30	0.30	0.09	0.39	0.39	0.55	0.55	0.55	0.55
Unif. delay d1	29.7	42.0	53.6	26.2	22.9	27.0	15.3	27.0	12.2
Delay factor k	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Increm. delay d2	0.2	28.7	38.0	1.5	0.2	298.4	1.2	79.8	0.0
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	29.9	70.7	91.6	27.7	23.1	325.4	16.5	106.8	12.2
Lane group LOS	C	E	F	C	C	F	B	F	B
Apprch. delay	70.3		46.0			234.0		105.3	
Approach LOS	E		D			F		F	
Intersec. delay	129.8		Intersection LOS					F	

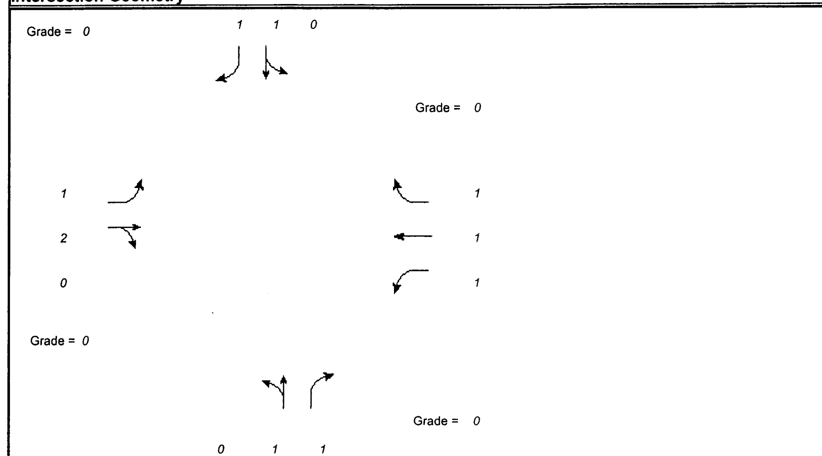
HCS2000™ Version 4.1c

INPUT WORKSHEET

General Information		Site Information	
Analyst	PJR	Intersection	Case2.2pm
Agency or Co.	PRA	Area Type	All other areas
Date Performed	4/14/2005	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case2.2pm*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	11	693	347	361	598	158	188	626	173	134	552	17
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
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
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time	2.0	2.0		2.0	2.0	2.0		2.0	2.0		2.0	2.0
Ext. eff. green	2.0	2.0		2.0	2.0	2.0		2.0	2.0		2.0	2.0
Arrival type	3	3		3	3	3		3	3		3	3
Unit Extension	3.0	3.0		3.0	3.0	3.0		3.0	3.0		3.0	3.0
Ped/Bike/RTOR Volume	0		100	0		75	0		65	0		15
Lane Width	12.0	12.0		12.0	12.0	12.0		12.0	12.0		12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0	0		0	0		0	0

	WB Only	EW Perm	03	04	NS Perm	06	07	08
Timing	G = 10.0	G = 21.0	G =	G =	G = 83.0	G =	G =	G =
	Y =	Y = 3.5	Y =	Y =	Y = 3.5	Y =	Y =	Y =

Duration of Analysis (hrs) = 0.25 — Cycle Length C = 121.0

HCS2000™ Version 4.1c

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case2.2pm*

Capacity Analysis

	EB			WB			NB			SB		
Lane group	L	TR		L	T	R		LT	R		LT	R
Adj. flow rate	11	969		372	616	86		839	111		707	2
Satflow rate	362	3467		1805	1900	1615		1170	1615		1209	1615
Lost time	2.0	2.0		2.0	2.0	2.0		2.0	2.0		2.0	2.0
Green ratio	0.17	0.17		0.08	0.26	0.26		0.69	0.69		0.69	0.69
Lane group cap.	63	602		149	487	414		803	1108		829	1108
v/c ratio	0.17	1.61		2.50	1.26	0.21		1.04	0.10		0.85	0.00
Flow ratio	0.03	0.28		0.21	0.32	0.05		0.72	0.07		0.58	0.00
Crit. lane group	N	Y		Y	N	N		Y	N		N	N
Sum flow ratios	1.20											
Lost time/cycle	7.00											
Critical v/c ratio	1.28											

Lane Group Capacity, Control Delay, and LOS Determination

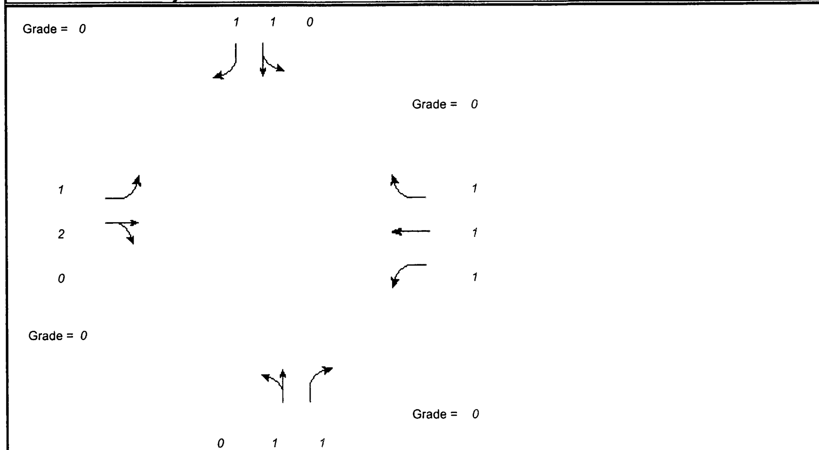
	EB			WB			NB			SB		
Lane group	L	TR		L	T	R		LT	R		LT	R
Adj. flow rate	11	969		372	616	86		839	111		707	2
Lane group cap.	63	602		149	487	414		803	1108		829	1108
v/c ratio	0.17	1.61		2.50	1.26	0.21		1.04	0.10		0.85	0.00
Green ratio	0.17	0.17		0.08	0.26	0.26		0.69	0.69		0.69	0.69
Unif. delay d1	42.6	50.0		55.5	45.0	35.4		19.0	6.4		14.4	6.0
Delay factor k	0.50	0.50		0.50	0.50	0.50		0.50	0.50		0.50	0.50
Increm. delay d2	5.9	282.0		693.1	134.8	1.1		44.1	0.2		10.8	0.0
PF factor	1.000	1.000		1.000	1.000	1.000		1.000	1.000		1.000	1.000
Control delay	48.6	332.0		748.6	179.8	36.5		63.1	6.6		25.2	6.0
Lane group LOS	D	F		F	F	D		E	A		C	A
Apprch. delay	328.8			365.3			56.5			25.1		
Approach LOS	F			F			E			C		
Intersec. delay	211.7			Intersection LOS						F		

INPUT WORKSHEET

General Information		Site Information	
Analyst	PJR	Intersection	Case3.2am
Agency or Co.	PRA	Area Type	All other areas
Date Performed	4/14/2005	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case3.2am*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	15	859	223	128	269	82	331	404	372	137	368	19
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time	2.0	2.0		2.0	2.0	2.0		2.0	2.0		2.0	2.0
Ext. eff. green	2.0	2.0		2.0	2.0	2.0		2.0	2.0		2.0	2.0
Arrival type	3	3		3	3	3		3	3		3	3
Unit Extension	3.0	3.0		3.0	3.0	3.0		3.0	3.0		3.0	3.0
Ped/Bike/RTOR Volume	0		100	0		40	0		65	0		10
Lane Width	12.0	12.0		12.0	12.0	12.0		12.0	12.0		12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0	0		0	0		0	0

Timing	WB Only	EW Perm	03	04	NS Perm	06	07	08
	G = 11.0	G = 36.0	G =	G =	G = 66.0	G =	G =	G =
	Y =	Y = 3.5	Y =	Y =	Y = 3.5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 120.0		

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case3.2am*

Capacity Analysis

	EB		WB			NB		SB	
Lane group	L	TR	L	T	R	LT	R	LT	R
Adj. flow rate	16	1068	139	292	46	799	334	549	10
Satflow rate	1104	3542	1805	1900	1615	881	1615	883	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.30	0.30	0.09	0.39	0.39	0.55	0.55	0.55	0.55
Lane group cap.	331	1063	165	744	633	485	888	486	888
v/c ratio	0.05	1.00	0.84	0.39	0.07	1.65	0.38	1.13	0.01
Flow ratio	0.01	0.30	0.08	0.15	0.03	0.91	0.21	0.62	0.01
Crit. lane group	N	Y	Y	N	N	Y	N	N	N
Sum flow ratios	1.29								
Lost time/cycle	7.00								
Critical v/c ratio	1.37								

Lane Group Capacity, Control Delay, and LOS Determination

	EB		WB			NB		SB	
Lane group	L	TR	L	T	R	LT	R	LT	R
Adj. flow rate	16	1068	139	292	46	799	334	549	10
Lane group cap.	331	1063	165	744	633	485	888	486	888
v/c ratio	0.05	1.00	0.84	0.39	0.07	1.65	0.38	1.13	0.01
Green ratio	0.30	0.30	0.09	0.39	0.39	0.55	0.55	0.55	0.55
Unif. delay d1	29.8	42.0	53.6	26.2	22.9	27.0	15.3	27.0	12.2
Delay factor k	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Increm. delay d2	0.3	28.7	38.0	1.6	0.2	300.5	1.2	81.4	0.0
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	30.1	70.7	91.6	27.8	23.1	327.5	16.5	108.4	12.2
Lane group LOS	C	E	F	C	C	F	B	F	B
Apprch. delay	70.1		45.9			235.8		106.7	
Approach LOS	E		D			F		F	
Intersec. delay	130.6		Intersection LOS					F	

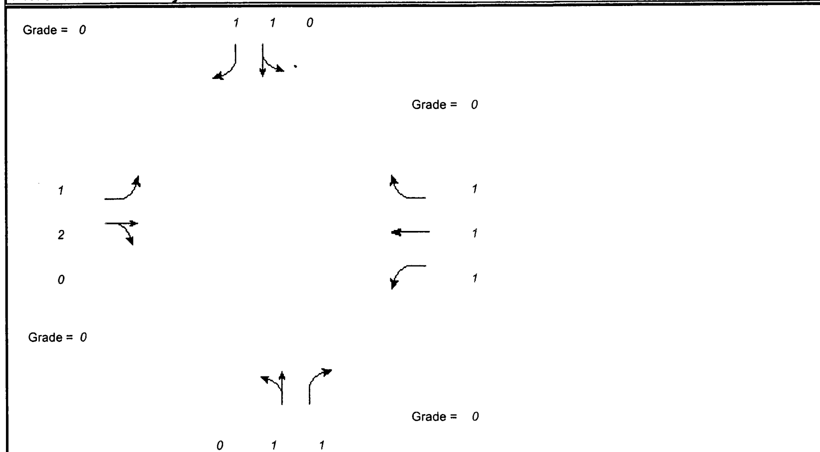
HCS2000™ Version 4.1c

INPUT WORKSHEET

General Information		Site Information	
Analyst	PJR	Intersection	Case3.2pm
Agency or Co.	PRA	Area Type	All other areas
Date Performed	4/14/2005	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case3.2pm*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	15	693	347	361	603	158	188	670	173	134	560	26
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
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
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time	2.0	2.0		2.0	2.0	2.0		2.0	2.0		2.0	2.0
Ext. eff. green	2.0	2.0		2.0	2.0	2.0		2.0	2.0		2.0	2.0
Arrival type	3	3		3	3	3		3	3		3	3
Unit Extension	3.0	3.0		3.0	3.0	3.0		3.0	3.0		3.0	3.0
Ped/Bike/RTOR Volume	0		100	0		75	0		65	0		15
Lane Width	12.0	12.0		12.0	12.0	12.0		12.0	12.0		12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0	0		0	0		0	0

	WB Only	EW Perm	03	04	NS Perm	06	07	08
Timing	G = 10.0	G = 21.0	G =	G =	G = 83.0	G =	G =	G =
	Y =	Y = 3.5	Y =	Y =	Y = 3.5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 121.0		

HCS2000™ Version 4.1c

Trip Assignment Worksheet

Pukalani Makai TIAR
March 2005

INTERSECTION NO 3
INTERSECTION OF Makani Road at Pukalani Bypass

No	Approach & Mvt		Case 1 Existing AM	Existing PM	Background Growth AM	Background Growth PM	Related Project Traffic AM	Related Project Traffic PM	Case 2 Cumulative AM	Cumulative PM	AM Distribution % In	AM Distribution % Out	AM Assignment In	AM Assignment Out	PM Distribution % In	PM Distribution % Out	PM Assignment In	PM Assignment Out	Project Trips AM	Project Trips PM	Case 3 Cumulative Plus Project AM	Cumulative Plus Project PM
1	N-	RT	446	122	45	12			491	134			0	0			0	0	0	0	491	134
2		TH	114	67	11	7			125	74	15%		5	0	6%		6	0	5	6	130	80
3		LT	87	16	9	2	60	185	156	203			0	0			0	0	0	0	156	203
4	E-	RT	51	14	5	1	5	35	61	50			0	0			0	0	0	0	61	50
5		TH	839	505	84	51	178	195	1101	751			0	0			0	0	0	0	1101	751
6		LT	19	31	2	3			21	34	14%		4	0	13%		14	0	4	14	25	48
7	S-	RT	94	34	9	3	253	15	356	52		4%	0	4		7%	0	4	4	4	360	56
8		TH	114	55	11	6			125	61		4%	0	4		8%	0	5	4	5	129	66
9		LT	24	12	2	1			26	13			0	0			0	0	0	0	26	13
10	W-	RT	2	25	0	3			2	28			0	0			0	0	0	0	2	28
11		TH	155	607	16	61			171	668			0	0			0	0	0	0	171	668
12		LT	26	211	3	21			29	232			0	0			0	0	0	0	29	232
TOTAL			1971	1699	197	171	496	430	2664	2300			9	8			20	9	17	29	2681	2329
Approach Totals																						
From North			647	205	65	21	60	185	772	411			5	0			6	0	5	6	777	417
From East			909	550	91	55	183	230	1183	835			4	0			14	0	4	14	1187	849
From South			232	101	22	10	253	15	507	126			0	8			0	9	8	9	515	135
From West			183	843	19	85	0	0	202	928			0	0			0	0	0	0	202	928
Total			1971	1699	197	171	496	430	2664	2300			9	8			20	9	17	29	2681	2329
Departure Totals																						
To North			191	280	19	28	5	35	215	343			0	4			0	5	4	5	219	348
To East			336	657	34	66	313	200	683	923			0	4			0	4	4	4	687	927
To South			135	123	13	13	0	0	148	136			9	0			20	0	9	20	157	156
To West			1309	639	131	64	178	195	1618	898			0	0			0	0	0	0	1618	898
Total			1971	1699	197	171	496	430	2664	2300			9	8			20	9	17	29	2681	2329
Leg Totals																						
North			838	485	84	49	65	220	987	754			5	4			6	5	9	11	996	765
East			1245	1207	125	121	496	430	1866	1758			4	4			14	4	8	18	1874	1776
South			367	224	35	23	253	15	655	262			9	8			20	9	17	29	672	291
West			1492	1482	150	149	178	195	1820	1826			0	0			0	0	0	0	1820	1826
Total			3942	3398	394	342	992	860	5328	4600			18	16			40	18	34	58	5362	4658

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case3.2pm*

Capacity Analysis

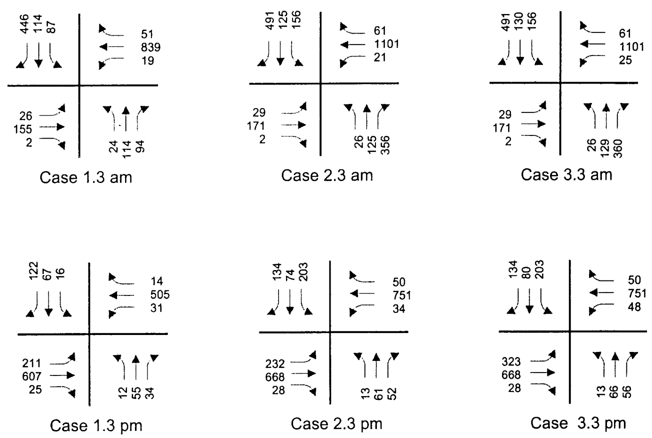
	EB		WB			NB		SB	
Lane group	L	TR	L	T	R	LT	R	LT	R
Adj. flow rate	15	969	372	622	86	885	111	715	11
Satflow rate	362	3467	1805	1900	1615	1181	1615	1180	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.17	0.17	0.08	0.26	0.26	0.69	0.69	0.69	0.69
Lane group cap.	63	602	149	487	414	810	1108	809	1108
v/c ratio	0.24	1.61	2.50	1.28	0.21	1.09	0.10	0.88	0.01
Flow ratio	0.04	0.28	0.21	0.33	0.05	0.75	0.07	0.61	0.01
Crit. lane group	N	Y	Y	N	N	Y	N	N	N
Sum flow ratios	1.23								
Lost time/cycle	7.00								
Critical v/c ratio	1.31								

Lane Group Capacity, Control Delay, and LOS Determination

	EB		WB			NB		SB	
Lane group	L	TR	L	T	R	LT	R	LT	R
Adj. flow rate	15	969	372	622	86	885	111	715	11
Lane group cap.	63	602	149	487	414	810	1108	809	1108
v/c ratio	0.24	1.61	2.50	1.28	0.21	1.09	0.10	0.88	0.01
Green ratio	0.17	0.17	0.08	0.26	0.26	0.69	0.69	0.69	0.69
Unif. delay d1	43.1	50.0	55.5	45.0	35.4	19.0	6.4	15.2	6.0
Delay factor k	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Increm. delay d2	8.7	282.0	693.1	139.9	1.1	59.9	0.2	13.5	0.0
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	51.8	332.0	748.6	184.9	36.5	78.9	6.6	28.6	6.0
Lane group LOS	D	F	F	F	D	E	A	C	A
Apprch. delay	327.7		367.3			70.8		28.3	
Approach LOS	F		F			E		C	
Intersec. delay	214.0			Intersection LOS		F			

HCS2000™ Version 4.1c

#3 PUKALANI BY PASS AT MAKANI ROAD

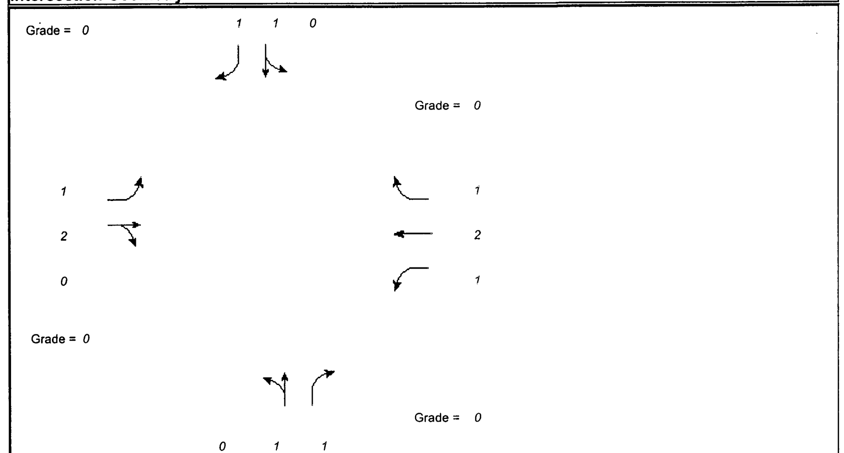


INPUT WORKSHEET

General Information		Site Information	
Analyst	PJR	Intersection	Case1.3am
Agency or Co.	PRA	Area Type	All other areas
Date Performed	4/14/2005	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case1.3am*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	26	155	2	19	839	51	24	114	94	87	114	446
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time	2.0	2.0		2.0	2.0	2.0		2.0	2.0		2.0	2.0
Ext. eff. green	2.0	2.0		2.0	2.0	2.0		2.0	2.0		2.0	2.0
Arrival type	3	3		3	3	3		3	3		3	3
Unit Extension	3.0	3.0		3.0	3.0	3.0		3.0	3.0		3.0	3.0
Ped/Bike/RTOR Volume	0		1	0		30	0		25	0		25
Lane Width	12.0	12.0		12.0	12.0	12.0		12.0	12.0		12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0	0		0	0		0	0

	Excl. Left	Thru & RT	03	04	NS Perm	06	07	08
Timing	G = 9.0	G = 57.0	G =	G =	G = 47.0	G =	G =	G =
	Y =	Y = 3.5	Y =	Y =	Y = 3.5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 120.0		

CAPACITY AND LOS WORKSHEET

General Information

Project Description Kauhale Lani Case1.3am

Capacity Analysis

	EB		WB			NB		SB	
Lane group	L	TR	L	T	R	LT	R	LT	R
Adj. flow rate	28	166	20	893	22	147	73	214	448
Satflow rate	1805	3607	1805	3610	1615	1767	1615	1490	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.08	0.47	0.08	0.47	0.47	0.39	0.39	0.39	0.39
Lane group cap.	135	1713	135	1715	767	692	633	584	633
v/c ratio	0.21	0.10	0.15	0.52	0.03	0.21	0.12	0.37	0.71
Flow ratio	0.02	0.05	0.01	0.25	0.01	0.08	0.05	0.14	0.28
Crit. lane group	Y	N	N	Y	N	N	N	N	Y
Sum flow ratios	0.54								
Lost time/cycle	7.00								
Critical v/c ratio	0.57								

Lane Group Capacity, Control Delay, and LOS Determination

	EB		WB			NB		SB	
Lane group	L	TR	L	T	R	LT	R	LT	R
Adj. flow rate	28	166	20	893	22	147	73	214	448
Lane group cap.	135	1713	135	1715	767	692	633	584	633
v/c ratio	0.21	0.10	0.15	0.52	0.03	0.21	0.12	0.37	0.71
Green ratio	0.08	0.47	0.08	0.47	0.47	0.39	0.39	0.39	0.39
Unif. delay d1	52.1	17.3	51.9	22.0	16.8	24.2	23.3	25.9	30.7
Delay factor k	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Increm. delay d2	3.5	0.1	2.3	1.1	0.1	0.7	0.4	1.8	6.6
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	55.6	17.4	54.2	23.1	16.8	24.9	23.6	27.7	37.3
Lane group LOS	E	B	D	C	B	C	C	C	D
Apprch. delay	23.0		23.6			24.5		34.2	
Approach LOS	C		C			C		C	
Intersec. delay	27.1		Intersection LOS					C	

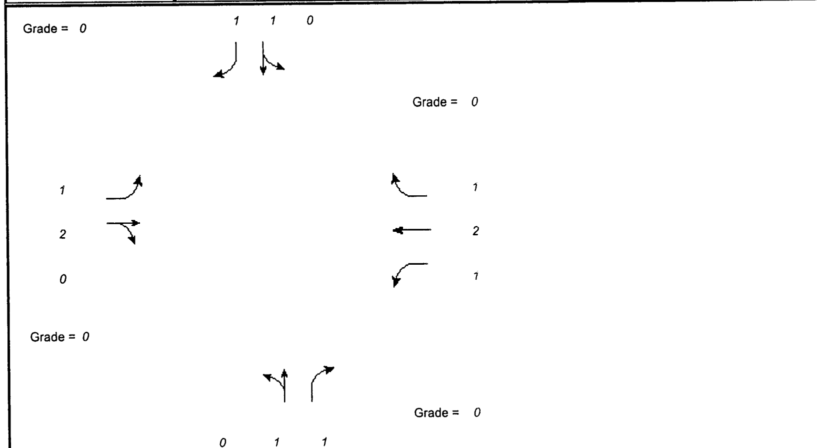
HCS2000™ Version 4.1c

INPUT WORKSHEET

General Information		Site Information	
Analyst	PJR	Intersection	Case1.3pm
Agency or Co.	PRA	Area Type	All other areas
Date Performed	4/14/2005	Jurisdiction	
Time Period		Analysis Year	

Project Description Kauhale Lani Case1.3pm

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	211	607	25	31	505	14	12	55	34	16	67	122
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time	2.0	2.0		2.0	2.0	2.0		2.0	2.0		2.0	2.0
Ext. eff. green	2.0	2.0		2.0	2.0	2.0		2.0	2.0		2.0	2.0
Arrival type	3	3		3	3	3		3	3		3	3
Unit Extension	3.0	3.0		3.0	3.0	3.0		3.0	3.0		3.0	3.0
Ped/Bike/RTOR Volume	0		10	0		0	0		30	0		65
Lane Width	12.0	12.0		12.0	12.0	12.0		12.0	12.0		12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0	0		0	0		0	0

	Excl. Left	Thru & RT	03	04	NS Perm	06	07	08
Timing	G = 27.0	G = 45.0	G =	G =	G = 41.0	G =	G =	G =
	Y =	Y = 3.5	Y =	Y =	Y = 3.5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 120.0		

HCS2000™ Version 4.1c

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case1.3pm*

Capacity Analysis

	EB		WB			NB		SB	
Lane group	L	TR	L	T	R	LT	R	LT	R
Adj. flow rate	224	662	33	537	15	72	4	88	61
Satflow rate	1805	3597	1805	3610	1615	1822	1615	1812	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.22	0.38	0.22	0.38	0.38	0.34	0.34	0.34	0.34
Lane group cap.	406	1349	406	1354	606	623	552	619	552
v/c ratio	0.55	0.49	0.08	0.40	0.02	0.12	0.01	0.14	0.11
Flow ratio	0.12	0.18	0.02	0.15	0.01	0.04	0.00	0.05	0.04
Crit. lane group	Y	Y	N	N	N	N	N	Y	N
Sum flow ratios	0.36								
Lost time/cycle	7.00								
Critical v/c ratio	0.38								

Lane Group Capacity, Control Delay, and LOS Determination

	EB		WB			NB		SB	
Lane group	L	TR	L	T	R	LT	R	LT	R
Adj. flow rate	224	662	33	537	15	72	4	88	61
Lane group cap.	406	1349	406	1354	606	623	552	619	552
v/c ratio	0.55	0.49	0.08	0.40	0.02	0.12	0.01	0.14	0.11
Green ratio	0.22	0.38	0.22	0.38	0.38	0.34	0.34	0.34	0.34
Unif. delay d1	41.1	28.7	36.7	27.5	23.7	27.1	26.1	27.3	27.0
Delay factor k	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Increm. delay d2	5.3	1.3	0.4	0.9	0.1	0.4	0.0	0.5	0.4
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	46.5	30.0	37.1	28.4	23.7	27.5	26.1	27.8	27.4
Lane group LOS	D	C	D	C	C	C	C	C	C
Apprch. delay	34.2		28.8			27.4		27.7	
Approach LOS	C		C			C		C	
Intersec. delay	31.4		Intersection LOS					C	

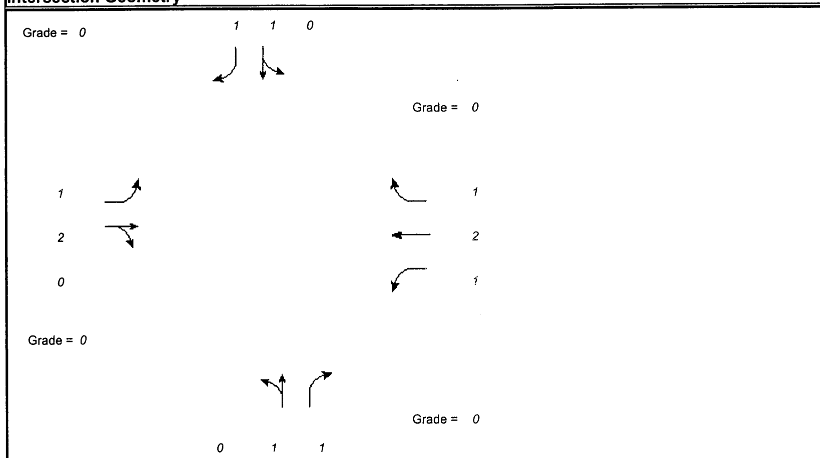
HCS2000™ Version 4.1c

INPUT WORKSHEET

General Information		Site Information	
Analyst	PJR	Intersection	Case2.3am
Agency or Co.	PRA	Area Type	All other areas
Date Performed	4/14/2005	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case2.3am*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	29	171	2	21	1101	61	26	125	356	156	125	491
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time	2.0	2.0		2.0	2.0	2.0		2.0	2.0		2.0	2.0
Ext. eff. green	2.0	2.0		2.0	2.0	2.0		2.0	2.0		2.0	2.0
Arrival type	3	3		3	3	3		3	3		3	3
Unit Extension	3.0	3.0		3.0	3.0	3.0		3.0	3.0		3.0	3.0
Ped/Bike/RTOR Volume	0		1	0		30	0		25	0		25
Lane Width	12.0	12.0		12.0	12.0	12.0		12.0	12.0		12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0	0		0	0		0	0

	Excl. Left	Thru & RT	03	04	NS Perm	06	07	08
Timing	G = 9.0	G = 57.0	G =	G =	G = 47.0	G =	G =	G =
	Y =	Y = 3.5	Y =	Y =	Y = 3.5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 120.0		

HCS2000™ Version 4.1c

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case2.3am*

Capacity Analysis

	EB		WB			NB		SB	
Lane group	L	TR	L	T	R	LT	R	LT	R
Adj. flow rate	31	183	22	1171	33	161	352	299	496
Satflow rate	1805	3607	1805	3610	1615	1740	1615	1209	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.08	0.47	0.08	0.47	0.47	0.39	0.39	0.39	0.39
Lane group cap.	135	1713	135	1715	767	682	633	474	633
v/c ratio	0.23	0.11	0.16	0.68	0.04	0.24	0.56	0.63	0.78
Flow ratio	0.02	0.05	0.01	0.32	0.02	0.09	0.22	0.25	0.31
Crit. lane group	Y	N	N	Y	N	N	N	N	Y
Sum flow ratios	0.65								
Lost time/cycle	7.00								
Critical v/c ratio	0.69								

Lane Group Capacity, Control Delay, and LOS Determination

	EB		WB			NB		SB	
Lane group	L	TR	L	T	R	LT	R	LT	R
Adj. flow rate	31	183	22	1171	33	161	352	299	496
Lane group cap.	135	1713	135	1715	767	682	633	474	633
v/c ratio	0.23	0.11	0.16	0.68	0.04	0.24	0.56	0.63	0.78
Green ratio	0.08	0.47	0.08	0.47	0.47	0.39	0.39	0.39	0.39
Unif. delay d1	52.2	17.4	52.0	24.5	16.9	24.5	28.4	29.5	32.0
Delay factor k	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Increm. delay d2	3.9	0.1	2.6	2.2	0.1	0.8	3.5	6.3	9.4
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	56.2	17.5	54.6	26.7	17.0	25.3	31.9	35.7	41.4
Lane group LOS	E	B	D	C	B	C	C	D	D
Apprch. delay	23.1		26.9			29.8		39.3	
Approach LOS	C		C			C		D	
Intersec. delay	30.8		Intersection LOS					C	

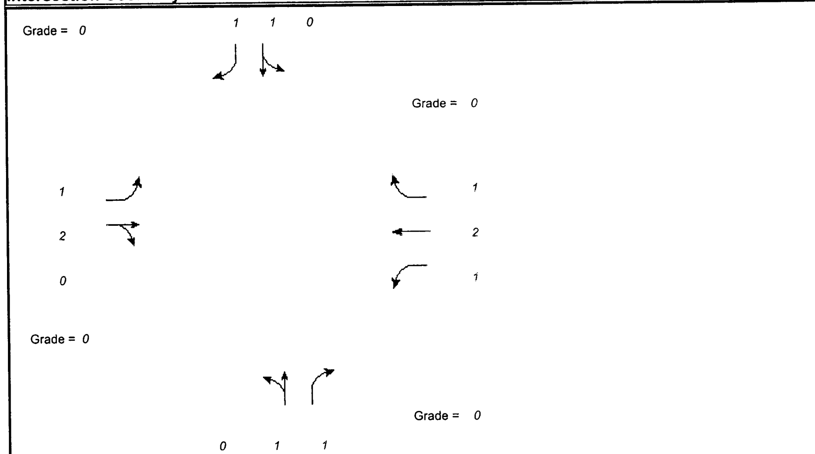
HCS2000™ Version 4.1c

INPUT WORKSHEET

General Information		Site Information	
Analyst	PJR	Intersection	Case2.3pm
Agency or Co.	PRA	Area Type	All other areas
Date Performed	4/14/2005	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case2.3pm*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	232	668	28	34	751	50	13	61	52	203	74	134
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time	2.0	2.0		2.0	2.0	2.0		2.0	2.0		2.0	2.0
Ext. eff. green	2.0	2.0		2.0	2.0	2.0		2.0	2.0		2.0	2.0
Arrival type	3	3		3	3	3		3	3		3	3
Unit Extension	3.0	3.0		3.0	3.0	3.0		3.0	3.0		3.0	3.0
Ped/Bike/RTOR Volume	0		10	0		25	0		30	0		65
Lane Width	12.0	12.0		12.0	12.0	12.0		12.0	12.0		12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0	0		0	0		0	0

	Excl. Left	Thru & RT	03	04	NS Perm	06	07	08
Timing	G = 27.0	G = 45.0	G =	G =	G = 41.0	G =	G =	G =
	Y =	Y = 3.5	Y =	Y =	Y = 3.5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 120.0		

HCS2000™ Version 4.1c

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case2.3pm*

Capacity Analysis

	EB		WB			NB		SB	
Lane group	L	TR	L	T	R	LT	R	LT	R
Adj. flow rate	247	730	36	799	27	79	23	295	73
Satflow rate	1805	3596	1805	3610	1615	1773	1615	1287	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.22	0.38	0.22	0.38	0.38	0.34	0.34	0.34	0.34
Lane group cap.	406	1349	406	1354	606	606	552	440	552
v/c ratio	0.61	0.54	0.09	0.59	0.04	0.13	0.04	0.67	0.13
Flow ratio	0.14	0.20	0.02	0.22	0.02	0.04	0.01	0.23	0.05
Crit. lane group	Y	N	N	Y	N	N	N	Y	N
Sum flow ratios	0.59								
Lost time/cycle	7.00								
Critical v/c ratio	0.62								

Lane Group Capacity, Control Delay, and LOS Determination

	EB		WB			NB		SB	
Lane group	L	TR	L	T	R	LT	R	LT	R
Adj. flow rate	247	730	36	799	27	79	23	295	73
Lane group cap.	406	1349	406	1354	606	606	552	440	552
v/c ratio	0.61	0.54	0.09	0.59	0.04	0.13	0.04	0.67	0.13
Green ratio	0.22	0.38	0.22	0.38	0.38	0.34	0.34	0.34	0.34
Unif. delay d1	41.8	29.4	36.8	30.1	23.8	27.2	26.4	33.7	27.2
Delay factor k	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Increm. delay d2	6.6	1.6	0.4	1.9	0.1	0.4	0.1	7.9	0.5
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	48.4	31.0	37.2	32.0	24.0	27.7	26.5	41.6	27.7
Lane group LOS	D	C	D	C	C	C	C	D	C
Apprch. delay	35.4		32.0			27.4		38.9	
Approach LOS	D		C			C		D	
Intersec. delay	34.3		Intersection LOS					C	

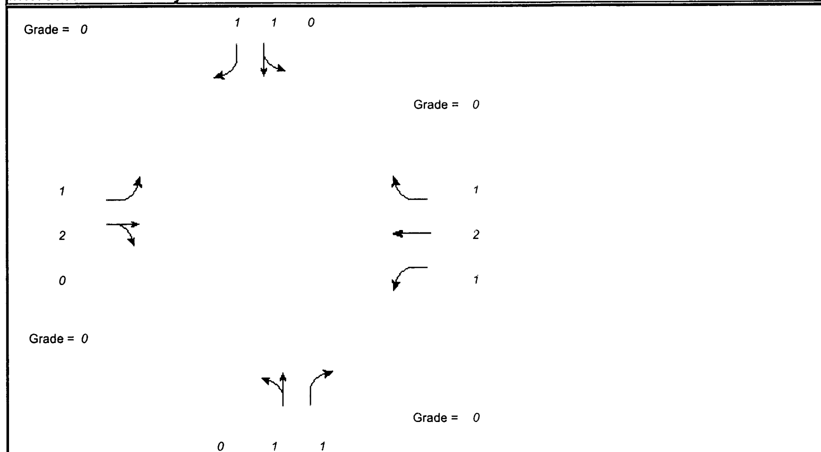
HCS2000™ Version 4.1c

INPUT WORKSHEET

General Information		Site Information	
Analyst	PJR	Intersection	Case3.3am
Agency or Co.	PRA	Area Type	All other areas
Date Performed	4/14/2005	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case3.3am*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	29	171	2	25	1101	61	26	129	360	156	130	491
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time	2.0	2.0		2.0	2.0	2.0		2.0	2.0		2.0	2.0
Ext. eff. green	2.0	2.0		2.0	2.0	2.0		2.0	2.0		2.0	2.0
Arrival type	3	3		3	3	3		3	3		3	3
Unit Extension	3.0	3.0		3.0	3.0	3.0		3.0	3.0		3.0	3.0
Ped/Bike/RTOR Volume	0		1	0		30	0		25	0		25
Lane Width	12.0	12.0		12.0	12.0	12.0		12.0	12.0		12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0	0		0	0		0	0

	Excl. Left	Thru & RT	03	04	NS Perm	06	07	08
Timing	G = 9.0	G = 57.0	G =	G =	G = 47.0	G =	G =	G =
	Y =	Y = 3.5	Y =	Y =	Y = 3.5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 120.0		

HCS2000™ Version 4.1c

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case3.3am*

Capacity Analysis

	EB		WB			NB		SB	
Lane group	L	TR	L	T	R	LT	R	LT	R
Adj. flow rate	31	183	27	1171	33	165	356	304	496
Satflow rate	1805	3607	1805	3610	1615	1742	1615	1205	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.08	0.47	0.08	0.47	0.47	0.39	0.39	0.39	0.39
Lane group cap.	135	1713	135	1715	767	682	633	472	633
v/c ratio	0.23	0.11	0.20	0.68	0.04	0.24	0.56	0.64	0.78
Flow ratio	0.02	0.05	0.01	0.32	0.02	0.09	0.22	0.25	0.31
Crit. lane group	Y	N	N	Y	N	N	N	N	Y
Sum flow ratios	0.65								
Lost time/cycle	7.00								
Critical v/c ratio	0.69								

Lane Group Capacity, Control Delay, and LOS Determination

	EB		WB			NB		SB	
Lane group	L	TR	L	T	R	LT	R	LT	R
Adj. flow rate	31	183	27	1171	33	165	356	304	496
Lane group cap.	135	1713	135	1715	767	682	633	472	633
v/c ratio	0.23	0.11	0.20	0.68	0.04	0.24	0.56	0.64	0.78
Green ratio	0.08	0.47	0.08	0.47	0.47	0.39	0.39	0.39	0.39
Unif. delay d1	52.2	17.4	52.1	24.5	16.9	24.5	28.5	29.7	32.0
Delay factor k	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Increm. delay d2	3.9	0.1	3.3	2.2	0.1	0.8	3.6	6.6	9.4
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	56.2	17.5	55.4	26.7	17.0	25.4	32.1	36.3	41.4
Lane group LOS	E	B	E	C	B	C	C	D	D
Apprch. delay	23.1		27.1			29.9		39.5	
Approach LOS	C		C			C		D	
Intersec. delay	30.9		Intersection LOS					C	

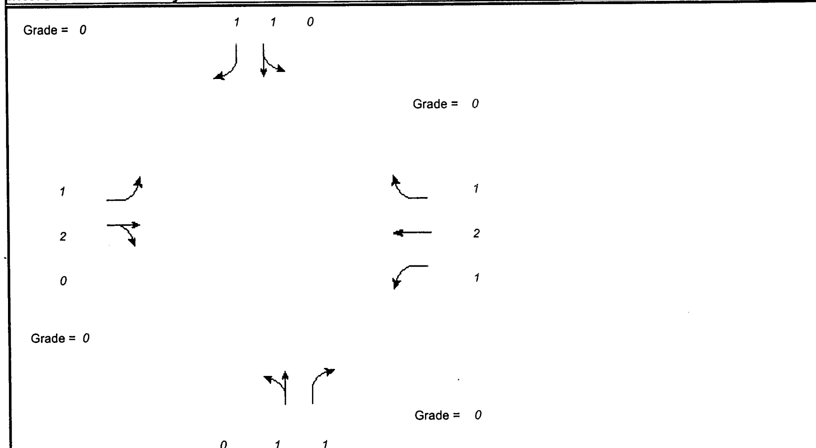
HCS2000™ Version 4.1c

INPUT WORKSHEET

General Information		Site Information	
Analyst	PJR	Intersection	Case3.3pm
Agency or Co.	PRA	Area Type	All other areas
Date Performed	4/14/2005	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case3.3pm*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	232	668	28	48	751	50	13	66	56	203	80	134
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time	2.0	2.0		2.0	2.0	2.0		2.0	2.0		2.0	2.0
Ext. eff. green	2.0	2.0		2.0	2.0	2.0		2.0	2.0		2.0	2.0
Arrival type	3	3		3	3	3		3	3		3	3
Unit Extension	3.0	3.0		3.0	3.0	3.0		3.0	3.0		3.0	3.0
Ped/Bike/RTOR Volume	0		10	0		25	0		30	0		65
Lane Width	12.0	12.0		12.0	12.0	12.0		12.0	12.0		12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0	0		0	0		0	0

	Excl. Left	Thru & RT	03	04	NS Perm	06	07	08
Timing	G = 27.0	G = 45.0	G =	G =	G = 41.0	G =	G =	G =
	Y =	Y = 3.5	Y =	Y =	Y = 3.5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 120.0		

HCS2000™ Version 4.1c

Part 2.1

Trip Assignment Worksheet

Pukalani Makai TIAR
March 2005

INTERSECTION NO 4
INTERSECTION OF Haleakala Highway at Pukalani Bypass

No	Approach & Mvt	Case 1 Existing AM	Existing PM	Background Growth AM	Background Growth PM	Related Project Traffic AM	Related Project Traffic PM	Case 2 Cumulative AM	Cumulative PM	AM Distribution % In	AM Distribution % Out	AM Assignment In	AM Assignment Out	PM Distribution % In	PM Distribution % Out	PM Assignment In	PM Assignment Out	Project Trips AM	Project Trips PM	Case 3 Cumulative Plus Project AM	Case 3 Cumulative Plus Project PM
1	N- RT	0	0	0	0			0	0			0	0			0	0	0	0	0	0
2	TH	0	0	0	0			0	0			0	0			0	0	0	0	0	0
3	LT	0	0	0	0			0	0			0	0			0	0	0	0	0	0
4	E- RT	0	0	0	0			0	0			0	0			0	0	0	0	0	0
5	TH	1430	609	143	61	178	195	1751	865			0	0			0	0	0	0	1751	865
6	LT	0	0	0	0			0	0			0	0			0	0	0	0	0	0
7	S- RT	8	4	1	0			9	4			0	0			0	0	0	0	9	4
8	TH	0	0	0	0			0	0			0	0			0	0	0	0	0	0
9	LT	853	306	85	31	31	56	969	393		48%	0	46		25%	0	15	46	15	1015	408
10	W- RT	503	760	50	76	314	18	867	854	15%		5	0	46%		50	0	5	50	872	904
11	TH	0	946	0	95		236	0	1277			0	0			0	0	0	0	0	1277
12	LT	0	0	0	0			0	0			0	0			0	0	0	0	0	0
TOTAL		2794	2625	279	263	523	505	3596	3393			5	46			50	15	51	65	3647	3458
Approach Totals																					
From North		0	0	0	0	0	0	0	0			0	0			0	0	0	0	0	0
From East		1430	609	143	61	178	195	1751	865			0	0			0	0	0	0	1751	865
From South		861	310	86	31	31	56	978	397			0	46			0	15	46	15	1024	412
From West		503	1706	50	171	314	254	867	2131			5	0			50	0	5	50	872	2181
Total		2794	2625	279	263	523	505	3596	3393			5	46			50	15	51	65	3647	3458
Departure Totals																					
To North		0	0	0	0	0	0	0	0			0	0			0	0	0	0	0	0
To East		8	950	1	95	0	236	9	1281			0	0			0	0	0	0	9	1281
To South		503	760	50	76	314	18	867	854			5	0			50	0	5	50	872	904
To West		2283	915	228	92	209	251	2720	1258			0	46			0	15	46	15	2766	1273
Total		2794	2625	279	263	523	505	3596	3393			5	46			50	15	51	65	3647	3458
Leg Totals																					
North		0	0	0	0	0	0	0	0			0	0			0	0	0	0	0	0
East		1438	1559	144	156	178	431	1760	2146			0	0			0	0	0	0	1760	2146
South		1364	1070	136	107	345	74	1845	1251			5	46			50	15	51	65	1896	1316
West		2786	2621	278	263	523	505	3587	3389			5	46			50	15	51	65	3638	3454
Total		5588	5250	558	526	1046	1010	7192	6786			10	92			100	30	102	130	7294	6916

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case3.3pm*

Capacity Analysis

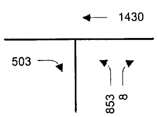
	EB		WB			NB		SB	
Lane group	L	TR	L	T	R	LT	R	LT	R
Adj. flow rate	247	730	51	799	27	84	28	301	73
Satflow rate	1805	3596	1805	3610	1615	1778	1615	1278	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.22	0.38	0.22	0.38	0.38	0.34	0.34	0.34	0.34
Lane group cap.	406	1349	406	1354	606	607	552	437	552
v/c ratio	0.61	0.54	0.13	0.59	0.04	0.14	0.05	0.69	0.13
Flow ratio	0.14	0.20	0.03	0.22	0.02	0.05	0.02	0.24	0.05
Crit. lane group	Y	N	N	Y	N	N	N	Y	N
Sum flow ratios	0.59								
Lost time/cycle	7.00								
Critical v/c ratio	0.63								

Lane Group Capacity, Control Delay, and LOS Determination

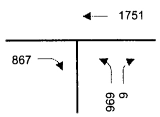
	EB		WB			NB		SB	
Lane group	L	TR	L	T	R	LT	R	LT	R
Adj. flow rate	247	730	51	799	27	84	28	301	73
Lane group cap.	406	1349	406	1354	606	607	552	437	552
v/c ratio	0.61	0.54	0.13	0.59	0.04	0.14	0.05	0.69	0.13
Green ratio	0.22	0.38	0.22	0.38	0.38	0.34	0.34	0.34	0.34
Unif. delay d1	41.8	29.4	37.1	30.1	23.8	27.3	26.5	34.0	27.2
Delay factor k	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Increm. delay d2	6.6	1.6	0.6	1.9	0.1	0.5	0.2	8.6	0.5
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	48.4	31.0	37.7	32.0	24.0	27.8	26.6	42.6	27.7
Lane group LOS	D	C	D	C	C	C	C	D	C
Apprch. delay	35.4		32.1			27.5		39.7	
Approach LOS	D		C			C		D	
Intersec. delay	34.5		Intersection LOS					C	

HCS2000™ Version 4.1c

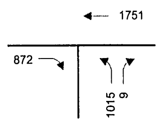
#4 PUKALANI BY PASS AT OLD HALEAKALA HIGHWAY



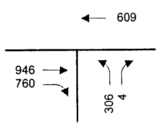
Case 1.4 am



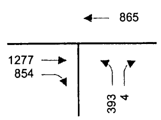
Case 2.4 am



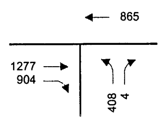
Case 3.4 am



Case 1.4 pm



Case 2.4 pm



Case 3.4 pm

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*PJR*	Intersection	*Case1.4pm*
Agency/Co.	*PRA*	Jurisdiction	
Date Performed	*4/6/2005*	Analysis Year	
Analysis Time Period			
Project Description *Kauhale Lani*			
East/West Street: *Haleakala Hwy/Bypass*		North/South Street: *Old Haleakala Highway*	
Intersection Orientation: *East-West*		Study Period (hrs): *0.25*	

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	0	946	760	0	609	0
Peak-Hour Factor, PHF	1.00	0.96	0.96	1.00	0.96	1.00
Hourly Flow Rate, HFR	0	984	791	0	634	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			0
Lanes	0	1	1	0	1	0
Configuration		T	R		T	
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	306	0	4	0	0	0
Peak-Hour Factor, PHF	0.96	1.00	0.50	1.00	1.00	1.00
Hourly Flow Rate, HFR	318	0	8	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	1	0	1	0	0	0
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration			L		R			
v (vph)			318		8			
C (m) (vph)			343		304			
v/c			0.93		0.03			
95% queue length			9.47		0.08			
Control Delay			67.3		17.2			
LOS			F		C			
Approach Delay	--	--	66.0					
Approach LOS	--	--	F					

HCS2000™ Version 4.1c

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	PJR	Intersection	Case2.4pm
Agency/Co.	PRA	Jurisdiction	
Date Performed	4/6/2005	Analysis Year	
Analysis Time Period			

Project Description Kauhale Lani
East/West Street: Haleakala Hwy/Bypass — North/South Street: Old Haleakala Highway
Intersection Orientation: East-West — Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	0	1277	854	0	865	0
Peak-Hour Factor, PHF	1.00	1.00	0.96	1.00	0.96	1.00
Hourly Flow Rate, HFR	0	1277	889	0	901	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			0
Lanes	0	1	1	0	1	0
Configuration		T	R		T	
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	393	0	4	0	0	0
Peak-Hour Factor, PHF	0.96	1.00	0.50	1.00	1.00	1.00
Hourly Flow Rate, HFR	409	0	8	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	1	0	1	0	0	0
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration			L		R			
v (vph)			409		8			
C (m) (vph)			246		205			
v/c			1.66		0.04			
95% queue length			26.22		0.12			
Control Delay			350.9		23.3			
LOS			F		C			
Approach Delay	--	--	344.6					
Approach LOS	--	--	F					

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	PJR	Intersection	Case3.4pm
Agency/Co.	PRA	Jurisdiction	
Date Performed	4/6/2005	Analysis Year	
Analysis Time Period			

Project Description Kauhale Lani
East/West Street: Haleakala Hwy/Bypass — North/South Street: Old Haleakala Highway
Intersection Orientation: East-West — Study Period (hrs): 0.25

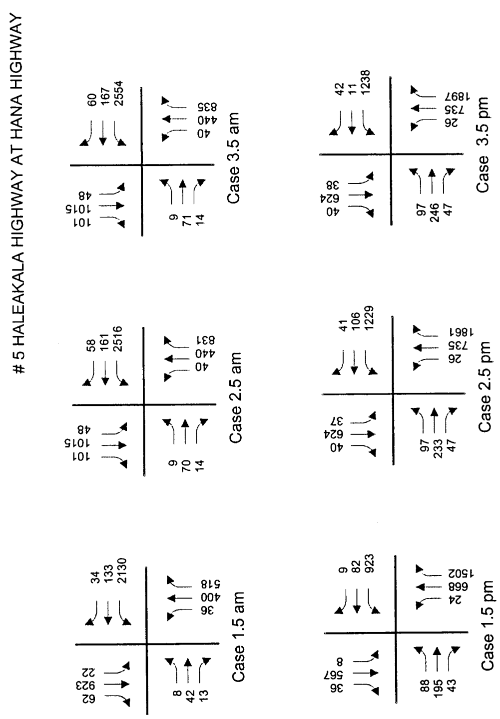
Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	0	1277	904	0	865	0
Peak-Hour Factor, PHF	1.00	1.00	0.96	1.00	0.96	1.00
Hourly Flow Rate, HFR	0	1277	941	0	901	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			0
Lanes	0	1	1	0	1	0
Configuration		T	R		T	
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	408	0	4	0	0	0
Peak-Hour Factor, PHF	0.96	1.00	0.50	1.00	1.00	1.00
Hourly Flow Rate, HFR	425	0	8	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	1	0	1	0	0	0
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration			L		R			
v (vph)			425		8			
C (m) (vph)			246		205			
v/c			1.73		0.04			
95% queue length			28.06		0.12			
Control Delay			378.8		23.3			
LOS			F		C			
Approach Delay	--	--	372.2					
Approach LOS	--	--	F					



Part 2.1

Trip Assignment Worksheet

Pukalani Makai TIAR
March 2005

INTERSECTION NO 5
INTERSECTION OF Haleakala Highway at Hana Highway

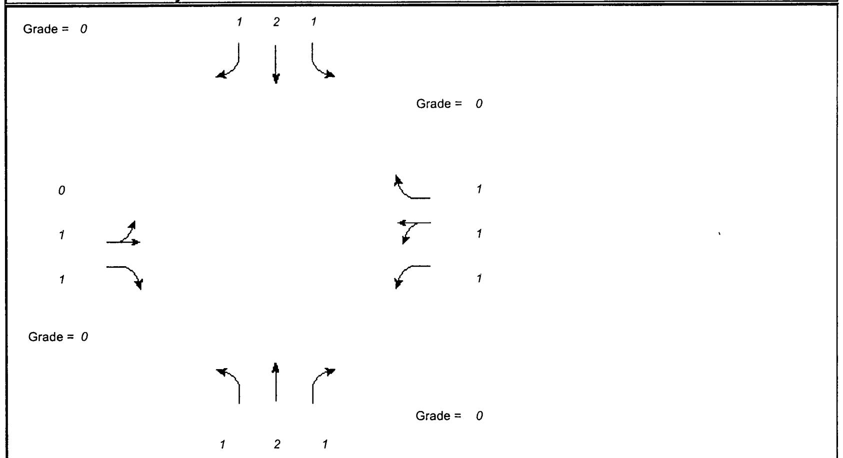
No	Approach & Mvt	Case 1 Existing AM	Existing PM	Background Growth AM	Background Growth PM	Related Project Traffic AM	Related Project Traffic PM	Case 2 Cumulative AM	Cumulative PM	AM Distribution % In	AM Distribution % Out	AM Assignment In	AM Assignment Out	PM Distribution % In	PM Distribution % Out	PM Assignment In	PM Assignment Out	Project Trips AM	Project Trips PM	Case 3 Cumulative Plus Project AM	Cumulative Plus Project PM
1	N- RT	92	36	9	4			101	40			0	0			0	0	0	0	101	40
2	TH	923	567	92	57			1015	624			0	0			0	0	0	0	1015	624
3	LT	22	8	2	1	24	28	48	37	1%		0	0	1%		1	0	0	1	48	38
4	E- RT	34	9	3	1	21	31	58	41		2%	0	2		1%	0	1	2	1	60	42
5	TH	133	82	13	8	15	16	161	106		6%	0	6		9%	0	5	6	5	167	111
6	LT	2130	923	213	92	173	214	2516	1229		40%	0	38		15%	0	9	38	9	2554	1238
7	S- RT	518	1502	52	150	261	209	831	1861	12%		4	0	33%		36	0	4	36	835	1897
8	TH	400	668	40	67			440	735			0	0			0	0	0	0	440	735
9	LT	36	24	4	2			40	26			0	0			0	0	0	0	40	26
10	W- RT	13	43	1	4			14	47			0	0			0	0	0	0	14	47
11	TH	42	195	4	20	24	18	70	233	2%		1	0	12%		13	0	1	13	71	246
12	LT	8	88	1	9			9	97			0	0			0	0	0	0	9	97
TOTAL		4351	4145	434	415	518	516	5303	5076			5	46			50	15	51	65	5354	5141
Approach Totals																					
From North		1037	611	103	62	24	28	1164	701			0	0			1	0	0	1	1164	702
From East		2297	1014	229	101	209	261	2735	1376			0	46			0	15	46	15	2781	1391
From South		954	2194	96	219	261	209	1311	2622			4	0			36	0	4	36	1315	2658
From West		63	326	6	33	24	18	93	377			1	0			13	0	1	13	94	390
Total		4351	4145	434	415	518	516	5303	5076			5	46			50	15	51	65	5354	5141
Departure Totals																					
To North		442	765	44	77	21	31	507	873			0	2			0	1	2	1	509	874
To East		582	1705	58	171	309	255	949	2131			5	0			50	0	5	50	954	2181
To South		3066	1533	306	153	173	214	3545	1900			0	38			0	9	38	9	3583	1909
To West		261	142	26	14	15	16	302	172			0	6			0	5	6	5	308	177
Total		4351	4145	434	415	518	516	5303	5076			5	46			50	15	51	65	5354	5141
Leg Totals																					
North		1479	1376	147	139	45	59	1671	1574			0	2			1	1	2	2	1673	1576
East		2879	2719	287	272	518	516	3684	3507			5	46			50	15	51	65	3735	3572
South		4020	3727	402	372	434	423	4856	4522			4	38			36	9	42	45	4898	4567
West		324	468	32	47	39	34	395	549			1	6			13	5	7	18	402	567
Total		8702	8290	868	830	1036	1032	10606	10152			10	92			100	30	102	130	10708	10282

INPUT WORKSHEET

General Information		Site Information	
Analyst	PJR	Intersection	Case1.5am
Agency or Co.	PRA	Area Type	All other areas
Date Performed	4/14/2005	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case1.5am*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	8	42	13	2130	133	34	36	400	518	22	923	62
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type		3	3	3	3	3	3	3	3	3	3	3
Unit Extension		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0		10	0		0	0		400	0		5
Lane Width		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr		0	0	0	0	0	0	0	0	0	0	0

	WB Only	EB Only	03	04	Excl. Left	Thru & RT	07	08
Timing	G = 116.0	G = 7.0	G =	G =	G = 4.0	G = 43.0	G =	G =
	Y = 3.5	Y = 3.5	Y =	Y =	Y = 0	Y = 3.5	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 180.5		

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case1.5am*

Capacity Analysis

	EB		WB			NB			SB		
Lane group	LT	R	L	LT	R	L	T	R	L	T	R
Adj. flow rate	54	3	1246	1161	36	38	426	126	23	982	61
Satflow rate	1884	1615	1805	1820	1615	1805	3610	1615	1805	3610	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.04	0.04	0.64	0.64	0.64	0.02	0.24	0.24	0.02	0.24	0.24
Lane group cap.	73	63	1160	1170	1038	40	860	385	40	860	385
v/c ratio	0.74	0.05	1.07	0.99	0.03	0.95	0.50	0.33	0.57	1.14	0.16
Flow ratio	0.03	0.00	0.69	0.64	0.02	0.02	0.12	0.08	0.01	0.27	0.04
Crit. lane group	Y	N	Y	N	N	Y	N	N	N	Y	N
Sum flow ratios	1.01										
Lost time/cycle	10.50										
Critical v/c ratio	1.07										

Lane Group Capacity, Control Delay, and LOS Determination

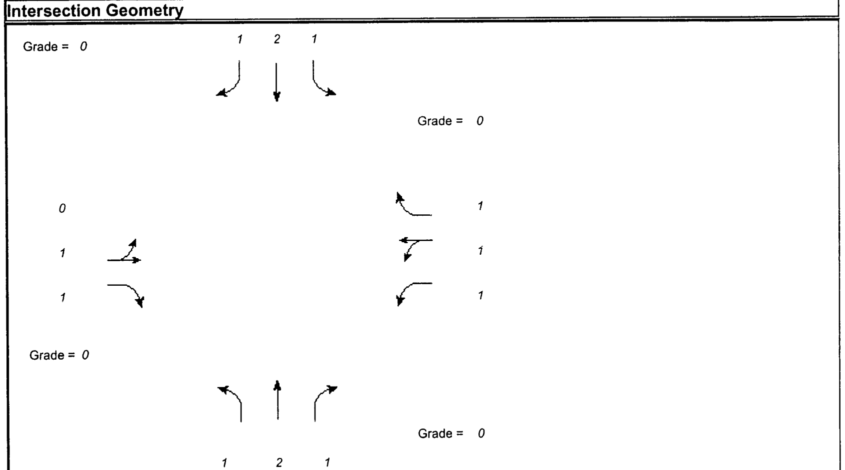
	EB		WB			NB			SB		
Lane group	LT	R	L	LT	R	L	T	R	L	T	R
Adj. flow rate	54	3	1246	1161	36	38	426	126	23	982	61
Lane group cap.	73	63	1160	1170	1038	40	860	385	40	860	385
v/c ratio	0.74	0.05	1.07	0.99	0.03	0.95	0.50	0.33	0.57	1.14	0.16
Green ratio	0.04	0.04	0.64	0.64	0.64	0.02	0.24	0.24	0.02	0.24	0.24
Unif. delay d1	85.8	83.5	32.2	31.8	11.8	88.2	59.4	56.8	87.4	68.8	54.4
Delay factor k	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Increm. delay d2	49.3	1.4	48.7	24.5	0.1	127.9	2.0	2.3	48.6	77.7	0.9
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	135.2	85.0	81.0	56.3	11.8	216.1	61.4	59.1	136.0	146.4	55.3
Lane group LOS	F	F	F	E	B	F	E	E	F	F	E
Apprch. delay	132.5		68.3			70.9			141.0		
Approach LOS	F		E			E			F		
Intersec. delay	88.2		Intersection LOS						F		

INPUT WORKSHEET

General Information		Site Information	
Analyst	PJR	Intersection	Case1.5pm
Agency or Co.	PRA	Area Type	All other areas
Date Performed	4/14/2005	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case1.5pm*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	88	195	43	923	82	9	24	668	1502	8	567	36
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type		3	3	3	3	3	3	3	3	3	3	3
Unit Extension		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0		25	0		0	0		1500	0		20
Lane Width		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr		0	0	0	0	0	0	0	0	0	0	0

	WB Only	EB Only	03	04	Excl. Left	Thru & RT	07	08
Timing	G = 78.0	G = 40.0	G =	G =	G = 5.0	G = 46.0	G =	G =
	Y = 3.5	Y = 3.5	Y =	Y =	Y = 0	Y = 3.5	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 179.5		

HCS2000™ Version 4.1c

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case1.5pm*

Capacity Analysis

	EB		WB			NB			SB		
Lane group	LT	R	L	LT	R	L	T	R	L	T	R
Adj. flow rate	295	19	529	517	9	25	696	2	8	591	17
Satflow rate	1871	1615	1805	1824	1615	1805	3610	1615	1805	3610	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.22	0.22	0.43	0.43	0.43	0.03	0.26	0.26	0.03	0.26	0.26
Lane group cap.	417	360	784	793	702	50	925	414	50	925	414
v/c ratio	0.71	0.05	0.67	0.65	0.01	0.50	0.75	0.00	0.16	0.64	0.04
Flow ratio	0.16	0.01	0.29	0.28	0.01	0.01	0.19	0.00	0.00	0.16	0.01
Crit. lane group	Y	N	Y	N	N	Y	Y	N	N	N	N
Sum flow ratios	0.66										
Lost time/cycle	10.50										
Critical v/c ratio	0.70										

Lane Group Capacity, Control Delay, and LOS Determination

	EB		WB			NB			SB		
Lane group	LT	R	L	LT	R	L	T	R	L	T	R
Adj. flow rate	295	19	529	517	9	25	696	2	8	591	17
Lane group cap.	417	360	784	793	702	50	925	414	50	925	414
v/c ratio	0.71	0.05	0.67	0.65	0.01	0.50	0.75	0.00	0.16	0.64	0.04
Green ratio	0.22	0.22	0.43	0.43	0.43	0.03	0.26	0.26	0.03	0.26	0.26
Unif. delay d1	64.4	54.9	40.6	40.0	28.9	86.0	61.5	49.7	85.2	59.4	50.2
Delay factor k	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Increm. delay d2	9.7	0.3	4.6	4.1	0.0	31.6	5.6	0.0	6.7	3.4	0.2
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	74.1	55.1	45.2	44.2	28.9	117.6	67.1	49.7	91.9	62.7	50.4
Lane group LOS	E	E	D	D	C	F	E	D	F	E	D
Apprch. delay	72.9		44.6			68.8			62.8		
Approach LOS	E		D			E			E		
Intersec. delay	58.5		Intersection LOS						E		

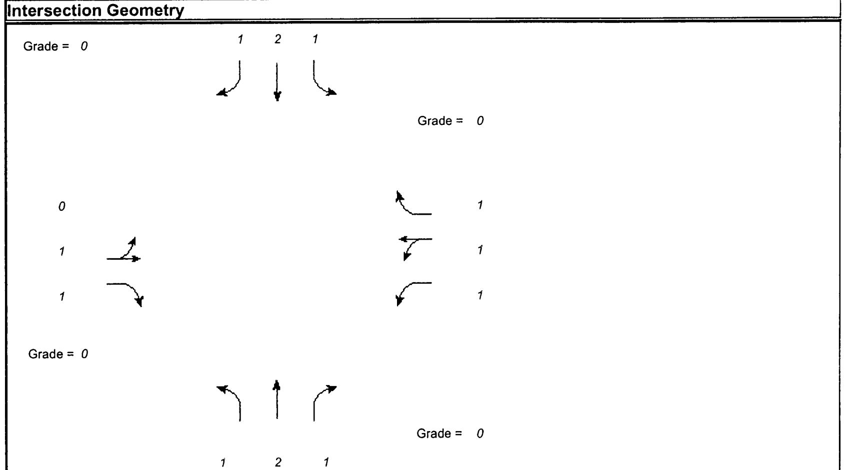
HCS2000™ Version 4.1c

INPUT WORKSHEET

General Information		Site Information	
Analyst	*PJR*	Intersection	*Case2.5am*
Agency or Co.	*PRA*	Area Type	*All other areas*
Date Performed	*4/14/2005*	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case2.5am*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	9	70	14	2516	161	58	40	440	831	48	1015	101
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type		3	3	3	3	3	3	3	3	3	3	3
Unit Extension		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0		10	0		45	0		400	0		5
Lane Width		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr		0	0	0	0	0	0	0	0	0	0	0

	WB Only	EB Only	03	04	Excl. Left	Thru & RT	07	08
Timing	G = 116.0	G = 7.0	G =	G =	G = 4.0	G = 43.0	G =	G =
	Y = 3.5	Y = 3.5	Y =	Y =	Y = 0	Y = 3.5	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 180.5		

HCS2000™ Version 4.1c

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case2.5am*

Capacity Analysis

	EB		WB			NB			SB		
Lane group	LT	R	L	LT	R	L	T	R	L	T	R
Adj. flow rate	84	4	1472	1376	14	43	468	459	51	1080	102
Satflow rate	1889	1615	1805	1820	1615	1805	3610	1615	1805	3610	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.04	0.04	0.64	0.64	0.64	0.02	0.24	0.24	0.02	0.24	0.24
Lane group cap.	73	63	1160	1170	1038	40	860	385	40	860	385
v/c ratio	1.15	0.06	1.27	1.18	0.01	1.08	0.54	1.19	1.27	1.26	0.26
Flow ratio	0.04	0.00	0.82	0.76	0.01	0.02	0.13	0.28	0.03	0.30	0.06
Crit. lane group	Y	N	Y	N	N	N	N	N	Y	Y	N
Sum flow ratios	1.19										
Lost time/cycle	10.50										
Critical v/c ratio	1.26										

Lane Group Capacity, Control Delay, and LOS Determination

	EB		WB			NB			SB		
Lane group	LT	R	L	LT	R	L	T	R	L	T	R
Adj. flow rate	84	4	1472	1376	14	43	468	459	51	1080	102
Lane group cap.	73	63	1160	1170	1038	40	860	385	40	860	385
v/c ratio	1.15	0.06	1.27	1.18	0.01	1.08	0.54	1.19	1.27	1.26	0.26
Green ratio	0.04	0.04	0.64	0.64	0.64	0.02	0.24	0.24	0.02	0.24	0.24
Unif. delay d1	86.8	83.6	32.2	32.2	11.6	88.3	60.2	68.8	88.3	68.8	55.9
Delay factor k	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Increm. delay d2	151.9	1.9	128.0	88.4	0.0	165.4	2.5	109.4	234.1	124.6	1.7
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	238.6	85.5	160.2	120.7	11.6	253.6	62.6	178.2	322.3	193.4	57.6
Lane group LOS	F	F	F	F	B	F	E	F	F	F	E
Apprch. delay	231.7		140.5			125.8			187.5		
Approach LOS	F		F			F			F		
Intersec. delay	150.5		Intersection LOS						F		

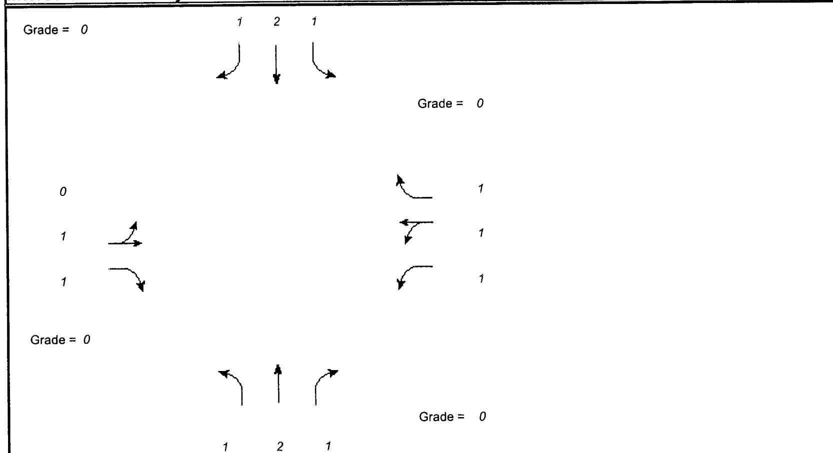
HCS2000™ Version 4.1c

INPUT WORKSHEET

General Information		Site Information	
Analyst	PJR	Intersection	Case2.5pm
Agency or Co.	PRA	Area Type	All other areas
Date Performed	4/14/2005	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case2.5pm*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	97	233	47	1229	106	41	26	735	1861	37	624	40
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type		3	3	3	3	3	3	3	3	3	3	3
Unit Extension		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0		25	0		30	0		1500	0		20
Lane Width		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr		0	0	0	0	0	0	0	0	0	0	0

	WB Only	EB Only	03	04	Excl. Left	Thru & RT	07	08
Timing	G = 78.0	G = 40.0	G =	G =	G = 5.0	G = 46.0	G =	G =
	Y = 3.5	Y = 3.5	Y =	Y =	Y = 0	Y = 3.5	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 179.5		

HCS2000™ Version 4.1c

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case2.5pm*

Capacity Analysis

	EB		WB			NB			SB		
Lane group	LT	R	L	LT	R	L	T	R	L	T	R
Adj. flow rate	344	23	704	686	11	27	766	376	39	650	21
Satflow rate	1873	1615	1805	1823	1615	1805	3610	1615	1805	3610	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.22	0.22	0.43	0.43	0.43	0.03	0.26	0.26	0.03	0.26	0.26
Lane group cap.	417	360	784	792	702	50	925	414	50	925	414
v/c ratio	0.82	0.06	0.90	0.87	0.02	0.54	0.83	0.91	0.78	0.70	0.05
Flow ratio	0.18	0.01	0.39	0.38	0.01	0.01	0.21	0.23	0.02	0.18	0.01
Crit. lane group	Y	N	Y	N	N	N	N	Y	Y	N	N
Sum flow ratios	0.83										
Lost time/cycle	10.50										
Critical v/c ratio	0.88										

Lane Group Capacity, Control Delay, and LOS Determination

	EB		WB			NB			SB		
Lane group	LT	R	L	LT	R	L	T	R	L	T	R
Adj. flow rate	344	23	704	686	11	27	766	376	39	650	21
Lane group cap.	417	360	784	792	702	50	925	414	50	925	414
v/c ratio	0.82	0.06	0.90	0.87	0.02	0.54	0.83	0.91	0.78	0.70	0.05
Green ratio	0.22	0.22	0.43	0.43	0.43	0.03	0.26	0.26	0.03	0.26	0.26
Unif. delay d1	66.4	55.0	47.1	46.0	28.9	86.1	63.0	64.7	86.7	60.5	50.3
Delay factor k	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Increm. delay d2	16.8	0.3	15.2	12.2	0.0	36.0	8.5	26.3	73.3	4.5	0.2
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	83.2	55.3	62.2	58.2	28.9	122.1	71.5	91.0	160.0	65.0	50.5
Lane group LOS	F	E	E	E	C	F	E	F	F	E	D
Apprch. delay	81.4		60.0			78.9			69.8		
Approach LOS	F		E			E			E		
Intersec. delay	70.1		Intersection LOS						E		

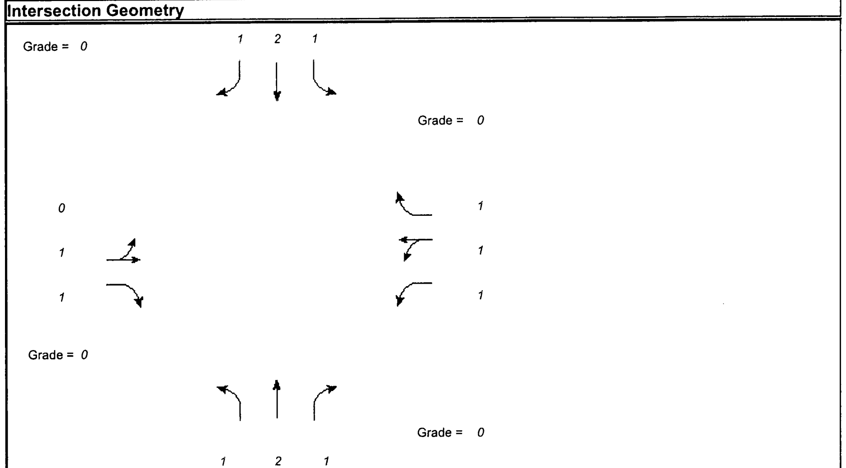
HCS2000™ Version 4.1c

INPUT WORKSHEET

General Information		Site Information	
Analyst	PJR	Intersection	Case3.5am
Agency or Co.	PRA	Area Type	All other areas
Date Performed	4/14/2005	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case3.5am*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	9	71	14	2554	167	60	40	440	835	48	1015	101
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type		3	3	3	3	3	3	3	3	3	3	3
Unit Extension		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0		10	0		45	0		400	0		5
Lane Width		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr		0	0	0	0	0	0	0	0	0	0	0

	WB Only	EB Only	03	04	Excl. Left	Thru & RT	07	08
Timing	G = 116.0	G = 7.0	G =	G =	G = 4.0	G = 43.0	G =	G =
	Y = 3.5	Y = 3.5	Y =	Y =	Y = 0	Y = 3.5	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 180.5		

HCS2000™ Version 4.1c

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case3.5am*

Capacity Analysis

	EB		WB			NB			SB		
Lane group	LT	R	L	LT	R	L	T	R	L	T	R
Adj. flow rate	86	4	1494	1401	16	43	468	463	51	1080	102
Satflow rate	1889	1615	1805	1821	1615	1805	3610	1615	1805	3610	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.04	0.04	0.64	0.64	0.64	0.02	0.24	0.24	0.02	0.24	0.24
Lane group cap.	73	63	1160	1170	1038	40	860	385	40	860	385
v/c ratio	1.18	0.06	1.29	1.20	0.02	1.08	0.54	1.20	1.27	1.26	0.26
Flow ratio	0.05	0.00	0.83	0.77	0.01	0.02	0.13	0.29	0.03	0.30	0.06
Crit. lane group	Y	N	Y	N	N	N	N	N	Y	Y	N
Sum flow ratios	1.20										
Lost time/cycle	10.50										
Critical v/c ratio	1.27										

Lane Group Capacity, Control Delay, and LOS Determination

	EB		WB			NB			SB		
Lane group	LT	R	L	LT	R	L	T	R	L	T	R
Adj. flow rate	86	4	1494	1401	16	43	468	463	51	1080	102
Lane group cap.	73	63	1160	1170	1038	40	860	385	40	860	385
v/c ratio	1.18	0.06	1.29	1.20	0.02	1.08	0.54	1.20	1.27	1.26	0.26
Green ratio	0.04	0.04	0.64	0.64	0.64	0.02	0.24	0.24	0.02	0.24	0.24
Unif. delay d1	86.8	83.6	32.2	32.2	11.6	88.3	60.2	68.8	88.3	68.8	55.9
Delay factor k	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Increm. delay d2	161.2	1.9	136.2	97.4	0.0	165.4	2.5	113.5	234.1	124.6	1.7
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	248.0	85.5	168.4	129.6	11.7	253.6	62.6	182.2	322.3	193.4	57.6
Lane group LOS	F	F	F	F	B	F	E	F	F	F	E
Apprch. delay	240.7		148.9			127.9			187.5		
Approach LOS	F		F			F			F		
Intersec. delay	155.7		Intersection LOS						F		

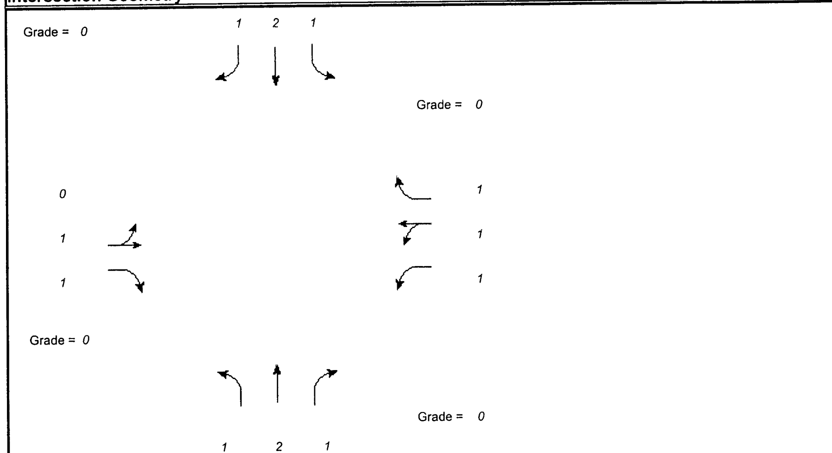
HCS2000™ Version 4.1c

INPUT WORKSHEET

General Information		Site Information	
Analyst	PJR	Intersection	Case3.5pm
Agency or Co.	PRA	Area Type	All other areas
Date Performed	4/14/2005	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case3.5pm*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	97	246	47	1238	111	42	26	735	1897	38	624	40
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Ext. eff. green		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival type		3	3	3	3	3	3	3	3	3	3	3
Unit Extension		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0		25	0		30	0		1500	0		20
Lane Width		12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr		0	0	0	0	0	0	0	0	0	0	0

	WB Only	EB Only	03	04	Excl. Left	Thru & RT	07	08
Timing	G = 78.0	G = 40.0	G =	G =	G = 5.0	G = 46.0	G =	G =
	Y = 3.5	Y = 3.5	Y =	Y =	Y = 0	Y = 3.5	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 179.5		

HCS2000™ Version 4.1c

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case3.5pm*

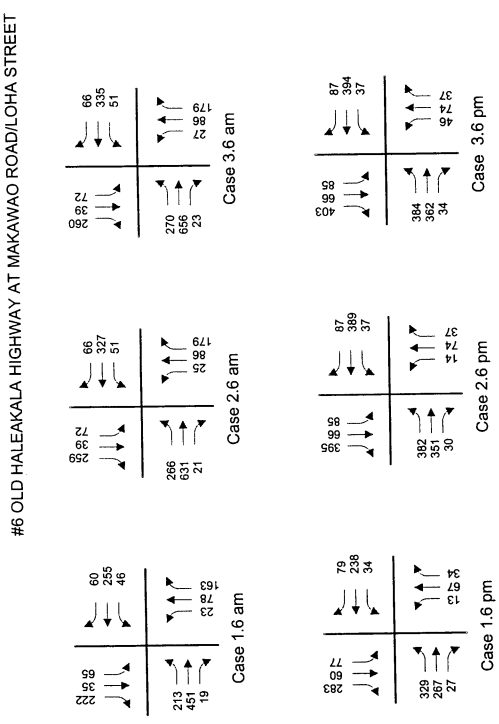
Capacity Analysis

	EB		WB			NB			SB		
Lane group	LT	R	L	LT	R	L	T	R	L	T	R
Adj. flow rate	357	23	710	696	13	27	766	414	40	650	21
Satflow rate	1873	1615	1805	1824	1615	1805	3610	1615	1805	3610	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.22	0.22	0.43	0.43	0.43	0.03	0.26	0.26	0.03	0.26	0.26
Lane group cap.	417	360	784	793	702	50	925	414	50	925	414
v/c ratio	0.86	0.06	0.91	0.88	0.02	0.54	0.83	1.00	0.80	0.70	0.05
Flow ratio	0.19	0.01	0.39	0.38	0.01	0.01	0.21	0.26	0.02	0.18	0.01
Crit. lane group	Y	N	Y	N	N	N	N	Y	Y	N	N
Sum flow ratios	0.86										
Lost time/cycle	10.50										
Critical v/c ratio	0.92										

Lane Group Capacity, Control Delay, and LOS Determination

	EB		WB			NB			SB		
Lane group	LT	R	L	LT	R	L	T	R	L	T	R
Adj. flow rate	357	23	710	696	13	27	766	414	40	650	21
Lane group cap.	417	360	784	793	702	50	925	414	50	925	414
v/c ratio	0.86	0.06	0.91	0.88	0.02	0.54	0.83	1.00	0.80	0.70	0.05
Green ratio	0.22	0.22	0.43	0.43	0.43	0.03	0.26	0.26	0.03	0.26	0.26
Unif. delay d1	67.0	55.0	47.3	46.4	28.9	86.1	63.0	66.8	86.8	60.5	50.3
Delay factor k	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Increm. delay d2	19.7	0.3	16.0	13.1	0.0	36.0	8.5	44.2	77.4	4.5	0.2
PF factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	86.7	55.3	63.3	59.5	29.0	122.1	71.5	111.0	164.2	65.0	50.5
Lane group LOS	F	E	E	E	C	F	E	F	F	E	D
Apprch. delay	84.8		61.1			86.2			70.2		
Approach LOS	F		E			F			E		
Intersec. delay	73.4		Intersection LOS						E		

HCS2000™ Version 4.1c



Part 2.1

Trip Assignment Worksheet

Pukalani Makai TIAR
March 2005

INTERSECTION NO 6
INTERSECTION OF Old Haleakala Highway at Makawao Road/Loha Street

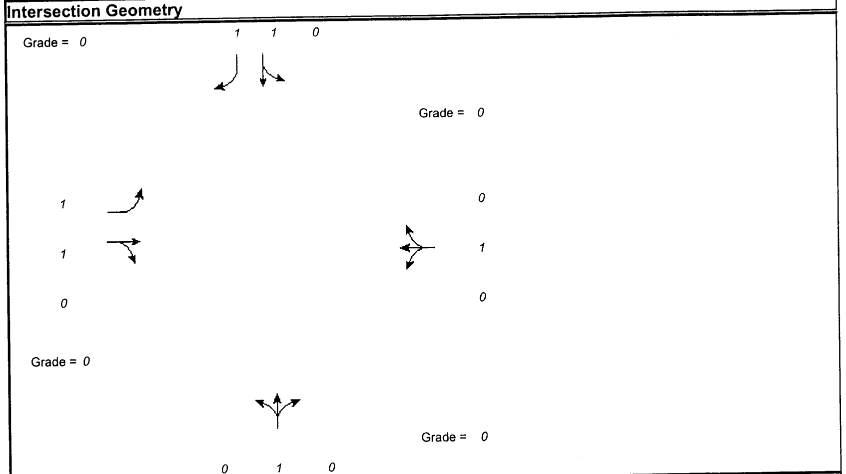
		Case 1						Case 2														Case 3	
		Existing		Background Growth		Related Project Traffic		Cumulative		AM Distribution		AM Assignment		PM Distribution		PM Assignment		Project Trips		Cumulative Plus Project	
No	Approach & Mvt	AM	PM	AM	PM	AM	PM	AM	PM	% In	% Out	In	Out	% In	% Out	In	Out	AM	PM	AM	PM
1	N- RT	222	283	22	28	15	84	259	395	4%		1	0	7%		8	0	1	8	260	403
2	TH	35	60	4	6			39	66			0	0			0	0	0	0	39	66
3	LT	65	77	7	8			72	85			0	0			0	0	0	0	72	85
4	E- RT	60	79	6	8			66	87			0	0			0	0	0	0	66	87
5	TH	255	238	26	24	46	127	327	389	25%		8	0	5%		5	0	8	5	335	394
6	LT	46	34	5	3			51	37			0	0			0	0	0	0	51	37
7	S- RT	163	34	16	3			179	37			0	0			0	0	0	0	179	37
8	TH	78	67	8	7			86	74			0	0			0	0	0	0	86	74
9	LT	23	13	2	1			25	14	6%		2	0	3%		3	0	2	3	27	17
10	W- RT	19	27	2	3			21	30		2%	0	2		7%	0	4	2	4	23	34
11	TH	451	267	45	27	135	57	631	351		26%	0	25		18%	0	11	25	11	656	362
12	LT	213	329	21	33	32	20	266	382		4%	0	4		3%	0	2	4	2	270	384
TOTAL		1630	1508	164	151	228	288	2022	1947			11	31			16	17	42	33	2064	1980
Approach Totals																					
From North		322	420	33	42	15	84	370	546			1	0			8	0	1	8	371	554
From East		361	351	37	35	46	127	444	513			8	0			5	0	8	5	452	518
From South		264	114	26	11	0	0	290	125			2	0			3	0	2	3	292	128
From West		683	623	68	63	167	77	918	763			0	31			0	17	31	17	949	780
Total		1630	1508	164	151	228	288	2022	1947			11	31			16	17	42	33	2064	1980
Departure Totals																					
To North		351	475	35	48	32	20	418	543			0	4			0	2	4	2	422	545
To East		679	378	68	38	135	57	882	473			0	25			0	11	25	11	907	484
To South		100	121	11	12	0	0	111	133			0	2			0	4	2	4	113	137
To West		500	534	50	53	61	211	611	798			11	0			16	0	11	16	622	814
Total		1630	1508	164	151	228	288	2022	1947			11	31			16	17	42	33	2064	1980
Leg Totals																					
North		673	895	68	90	47	104	788	1089			1	4			8	2	5	10	793	1099
East		1040	729	105	73	181	184	1326	986			8	25			5	11	33	16	1359	1002
South		364	235	37	23	0	0	401	258			2	2			3	4	4	7	405	265
West		1183	1157	118	116	228	288	1529	1561			11	31			16	17	42	33	1571	1594
Total		3260	3016	328	302	456	576	4044	3894			22	62			32	34	84	66	4128	3960

INPUT WORKSHEET

General Information		Site Information	
Analyst	PJR	Intersection	Case1.6am
Agency or Co.	PRA	Area Type	All other areas
Date Performed	4/14/2005	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case1.6am*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	213	451	19	46	255	60	23	78	163	65	35	222
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time	2.0	2.0			2.0			2.0			2.0	2.0
Ext. eff. green	2.0	2.0			2.0			2.0			2.0	2.0
Arrival type	3	3			3			3			3	3
Unit Extension	3.0	3.0			3.0			3.0			3.0	3.0
Ped/Bike/RTOR Volume	0		0	0		0	0		0	0		100
Lane Width	12.0	12.0			12.0			12.0			12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0			0			0			0	0

	EB Only	EW Perm	03	04	NS Perm	06	07	08
Timing	G = 14.0	G = 37.0	G =	G =	G = 22.0	G =	G =	G =
	Y =	Y = 3.5	Y =	Y =	Y = 3.5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 80.0		

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case1.6am*

Capacity Analysis

	EB		WB	NB	SB	
Lane group	L	TR	LTR	LTR	LT	R
Adj. flow rate	237	522	401	294	111	136
Satflow rate	1805	1889	1663	1693	1154	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.64	0.64	0.46	0.28	0.28	0.28
Lane group cap.	647	1204	769	466	317	444
v/c ratio	0.37	0.43	0.52	0.63	0.35	0.31
Flow ratio		0.28	0.24	0.17	0.10	0.08
Crit. lane group	N	N	Y	Y	N	N
Sum flow ratios	0.55					
Lost time/cycle	10.50					
Critical v/c ratio	0.63					

Lane Group Capacity, Control Delay, and LOS Determination

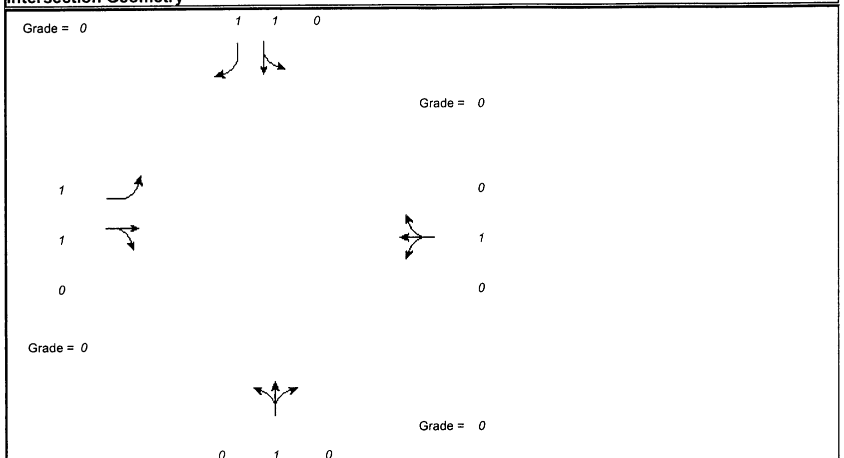
	EB		WB	NB	SB	
Lane group	L	TR	LTR	LTR	LT	R
Adj. flow rate	237	522	401	294	111	136
Lane group cap.	647	1204	769	466	317	444
v/c ratio	0.37	0.43	0.52	0.63	0.35	0.31
Green ratio	0.64	0.64	0.46	0.28	0.28	0.28
Unif. delay d1	7.5	7.3	15.2	25.4	23.3	23.0
Delay factor k	0.50	0.50	0.50	0.50	0.50	0.50
Increm. delay d2	1.6	1.1	2.5	6.4	3.0	1.8
PF factor	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	9.1	8.4	17.8	31.8	26.3	24.7
Lane group LOS	A	A	B	C	C	C
Apprch. delay	8.6		17.8	31.8	25.4	
Approach LOS	A		B	C	C	
Intersec. delay	17.2		Intersection LOS		B	

INPUT WORKSHEET

General Information		Site Information	
Analyst	*PJR*	Intersection	*Case1.6pm*
Agency or Co.	*PRA*	Area Type	*All other areas*
Date Performed	*4/14/2005*	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case1.6pm*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	329	267	27	34	238	79	13	67	34	77	60	283
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time	2.0	2.0			2.0			2.0			2.0	2.0
Ext. eff. green	2.0	2.0			2.0			2.0			2.0	2.0
Arrival type	3	3			3			3			3	3
Unit Extension	3.0	3.0			3.0			3.0			3.0	3.0
Ped/Bike/RTOR Volume	0		0	0		0	0		0	0		200
Lane Width	12.0	12.0			12.0			12.0			12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0			0			0			0	0

	EB Only	EW Perm	03	04	NS Perm	06	07	08
Timing	G = 18.0	G = 39.0	G =	G =	G = 16.0	G =	G =	G =
	Y =	Y = 3.5	Y =	Y =	Y = 3.5	Y =	Y =	Y =

Duration of Analysis (hrs) = 0.25 — Cycle Length C = 80.0

HCS2000™

Version 4.1c

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case1.6pm*

Capacity Analysis

	EB		WB	NB	SB	
Lane group	L	TR	LTR	LTR	LT	R
Adj. flow rate	366	327	390	126	153	92
Satflow rate	1805	1874	1745	1757	1411	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.71	0.71	0.49	0.20	0.20	0.20
Lane group cap.	770	1335	851	351	282	323
v/c ratio	0.48	0.24	0.46	0.36	0.54	0.28
Flow ratio		0.17	0.22	0.07	0.11	0.06
Crit. lane group	N	N	Y	N	Y	N
Sum flow ratios	0.52					
Lost time/cycle	10.50					
Critical v/c ratio	0.60					

Lane Group Capacity, Control Delay, and LOS Determination

	EB		WB	NB	SB	
Lane group	L	TR	LTR	LTR	LT	R
Adj. flow rate	366	327	390	126	153	92
Lane group cap.	770	1335	851	351	282	323
v/c ratio	0.48	0.24	0.46	0.36	0.54	0.28
Green ratio	0.71	0.71	0.49	0.20	0.20	0.20
Unif. delay d1	5.6	4.0	13.5	27.6	28.7	27.1
Delay factor k	0.50	0.50	0.50	0.50	0.50	0.50
Increm. delay d2	2.1	0.4	1.8	2.8	7.3	2.2
PF factor	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	7.7	4.4	15.3	30.4	36.0	29.4
Lane group LOS	A	A	B	C	D	C
Apprch. delay	6.2		15.3	30.4	33.5	
Approach LOS	A		B	C	C	
Intersec. delay	15.3		Intersection LOS		B	

HCS2000™

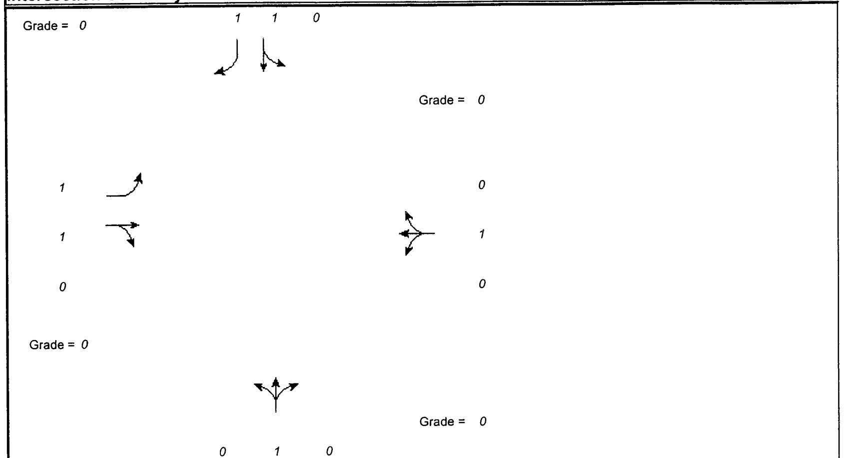
Version 4.1c

INPUT WORKSHEET

General Information		Site Information	
Analyst	PJR	Intersection	Case2.6am
Agency or Co.	PRA	Area Type	All other areas
Date Performed	4/14/2005	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case2.6am*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	266	631	21	51	327	66	25	86	179	72	39	259
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time	2.0	2.0			2.0			2.0			2.0	2.0
Ext. eff. green	2.0	2.0			2.0			2.0			2.0	2.0
Arrival type	3	3			3			3			3	3
Unit Extension	3.0	3.0			3.0			3.0			3.0	3.0
Ped/Bike/RTOR Volume	0		0	0		0	0		0	0		100
Lane Width	12.0	12.0			12.0			12.0			12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0			0			0			0	0

	EB Only	EW Perm	03	04	NS Perm	06	07	08
Timing	G = 14.0	G = 37.0	G =	G =	G = 22.0	G =	G =	G =
	Y =	Y = 3.5	Y =	Y =	Y = 3.5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 80.0		

HCS2000™ Version 4.1c

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case2.6am*

Capacity Analysis

	EB			WB			NB			SB		
Lane group	L	TR			LTR			LTR			LT	R
Adj. flow rate	296	724			493			323			123	177
Satflow rate	1805	1891			1617			1690			1049	1615
Lost time	2.0	2.0			2.0			2.0			2.0	2.0
Green ratio	0.64	0.64			0.46			0.28			0.28	0.28
Lane group cap.	595	1206			748			465			288	444
v/c ratio	0.50	0.60			0.66			0.69			0.43	0.40
Flow ratio		0.38			0.30			0.19			0.12	0.11
Crit. lane group	N	N			Y			Y			N	N
Sum flow ratios	0.63											
Lost time/cycle	10.50											
Critical v/c ratio	0.73											

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Lane group	L	TR			LTR			LTR			LT	R
Adj. flow rate	296	724			493			323			123	177
Lane group cap.	595	1206			748			465			288	444
v/c ratio	0.50	0.60			0.66			0.69			0.43	0.40
Green ratio	0.64	0.64			0.46			0.28			0.28	0.28
Unif. delay d1	8.4	8.5			16.6			26.0			23.8	23.6
Delay factor k	0.50	0.50			0.50			0.50			0.50	0.50
Increm. delay d2	3.0	2.2			4.5			8.3			4.6	2.7
PF factor	1.000	1.000			1.000			1.000			1.000	1.000
Control delay	11.4	10.7			21.1			34.3			28.4	26.3
Lane group LOS	B	B			C			C			C	C
Apprch. delay	10.9			21.1			34.3			27.1		
Approach LOS	B			C			C			C		
Intersec. delay	19.1			Intersection LOS						B		

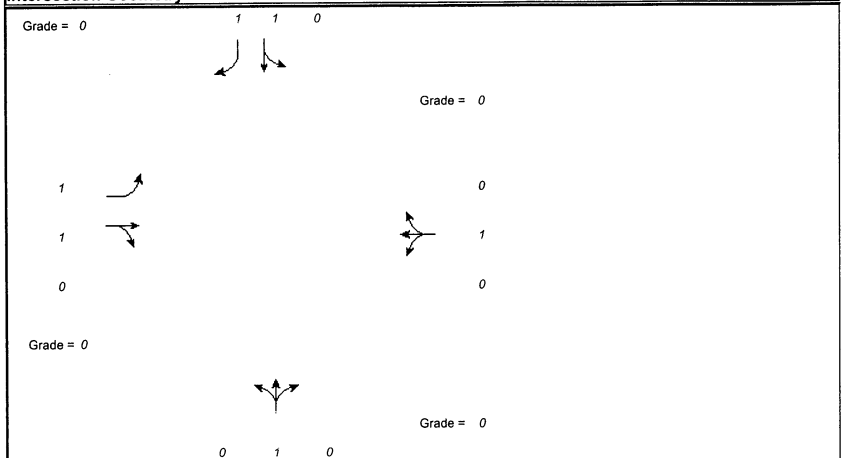
HCS2000™ Version 4.1c

INPUT WORKSHEET

General Information		Site Information	
Analyst	PJR	Intersection	Case2.6pm
Agency or Co.	PRA	Area Type	All other areas
Date Performed	4/14/2005	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case2.6pm*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	382	351	30	37	389	87	14	74	37	85	66	395
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time	2.0	2.0			2.0			2.0			2.0	2.0
Ext. eff. green	2.0	2.0			2.0			2.0			2.0	2.0
Arrival type	3	3			3			3			3	3
Unit Extension	3.0	3.0			3.0			3.0			3.0	3.0
Ped/Bike/RTOR Volume	0		0	0		0	0		0	0		200
Lane Width	12.0	12.0			12.0			12.0			12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0			0			0			0	0

	EB Only	EW Perm	03	04	NS Perm	06	07	08
Timing	G = 18.0	G = 39.0	G =	G =	G = 16.0	G =	G =	G =
	Y =	Y = 3.5	Y =	Y =	Y = 3.5	Y =	Y =	Y =

Duration of Analysis (hrs) = 0.25 Cycle Length C = 80.0

HCS2000™ Version 4.1c

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case2.6pm*

Capacity Analysis

	EB		WB	NB	SB	
Lane group	L	TR	LTR	LTR	LT	R
Adj. flow rate	424	423	570	139	167	217
Satflow rate	1805	1878	1765	1711	1332	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.71	0.71	0.49	0.20	0.20	0.20
Lane group cap.	669	1338	860	342	266	323
v/c ratio	0.63	0.32	0.66	0.41	0.63	0.67
Flow ratio		0.23	0.32	0.08	0.13	0.13
Crit. lane group	N	N	Y	N	N	Y
Sum flow ratios	0.64					
Lost time/cycle	10.50					
Critical v/c ratio	0.74					

Lane Group Capacity, Control Delay, and LOS Determination

	EB		WB	NB	SB	
Lane group	L	TR	LTR	LTR	LT	R
Adj. flow rate	424	423	570	139	167	217
Lane group cap.	669	1338	860	342	266	323
v/c ratio	0.63	0.32	0.66	0.41	0.63	0.67
Green ratio	0.71	0.71	0.49	0.20	0.20	0.20
Unif. delay d1	7.3	4.3	15.5	27.9	29.3	29.6
Delay factor k	0.50	0.50	0.50	0.50	0.50	0.50
Increm. delay d2	4.5	0.6	4.0	3.6	10.7	10.6
PF factor	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	11.8	4.9	19.5	31.4	40.0	40.2
Lane group LOS	B	A	B	C	D	D
Apprch. delay	8.4		19.5	31.4	40.1	
Approach LOS	A		B	C	D	
Intersec. delay	19.6		Intersection LOS		B	

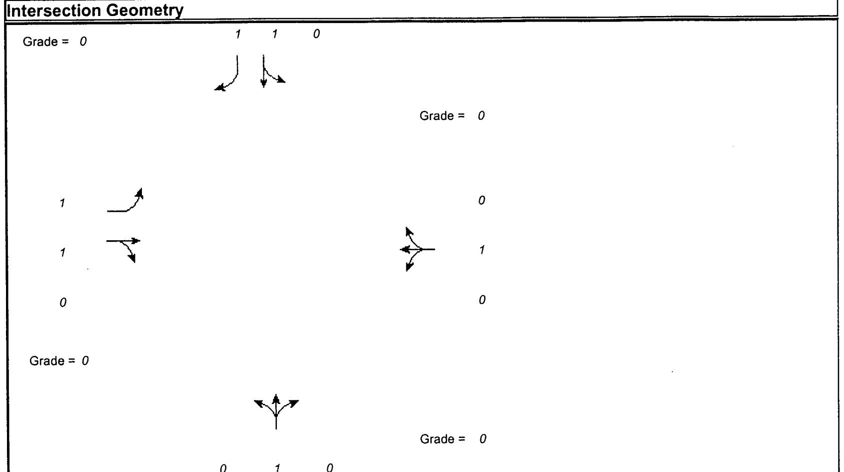
HCS2000™ Version 4.1c

INPUT WORKSHEET

General Information		Site Information	
Analyst	PJR	Intersection	Case3.6am
Agency or Co.	PRA	Area Type	All other areas
Date Performed	4/14/2005	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case3.6am*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	270	656	23	51	335	66	27	86	179	72	39	260
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time	2.0	2.0			2.0			2.0			2.0	2.0
Ext. eff. green	2.0	2.0			2.0			2.0			2.0	2.0
Arrival type	3	3			3			3			3	3
Unit Extension	3.0	3.0			3.0			3.0			3.0	3.0
Ped/Bike/RTOR Volume	0		0	0		0	0		0	0		100
Lane Width	12.0	12.0			12.0			12.0			12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0			0			0			0	0

	EB Only	EW Perm	03	04	NS Perm	06	07	08
Timing	G = 14.0	G = 37.0	G =	G =	G = 22.0	G =	G =	G =
	Y =	Y = 3.5	Y =	Y =	Y = 3.5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 80.0		

HCS2000™ Version 4.1c

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case3.6am*

Capacity Analysis

	EB		WB	NB	SB	
Lane group	L	TR	LTR	LTR	LT	R
Adj. flow rate	300	755	502	325	123	178
Satflow rate	1805	1890	1612	1687	1047	1615
Lost time	2.0	2.0	2.0	2.0	2.0	2.0
Green ratio	0.64	0.64	0.46	0.28	0.28	0.28
Lane group cap.	590	1205	746	464	288	444
v/c ratio	0.51	0.63	0.67	0.70	0.43	0.40
Flow ratio		0.40	0.31	0.19	0.12	0.11
Crit. lane group	N	N	Y	Y	N	N
Sum flow ratios	0.64					
Lost time/cycle	10.50					
Critical v/c ratio	0.74					

Lane Group Capacity, Control Delay, and LOS Determination

	EB		WB	NB	SB	
Lane group	L	TR	LTR	LTR	LT	R
Adj. flow rate	300	755	502	325	123	178
Lane group cap.	590	1205	746	464	288	444
v/c ratio	0.51	0.63	0.67	0.70	0.43	0.40
Green ratio	0.64	0.64	0.46	0.28	0.28	0.28
Unif. delay d1	8.5	8.8	16.8	26.0	23.8	23.6
Delay factor k	0.50	0.50	0.50	0.50	0.50	0.50
Increm. delay d2	3.1	2.5	4.8	8.5	4.6	2.7
PF factor	1.000	1.000	1.000	1.000	1.000	1.000
Control delay	11.6	11.2	21.6	34.6	28.4	26.3
Lane group LOS	B	B	C	C	C	C
Apprch. delay	11.3		21.6	34.6	27.2	
Approach LOS	B		C	C	C	
Intersec. delay	19.3		Intersection LOS		B	

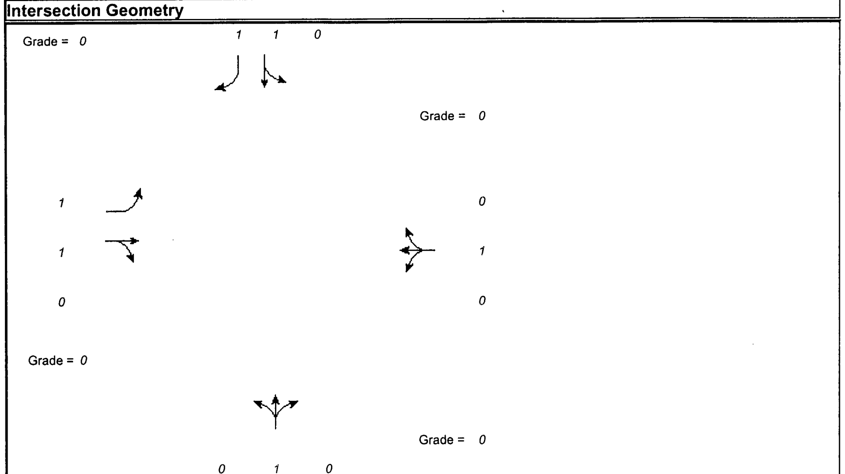
HCS2000™ Version 4.1c

INPUT WORKSHEET

General Information		Site Information	
Analyst	PJR	Intersection	Case3.6pm
Agency or Co.	PRA	Area Type	All other areas
Date Performed	4/14/2005	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case3.6pm*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	384	362	34	37	394	87	46	74	37	85	66	403
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup lost time	2.0	2.0			2.0			2.0			2.0	2.0
Ext. eff. green	2.0	2.0			2.0			2.0			2.0	2.0
Arrival type	3	3			3			3			3	3
Unit Extension	3.0	3.0			3.0			3.0			3.0	3.0
Ped/Bike/RTOR Volume	0		0	0		0	0		0	0		200
Lane Width	12.0	12.0			12.0			12.0			12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0			0			0			0	0

	EB Only	EW Perm	03	04	NS Perm	06	07	08
Timing	G = 18.0	G = 39.0	G =	G =	G = 16.0	G =	G =	G =
	Y =	Y = 3.5	Y =	Y =	Y = 3.5	Y =	Y =	Y =

Duration of Analysis (hrs) = 0.25 | Cycle Length C = 80.0

HCS2000™ Version 4.1c

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case3.6pm*

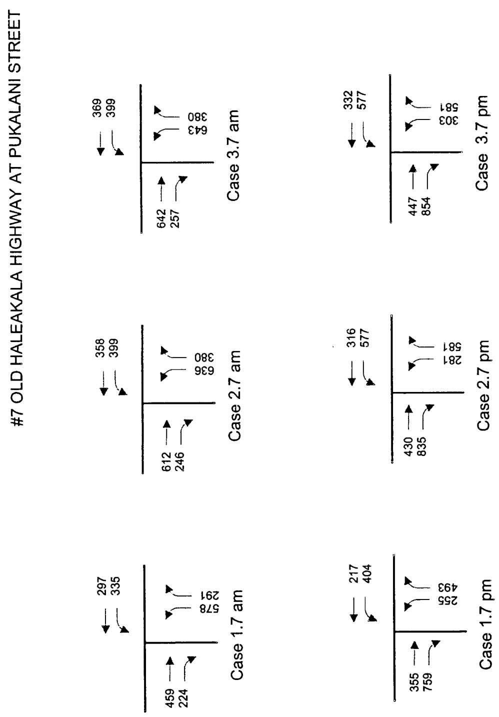
Capacity Analysis

	EB			WB		NB		SB	
Lane group	L	TR		LTR		LTR		LT	R
Adj. flow rate	427	440		576		174		167	226
Satflow rate	1805	1875		1764		1185		1272	1615
Lost time	2.0	2.0		2.0		2.0		2.0	2.0
Green ratio	0.71	0.71		0.49		0.20		0.20	0.20
Lane group cap.	666	1336		860		237		254	323
v/c ratio	0.64	0.33		0.67		0.73		0.66	0.70
Flow ratio		0.23		0.33		0.15		0.13	0.14
Crit. lane group	N	N		Y		Y		N	N
Sum flow ratios	0.66								
Lost time/cycle	10.50								
Critical v/c ratio	0.76								

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB		NB		SB	
Lane group	L	TR		LTR		LTR		LT	R
Adj. flow rate	427	440		576		174		167	226
Lane group cap.	666	1336		860		237		254	323
v/c ratio	0.64	0.33		0.67		0.73		0.66	0.70
Green ratio	0.71	0.71		0.49		0.20		0.20	0.20
Unif. delay d1	7.4	4.3		15.6		30.0		29.5	29.8
Delay factor k	0.50	0.50		0.50		0.50		0.50	0.50
Increm. delay d2	4.7	0.7		4.1		18.2		12.6	11.9
PF factor	1.000	1.000		1.000		1.000		1.000	1.000
Control delay	12.1	5.0		19.7		48.2		42.1	41.7
Lane group LOS	B	A		B		D		D	D
Apprch. delay	8.5			19.7		48.2		41.8	
Approach LOS	A			B		D		D	
Intersec. delay	21.7			Intersection LOS				C	

HCS2000™ Version 4.1c



Part 2.1

Trip Assignment Worksheet

Pukalani Makai TIAR
March 2005

INTERSECTION NO 7
INTERSECTION OF Old Haleakala Highway at Pukalani Street

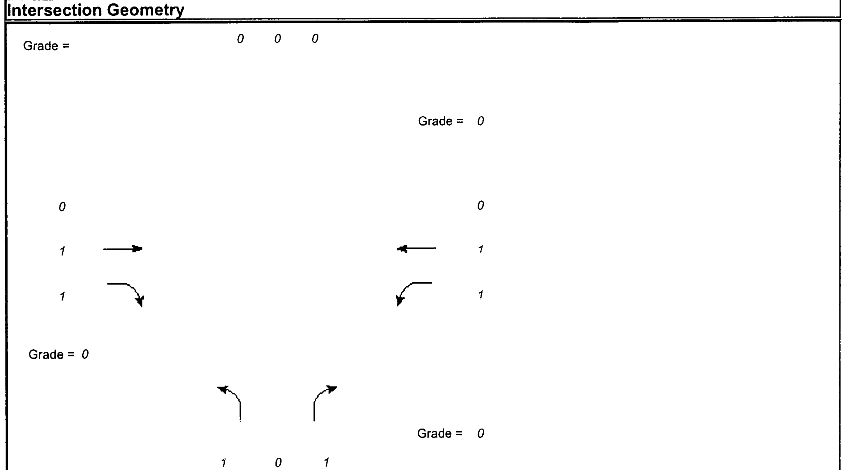
			Case 1						Case 2												Case 3 Cumulative Plus Project	
	Approach		Existing		Background Growth		Related Project Traffic		Cumulative		AM Distribution		AM Assignment		PM Distribution		PM Assignment		Project Trips			
No	& Mvt		AM	PM	AM	PM	AM	PM	AM	PM	% In	% Out	In	Out	% In	% Out	In	Out	AM	PM	AM	PM
1	N-	RT	0	0	0	0			0	0			0	0			0	0	0	0	0	0
2		TH	0	0	0	0			0	0			0	0			0	0	0	0	0	0
3		LT	0	0	0	0			0	0			0	0			0	0	0	0	0	0
4	E-	RT	0	0	0	0			0	0			0	0			0	0	0	0	0	0
5		TH	297	217	30	22	31	77	358	316	35%		11	0	15%		16	0	11	16	369	332
6		LT	335	404	34	40	30	133	399	577			0	0			0	0	0	0	399	577
7	S-	RT	291	493	29	49	60	39	380	581			0	0			0	0	0	0	380	581
8		TH	0	0	0	0			0	0			0	0			0	0	0	0	0	0
9		LT	578	255	58	26			636	281	21%		7	0	20%		22	0	7	22	643	303
10	W-	RT	224	759	22	76			246	835		12%	0	11		32%	0	19	11	19	257	854
11		TH	459	355	46	36	107	39	612	430		32%	0	30		28%	0	17	30	17	642	447
12		LT	0	0	0	0			0	0			0	0			0	0	0	0	0	0
TOTAL			2184	2483	219	249	228	288	2631	3020			18	41			38	36	59	74	2690	3094
Approach Totals																						
From North			0	0	0	0	0	0	0	0			0	0			0	0	0	0	0	0
From East			632	621	64	62	61	210	757	893			11	0			16	0	11	16	768	909
From South			869	748	87	75	60	39	1016	862			7	0			22	0	7	22	1023	884
From West			683	1114	68	112	107	39	858	1265			0	41			0	36	41	36	899	1301
Total			2184	2483	219	249	228	288	2631	3020			18	41			38	36	59	74	2690	3094
Departure Totals																						
To North			0	0	0	0	0	0	0	0			0	0			0	0	0	0	0	0
To East			750	848	75	85	167	78	992	1011			0	30			0	17	30	17	1022	1028
To South			559	1163	56	116	30	133	645	1412			0	11			0	19	11	19	656	1431
To West			875	472	88	48	31	77	994	597			18	0			38	0	18	38	1012	635
Total			2184	2483	219	249	228	288	2631	3020			18	41			38	36	59	74	2690	3094
Leg Totals																						
North			0	0	0	0	0	0	0	0			0	0			0	0	0	0	0	0
East			1382	1469	139	147	228	288	1749	1904			11	30			16	17	41	33	1790	1937
South			1428	1911	143	191	90	172	1661	2274			7	11			22	19	18	41	1679	2315
West			1558	1586	156	160	138	116	1852	1862			18	41			38	36	59	74	1911	1936
Total			4368	4966	438	498	456	576	5262	6040			36	82			76	72	118	148	5380	6188

INPUT WORKSHEET

General Information		Site Information	
Analyst	PJR	Intersection	Case1.7am
Agency or Co.	PRA	Area Type	All other areas
Date Performed	4/14/2005	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case1.7am*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)		459	224	335	297		578		291			
% Heavy veh		0	0	0	0		0		0			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
Actuated (P/A)		P	P	P	P		P		P			
Startup lost time		2.0	2.0	2.0	2.0		2.0		2.0			
Ext. eff. green		2.0	2.0	2.0	2.0		2.0		2.0			
Arrival type		3	3	3	3		3		3			
Unit Extension		3.0	3.0	3.0	3.0		3.0		3.0			
Ped/Bike/RTOR Volume	0		125				0		125	0		
Lane Width		12.0	12.0	12.0	12.0		12.0		12.0			
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr		0	0	0	0		0		0			

	WB Only	EW Perm	03	04	NB Only	06	07	08
Timing	G = 17.0	G = 28.0	G =	G =	G = 28.0	G =	G =	G =
	Y =	Y = 3.5	Y =	Y =	Y = 3.5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25					Cycle Length C = 80.0			

HCS2000™ Version 4.1c

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case1.7am*

Capacity Analysis

	EB			WB			NB			SB		
Lane group		T	R	L	T		L		R			
Adj. flow rate		510	110	372	330		642		184			
Satflow rate		1900	1615	1805	1900		1805		1615			
Lost time		2.0	2.0	2.0	2.0		2.0		2.0			
Green ratio		0.35	0.74	0.56	0.56		0.35		0.61			
Lane group cap.		665	1201	442	1069		632		979			
v/c ratio		0.77	0.09	0.84	0.31		1.02		0.19			
Flow ratio		0.27	0.07		0.17		0.36		0.11			
Crit. lane group		Y	N	N	N		Y	N	N		N	
Sum flow ratios	0.80											
Lost time/cycle	10.50											
Critical v/c ratio	0.92											

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Lane group		T	R	L	T		L		R			
Adj. flow rate		510	110	372	330		642		184			
Lane group cap.		665	1201	442	1069		632		979			
v/c ratio		0.77	0.09	0.84	0.31		1.02		0.19			
Green ratio		0.35	0.74	0.56	0.56		0.35		0.61			
Unif. delay d1		23.1	2.8	16.0	9.3		26.0		7.0			
Delay factor k		0.50	0.50	0.50	0.50		0.50		0.50			
Increm. delay d2		8.3	0.2	17.4	0.8		39.8		0.4			
PF factor		1.000	1.000	1.000	1.000		1.000		1.000			
Control delay		31.4	3.0	33.4	10.0+		65.8		7.4			
Lane group LOS		C	A	C	B		E		A			
Apprch. delay	26.3			22.4			52.8					
Approach LOS	C			C			D					
Intersec. delay	35.2			Intersection LOS						D		

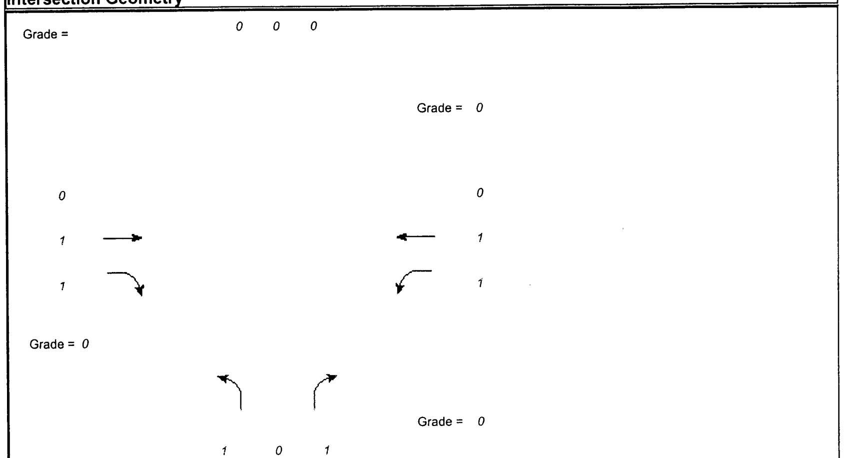
HCS2000™ Version 4.1c

INPUT WORKSHEET

General Information		Site Information	
Analyst	PJR	Intersection	Case1.7pm
Agency or Co.	PRA	Area Type	All other areas
Date Performed	4/14/2005	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case1.7pm*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)		355	759	404	217		255		493			
% Heavy veh		0	0	0	0		0		0			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
Actuated (P/A)		P	P	P	P		P		P			
Startup lost time		2.0	2.0	2.0	2.0		2.0		2.0			
Ext. eff. green		2.0	2.0	2.0	2.0		2.0		2.0			
Arrival type		3	3	3	3		3		3			
Unit Extension		3.0	3.0	3.0	3.0		3.0		3.0			
Ped/Bike/RTOR Volume	0		150				0		200	0		
Lane Width		12.0	12.0	12.0	12.0		12.0		12.0			
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr		0	0	0	0		0		0			

	WB Only	EW Perm	03	04	NB Only	06	07	08
Timing	G = 27.0	G = 28.0	G =	G =	G = 20.0	G =	G =	G =
	Y =	Y = 3.5	Y =	Y =	Y = 3.5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 82.0		

HCS2000™ Version 4.1c

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case1.7pm*

Capacity Analysis

	EB			WB			NB			SB		
Lane group		T	R	L	T		L		R			
Adj. flow rate		394	677	449	241		283		326			
Satflow rate		1900	1615	1805	1900		1805		1615			
Lost time		2.0	2.0	2.0	2.0		2.0		2.0			
Green ratio		0.34	0.63	0.67	0.67		0.24		0.62			
Lane group cap.		649	1014	701	1274		440		995			
v/c ratio		0.61	0.67	0.64	0.19		0.64		0.33			
Flow ratio		0.21	0.42		0.13		0.16		0.20			
Crit. lane group		N	Y	N	N		N	N	N		N	
Sum flow ratios	0.67											
Lost time/cycle	7.00											
Critical v/c ratio	0.73											

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Lane group		T	R	L	T		L		R			
Adj. flow rate		394	677	449	241		283		326			
Lane group cap.		649	1014	701	1274		440		995			
v/c ratio		0.61	0.67	0.64	0.19		0.64		0.33			
Green ratio		0.34	0.63	0.67	0.67		0.24		0.62			
Unif. delay d1		22.4	9.8	9.1	5.1		27.8		7.6			
Delay factor k		0.50	0.50	0.50	0.50		0.50		0.50			
Increm. delay d2		4.2	3.5	4.5	0.3		7.1		0.9			
PF factor		1.000	1.000	1.000	1.000		1.000		1.000			
Control delay		26.6	13.3	13.5	5.4		34.9		8.5			
Lane group LOS		C	B	B	A		C		A			
Apprch. delay	18.2			10.7			20.7					
Approach LOS	B			B			C					
Intersec. delay	16.6			Intersection LOS						B		

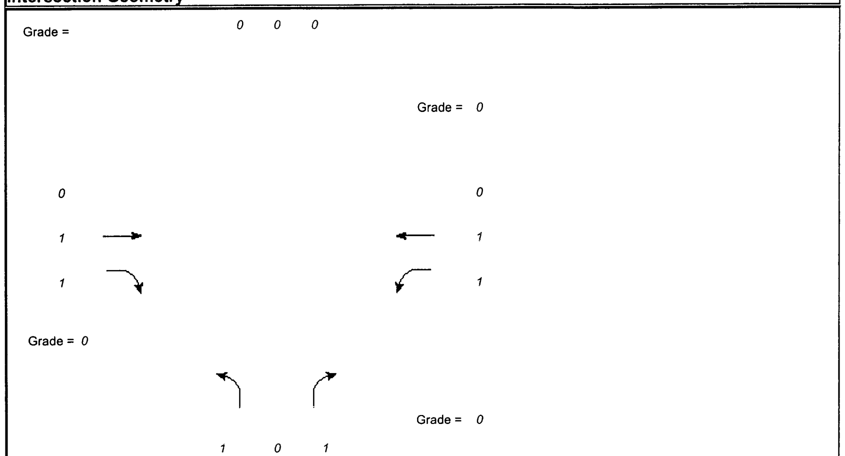
HCS2000™ Version 4.1c

INPUT WORKSHEET

General Information		Site Information	
Analyst	*PJR*	Intersection	*Case2.7am*
Agency or Co.	*PRA*	Area Type	*All other areas*
Date Performed	*4/14/2005*	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case2.7am*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)		612	246	399	358		636		380			
% Heavy veh		0	0	0	0		0		0			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
Actuated (P/A)		P	P	P	P		P		P			
Startup lost time		2.0	2.0	2.0	2.0		2.0		2.0			
Ext. eff. green		2.0	2.0	2.0	2.0		2.0		2.0			
Arrival type		3	3	3	3		3		3			
Unit Extension		3.0	3.0	3.0	3.0		3.0		3.0			
Ped/Bike/RTOR Volume	0		125				0		125	0		
Lane Width		12.0	12.0	12.0	12.0		12.0		12.0			
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr		0	0	0	0		0		0			

	WB Only	EW Perm	03	04	NB Only	06	07	08
Timing	G = 17.0	G = 28.0	G =	G =	G = 28.0	G =	G =	G =
	Y =	Y = 3.5	Y =	Y =	Y = 3.5	Y =	Y =	Y =

Duration of Analysis (hrs) = 0.25 | Cycle Length C = 80.0

HCS2000™ Version 4.1c

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case2.7am*

Capacity Analysis

	EB			WB			NB			SB		
Lane group		T	R	L	T		L		R			
Adj. flow rate		680	134	443	398		707		283			
Satflow rate		1900	1615	1805	1900		1805		1615			
Lost time		2.0	2.0	2.0	2.0		2.0		2.0			
Green ratio		0.35	0.74	0.56	0.56		0.35		0.61			
Lane group cap.		665	1201	411	1069		632		979			
v/c ratio		1.02	0.11	1.08	0.37		1.12		0.29			
Flow ratio		0.36	0.08		0.21		0.39		0.18			
Crit. lane group		N	N	N	N		Y	N	N		N	
Sum flow ratios	1.09											
Lost time/cycle	7.00											
Critical v/c ratio	1.19											

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Lane group		T	R	L	T		L		R			
Adj. flow rate		680	134	443	398		707		283			
Lane group cap.		665	1201	411	1069		632		979			
v/c ratio		1.02	0.11	1.08	0.37		1.12		0.29			
Green ratio		0.35	0.74	0.56	0.56		0.35		0.61			
Unif. delay d1		26.0	2.9	22.6	9.7		26.0		7.5			
Delay factor k		0.50	0.50	0.50	0.50		0.50		0.50			
Increm. delay d2		40.7	0.2	66.8	1.0		73.0		0.7			
PF factor		1.000	1.000	1.000	1.000		1.000		1.000			
Control delay		66.7	3.1	89.4	10.7		99.0		8.3			
Lane group LOS		E	A	F	B		F		A			
Apprch. delay	56.2			52.2			73.1					
Approach LOS	E			D			E					
Intersec. delay	61.2			Intersection LOS						E		

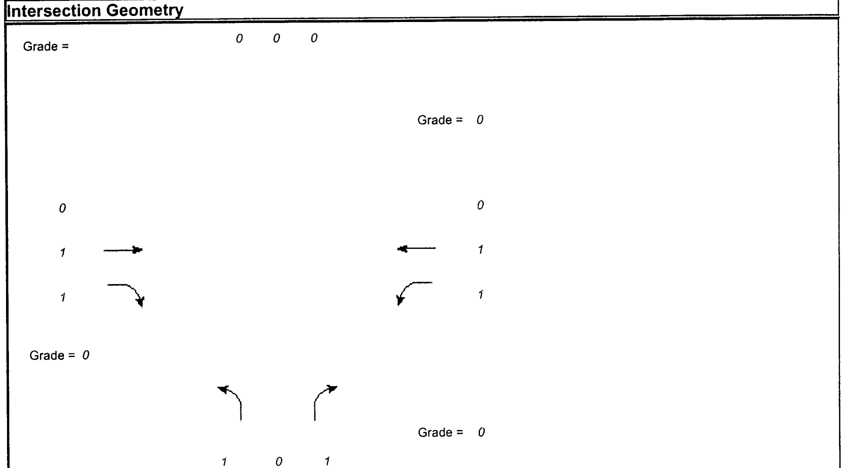
HCS2000™ Version 4.1c

INPUT WORKSHEET

General Information		Site Information	
Analyst	PJR	Intersection	Case2.7pm
Agency or Co.	PRA	Area Type	All other areas
Date Performed	4/14/2005	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case2.7pm*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)		430	835	577	316		281		581			
% Heavy veh		0	0	0	0		0		0			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
Actuated (P/A)		P	P	P	P		P		P			
Startup lost time		2.0	2.0	2.0	2.0		2.0		2.0			
Ext. eff. green		2.0	2.0	2.0	2.0		2.0		2.0			
Arrival type		3	3	3	3		3		3			
Unit Extension		3.0	3.0	3.0	3.0		3.0		3.0			
Ped/Bike/RTOR Volume	0		150				0		200	0		
Lane Width		12.0	12.0	12.0	12.0		12.0		12.0			
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr		0	0	0	0		0		0			

	WB Only	EW Perm	03	04	NB Only	06	07	08
Timing	G = 27.0	G = 28.0	G =	G =	G = 20.0	G =	G =	G =
	Y =	Y = 3.5	Y =	Y =	Y = 3.5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 82.0		

HCS2000™ Version 4.1c

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case2.7pm*

Capacity Analysis

	EB			WB			NB			SB		
Lane group	T	R		L	T		L		R			
Adj. flow rate	478	761		641	351		312		423			
Satflow rate	1900	1615		1805	1900		1805		1615			
Lost time	2.0	2.0		2.0	2.0		2.0		2.0			
Green ratio	0.34	0.63		0.67	0.67		0.24		0.62			
Lane group cap.	649	1014		658	1274		440		995			
v/c ratio	0.74	0.75		0.97	0.28		0.71		0.43			
Flow ratio	0.25	0.47			0.18		0.17		0.26			
Crit. lane group	N	N		N	N		Y	N	N		N	
Sum flow ratios	0.79											
Lost time/cycle	7.00											
Critical v/c ratio	0.87											

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Lane group	T	R		L	T		L		R			
Adj. flow rate	478	761		641	351		312		423			
Lane group cap.	649	1014		658	1274		440		995			
v/c ratio	0.74	0.75		0.97	0.28		0.71		0.43			
Green ratio	0.34	0.63		0.67	0.67		0.24		0.62			
Unif. delay d1	23.8	10.7		19.7	5.5		28.3		8.2			
Delay factor k	0.50	0.50		0.50	0.50		0.50		0.50			
Increm. delay d2	7.3	5.1		29.3	0.5		9.3		1.3			
PF factor	1.000	1.000		1.000	1.000		1.000		1.000			
Control delay	31.1	15.8		49.0	6.0		37.7		9.5			
Lane group LOS	C	B		D	A		D		A			
Apprch. delay	21.7			33.8			21.5					
Approach LOS	C			C			C					
Intersec. delay	25.7			Intersection LOS						C		

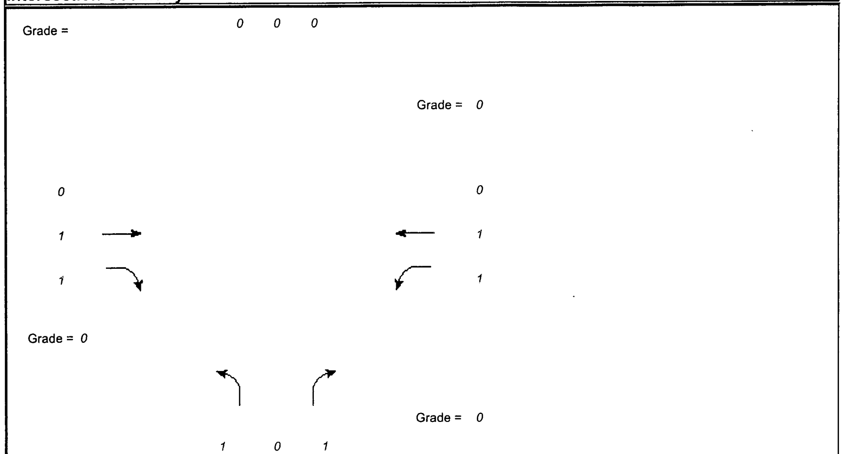
HCS2000™ Version 4.1c

INPUT WORKSHEET

General Information		Site Information	
Analyst	PJR	Intersection	Case3.7am
Agency or Co.	PRA	Area Type	All other areas
Date Performed	4/14/2005	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case3.7am*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)		642	257	399	369		643		380			
% Heavy veh		0	0	0	0		0		0			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
Actuated (P/A)		P	P	P	P		P		P			
Startup lost time		2.0	2.0	2.0	2.0		2.0		2.0			
Ext. eff. green		2.0	2.0	2.0	2.0		2.0		2.0			
Arrival type		3	3	3	3		3		3			
Unit Extension		3.0	3.0	3.0	3.0		3.0		3.0			
Ped/Bike/RTOR Volume	0		125				0		125	0		
Lane Width		12.0	12.0	12.0	12.0		12.0		12.0			
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr		0	0	0	0		0		0			

	WB Only	EW Perm	03	04	NB Only	06	07	08
Timing	G = 17.0	G = 28.0	G =	G =	G = 28.0	G =	G =	G =
	Y =	Y = 3.5	Y =	Y =	Y = 3.5	Y =	Y =	Y =

Duration of Analysis (hrs) = 0.25 — Cycle Length C = 80.0

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case3.7am*

Capacity Analysis

	EB		WB			NB			SB		
Lane group	T	R	L	T		L		R			
Adj. flow rate	713	147	443	410		714		283			
Satflow rate	1900	1615	1805	1900		1805		1615			
Lost time	2.0	2.0	2.0	2.0		2.0		2.0			
Green ratio	0.35	0.74	0.56	0.56		0.35		0.61			
Lane group cap.	665	1201	411	1069		632		979			
v/c ratio	1.07	0.12	1.08	0.38		1.13		0.29			
Flow ratio	0.38	0.09		0.22		0.40		0.18			
Crit. lane group	N	N	N	N		Y	N	N		N	
Sum flow ratios	1.09										
Lost time/cycle	7.00										
Critical v/c ratio	1.19										

Lane Group Capacity, Control Delay, and LOS Determination

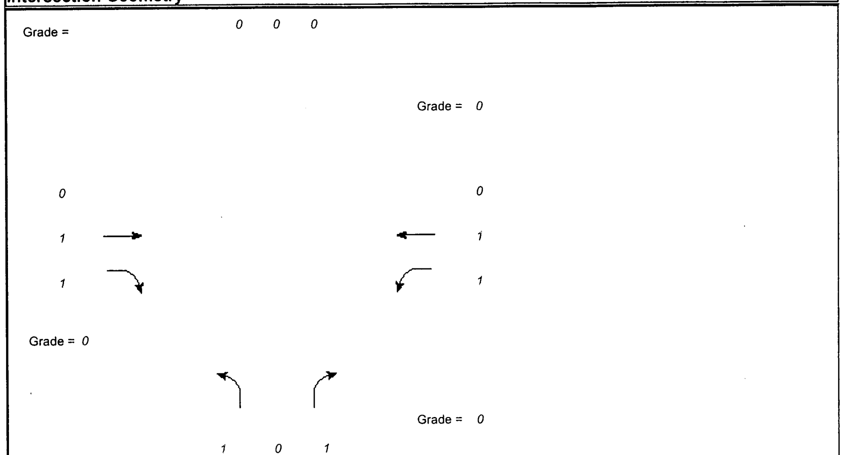
	EB		WB			NB			SB		
Lane group	T	R	L	T		L		R			
Adj. flow rate	713	147	443	410		714		283			
Lane group cap.	665	1201	411	1069		632		979			
v/c ratio	1.07	0.12	1.08	0.38		1.13		0.29			
Green ratio	0.35	0.74	0.56	0.56		0.35		0.61			
Unif. delay d1	26.0	2.9	22.7	9.8		26.0		7.5			
Delay factor k	0.50	0.50	0.50	0.50		0.50		0.50			
Increm. delay d2	55.9	0.2	66.8	1.0		77.2		0.7			
PF factor	1.000	1.000	1.000	1.000		1.000		1.000			
Control delay	81.9	3.1	89.5	10.8		103.2		8.3			
Lane group LOS	F	A	F	B		F		A			
Apprch. delay	68.4		51.7			76.2					
Approach LOS	E		D			E					
Intersec. delay	66.0		Intersection LOS						E		

INPUT WORKSHEET

General Information		Site Information	
Analyst	PJR	Intersection	Case3.7pm
Agency or Co.	PRA	Area Type	All other areas
Date Performed	4/14/2005	Jurisdiction	
Time Period		Analysis Year	

Project Description *Kauhale Lani Case3.7pm*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)		447	854	577	332		303		581			
% Heavy veh		0	0	0	0		0		0			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
Actuated (P/A)		P	P	P	P		P		P			
Startup lost time		2.0	2.0	2.0	2.0		2.0		2.0			
Ext. eff. green		2.0	2.0	2.0	2.0		2.0		2.0			
Arrival type		3	3	3	3		3		3			
Unit Extension		3.0	3.0	3.0	3.0		3.0		3.0			
Ped/Bike/RTOR Volume	0		150				0		200	0		
Lane Width		12.0	12.0	12.0	12.0		12.0		12.0			
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr		0	0	0	0		0		0			

	WB Only	EW Perm	03	04	NB Only	06	07	08
Timing	G = 27.0	G = 28.0	G =	G =	G = 20.0	G =	G =	G =
	Y =	Y = 3.5	Y =	Y =	Y = 3.5	Y =	Y =	Y =

Duration of Analysis (hrs) = 0.25 | Cycle Length C = 82.0

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1c

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kauhale Lani Case3.7pm*

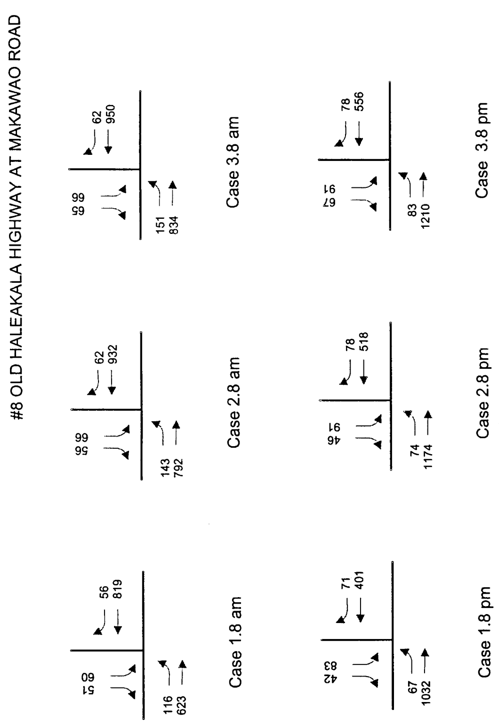
Capacity Analysis

	EB			WB			NB			SB		
Lane group		T	R	L	T		L		R			
Adj. flow rate		497	782	641	369		337		423			
Satflow rate		1900	1615	1805	1900		1805		1615			
Lost time		2.0	2.0	2.0	2.0		2.0		2.0			
Green ratio		0.34	0.63	0.67	0.67		0.24		0.62			
Lane group cap.		649	1014	649	1274		440		995			
v/c ratio		0.77	0.77	0.99	0.29		0.77		0.43			
Flow ratio		0.26	0.48		0.19		0.19		0.26			
Crit. lane group		N	N	N	N		Y	N	N		N	
Sum flow ratios	0.83											
Lost time/cycle	7.00											
Critical v/c ratio	0.91											

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Lane group		T	R	L	T		L		R			
Adj. flow rate		497	782	641	369		337		423			
Lane group cap.		649	1014	649	1274		440		995			
v/c ratio		0.77	0.77	0.99	0.29		0.77		0.43			
Green ratio		0.34	0.63	0.67	0.67		0.24		0.62			
Unif. delay d1		24.1	11.0	20.5	5.5		28.8		8.2			
Delay factor k		0.50	0.50	0.50	0.50		0.50		0.50			
Increm. delay d2		8.4	5.7	32.4	0.6		12.0		1.3			
PF factor		1.000	1.000	1.000	1.000		1.000		1.000			
Control delay		32.5	16.7	52.9	6.1		40.8		9.5			
Lane group LOS		C	B	D	A		D		A			
Apprch. delay	22.8			35.8			23.4					
Approach LOS	C			D			C					
Intersec. delay	27.3			Intersection LOS						C		

HCS2000™ Copyright © 2000 University of Florida, All Rights Reserved Version 4.1c



Part
Trip Assigr
Pukalani Makai TIAR
March 2005

INTERSECTION NO 8
INTERSECTION OF Old Haleakala Highway at Makawao Road

No	Approach & Mvt	Case 1 Existing AM	Existing PM	Background Growth AM	Background Growth PM	Related Project Traffic AM	Related Project Traffic PM	Case 2 Cumulative AM	Cumulative PM	AM Distribution % In	AM Distribution % Out	AM Assignment In	AM Assignment Out	PM Distribution % In	PM Distribution % Out	PM Assignment In	PM Assignment Out	Project Trips AM	Project Trips PM	Case 3 Cumulative Plus Project AM	Cumulative Plus Project PM
1	N- RT	51	42	5	4			56	46	29%		9	0	19%		21	0	9	21	65	67
2	TH	0	0	0	0			0	0			0	0			0	0	0	0	0	0
3	LT	60	83	6	8			66	91			0	0			0	0	0	0	66	91
4	E- RT	56	71	6	7			62	78			0	0			0	0	0	0	62	78
5	TH	819	401	82	40	31	77	932	518	56%		18	0	35%		38	0	18	38	950	556
6	LT	0	0	0	0			0	0			0	0			0	0	0	0	0	0
7	S- RT	0	0	0	0			0	0			0	0			0	0	0	0	0	0
8	TH	0	0	0	0			0	0			0	0			0	0	0	0	0	0
9	LT	0	0	0	0			0	0			0	0			0	0	0	0	0	0
10	W- RT	0	0	0	0			0	0			0	0			0	0	0	0	0	0
11	TH	623	1032	62	103	107	39	792	1174		44%	0	42		60%	0	36	42	36	834	1210
12	LT	116	67	12	7	15		143	74		8%	0	8		15%	0	9	8	9	151	83
TOTAL		1725	1696	173	169	153	116	2051	1981			27	50			59	45	77	104	2128	2085
Approach Totals																					
From North		111	125	11	12	0	0	122	137			9	0			21	0	9	21	131	158
From East		875	472	88	47	31	77	994	596			18	0			38	0	18	38	1012	634
From South		0	0	0	0	0	0	0	0			0	0			0	0	0	0	0	0
From West		739	1099	74	110	122	39	935	1248			0	50			0	45	50	45	985	1293
Total		1725	1696	173	169	153	116	2051	1981			27	50			59	45	77	104	2128	2085
Departure Totals																					
To North		172	138	18	14	15	0	205	152			0	8			0	9	8	9	213	161
To East		683	1115	68	111	107	39	858	1265			0	42			0	36	42	36	900	1301
To South		0	0	0	0	0	0	0	0			0	0			0	0	0	0	0	0
To West		870	443	87	44	31	77	988	564			27	0			59	0	27	59	1015	623
Total		1725	1696	173	169	153	116	2051	1981			27	50			59	45	77	104	2128	2085
Leg Totals																					
North		283	263	29	26	15	0	327	289			9	8			21	9	17	30	344	319
East		1558	1587	156	158	138	116	1852	1861			18	42			38	36	60	74	1912	1935
South		0	0	0	0	0	0	0	0			0	0			0	0	0	0	0	0
West		1609	1542	161	154	153	116	1923	1812			27	50			59	45	77	104	2000	1916
Total		3450	3392	346	338	306	232	4102	3962			54	100			118	90	154	208	4256	4170

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	PJR
Agency/Co.	PRA
Date Performed	4/6/2005
Analysis Time Period	

Site Information

Intersection	Case1.8am
Jurisdiction	
Analysis Year	

Project Description Kauhale Lani
East/West Street: Old Haleakala Highway
North/South Street: Makani Road
Intersection Orientation: East-West
Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	116	623	0	0	819	56
Peak-Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Hourly Flow Rate, HFR	122	655	0	0	862	58
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	1	0	0	1	1
Configuration	L	T			T	R
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	.R
Volume	0	0	0	60	0	51
Peak-Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Hourly Flow Rate, HFR	0	0	0	63	0	53
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	1	0	1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		R
v (vph)	122					63		53
C (m) (vph)	750					79		358
v/c	0.16					0.80		0.15
95% queue length	0.58					3.96		0.51
Control Delay	10.7					140.8		16.8
LOS	B					F		C
Approach Delay	--	--				84.1		
Approach LOS	--	--				F		

HCS2000™ Version 4.1c

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	PJR
Agency/Co.	PRA
Date Performed	4/6/2005
Analysis Time Period	

Site Information

Intersection	Case2.8am
Jurisdiction	
Analysis Year	

Project Description Kauhale Lani
East/West Street: Old Haleakala Highway
North/South Street: Makani Road
Intersection Orientation: East-West
Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	143	792	0	0	932	62
Peak-Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Hourly Flow Rate, HFR	150	833	0	0	981	65
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	1	0	0	1	1
Configuration	L	T			T	R
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	66	0	56
Peak-Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Hourly Flow Rate, HFR	0	0	0	69	0	58
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	1	0	1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		R
v (vph)	150					69		58
C (m) (vph)	673					44		305
v/c	0.22					1.57		0.19
95% queue length	0.85					6.88		0.69
Control Delay	11.9					486.8		19.6
LOS	B					F		C
Approach Delay	--	--				273.4		
Approach LOS	--	--				F		

HCS2000™ Version 4.1c

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	PJR
Agency/Co.	PRA
Date Performed	4/6/2005
Analysis Time Period	

Site Information

Intersection	Case3.8am
Jurisdiction	
Analysis Year	

Project Description *Kauhale Lani*
East/West Street: *Old Haleakala Highway* | North/South Street: *Makani Road*
Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	151	834	0	0	950	62
Peak-Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Hourly Flow Rate, HFR	158	877	0	0	1000	65
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	1	0	0	1	1
Configuration	L	T			T	R
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	66	0	56
Peak-Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Hourly Flow Rate, HFR	0	0	0	69	0	58
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	1	0	1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		R
v (vph)	158					69		58
C (m) (vph)	662					38		298
v/c	0.24					1.82		0.19
95% queue length	0.93					7.38		0.71
Control Delay	12.1					616.6		20.0
LOS	B					F		C
Approach Delay	--	--				344.1		
Approach LOS	--	--				F		

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	PJR
Agency/Co.	PRA
Date Performed	4/6/2005
Analysis Time Period	

Site Information

Intersection	Case1.8pm
Jurisdiction	
Analysis Year	

Project Description *Kauhale Lani*
East/West Street: *Old Haleakala Highway* | North/South Street: *Makani Road*
Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	67	1032	0	0	401	71
Peak-Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Hourly Flow Rate, HFR	70	1086	0	0	422	74
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	1	0	0	1	1
Configuration	L	T			T	R
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	83	0	42
Peak-Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Hourly Flow Rate, HFR	0	0	0	87	0	44
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	1	0	1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		R
v (vph)	70					87		44
C (m) (vph)	1078					103		636
v/c	0.06					0.84		0.07
95% queue length	0.21					4.80		0.22
Control Delay	8.6					125.4		11.1
LOS	A					F		B
Approach Delay	--	--				87.0		
Approach LOS	--	--				F		

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	PJR
Agency/Co.	PRA
Date Performed	4/6/2005
Analysis Time Period	

Site Information

Intersection	Case2.8pm
Jurisdiction	
Analysis Year	

Project Description Kauhale Lani
East/West Street: Old Haleakala Highway
North/South Street: Makani Road
Intersection Orientation: East-West
Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	74	1174	0	0	518	78
Peak-Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Hourly Flow Rate, HFR	77	1235	0	0	545	82
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	1	0	0	1	1
Configuration	L	T			T	R
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	91	0	46
Peak-Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Hourly Flow Rate, HFR	0	0	0	95	0	48
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	1	0	1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		R
v (vph)	77					95		48
C (m) (vph)	965					67		542
v/c	0.08					1.42		0.09
95% queue length	0.26					7.97		0.29
Control Delay	9.1					360.4		12.3
LOS	A					F		B
Approach Delay	--	--				243.6		
Approach LOS	--	--				F		

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	PJR
Agency/Co.	PRA
Date Performed	4/6/2005
Analysis Time Period	

Site Information

Intersection	Case3.8pm
Jurisdiction	
Analysis Year	

Project Description Kauhale Lani
East/West Street: Old Haleakala Highway
North/South Street: Makani Road
Intersection Orientation: East-West
Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	83	1210	0	0	556	78
Peak-Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Hourly Flow Rate, HFR	87	1273	0	0	585	82
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	1	0	0	1	1
Configuration	L	T			T	R
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	91	0	67
Peak-Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Hourly Flow Rate, HFR	0	0	0	95	0	70
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	1	0	1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		R
v (vph)	87					95		70
C (m) (vph)	932					58		515
v/c	0.09					1.64		0.14
95% queue length	0.31					8.71		0.47
Control Delay	9.3					468.2		13.1
LOS	A					F		B
Approach Delay	--	--				275.1		
Approach LOS	--	--				F		

Part 2.1

Trip Assignment Worksheet

Pukalani Makai TIAR
March 2005

INTERSECTION NO 10
INTERSECTION OF Old Haleakala Highway at Project Drive B

No	Approach & Mvt	Case 1 Existing AM	Case 1 Existing PM	Background Growth AM	Background Growth PM	Related Project Traffic AM	Related Project Traffic PM	Case 2 Cumulative AM	Case 2 Cumulative PM	AM Distribution % In	AM Distribution % Out	AM Assignment In	AM Assignment Out	PM Distribution % In	PM Distribution % Out	PM Assignment In	PM Assignment Out	Project Trips AM	Project Trips PM	Case 3 Cumulative Plus Project AM	Case 3 Cumulative Plus Project PM
1	N- RT	0	0	0	0			0	0			0	0			0	0	0	0	0	0
2	TH	0	0	0	0			0	0			0	0			0	0	0	0	0	0
3	LT	0	0	0	0			0	0			0	0			0	0	0	0	0	0
4	E- RT	0	0	0	0			0	0			0	0			0	0	0	0	0	0
5	TH	861	310	86	31	31	56	978	397			0	0			0	0	0	0	978	397
6	LT	0	0	0	0			0	0	85%		27	0	54%		58	0	27	58	27	58
7	S- RT	0	0	0	0			0	0		26%	0	25		38%	0	23	25	23	25	23
8	TH	0	0	0	0			0	0			0	0			0	0	0	0	0	0
9	LT	0	0	0	0			0	0		48%	0	46		25%	0	15	46	15	46	15
10	W- RT	0	0	0	0			0	0	5%		2	0	18%		19	0	2	19	2	19
11	TH	503	760	50	76	319	18	872	854		26%	0	25		37%	0	22	25	22	897	876
12	LT	0	0	0	0			0	0			0	0			0	0	0	0	0	0
TOTAL		1364	1070	136	107	350	74	1850	1251			29	96			77	60	125	137	1975	1388
Approach Totals																					
From North		0	0	0	0	0	0	0	0			0	0			0	0	0	0	0	0
From East		861	310	86	31	31	56	978	397			27	0			58	0	27	58	1005	455
From South		0	0	0	0	0	0	0	0			0	71			0	38	71	38	71	38
From West		503	760	50	76	319	18	872	854			2	25			19	22	27	41	899	895
Total		1364	1070	136	107	350	74	1850	1251			29	96			77	60	125	137	1975	1388
Departure Totals																					
To North		0	0	0	0	0	0	0	0			0	0			0	0	0	0	0	0
To East		503	760	50	76	319	18	872	854			0	50			0	45	50	45	922	899
To South		0	0	0	0	0	0	0	0			29	0			77	0	29	77	29	77
To West		861	310	86	31	31	56	978	397			0	46			0	15	46	15	1024	412
Total		1364	1070	136	107	350	74	1850	1251			29	96			77	60	125	137	1975	1388
Leg Totals																					
North		0	0	0	0	0	0	0	0			0	0			0	0	0	0	0	0
East		1364	1070	136	107	350	74	1850	1251			27	50			58	45	77	103	1927	1354
South		0	0	0	0	0	0	0	0			29	71			77	38	100	115	100	115
West		1364	1070	136	107	350	74	1850	1251			2	71			19	37	73	56	1923	1307
Total		2728	2140	272	214	700	148	3700	2502			58	192			154	120	250	274	3950	2776

Part 2.1

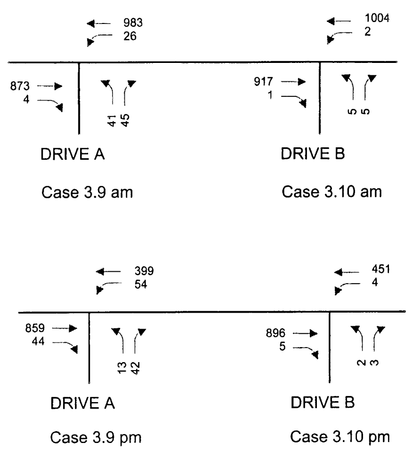
Trip Assignment Worksheet

Pukalani Makai TIAR
March 2005

INTERSECTION NO 9
INTERSECTION OF Old Haleakala Highway at Project Drive A

No	Approach & Mvt	Case 1 Existing AM	Case 1 Existing PM	Background Growth AM	Background Growth PM	Related Project Traffic AM	Related Project Traffic PM	Case 2 Cumulative AM	Case 2 Cumulative PM	AM Distribution % In	AM Distribution % Out	AM Assignment In	AM Assignment Out	PM Distribution % In	PM Distribution % Out	PM Assignment In	PM Assignment Out	Project Trips AM	Project Trips PM	Case 3 Cumulative Plus Project AM	Case 3 Cumulative Plus Project PM
1	N- RT	0	0	0	0			0	0			0	0			0	0	0	0	0	0
2	TH	0	0	0	0			0	0			0	0			0	0	0	0	0	0
3	LT	0	0	0	0			0	0			0	0			0	0	0	0	0	0
4	E- RT	0	0	0	0			0	0			0	0			0	0	0	0	0	0
5	TH	861	310	86	31	31	56	978	397		48%	0	46		25%	0	15	46	15	1024	412
6	LT	0	0	0	0			0	0			0	0			0	0	0	0	0	0
7	S- RT	0	0	0	0			0	0		26%	0	25		37%	0	22	25	22	25	22
8	TH	0	0	0	0			0	0			0	0			0	0	0	0	0	0
9	LT	0	0	0	0			0	0			0	0			0	0	0	0	0	0
10	W- RT	0	0	0	0			0	0	10%		3	0	28%		30	0	3	30	3	30
11	TH	503	760	50	76	319	18	872	854	5%		2	0	18%		19	0	2	19	874	873
12	LT	0	0	0	0			0	0			0	0			0	0	0	0	0	0
TOTAL		1364	1070	136	107	350	74	1850	1251			5	71			49	37	76	86	1926	1337
Approach Totals																					
From North		0	0	0	0	0	0	0	0			0	0			0	0	0	0	0	0
From East		861	310	86	31	31	56	978	397			0	46			0	15	46	15	1024	412
From South		0	0	0	0	0	0	0	0			0	25			0	22	25	22	25	22
From West		503	760	50	76	319	18	872	854			5	0			49	0	5	49	877	903
Total		1364	1070	136	107	350	74	1850	1251			5	71			49	37	76	86	1926	1337
Departure Totals																					
To North		0	0	0	0	0	0	0	0			0	0			0	0	0	0	0	0
To East		503	760	50	76	319	18	872	854			2	25			19	22	27	41	899	895
To South		0	0	0	0	0	0	0	0			3	0			30	0	3	30	3	30
To West		861	310	86	31	31	56	978	397			0	46			0	15	46	15	1024	412
Total		1364	1070	136	107	350	74	1850	1251			5	71			49	37	76	86	1926	1337
Leg Totals																					
North		0	0	0	0	0	0	0	0			0	0			0	0	0	0	0	0
East		1364	1070	136	107	350	74	1850	1251			2	71			19	37	73	56	1923	1307
South		0	0	0	0	0	0	0	0			3	25			30	22	28	52	28	52
West		1364	1070	136	107	350	74	1850	1251			5	46			49	15	51	64	1901	1315
Total		2728	2140	272	214	700	148	3700	2502			10	142			98	74	152	172	3852	2674

#9 OLD HALEAKALA HIGHWAY AT DRIVE A
#10 OLD HALEAKALA HIGHWAY AT DRIVE B



TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*PJR*	Intersection	*Case3.9am*
Agency/Co.	*PRA*	Jurisdiction	
Date Performed	*4/14/2005*	Analysis Year	
Analysis Time Period			

Project Description *Kauhale Lani*	
East/West Street: *Old Haleakala Highway*	North/South Street: *Drive A*
Intersection Orientation: *East-West*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	*0*	*873*	*4*	*26*	*983*	*0*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR	*0*	*970*	*4*	*28*	*1092*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	*41*	*0*	*45*	*0*	*0*	*0*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate, HFR	*45*	*0*	*50*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*		*LR*				
v (vph)		*28*		*95*				
C (m) (vph)		*716*		*95*				
v/c		*0.04*		*1.00*				
95% queue length		*0.12*		*5.97*				
Control Delay		*10.2*		*173.5*				
LOS		*B*		*F*				
Approach Delay	--	--	*173.5*					
Approach LOS	--	--	*F*					

HCS2000™ Version 4.1c

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	PJR
Agency/Co.	PRA
Date Performed	4/14/2005
Analysis Time Period	

Site Information

Intersection	Case3.9pm
Jurisdiction	
Analysis Year	

Project Description *Kauhale Lani*

East/West Street: *Old Haleakala Highway* — North/South Street: *Drive A*

Intersection Orientation: *East-West* — Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	0	859	44	54	399	0
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	0	954	48	60	443	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration			TR	LT		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	13	0	42	0	0	0
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	14	0	46	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT		LR				
v (vph)		60		60				
C (m) (vph)		699		223				
v/c		0.09		0.27				
95% queue length		0.28		1.05				
Control Delay		10.6		27.0				
LOS		B		D				
Approach Delay	--	--		27.0				
Approach LOS	--	--		D				

HCS2000™ Version 4.1c

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	PJR
Agency/Co.	PRA
Date Performed	4/14/2005
Analysis Time Period	

Site Information

Intersection	Case3.9am w/ MITIGATION
Jurisdiction	
Analysis Year	

Project Description *Kauhale Lani*

East/West Street: *Old Haleakala Highway* — North/South Street: *Drive A*

Intersection Orientation: *East-West* — Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	0	873	4	26	983	0
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	0	970	4	28	1092	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			0
Lanes	0	1	0	1	1	0
Configuration			TR	L	T	
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	41	0	45	0	0	0
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	45	0	50	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		L		LR				
v (vph)		28		95				
C (m) (vph)		716		226				
v/c		0.04		0.42				
95% queue length		0.12		1.94				
Control Delay		10.2		32.0				
LOS		B		D				
Approach Delay	--	--		32.0				
Approach LOS	--	--		D				

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	PJR
Agency/Co.	PRA
Date Performed	4/14/2005
Analysis Time Period	

Site Information

Intersection	Case3.9pm w/ MITIGATION
Jurisdiction	
Analysis Year	

Project Description Kauhale Lani
East/West Street: Old Haleakala Highway
North/South Street: Drive A
Intersection Orientation: East-West
Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	0	859	44	54	399	0
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	0	954	48	60	443	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			0
Lanes	0	1	0	1	1	0
Configuration			TR	L	T	
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	13	0	42	0	0	0
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	14	0	46	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		L		LR				
v (vph)		60		60				
C (m) (vph)		699		291				
v/c		0.09		0.21				
95% queue length		0.28		0.76				
Control Delay		10.6		20.6				
LOS		B		C				
Approach Delay	--	--		20.6				
Approach LOS	--	--		C				

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	PJR
Agency/Co.	PRA
Date Performed	4/14/2005
Analysis Time Period	

Site Information

Intersection	Case3.10am
Jurisdiction	
Analysis Year	

Project Description Kauhale Lani
East/West Street: Old Haleakala Highway
North/South Street: Drive A
Intersection Orientation: East-West
Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	0	917	1	2	1004	0
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	0	1018	1	2	1115	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration			TR	LT		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	5	0	5	0	0	0
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	5	0	5	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT		LR				
v (vph)		2		10				
C (m) (vph)		689		93				
v/c		0.00		0.11				
95% queue length		0.01		0.35				
Control Delay		10.2		48.3				
LOS		B		E				
Approach Delay	--	--		48.3				
Approach LOS	--	--		E				

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*PJR*	Intersection	*Case3.10pm*
Agency/Co.	*PRA*	Jurisdiction	
Date Performed	*4/14/2005*	Analysis Year	
Analysis Time Period			

Project Description *Kauhale Lani*	
East/West Street: *Old Haleakala Highway*	North/South Street: *Drive A*
Intersection Orientation: *East-West*	Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	0	896	5	4	451	0
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	0	995	5	4	501	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration			TR	LT		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	2	0	3	0	0	0
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	2	0	3	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT		LR				
v (vph)		4		5				
C (m) (vph)		700		199				
v/c		0.01		0.03				
95% queue length		0.02		0.08				
Control Delay		10.2		23.6				
LOS		B		C				
Approach Delay	--	--	23.6					
Approach LOS	--	--	C					

G

Air Quality Study

AIR QUALITY STUDY

FOR THE PROPOSED

KAUHALE LANI COMMUNITY

PUKALANI, MAUI, HAWAII

Prepared for:

Maui Land & Pineapple Company, Inc.

May 2005

B.D. NEAL & ASSOCIATES
*Applied Meteorology * Air Quality * Computer Science*
P.O. BOX 1808 * KAILUA-KONA, HAWAII 96745 * TELEPHONE (808) 329-1627 * FAX (808) 331-8428
EMAIL: bdneal@kona.net

CONTENTS

FIGURES

TABLES

TABLES (cont.)

1.0 SUMMARY

Maui Land & Pineapple Company, Inc. is proposing to develop the Kauhale Lani community on 89 acres of vacant land located in the Pukalani area on Maui. Kauhale Lani will consist of 165 residential units, a community park, and other associated community facilities. Development and full occupancy of Kauhale Lani is expected to be completed by 2010. 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 except those for nitrogen dioxide and carbon monoxide which are more stringent than the national standards.

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 Pukalani area is very much affected by its mauka situation on the slopes of Haleakala. Winds are often breezy trade winds from the north or northeast. Temperatures in the Pukalani area are relatively cool due to the upcountry elevation with an average daily temperature range of about 60°F to 75°F. Average annual rainfall in the area amounts to about 43 inches.

No ambient air quality data for the Pukalani area has been reported by the state Department of Health. However, except for periodic impacts from distant volcanic emissions (vog) and possibly occasional localized impacts from traffic congestion or agricultural activities, the present air quality of the Pukalani area is good.

If Kauhale Lani is given the necessary approvals to proceed, it is inevitable that some short- and long-term impacts on air quality will occur either directly or indirectly as a consequence of Kauhale Lani's construction and use. Short-term impacts from fugitive dust will likely occur during the construction phase. 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 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 Kauahle Lani areas early in the construction schedule will also reduce dust emissions. Monitoring dust at Kauhale Lani's boundary during the period of construction could be considered as a means to evaluate the effectiveness of the dust control program. Exhaust emissions can be mitigated by moving construction equipment and workers to and from the site during off-peak traffic hours.

After construction, motor vehicles coming to and from Kauhale Lani will result in a long-term increase in air pollution emissions in the project area. To assess the impact of emissions from these vehicles, an air quality modeling study was undertaken to estimate current ambient concentrations of carbon monoxide at intersections in the project vicinity and to predict future levels both with and without Kauhale Lani. During worst-case conditions, model results indicated that present 1-hour and 8-hour carbon monoxide concentrations are well within both the state and the national ambient air quality standards. In the year 2010 without Kauhale Lani, carbon monoxide concentrations were predicted to remain unchanged or decrease somewhat at two of the three locations studied despite the expected increase in ambient traffic volumes. This is because some older vehicles that emit more air pollution will be retired during the intervening years. Carbon monoxide concentrations were predicted to increase without Kauhale Lani during the morning peak traffic hour at the intersection of Old Haleakala Highway and Pukalani Street due to overcapacity conditions. With Kauhale Lani in the year 2010, the maximum carbon monoxide concentrations were estimated to increase by about 7 percent or less in the project area compared to the without project case, but concentrations should remain within state and federal standards. Implementing mitigation measures for traffic-related air quality impacts is thus unnecessary and unwarranted.

Depending on the demand levels, long-term impacts on air quality are also possible due to indirect emissions associated with a development's electrical power and solid waste disposal requirements. Quantitative estimates of these potential impacts were not made, but based on the estimated demand levels and emission rates involved, any significant impacts are unlikely. Nevertheless, incorporating energy conservation design features and promoting conservation and recycling programs within the proposed development could serve to further reduce any associated impacts and conserve the island's resources.

2.0 INTRODUCTION

Maui Land & Pineapple Company, Inc. is proposing to develop the Kauhale Lani community on approximately 89 acres of land in the Pukalani area on Maui (see Figure 1 for project location). The proposed development is a master planned community that includes 165 residential units, a neighborhood park, community trails, and other associated community facilities. It is intended to be a pedestrian community that emphasizes walking and biking within the development. The Kauhale Lani site includes a 50-acre parcel of land west of Old Haleakala Highway that will include the residential neighborhood and a 39-acre parcel between Old Haleakala Highway and Haleakala Highway that will be used for the project open space areas. Construction of the community is expected to be completed in phases with full development and occupancy by 2010.

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 impacts by the project 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 U.S. Environmental Protection Agency (EPA) is currently working on a plan to phase out the national 1-hour ozone standard in favor of the new (and more stringent) 8-hour standard.

The Hawaii AAQS for sulfur dioxide were relaxed in 1986 to make the state standards essentially the same as the national limits. In 1993, the state also revised its particulate standards to follow those set by the federal government. During 1997, the federal government again revised its standards for particulate, but the new standards were challenged in federal court. A Supreme Court ruling was issued during February 2001, and at this time, it is expected that the new standards for particulate will be implemented by 2005. To date, the Hawaii Department of Health has not updated the state particulate standards. In September 2001, the state vacated the state 1-hour standard for ozone and an 8-hour standard was adopted.

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 topography of Maui is dominated by the great volcanic masses of Haleakala (10,023 feet) and the West Maui Mountains (5,788 feet). The island consists entirely of the slopes of these mountains and of a connecting isthmus. Haleakala is still considered to be an active volcano and last erupted about 1790. The project site is located along the lower western slope of Haleakala at an elevation of about 1,500 feet.

Maui lies well within the belt of northeasterly trade winds generated by the semi-permanent Pacific high pressure cell to the north and east. The valley between Haleakala and the West Maui Mountains tends to channel the trade winds through the valley making Pukalani and other areas within the valley relatively breezy. Local winds such as land/sea breezes and/or upslope/downslope winds also influence the wind pattern for the area. During the daytime, when the trade winds are weak or absent, winds typically move onshore because of seabreeze and/or upslope effects. At night, winds are often 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 mauka location results in cooler temperatures compared to coastal locations at lower elevations. In the Makawao area at an elevation of about 2,100 feet, which is a few miles northeast of the project site, average daily minimum and maximum temperatures are 59°F and 72°F, respectively [1]. Temperatures at the project site are slightly warmer due to the lower elevation.

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 Pukualani 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 nearby mountains. 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 3,000 feet (1,000 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 relatively moderate with respect to precipitation. Historical records from Haleakala Ranch show that this area of Maui averages about 43 inches of precipitation per year with the summer months being the driest [1].

5.0 PRESENT AIR QUALITY

Present air quality in the Pukalani 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 Maui for calendar year 1993. 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, most of the manmade particulate and sulfur oxides emissions on Maui originate from point sources, such as power plants and other fuel-burning industries. Nitrogen oxides emissions are roughly equally divided between point sources and area sources (mostly motor vehicle traffic). The majority of carbon monoxide emissions occur from area sources (motor vehicle traffic and sugar cane burning), while hydrocarbons are emitted mainly from point sources.

The largest sources of air pollution in the project area are probably agricultural operations and automobile traffic using local roadways. Emissions from these sources consist primarily of particulate, carbon monoxide and nitrogen oxides.

The State Department of Health operates a network of air quality monitoring stations at various locations around the state, but only very limited data are available for Maui Island. The only air quality data for the project area consists of particulate measurements collected at Paia, which is situated downslope from the Pukalani area about 5 miles to the north. These data are probably only semi-representative of the project area. Table 3

summarizes the data from the Paia monitoring station. Annual second-highest 24-hour particulate concentrations (which are most relevant to the air quality standards) ranged from 45 to 98 $\mu g/m^3$ between 1997 and 2001. Average annual concentrations ranged from 17 to 20 $\mu g/m^3$. All values reported were within the state and national AAQS.

Given the limited air pollution sources in the area, it is likely that air pollution concentrations are near natural background levels, except possibly for locations adjacent to agricultural operations or near traffic-congested intersections. 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 KAUHALE LANI

Short-term direct and indirect impacts on air quality could potentially occur due to 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 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 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 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 its 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 Kauhale Lani's 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 standard for nitrogen dioxide is set on an annual basis and is not likely to be violated by short-term construction equipment emissions. Carbon monoxide emissions from diesel engines, on the other hand, are low and should be relatively insignificant compared to vehicular emissions on nearby roadways.

Kauhale Lani's 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 KAUHALE LANI

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 requires further emission reductions, which have been phased in since 1994. More recently, additional restrictions were signed into law during the Clinton administration, which will begin to take effect during the next decade. The added restrictions on emissions from new motor vehicles will lower average emissions each year as more and 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 30 to 40 percent per vehicle during the next 10 years due to the replacement of older vehicles with newer models.

To evaluate the potential long-term indirect ambient air quality impact of increased roadway traffic associated with a project such as this, computerized emission and atmospheric dispersion models can be used to estimate ambient carbon monoxide concentrations along roadways leading to and from Kauhale Lani. 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 new development.

For this project, three scenarios were selected for the carbon monoxide modeling study: (1) year 2005 with present conditions, (2) year 2010 without the project, and (3) year 2010 with the project. Year 2010 is when full development and occupancy is expected to be achieved. To begin the modeling study of the three scenarios, critical receptor areas in the vicinity of the Kauhale Lani site 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, three key intersections identified in the traffic study were selected for air quality analysis. These included the following intersections:

- Old Haleakala Highway at Pukalani Street;
- Old Haleakala Highway at Makani Road;
- Old Haleakala Highway at Haleakala Highway.

The above intersections were selected for analysis based on their close proximity to the project and the expected higher project traffic volumes at these locations. The traffic impact report for Kauhale Lani [4] describes the existing and projected traffic conditions and laneage configurations of these intersections in detail.

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 report evaluated morning and afternoon peak traffic periods. These same periods were evaluated in the air quality impact assessment.

The EPA computer model MOBILE6 [5] was used to calculate vehicular carbon monoxide emissions for each year studied. One of the key inputs to MOBILE6 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 42.3% light-duty gasoline-powered automobiles, 44.9% light-duty gasoline-powered trucks and vans, 3.6% heavy-duty gasoline-powered vehicles, 0.2% light-duty diesel-powered vehicles, 8.4% heavy-duty diesel-powered trucks and buses, and 0.6% motorcycles. For the future scenarios studied, the vehicle mix was estimated to change slightly 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 emission estimates given by MOBILE6 generally have an inverse relationship to the ambient temperature.

After computing vehicular carbon monoxide emissions through the use of MOBILE6, this data was then input into 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 has 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 based on assumed free-flow vehicle speeds corresponding to the posted 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 implies that pedestrian sidewalks either already exist or are assumed to exist in the future. All receptor heights were placed at 1.5 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 suburban 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 2005. Although increased traffic is expected to occur within the Pukalani area within the next several years with or without Kauhale Lani, 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.

<u>Predicted Worst-Case 1-Hour Concentrations</u>

Table 4 summarizes the 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 2005 with existing traffic, year 2010 without the project and year 2010 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 (2005) case was 7.4 mg/m^3. This was projected to occur during the morning peak traffic hour near the intersection of Old Haleakala Highway and Haleakala Highway. Concentrations at other locations and times studied were 6.4 mg/m^3 or lower. All predicted worst-case 1-hour concentrations for the 2005 scenario were well within both the national AAQS of 40 mg/m^3 and the state standard of 10 mg/m^3.

In the year 2010 without the proposed project, the predicted worst-case concentrations either decreased somewhat or remained unchanged compared to the existing case except at the intersection of Old Haleakala Highway and Pukalani Street during the morning peak hour. This indicates that despite expected increases in traffic volumes emissions from the higher volumes of traffic will in most instances be offset by the decrease in motor vehicle emissions which result from older vehicles being retired during the next several years. Overcapacity conditions during the morning at the intersection of Old Haleakala Highway and Pukalani Street cause that trend to be reversed at this location. For the 2010 without project scenario, the highest worst-case 1-hour concentration was again predicted to occur during the morning at the intersection of Old Haleakala Highway and Pukalani Street. A value of 8.7 mg/m^3 was predicted to occur at this location. Peak-hour worst-case values at the other locations and times studied for the 2010 without project scenario ranged between 2.4 and 7.0 mg/m^3. All projected worst-case concentrations for this scenario remained within the state and national standards.

The predicted highest 1-hour worst-case concentrations for the 2010 with project scenario ranged from unchanged up to 7 percent

higher compared to the 2010 without project case. The highest worst-case concentration for this scenario, 9.3 mg/m^3, was predicted to occur during the morning at the intersection of Old Haleakala Highway and Pukalani Street. The highest concentrations at other locations and times studied ranged between 2.5 and 7.1 mg/m^3. All predicted worst-case 1-hour concentrations for the 2010 with project scenario were well within both the national and the state AAQS.

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 Kauhale Lani 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 5. For the 2005 scenario, the estimated worst-case 8-hour carbon monoxide concentrations for the three locations studied ranged from 2.2 mg/m^3 at the intersection of Old Haleakala Highway and Makani Road to 3.7 mg/m^3 at Old Haleakala Highway and Haleakala Highway. The estimated worst-case concentrations were well within both the state standard of 5 mg/m^3 and the national limit of 10 mg/m^3.

For the year 2010 without project scenario, worst-case concentrations ranged between 2.0 and 4.4 mg/m^3, with the highest concentration at the Old Haleakala Highway and Pukalani Street intersection. Compared to the existing case, the 8-hour worst-case concentration increased substantially at the intersection of Old Haleakala Highway and Pukalani Street but concentrations decreased somewhat at the other two locations studied. Despite the predicted higher concentration at Old Haleakala Highway and Pukalani Street, the predicted concentrations at all locations were within the standards.

For the 2010 with project scenario, the highest worst-case concentrations increased by 5 percent or less compared to the without project case. Concentrations ranged from 2.0 mg/m^3 at Old Haleakala Highway and Makani Road to 4.6 mg/m^3 at Old Haleakala Highway and Pukalani Street. All predicted 8-hour concentrations for this scenario were 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 Electrical Demand

Kauhale Lani also will cause indirect air pollution emissions from power generating facilities as a consequence of electrical power usage. The peak electrical demand of Kauhale Lani when fully developed is expected to reach about 1.2 megawatts [12]. Assuming the average demand is approximately one-fourth the peak demand, the annual electrical demand of the project will reach approximately 2.6 million kilowatt-hours. Electrical power will most probably be provided mainly by fossil fuel-fired generating facilities, but some of the power may also be derived from solar power, wind power or other sources. In order to meet the electrical power needs, power generating facilities will likely be required to burn more fuel and hence more air pollution will be emitted at these facilities. Given in Table 5 are estimates of the indirect air pollution emissions that would result from Kauhale Lani's electrical demand assuming all power is provided by burning more fuel oil at local power plants. These values can be compared to the island-wide emission estimates for 1993 given in Table 2. The estimated indirect emissions from the electrical demand amount to less than 1 percent of the present air pollution emissions occurring on Maui even if all power is assumed to be derived from fossil fuel.

7.3 Solid Waste Disposal

Solid waste generated by the proposed development when fully completed and occupied is not expected to exceed about 270 tons per year [13]. Currently, all solid waste on the island is buried at solid waste landfills. Thus, assuming this continues to be the method for solid waste disposal, the only associated air pollution emissions that will occur will be from trucking the waste to the landfill and burying it. These emissions should be relatively minor. If the solid waste was burned to generate power instead buried in a landfill, the emissions shown in Table 6 could result. These would represent much less than 1 percent of the current island-wide emissions.

8.0 CONCLUSIONS AND RECOMMENDATIONS

The major potential short-term air quality impact of Kauhale Lani will occur from the emission of fugitive dust during construction. 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 Kauhale Lani. 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 Kauhale Lani is completed, any long-term impacts on air quality in the area due to emissions from project-related motor vehicle traffic should be small. Worst-case concentrations of carbon monoxide should remain within both the state and the national ambient air quality standards. Implementing any air quality mitigation measures for long-term traffic-related impacts is unnecessary and unwarranted.

Any long-term impacts on air quality due to indirect emissions from supplying Kauhale Lani with electricity and from the disposal of waste materials generated by Kauhale Lani will likely be small based on the relatively small magnitudes of these emissions. Nevertheless, indirect emissions from Kauhale Lani electrical demand could likely be reduced somewhat by incorporating energy-saving features into design requirements. This might include the use of solar water heaters; designing building space so that window positions maximize indoor light without unduly increasing indoor heat; using landscaping where feasible to provide afternoon shade to cut down on the use of air conditioning; installation of insulation and double-glazed doors to reduce the effects of the sun and heat; providing movable, controlled openings for ventilation at opportune times; and possibly installing automated room occupancy sensors. Solid waste related air pollution could likely be reduced somewhat by the promotion of conservation and recycling programs within the proposed development. This could reduce solid waste volumes, which would in turn reduce any related air pollution emissions proportionately.

REFERENCES

1. U.S. Department of Commerce, Weather Bureau, "Climatography of the United States No. 86-44, Decennial Census of the United States Climate, Climatic Summary of the United States, Supplement for 1951 through 1960, Hawaii and Pacific", 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. Phillip Rowell and Associates, Traffic Impact Report for Kauhale Lani, Draft, April 2005.

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.

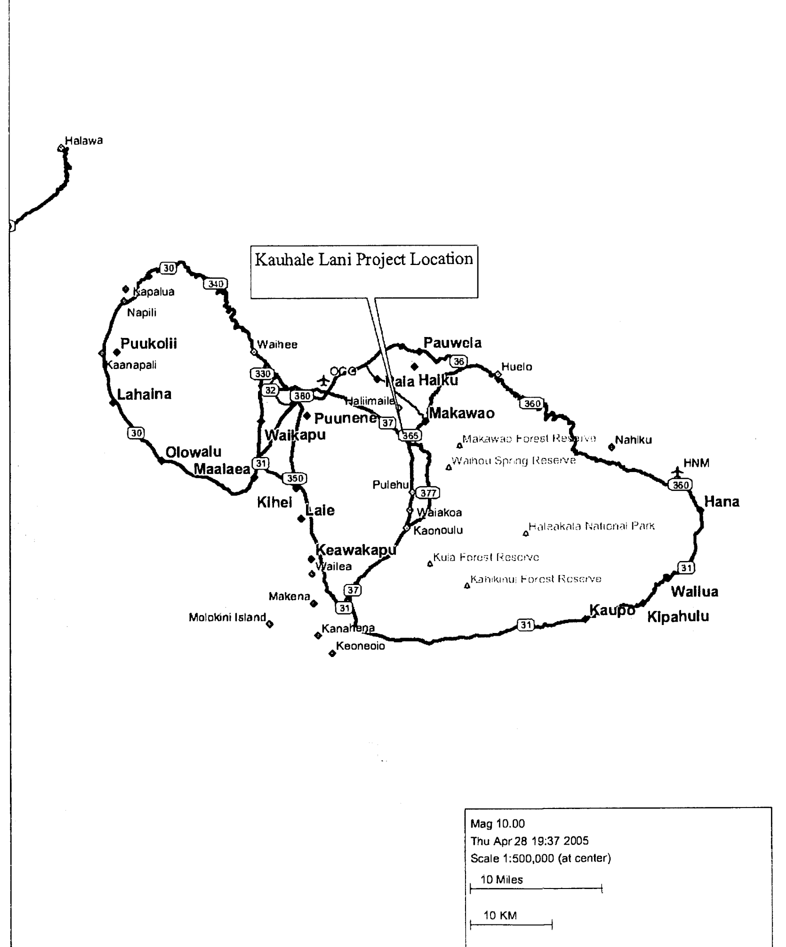
10. Guideline for Modeling Carbon Monoxide from Roadway Intersections, U.S. Environmental Protection Agency, EPA-454/R-92-005, November 1992.

11. Annual Summaries, Hawaii Air Quality Data, 1999-2003, State of Hawaii Department of Health.

12. MK Engineers, Ltd. Final Kauhale Lani Subdivision Preliminary Electrical Engineering Report, March 21, 2005.

13. Personal communication, Tom Schnell, PBR Hawaii, Inc., to Barry D. Neal, B.D. Neal & Associates, April 29, 2005.

Figure 1 - Kauhale Lani Project Location



© 2000 DeLorme. Street Atlas USA; © 2000 GDT, Inc., Rel. 04/2000

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 24 Hours	50[a] 150[b]	50[a] 150[b]	50 150[c]
Particulate Matter (<2.5 microns)	μg/m³	Annual 24 Hours	15[a] 65[d]	15[a] 65[d]	- -
Sulfur Dioxide	μg/m³	Annual 24 Hours 3 Hours	80 365[c] -	- - 1300[c]	80 365[c] 1300[c]
Nitrogen Dioxide	μg/m³	Annual	100	100	70
Carbon Monoxide	mg/m³	8 Hours 1 Hour	10[c] 40[c]	- -	5[c] 10[c]
Ozone	μg/m³	8 Hours 1 Hour	157[e] 235[f]	157[e] 235[f]	157[e] -
Lead	μg/m³	Calendar Quarter	1.5	1.5	1.5
Hydrogen Sulfide	μg/m³	1 Hour	-	-	35[c]

[a] Three-year average of annual arithmetic mean.
[b] 99th percentile value averaged over three years.
[c] Not to be exceeded more than once per year.
[d] 98th percentile value averaged over three years.
[e] Three-year average of fourth-highest daily 8-hour maximum.
[f] Standard is attained when the expected number of exceedances is less than or equal to 1.

Table 2

AIR POLLUTION EMISSIONS INVENTORY FOR ISLAND OF MAUI, 1993

Air Pollutant	Point Sources (tons/year)	Area Sources (tons/year)	Total (tons/year)
Particulate	63,275	7,030	70,305
Sulfur Oxides	6,419	nil	6,419
Nitrogen Oxides	7,312	8,618	15,930
Carbon Monoxide	4,612	20,050	24,662
Hydrocarbons	1,991	234	2,225

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 KAUHALE LANI

Parameter / Location	1997	1998	1999	2000	2001
Particulate (PM-10) / Paia					
24-Hour Averaging Period:					
No. of Samples	353	354	359	350	337
Highest Concentration ($\mu g/m^3$)	59	67	131	48	83
2^{nd} Highest Concentration ($\mu g/m^3$)	54	50	98	45	80
No. of State AAQS Exceedances	0	0	0	0	0
Annual Average Concentration ($\mu g/m^3$)	20	17	18	18	20

Source: State of Hawaii Department of Health, "Annual Summaries, Hawaii Air Quality Data, 1997 - 2001"

Table 4

ESTIMATED WORST-CASE 1-HOUR CARBON MONOXIDE CONCENTRATIONS ALONG ROADWAYS NEAR KAUHALE LANI (milligrams per cubic meter)

Roadway Intersection	Year/Scenario					
	2005/Present		2010/Without Project		2010/With Project	
	AM	PM	AM	PM	AM	PM
Old Haleakala Highway at Pukalani Street	6.4	3.1	8.7	3.0	9.3	3.0
Old Haleakala Highway at Makani Road	4.5	2.5	3.9	2.4	4.1	2.5
Old Haleakala Highway at Haleakala Highway	7.4	4.5	7.0	4.1	7.1	4.1

Hawaii State AAQS: 10
National AAQS: 40

Table 5

ESTIMATED WORST-CASE 8-HOUR CARBON MONOXIDE CONCENTRATIONS ALONG ROADWAYS NEAR KAUHALE LANI (milligrams per cubic meter)

Roadway Intersection	Year/Scenario		
	2005/Present	2010/Without Project	2010/With Project
Old Haleakala Highway at Pukalani Street	3.2	4.4	4.6
Old Haleakala Highway at Makani Road	2.2	2.0	2.0
Old Haleakala Highway at Haleakala Highway	3.7	3.5	3.6

Hawaii State AAQS: 5
National AAQS: 10

Table 6

ESTIMATED INDIRECT AIR POLLUTION EMISSIONS FROM KAUHALE LANI ELECTRICAL DEMAND[a]

Air Pollutant	Emission Rate (tons/year)
Particulate	1
Sulfur Dioxide	7
Carbon Monoxide	1
Volatile Organics	<1
Nitrogen Oxides	3

[a]Based on U.S. EPA emission factors for utility boilers [2]. Assumes project electrical demand of 2.6 million kw-hrs per year. Estimated emission rates assume low-sulfur oil used to generate power.

Table 7

ESTIMATED INDIRECT AIR POLLUTION EMISSIONS FROM KAUHALE LANI SOLID WASTE DISPOSAL DEMAND[a]

Air Pollutant	Emission Rate (tons/year)
Particulate	<1
Sulfur Dioxide	<1
Carbon Monoxide	<1
Nitrogen Oxides	1

[a]Based on U.S. EPA emission factors for refuse-derived fuel-fired combustors [2]. Assumes spray dryer/fabric filter for emissions control and solid waste disposal demand of 270 tons per year.

H

Noise Study

D. L. ADAMS ASSOCIATES, LTD.
Consultants in Acoustics and Performing Arts Technologies

Environmental Noise Assessment Report
Kauhale Lani Residential Community
Pukalani, Maui, Hawaii

May 2005

DLAA Project No. 04-26

Prepared by: David L. Adams Associates, Ltd.
Kailua, O'ahu, Hawaii

Prepared for: Maui Land & Pineapple Company, Ltd.
Kahului, Maui, Hawaii

970 N. KALAHEO AVE. • SUITE A311 • KAILUA, HAWAII 96734
808/254-3318 • FAX 808/254-5295
www.dlaa.com • hawaii@dlaa.com

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICIES

1.0 EXECUTIVE SUMMARY

1.1 The Kauhale Lani community is located near Pukalani, Maui, Hawaii. The community includes the development of 165 private residences and outdoor space for community activities.

1.2 The dominant noise sources during the project construction phase will probably be earth moving equipment, such as bulldozers and diesel powered trucks. Noise from construction activities will occur on the project site. Noise from construction activities should be short term and must comply with State Department of Health noise regulations.

1.3 Vehicular traffic noise impacts on the surround community were evaluated. The results of the noise analyses show noise level increases of less than 1 dB due to the project. The analyses include existing conditions, year 2010 traffic projections without the project, and year 2010 traffic projections with the project. These small increases are not considered significant. Noise impacts from project generated vehicular traffic noise on the surrounding community are not expected.

1.4 Based on year 2010 traffic projections with the project, new homes in the Kauhale Lani community that are 350 feet or more from Haleakala Highway comply with the FHWA/HDOT noise criteria without noise mitigation. However, noise mitigation should be considered for new homes within 350 feet of Haleakala Highway. Noise mitigation options could include air-conditioning the impacted homes or building an earth berm or sound barrier wall.

1.5 Although the HUD and EPA design goals and guidelines regarding noise are not enforceable regulations, they can be used as useful design guides and design goals. Based on noise measurements taken near the project site and on year 2010 traffic projections with the project, the HUD noise guidelines and the EPA existing noise design goal $L_{dn} \leq 65$ dBA is satisfied. The EPA further recommends a future design goal $L_{dn} \leq 55$ dBA. Noise mitigation could be considered for homes within 600 feet of Haleakala Highway to satisfy the EPA future design goal.

2.0 PROJECT DESCRIPTION

The Kauhale Lani is proposed to contain 165 new residential homes on a 50-acre parcel and open space parks on a 39-acre parcel in Pukalani. Old Haleakala Highway divides the two land parcels. Both parcels are located near the "Y" intersection where Old Haleakala branches off from Haleakala Highway.

The 50-acre parcel will contain mostly single family homes and a park and community area. The 39-acre parcel will contain community facilities, including open space, trails, etc.

3.0 NOISE STANDARDS

Various local and federal agencies have established guidelines and standards for assessing environmental noise impacts and set noise limits as a function of land use. A brief description of common acoustic terminology used in these guidelines and standards is presented in Appendix A.

3.1 State of Hawaii, Community Noise Control

The State of Hawaii Community Noise Control Rule [Reference 1] defines three classes of zoning districts and specifies corresponding maximum permissible sound levels due to *stationary* noise sources such as air-conditioning units, exhaust systems, generators, compressors, pumps, etc. The Community Noise Control Rule does not specifically address most *moving* sources, such as vehicular traffic noise, air traffic noise, or rail traffic noise. However, the Community Noise Control Rule does include equipment related to agricultural, construction, and industrial activities, which may not be stationary.

These maximum permissible noise levels are enforced by the State Department of Health (DOH) for any location at or beyond the property line and shall not be exceeded for more than 10% of the time during any 20-minute period. The specified noise limits which apply are a function of the zoning and time of day as shown in Figure 1. With respect to mixed zoning districts, the rule specifies that the primary land use designation shall be used to determine the applicable zoning district class and the maximum permissible sound level. In determining the maximum permissible sound level, the background noise level is taken into account by the DOH.

3.2 U.S. Federal Highway Administration (FHWA)

The FHWA defines four land use categories and assigns corresponding maximum hourly equivalent sound levels, $L_{eq(h)}$, for traffic noise exposure [Reference 2], which are listed in Figure 2. For example, Category B, defined as picnic and recreation areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals, has a corresponding maximum exterior L_{eq} of 67dBA and a maximum interior L_{eq} of 52 dBA. These limits are viewed as design goals, and all projects meeting these limits are deemed in conformance with FHWA noise standards.

Calculation of traffic noise levels should be conducted using the Federal Highway Administration's Traffic Noise Model, 1978 [Reference 3].

3.3 Hawaii Department of Transportation (HDOT)

The HDOT has adopted FHWA's design goals for traffic noise exposure in its noise analysis and abatement policy [Reference 4]. According to the policy, a traffic noise impact occurs when the predicted traffic noise levels "approach" or exceed FHWA's design goals or when the predicted traffic noise levels "substantially exceed the existing noise levels." The policy also states that "approach" means at least 1 dB less than FHWA's design goals and "substantially exceed the existing noise levels" means an increase of at least 15dB.

3.4 U.S. Environmental Protection Agency (EPA)

The U.S. EPA has identified a range of yearly day-night equivalent sound levels, L_{dn}, sufficient to protect public health and welfare from the effects of environmental noise [Reference 5]. The EPA has established a goal to reduce exterior environmental noise to an L_{dn} not exceeding 65 dBA and a future goal to further reduce exterior environmental noise to an L_{dn} not exceeding 55 dBA. Additionally, the EPA states that these goals are not intended as regulations as it has no authority to regulate noise levels, but rather they are intended to be viewed as levels below which the general population will not be at risk from any of the identified effects of noise.

3.5 U.S. Department of Housing and Urban Development (HUD)

HUD's environmental noise criteria and standards in 24 CFR 51 [Reference 6] were established for determining housing project site acceptability. These standards are based on day-night equivalent sound levels, L_{dn}, and are not limited to traffic noise exposure. However, for project sites in the vicinity of highways, the L_{dn} may be estimated to be equal to the design hour $L_{eq(h)}$, provided "heavy trucks (vehicles with three or more axles) do not exceed 10 percent of the total traffic flow in vehicles per 24 hours and the traffic flow between 10:00 p.m. and 7:00 a.m. does not exceed 15 percent of the average daily traffic flow in vehicles per 24 hours." For these same conditions, L_{dn}, may also be estimated as 3 dB less than the design hour L_{10}.

HUD site acceptability criteria rank sites as Acceptable, Normally Unacceptable, or Unacceptable. "Acceptable" sites are those where exterior noise levels do not exceed an L_{dn} of 65 dBA. Proposed housing projects on "Acceptable" sites do not require additional noise attenuation other than that provided by customary building techniques. "Normally Unacceptable" sites are those where the L_{dn} is above 65 dBA, but does not exceed 75 dBA. Housing on "Normally Unacceptable" sites requires some form of noise abatement, either at the property line or in the building construction, to ensure the interior noise levels are acceptable. "Unacceptable" sites are those where the L_{dn} is 75 dBA or higher.

The term "Unacceptable" does not necessarily mean that housing cannot be built on those sites; however, more elaborate sound attenuation will likely be needed.

4.0 EXISTING ACOUSTICAL ENVIRONMENT

Continuous long-term ambient noise level measurements were conducted at one (1) location, as shown in Figure 3. The noise measurements were conducted between December 2, 2004 and December 4, 2004. In addition, short term noise measurements and traffic counts were conducted on December 2, 2004. The purpose of the short-term measurements and traffic counts was to calibrate the traffic noise model prediction software.

4.1 Noise Measurement Procedure

Long-Term Noise Measurements
The microphone was mounted on a tripod, approximately 5 feet above grade. A windscreen covered the microphone during the entire measurement period. The sound level meter was secured in a weather resistant case.

Continuous, hourly, equivalent sound levels, L_{eq}, were recorded during the measurement period. The measurements were taken using a Larson-Davis Laboratories, Model 820, Type-1 Sound Level Meter together with a Larson-Davis, Model 2560 Type-1 Microphone. Calibration was checked before and after the measurements with a Larson-Davis Model CAL200 calibrator. Both the sound level meter and the calibrator have been certified by the manufacturer within the recommended calibration period.

Short-Term Noise Measurements
The microphone and sound level meter were mounted on a tripod, approximately 5 feet above grade. A windscreen covered the microphone during the entire measurement period.

An approximate 30-minute equivalent sound level, L_{eq}, was measured. The measurement was taken using a Larson-Davis Laboratories, Model 824, Type-1 Sound Level Meter together with a Larson-Davis, Model 2541 Type-1 Microphone. Calibration was checked before and after the measurements with a Larson-Davis Model CAL200 calibrator. Both the sound level meter and the calibrator have been certified by the manufacturer within the recommended calibration period.

4.2 Noise Measurement Location

The long-term noise measurement location was positioned along Haleakala Highway approximately 2,200 feet east of the "Y" intersection of Haleakala Highway and Old Haleakala Highway, as shown on Figure 3. The noise measurement location was approximately 110 feet south of the edge of pavement on Haleakala Highway. This noise measurement location was selected as the

"worst case" location for exterior noise levels. The measurement location had a clear line-of-sight with Haleakala Highway.

4.3 Noise Measurement Results

The results from the long-term noise measurements are graphically presented in Figure 4, which shows the measured equivalent sound level, L_{eq}, and the 90 percent exceedance level, L_{90}, in A-weighted decibels (dBA) as a function of the measurement date and time.

The sound levels are relatively dynamic and depend significantly on the traffic patterns along Haleakala Highway. The hourly L_{eq} noise levels generally range from 50 dBA during low traffic times at night to 65 dBA during the daytime high traffic times. The hourly L_{90} ranges from 35 dBA to 55 dBA. The dominant and secondary noise sources are described below:

Noise Sources

Dominant: Vehicular traffic on Haleakala Highway.

Secondary: Vehicular traffic on other roads in the area, an occasional aircraft flyovers, wind, birds, and crickets.

4.4 Existing Vehicular Traffic Noise

Noise levels generated by existing vehicular traffic were calculated using the FHWA Traffic Noise Model (1978) [Reference 3]. The traffic noise analysis is based on the traffic counts provided by the Traffic Consultant [Reference 7]. Existing traffic noise levels were calculated for three locations, Locations 1, 2, and 3, as shown on Figure 3. The results of the existing traffic noise level calculations are shown in Table 1.

5.0 POTENTIAL NOISE IMPACTS DUE TO THE PROJECT

5.1 Project Construction Noise

Development of project areas will involve excavation, grading, and other typical construction activities during construction. The various construction phases of the project may generate significant amounts of noise. The surrounding residences may be impacted by the construction noise due to their proximity to the project. The actual noise levels produced during construction will be a function of the methods employed during each stage of the construction process. Typical ranges of construction equipment noise are shown in Figure 5.

5.2 Project Generated Stationary Mechanical Noise & Compliance with State of Hawaii Community Noise Control Rule

The new residences will incorporate stationary mechanical equipment that is typical for residential housing. Expected mechanical equipment may include air handling equipment, outdoor condensing units, etc. Noise from this mechanical equipment and other equipment must meet the State noise rules, which stipulate maximum permissible noise limits at the property line. These noise limits are 55 dBA during the daytime hours (7:00 am to 10:00 pm) and 45 dBA during the night time hours (10:00 pm to 7:00 am) for residential areas. For commercial areas, the noise limits are 60 dBA during the day and 50 dBA during the night.

5.3 Projection of Project Generated Vehicular Traffic Noise

A vehicular traffic noise analysis was completed for the existing conditions (see Section 4.4 of this report), future year 2010 projections without the project, and future year 2010 projections with the project. A map of the noise prediction locations is shown in Figure 3. The prediction locations include two positions along Haleakala, mauka and makai of Kauhale Lani, and along Old Haleakala Highway. The results of the traffic noise analysis are shown in Table 1.

All traffic noise predictions and calculations were completed using the FHWA Traffic Noise Model (1978) [Reference 3]. The traffic noise analysis is based on the traffic counts provided by the Traffic Consultant [Reference 7].

5.4 Compliance with FHWA/HDOT Land Use Noise Limits

5.4.1 Vehicular Traffic Noise Impacts on the Surrounding Community

Noise predictions at Locations 1 and 3 satisfy the FHWA/HDOT noise criteria. Noise predictions at Location 2 also satisfy the FHWA/HDOT noise criteria even though the predicted peak hour noise levels are above 67 dBA. The FHWA/HDOT noise criteria is satisfied because the existing noise levels are already above 67 dBA, and the increase in traffic noise due to the project is less than 1 dB. Therefore, a significant noise impact on the surrounding community due to project generated traffic noise is not expected.

5.4.2 Vehicular Traffic Noise Impacts on the Project

To evaluate traffic noise impacts on the project, the year 2010 future traffic projections with the project are used. Most of the residences in the Kauhale Lani community will be far enough away from Haleakala Highway to satisfy the FHWA/HDOT maximum noise limit of 67 dBA during peak hour traffic times with no noise mitigation. However, noise mitigation should be considered for homes 350 feet or less from Haleakala Highway to satisfy FHWA/HDOT noise criteria. Figure 6 shows a map of these impacted residential properties.

In addition to residential homes, outdoor playgrounds, ball fields, and recreational areas should also be at least 350 feet from Haleakala Highway to satisfy the FHWA/HDOT noise criteria. The primary recreational area for the Kauhale Lani community is well over 350 feet from Haleakala

Highway. Therefore, the FHWA/HDOT noise criteria is satisfied for the primary recreational areas of the Kauhale Lani community.

5.5 Compliance with HUD and EPA Noise Guidelines

Based on noise measurements taken along Haleakala Highway near the project site and on future year 2010 traffic projections, noise levels at Kauhale Lani project site are within the HUD noise guidelines, which provide a design goal $L_{dn} \leq 65$ dBA for the exterior noise level. The EPA has an existing design goal $L_{dn} \leq 65$ dBA and a future design goal $L_{dn} \leq 55$ dBA for exterior noise levels. Although the new homes in the Kauhale Lani project meet the EPA existing design goal, noise mitigation could be considered to meet the EPA future design goal. Homes within 600 feet of Haleakala Highway may expect to have noise levels that exceed the EPA future design goal.

It is important to note that the HUD and EPA noise guidelines are design goals and not enforceable regulations. The EPA future goal of L_{dn} 55 dBA is often difficult to achieve for many residential projects near busy roads, such as the Kauhale Lani community.

6.0 NOISE IMPACT MITIGATION

6.1 Mitigation of Construction Noise

In cases where construction noise exceeds, or is expected to exceed the State's "maximum permissible" property line noise levels [Reference 1], a permit must be obtained from the State DOH to allow the operation of vehicles, cranes, construction equipment, power tools, etc., which emit noise levels in excess of the "maximum permissible" levels.

In order for the State DOH to issue a construction noise permit, the Contractor must submit a noise permit application to the DOH, which describes the construction activities for the project. Prior to issuing the noise permit, the State DOH may require action by the Contractor to incorporate noise mitigation into the construction plan. The DOH may also require the Contractor to conduct noise monitoring or community meetings inviting the neighboring residents and business owners to discuss construction noise. The Contractor should use reasonable and standard practices to mitigate noise, such as using mufflers on diesel and gasoline engine machines, using properly tuned and balanced machines, etc. However, the State DOH may require additional noise mitigation, such as temporary noise barriers, or time of day usage limits for certain kinds of construction activities.

Specific permit restrictions for construction activities [Reference 1] are:

> "No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels ... before 7:00 a.m. and after 6:00 p.m. of the same day, Monday through Friday."
>
> "No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels... before 9:00 a.m. and after 6:00 p.m. on Saturday."
>
> "No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels on Sundays and on holidays."

The use of hoe rams and jack hammers 25 lbs. or larger, high pressure sprayers, chain saws, and pile drivers must be restricted to 9:00 a.m. to 5:30 p.m., Monday through Friday.

The DOH noise permit does not limit the noise *level* generated at the construction site, but rather the *times* at which noisy construction can take place. Therefore, noise mitigation for construction activities should be addressed using project management, such that the time restrictions within the DOH permit are followed.

6.2 Mitigation of Project Generated Mechanical Noise

The design of the new Kauhale Lani residences should give consideration to controlling the noise emanating from stationary mechanical equipment, such as chiller, compressors, air conditioning units, etc. so as to comply with the State Department of Health *Community Noise Control* rules [Reference 1]. Noisy equipment should be located away from neighbors and residential units, as much as is practical. Enclosed mechanical rooms may be required for some equipment.

6.3 Mitigation of Vehicular Traffic Noise

In order to meet the FHWA/HDOT design goals, noise mitigation should be considered for new homes in the Kauhale Lani project built within 350 feet of Haleakala Highway. In addition, new homes built within 600 feet of Haleakala Highway could also be considered to meet the EPA future design goal. The following noise mitigation options could be considered. One of the options listed below should be considered during the design of the new homes.

1. Install air conditioning in the new homes.
2. Construct an earth berm or sound barrier wall to block the line-of-sight between the impacted residences and the highway.

REFERENCES

1. Chapter 46, *Community Noise Control*, Department of Health, State of Hawaii, Administrative Rules, Title 11, September 23, 1996.
2. *Department of Transportation, Federal Highway Administration Procedures for Abatement of Highway Traffic Noise*, Title 23, CFR, Chapter 1, Subchapter J, Part 772, 38 FR 15953, June 19, 1973; Revised at 47 FR 29654, July 8, 1982.
3. *Federal Highway Administration's Traffic Noise Model*, FHWA-RD-77-108; U.S. Department of Transportation, December 1978.
4. *Noise Analysis and Abatement Policy*, Department of Transportation, Highways Division, State of Hawaii, June 1977.
5. *Toward a National Strategy for Noise Control*, U.S. Environmental Protection Agency, April 1977.
6. Department of Housing and Urban Development Environmental Criteria and Standards, Title 24 CFR, Part 51, 44 FR 40860, July 12, 1979, Amended by 49 FR 880, January 6, 1984.
7. *Traffic Impact Analysis Report for Kauhale Lani,* Phillip Rowell and Associates, April 2005.

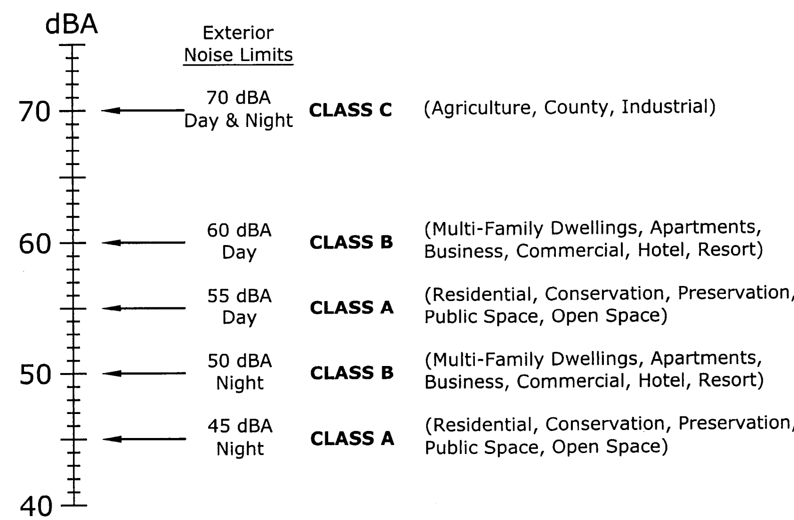
TABLE 1
Predicted Traffic Noise Levels With and Without the Project and Resulting Increases Due to the Project

Noise levels shown in the table are based on peak-hour traffic volumes, and are expressed in A-weighted decibels (dBA).

	Location 1* (Old Haleakala Highway)		**Location 2* (Haleakala Hwy - Makai)**		**Location 3* (Haleakala Hwy - Mauka)**	
	AM	**PM**	**AM**	**PM**	**AM**	**PM**
Existing (Calculated)	64.5	64.9	69.2	69.1	63.3	63.4
Future Without Project (2020)	65.4	65.6	70.2	70.2	63.8	64.8
Future With Project (2020)	65.6	65.8	70.3	70.3	63.8	64.8
Future Increase Without Project (2020)	0.9	0.7	1.0	1.1	0.5	1.4
Future Increase With Project (2020)	1.1	0.9	1.1	1.2	0.5	1.4
Future Increase Due to Project (2020)	**0.2**	**0.2**	**0.1**	**0.1**	**0.0**	**0.0**

* Location 1 – 40 feet south of Old Haleakala Highway
Location 2 – 150 feet south of Haleakala Highway
Location 3 – 350 feet south of Haleakala Highway

Zoning District	**Day Hours** (7 AM to 10 PM)	**Night Hours** (10 PM to 7 AM)
CLASS A Residential, Conservation, Preservation, Public Space, Open Space	55 dBA (Exterior)	45 dBA (Exterior)
CLASS B Multi-Family Dwellings, Apartments, Business, Commercial, Hotel, Resort	60 dBA (Exterior)	50 dBA (Exterior)
CLASS C Agriculture, County, Industrial	70 dBA (Exterior)	70 dBA (Exterior)



D. L. ADAMS ASSOCIATES, LTD.
970 N. KALAHEO AVE, A-311
KAILUA, HAWAII 96734
808/254-3318 FAX 808/254-5295

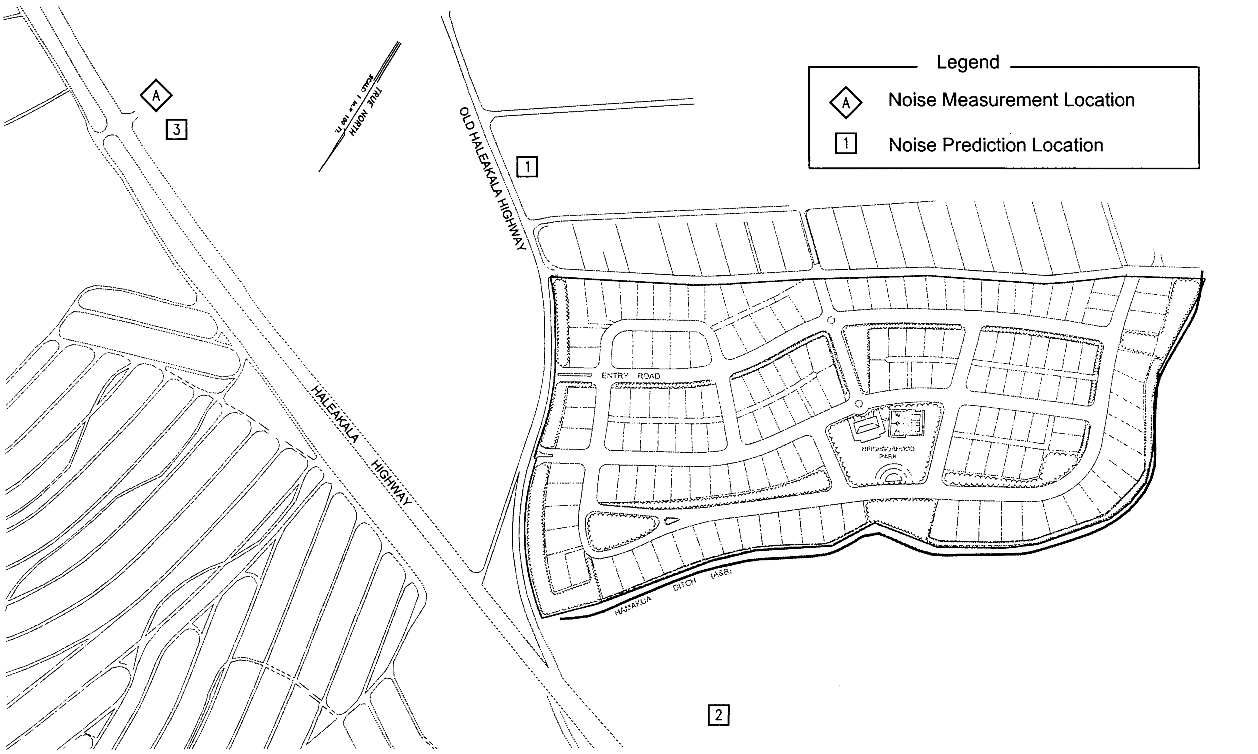
Hawaii Maximum Permissible Sound Levels for Various Zoning Districts

Kauhale Lani

not to scale

Date May 2005 | Project No. 04-26 | Drawn By TRB

Figure No 1



D. L. ADAMS ASSOCIATES, LTD.
970 N. KALAHEO AVE. A-311
KAILUA, HAWAII 96734
808/254-3318 FAX 808/254-5295

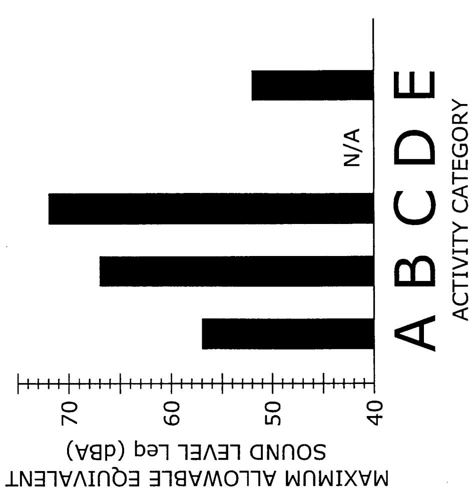
Map of Noise Measurement/Prediction Locations

Residences at Kapalua Bay

not to scale

Date	Project No.	Drawn By	Figure No
May 2005	04-84	TRB	3

ACTIVITY CATEGORY	ACTIVITY CATEGORY DESCRIPTION	MAXIMUM EQUIVALENT SOUND LEVEL $L_{eq(h)}$
A	LANDS ON WHICH SERENITY AND QUIET ARE OF EXTRAORDINARY SIGNIFICANCE AND SERVE AN IMPORTANT PUBLIC NEED AND WHERE THE PRESERVATION OF THOSE QUALITIES IS ESSENTIAL IF THE AREA IS TO CONTINUE TO SERVE ITS INTENDED PURPOSE.	57 dBA (EXTERIOR)
B	PICNIC AREAS, RECREATION AREAS, PLAYGROUNDS, ACTIVE SPORT AREAS, PARKS, RESIDENCES, MOTELS, HOTELS, ACHOOLS, CHURCHES, LIBRARIES, AND HOSPITALS.	67 dBA (EXTERIOR)
C	DEVELOPED LANDS, PROPERTIES, OR ACTIVITIES NOT INCLUDED IN ACTIVITY CATEGORIES A OR B ABOVE.	72 dBA (EXTERIOR)
D	UNDEVELOPED LAND	N/A
E	RESIDENCES, MOTELS, HOTELS, PUBLIC MEETING ROOMS, SCHOOLS, CHURCHES, LIBRARIES, HOSPITALS, AND AUDITORIUMS.	52 dBA (INTERIOR)



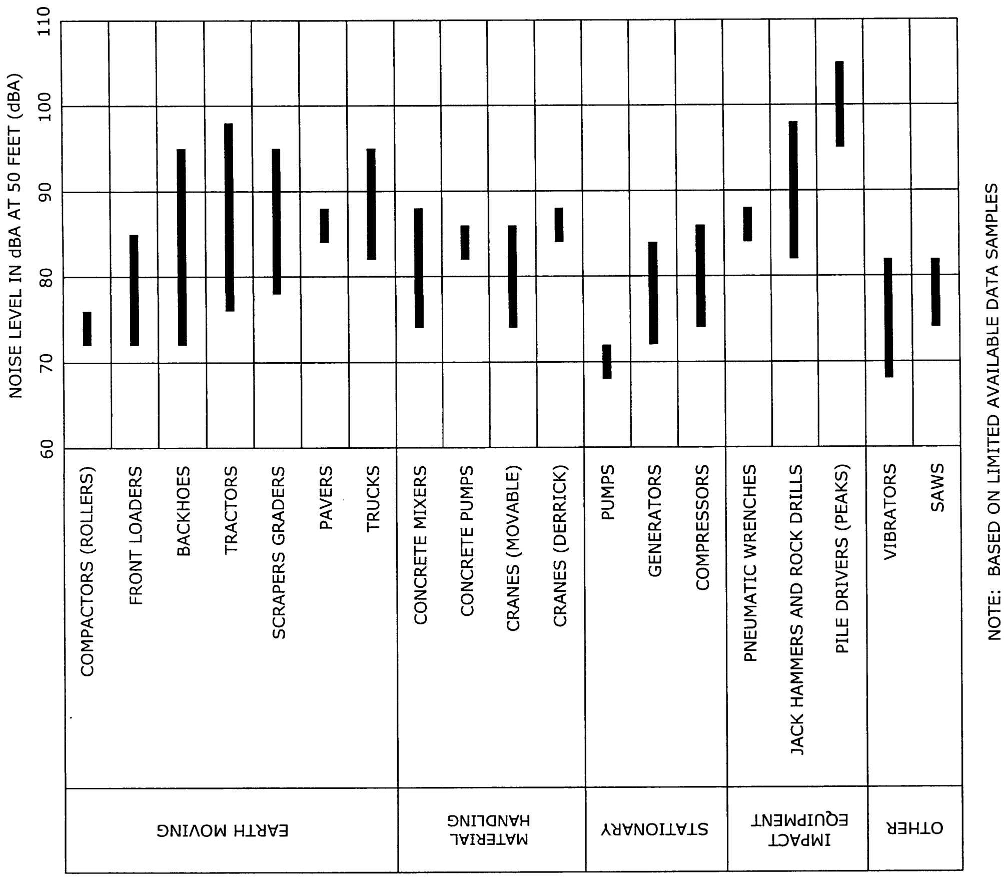
D. L. ADAMS ASSOCIATES, LTD.
970 N. KALAHEO AVE. A-311
KAILUA, HAWAII 96734
808/254-3318 FAX 808/254-5295

Federal Highways Administration Recommended Equivalent Hourly Sound Levels Based on Land Use

Kauhale Lani

not to scale

Date	Project No.	Drawn By	Figure No
May 2005	04-26	TRB	2



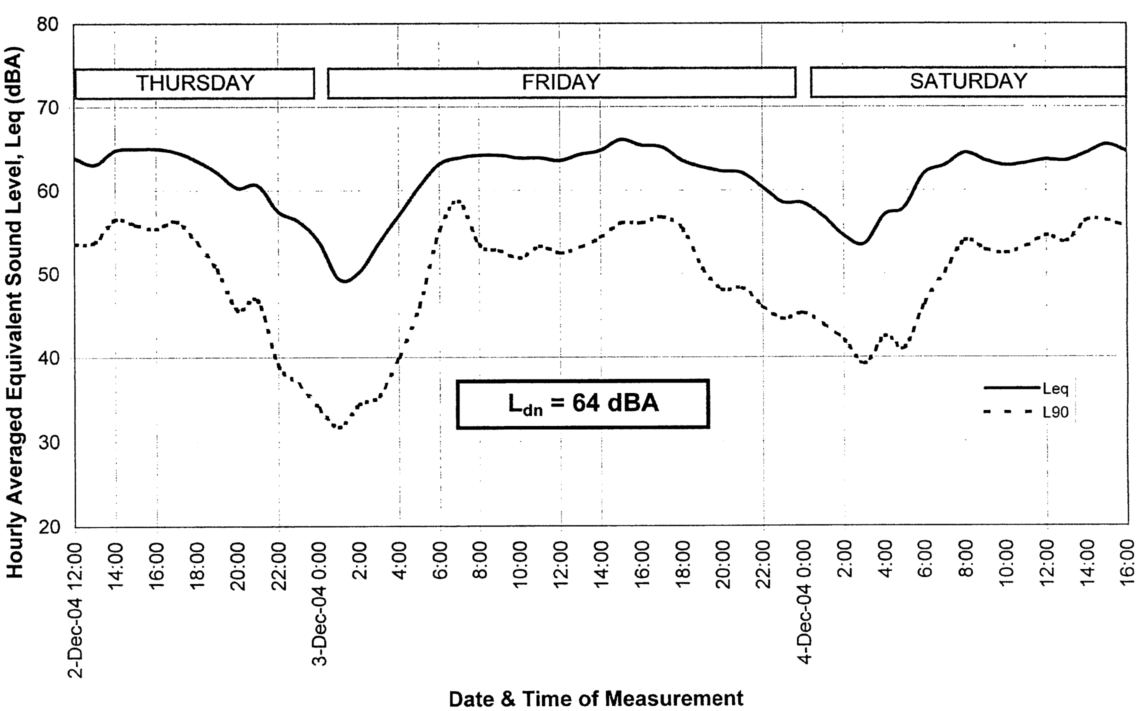
D. L. ADAMS ASSOCIATES, LTD.
970 N. KALAHEO AVE, A-311
KAILUA, HAWAII 96734
808/254-3318 FAX 808/254-5295

Typical Sound Levels from Construction Equipment

Kauhale Lani

not to scale

Date	Project No.	Drawn By	Figure No
May 2005	04-26	TRB	5



D. L. ADAMS ASSOCIATES, LTD.
970 N. KALAHEO AVE, A-311
KAILUA, HAWAII 96734
808/254-3318 FAX 808/254-5295

Graph of Long Term Noise Measurements

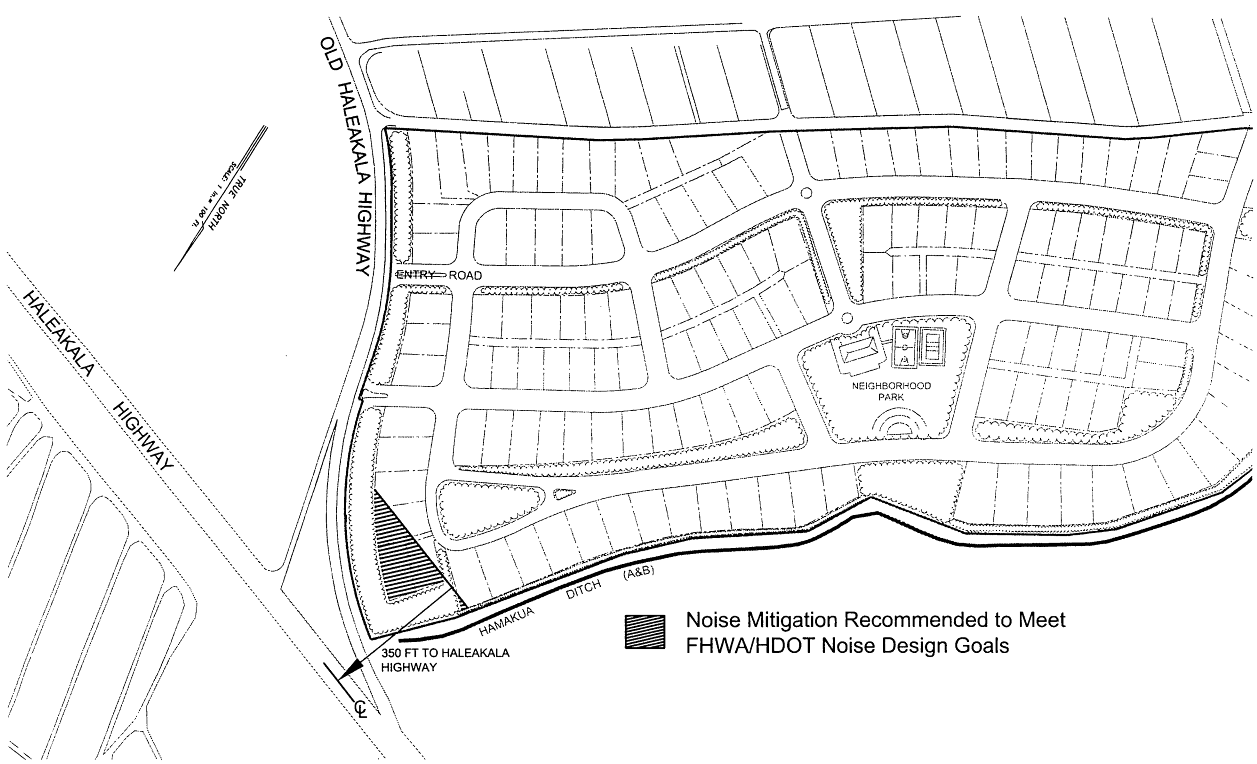
Kauhale Lani

not to scale

Date	Project No.	Drawn By	Figure No
May 2005	04-26	TRB	4

APPENDIX A

Acoustic Terminology



D. L. ADAMS ASSOCIATES, LTD.
970 N. KALAHEO AVE. A-311
KAILUA, HAWAII 96734
808/254-3318 FAX 808/254-5295

Residences Needing Noise Mitigation to Satisfy FHWA/HDOT Criteria

Kauhale Lani

not to scale

Date	Project No.	Drawn By	Figure No
May 2005	04-26	TRB	6

Acoustic Terminology

Sound Pressure Level
Sound, or noise, is the term given to variations in air pressure that are capable of being detected by the human ear. Small fluctuations in atmospheric pressure (sound pressure) constitute the physical property measured with a sound pressure level meter. Because the human ear can detect variations in atmospheric pressure over such a large range of magnitudes, sound pressure is expressed on a logarithmic scale in units called decibels (dB). Noise is defined as "unwanted" sound.

Technically, sound pressure level (SPL) is defined as:

$$SPL = 20 \log (P/P_{ref}) \text{ dB}$$

where P is the sound pressure fluctuation (above or below atmospheric pressure) and P_{ref} is the reference pressure, 20 μPa, which is approximately the lowest sound pressure that can be detected by the human ear. For example:

If P = 20 μPa, then SPL = 0 dB
If P = 200 μPa, then SPL = 20 dB
If P = 2000 μPa, then SPL = 40 dB

The sound pressure level that results from a combination of noise sources is not the arithmetic sum of the individual sound sources, but rather the logarithmic sum. For example, two sound levels of 50 dB produce a combined sound level of 53 dB, not 100 dB. Two sound levels of 40 and 50 dB produce a combined level of 50.4 dB.

Human sensitivity to changes in sound pressure level is highly individualized. Sensitivity to sound depends on frequency content, time of occurrence, duration, and psychological factors such as emotions and expectations. However, in general, a change of 1 or 2 dB in the level of sound is difficult for most people to detect. A 3 dB change is commonly taken as the smallest perceptible change and a 6 dB change corresponds to a noticeable change in loudness. A 10 dB increase or decrease in sound level corresponds to an approximate doubling or halving of loudness, respectively.

A-Weighted Sound Level
Studies have shown conclusively that at equal sound pressure levels, people are generally more sensitive to certain higher frequency sounds (such as made by speech, horns, and whistles) than most lower frequency sounds (such as made by motors and engines)[1] at the same level. To address this preferential response to frequency, the A-weighted scale was developed. The A-weighted scale adjusts the sound level in each frequency band in much the same manner that the human auditory system does. Thus the A-weighted sound level (read as "dBA") becomes a single number that defines the level of a sound and has some correlation with the sensitivity of the human ear to that sound. Different sounds with the same A-weighted sound level are perceived as being equally loud. The A-weighted noise level is commonly used today in environmental noise analysis and in noise regulations. Typical values of the A-weighted sound level of various noise sources are shown in Figure A-1.

[1] D.W. Robinson and R.S. Dadson, "A Re-Determination of the Equal-Loudness Relations for Pure Tones," *British Journal of Applied Physics*, vol. 7, pp. 166 - 181, 1956. (Adopted by the International Standards Organization as Recommendation R-226.

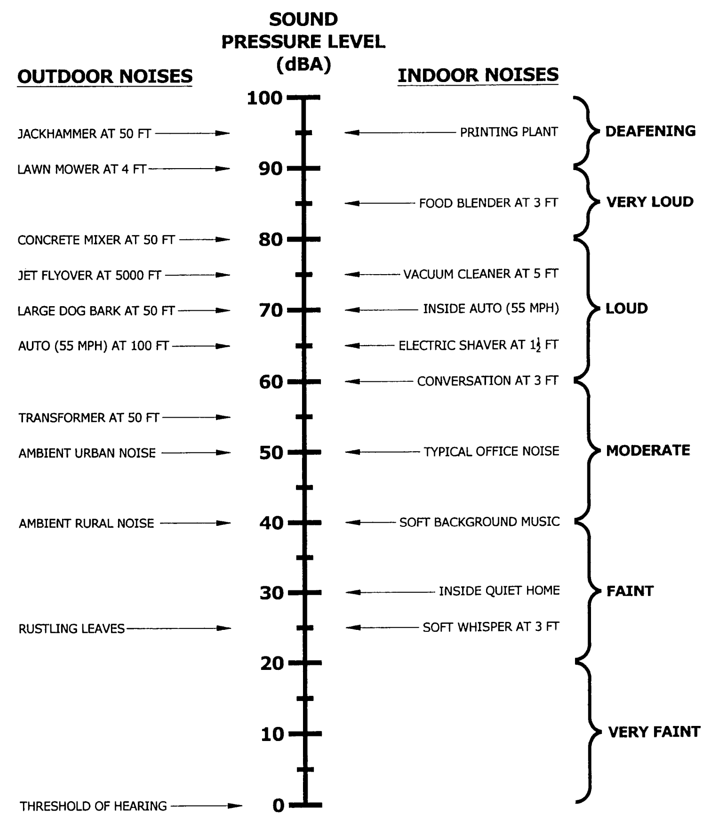


Figure A-1. Common Outdoor/Indoor Sound Levels

Equivalent Sound Level

The Equivalent Sound Level (L_{eq}) is a type of average which represents the steady level that, integrated over a time period, would produce the same energy as the actual signal. The actual *instantaneous* noise levels typically fluctuate above and below the measured L_{eq} during the measurement period. The A-weighted L_{eq} is a common index for measuring environmental noise. A graphical description of the equivalent sound level is shown in Figure A-2.

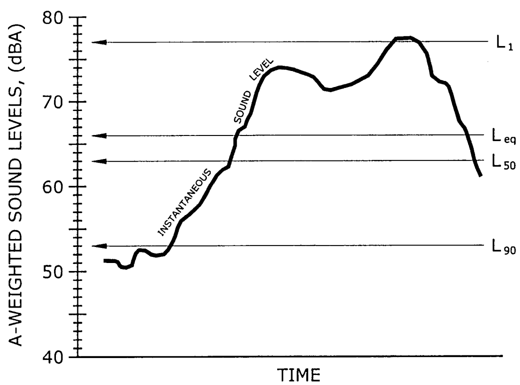


Figure A-2. Example Graph of Equivalent and Statistical Sound Levels

Statistical Sound Level

The sound levels of long-term noise producing activities such as traffic movement, aircraft operations, etc., can vary considerably with time. In order to obtain a single number rating of such a noise source, a statistically-based method of expressing sound or noise levels has been developed. It is known as the Exceedence Level, L_n. The L_n represents the sound level that is exceeded for n% of the measurement time period. For example, L_{10} = 60 dBA indicates that for the duration of the measurement period, the sound level exceeded 60 dBA 10% of the time. Typically, in noise regulations and standards, the specified time period is one hour. Commonly used Exceedence Levels include L_{01}, L_{10}, L_{50}, and L_{90}, which are widely used to assess community and environmental noise. A graphical description of the equivalent sound level is shown in Figure A-2.

Day-Night Equivalent Sound Level

The Day-Night Equivalent Sound Level, L_{dn}, is the Equivalent Sound Level, L_{eq}, measured over a 24-hour period. However, a 10 dB penalty is added to the noise levels recorded between 10 p.m. and 7 a.m. to account for people's higher sensitivity to noise at night when the background noise level is typically lower. The L_{dn} is a commonly used noise descriptor in assessing land use compatibility, and is widely used by federal and local agencies and standards organizations.

I

Market / Economic Report

THE HALLSTROM GROUP INC.
REAL ESTATE CONSULTANTS & APPRAISERS

Market Study,
Economic Impact Analysis
and
Public Costs/Benefits Assessment
of the Proposed

KAUHALE LANI

To be Located at

Pukalani, Maui, Hawaii

Prepared for

Mr. Robert M. McNatt
Maui Land & Pineapple Company, Inc.

April 2005

ARBITRATION
VALUATION AND
MARKET STUDIES

PAUAHI TOWER
SUITE 1330
1001 BISHOP STREET
HONOLULU
HAWAII 96813

(808) 526-0444
FAX (808) 533-0347
email@hallstromgroup.com
www.hallstromgroup.com

TABLE OF CONTENTS

Table of Contents (continued)

ASSIGNMENT AND SUMMARY OF CONCLUSIONS

Assignment

Kauhale Lani will be a single-family residential community containing 165 single-family home sites, ranging in size from 6,000 to 12,000 square feet, a neighborhood park/recreation center, and paths/open spaces, on a 59-acre tract within Pukalani Village.

The purpose of our assignment was to analyze the proposed subject project in light of competitive, regional, prevailing and forecast economic/market conditions in order to answer five foundational study questions:

1. Is there sufficient market demand to absorb the 165 lots/homes of the Kauhale Lani master plan during a reasonable exposure period given competing developments and statewide/regional economic trends?

2. From a market perspective, will the subject project be a favorable use of the site relative to governmental land planning objectives, accepted master plan design characteristics, and the area environs?

3. What will be the general/specific and direct/indirect economic impacts on Maui resulting from the undertaking of the subject development through capital investments, jobs, wages, business revenues and profits, de facto population, and resident/guest discretionary expenditures?

4. What will be the impact on the state and county "public purse" from the project in regards to costs of services required versus increased tax/fee receipts?

These issues were addressed through a comprehensive research and inquiry process utilizing data from market investigation, governmental agencies, various Hawaii-based media, industry spokespersons/ sources, on-line databases, and published public and private documents.

The pertinent results of our assignment are highlighted in this narrative report. Our study findings are divided into seven chapters as follows:

Study Conclusions
The Subject Property and Proposed Development
Environs – Maui, Upcountry, and the Pukalani Community
The Upcountry Residential Market
Subject Site Appropriateness and Absorption Conclusions
Economic Impact Analysis
Public Cost/Benefit Assessment

For this analysis, we have been provided with Kauhale Lani conceptual master plans, project descriptions, timetables and other analytical data prepared by the owner/developer and PBR Hawaii, Inc. Additional source information regarding the subject was taken from the files of our past studies regarding the subject holding.

Study Conclusions

Based on our inspection of the subject site, its environs and analysis of the historic and forecast Upcountry/Pukalani real estate market, we have reached the following conclusions about the proposed Kauhale Lani project:

The Upcountry Residential Market

Historically, the Upcountry residential sector has been dominated by single family development, ranging from smaller plantation-style subdivisions (as at Hailiimaile) to bulk acreage ranch and agricultural lots (in Olinda and Kula). Prices cover a similar spectrum, from entry level homes to upscale farms. The low density "country" ambience and housing alternatives have been major attractions of the region.

As a result of the increasing urbanization of the island, limited housing opportunities in Wailuku/Kahului, and the relative proximity of Upcountry to Maui economic centers, the study region is evolving into a bedroom community offering a variety of unit types typical of suburban development. The movement has gained inertia in recent years as the ease of commute has been enhanced through the expansion of the Haleakala Highway and completion of the Pukalani Bypass.

Escalating residential densities are a by-product of Upcountry modernization; an effort to provide greater supply within a high demand area having limited infrastructure and zoned land resources.

The average size of house lots in the region has decreased in recent years, and multifamily units are slowly entering the market.

The study region has experienced subdued development recently; limited to less than 200 new home sites in the last three years. However, more than 500 additional units/lots have been proposed, and the Upcountry is acknowledged by government agencies and private interests as a meaningful suburban growth node.

Based on our analysis, the actualization of a healthy and stable housing market in the study area will require the construction of between 3,264 and 5,954 additional housing units in the Upcountry area by the Year 2020. The mid-point demand would be for 4,609 units, or 56 percent more than the in-place inventory.

About 46 percent of the regional units required through 2020 should be priced below a current level of $380,000, which would be generally affordable to the "low" and "low-moderate" income groups; 25 percent of demand will have price limits between $380,000 and $650,000 (affordable to lower market categories); 17 percent of demand will be oriented towards homes having prices of $650,000 to $900,000 (moderate market pricing); and, 12 percent will seek properties having a price above $900,000.

The subject inventory will likely be oriented towards the 29 percent of the purchasers seeking homes at market price levels (more than $650,000).

Single family lots will remain the focus of Upcountry development, although we expect it will decline from the current level of comprising some 90-plus percent of the sector to 70 percent by 2020. The drop-off is a function of the increasing number of multifamily units and the trend towards "spec" and "tract" homes seen throughout the neighbor islands.

The total mid-point demand for multi-family development over the next two decades is estimated at 311 units. For single-family types the demand will be for 638 houses and 3,659 building lots.

Including Kauhale Lani, there are six major projects (10 lots or more) approved or proposed in the general study area at this time. The projects will provide a total of 409 house lots.

Therefore, announced/pending/approved supply will fall short of projected demand by nearly 3,900 single family housing units during the 16 year modeling period.

The Upcountry area single family residential real estate market, like most sectors throughout the state, is currently in the midst of a major up-cycle. Sales volumes are well up, market times are way down, appreciation is meaningful, and realtors report exceptional interest levels. However, due to the limited inventory available in the region, the number of sales has remained relatively static resulting in rapidly escalating per unit prices.

We uncovered no indicators in our research and interviews which demonstrated anything other than the subject area being in the midst of a significant up-cycle. We conclude there is strong market support for the proposed Kauhale Lani project.

Subject Appropriateness and Absorption Estimates

The 59-acre interior subject parcel, a rectangular-shaped holding fronting the Old Haleakala Highway, is a highly appropriate and favorably competitive location for the proposed Kauhale Lani residential project. We conclude the physical, functional, scope, and amenity characteristics of the property are desirable from a market perspective, and enhance the salability of the finished single-family lots/homes inventory.

Primary contributing factors to this conclusion include:

- The subject property is an urban expansion site for the Pukalani community, having highway frontage, abutting existing homesite development, and otherwise defined by Hamakua Ditch (the southerly boundary of the town).
- Pukalani is an expanding suburban village which will be a focal point of Upcountry development over the coming decades.
- The proposed project represents the highest and best use potential of the property at this time, and is consistent with existing residential uses in the immediate neighborhood.
- The parcel is of sufficient size, shape, access and terrain to support a competitive, leading-edge, residential project.

We have quantified absorption rates using three techniques, all of which point to a reasonable sell-out period of three years or less for the 165 subject home sites.

The gross analysis method indicates there are insufficient competitive lots apart from the subject to meet demand regardless of other factors. The residual method demonstrates that the proposed competing developments could all achieve a reasonable absorption level and there would still be remaining demand for the subject product. And the market shares method indicates the Kauhale Lani product would be absorbed in a timely manner based on its competitive penetration in the market.

Economic Impact of the Subject Development(1)

The project will generate some $81.7 million in direct, new capital investment and spending into the Maui economy during a seven-year planning and construction period. This will create an estimated $11.4 million in profits for local contractors and suppliers. On a stabilized basis after completion, some 21 maintenance/renovation workers and other on- and off-site positions will earn $597,000 in wages each year, and resident/guest users of the project will spend $18.9 million annually in the local market.

A total of 522 worker/years of direct on-site employment will be created during the 10-year construction and operation study timeframe, along with an additional 209 worker/years in associated and indirect off-site employment. The total wages paid during the initial decade of development and use will be $33.6 million, peaking in year 7 of the project.

The full-time resident population at the subject is estimated to reach 475 persons, with approximately 119 school-aged children. Second-home owners and guests are expected to add a daily average of 73 persons to the community, resulting in a de facto population of 548 persons for the project. The discretionary expenditures by these individuals is expected to reach $18.9 million annually at build-out. The total household income of full-time residents is forecast to reach a stabilized level of $27.0 million per year.

The expenditure of employee wages, business profits, and resident/guest discretionary funds into the Maui market will enhance

(1) All dollar amounts contained in this report are based on constant, uninflated 2005 dollars.

hundreds of additional off-site, secondary/indirect jobs on the island, and generate several million dollars in additional wages.

The total direct, local economic impact to Maui (dollars flowing into the island market) is estimated to be $162.4 million during the initial decade construction and operation study period, and stabilize at $21.5 million annually thereafter. As these dollars move through the island market, they will have a multiplier effect increasing the economic impact of Kauhale Lani to Maui during its first 10 years to some $324.9 million.

Public Cost/Benefit of the Subject Development

The county of Maui will receive $6.1 million in real property tax receipts from the project over the 10-year study projection period, and an estimated $864,000 per year thereafter. The county government operating costs associated with serving the subject, using a per capita basis, will total $4.6 million for the initial decade timeframe, and be some $802,000 on a stabilized basis. The county will enjoy a net revenue benefit (taxes less costs), totaling $1.5 million during the first 10 years of construction and use, and $62,000 each year after build-out.

The State of Hawaii will also show a positive net revenue benefit from Kauhale Lani. The total gross tax revenues during the 10-year modeling period will reach $20.1 million from income and gross excise taxes, and will stabilize at $2.5 million annually following build-out. State costs associated with the project on a per capita basis will be $11.6 million during the projection timeframe and $2.0 million per year subsequently. The state will experience a net profit of $8.5 million in the 10 years and a stabilized benefit of $502,000 annually after build-out.

In no year does either the county or the state suffer a revenue shortfall due to the subject project.

THE SUBJECT PROPERTY AND PROPOSED DEVELOPMENT

Land

The 59 acre subject tract is a generally rectangular-shaped holding stretching westerly from Old Haleakala Highway at the down slope entrance to Pukalani Village, on the lower northerly flanks of

Haleakala approximately eight miles from Kahului Airport. The property, identified on State of Hawaii Tax Maps as Second Division, Tax Map Key 2-3-9, Parcels 7 and 69, is at circa 3,000 feet above sea level, just mauka of the Hamakua Ditch.

The site varies in depth, east/west from the road frontage, between 2,100 and 2,400 feet, and in width, north/south, from 800 to 1,200 feet. The slope is gentle to moderate and generally consistent, with nominally undulating topography. The highway frontage of the parcel ranges from at to slightly above the road grade (it is cut in places).

The property is in the Agricultural District on State Land Use Maps, and is shown as agriculture use on the Maui County general plan and zoning maps. These classifications will require change before the proposed subdivision may be built.

Access to the site is available from Old Haleakala Highway which forms the easterly boundary of the tract. The roadway is two-lane, macadam surfaced, and extends from Hana Highway near the shoreline upslope through Pukalani and on to the mountain summit. The opening of the Pukalani Bypass, which veers off from the Highway just down slope from the subject, now carries the bulk of vehicles in the region; the old highway is mainly used now by village residents and other Pukalani destination-bound traffic.

The view panoramas from the property are exceptional, with a vista encompassing the Central Maui isthmus, West Maui Mountains and vast reaches of the Pacific Ocean. The scenes are available from most points on the subject site, unobstructed by development lower down the mountainside. Mauka views to the upper slopes of Haleakala are limited by terrain, trees and buildings.

The property, a now-fallow pineapple field, is currently overgrown with grasses and small shrubs. We are aware of no archeological sites on the holding or environmental issues which would impede residential development.

The tract is surrounded on three sides by feral agricultural lands (north, east and west). Mauka is an existing residential/agricultural subdivision.

Proposed Development

Kauhale Lani will be a residential community containing 165 home sites ranging in size from 6,000 to 12,000 square feet. At the center of the project will be a park/community center featuring a pavilion, hard courts and ball fields. The development will also have a pedestrian/bike trail looping around the perimeter, as well as a landscaped entry and drives, open spaces and detention ponds.

The house lot inventory will be divided as follows:

Type	Size in Sq. Ft.
Edge/View	10,000 to 12,000
Interior/West	6,000 to 7,000
Interior/East	7,000 to 8,000
Edge/Buffer	6,000 to 7,000

The master plan is intended to provide a range of purchase options and prices.

The project will be accessed from the Old Haleakala Highway near the southerly (upslope) corner of the property. A central roadway leading west from the road will loop around the entire interior of the development. This primary project arterial will have secondary streets extending in loops throughout the subdivision, creating a series of distinct pods each containing up to 20 lots. There will be a connector roadway at mid-project leading into the southerly abutting existing subdivision. For the most part, the residential components will be double-loaded off of the interior roadways.

The larger lots will be along the exterior tier of the project, with smaller parcels forming the interior.

While the exterior home sites will all enjoy panoramic views, the gradual/moderate makai slope of the site may limit general views from interior lots, particularly as the home construction on down slope lots creates obstructions. However, there will be ocean and/or mountain scenes available from selected lots in the central and mauka areas of the project.

Overall, the proposed subject development embodies modern residential planning concepts and contains the fundamental characteristics necessary for its product to be competitive in the regional market.

ENVIRONS

Maui, the second largest island in the Hawaiian chain, lies midway between Oahu and Hawaii. The island is often called the "Valley Island," because of its valley-like central isthmus stretching between two mountain masses. The island measures 25 miles from north to south, a maximum 38 miles from east to west, and contains 728 total square miles. The western shores of the island of Maui include approximately 20 miles of clean, accessible, sandy beaches.

The Kauhale Lani holding is located in the southerly central highlands of the volcanic-created island on the northerly flank of Haleakala, approximately eight miles from the county seat, interisland airport and harbor facilities at Wailuku/Kahului. The area is generally referred to as "Upcountry".

The region historically was used for sugar cane and pineapple cultivation and ranching, with most holdings devoted to agriculture, small villages or rural home sites. Over the past three decades, the area has evolved into a suburban community, providing quality housing and lifestyle opportunities. The primary draws of the area to local residents are its desirable cool climate, excellent view panoramas, ease of access to central Maui employment, commercial and public facilities, and a unique modern, rural/suburban ambience.

Wailuku, the historical hub of island business, is the seat of government for Maui County, which includes the major islands of Maui, Molokai, Lanai, and Kahoolawe. Adjacent is Kahului, the headquarters for HC&S, the world's largest sugar plantation, and the site of the primary transshipment facilities at Kahului Harbor and Kahului Airport. The Wailuku/Kahului central windward area of the island is the focus for Maui industrial activity, and the employment and resident population centers of the county outside the destination resorts. Sugar production has traditionally been the island's base industry; however, with the closure of Wailuku Mill in the early 1980s and the pending shut down of Pioneer Mill (Lahaina), alternative agricultural, commercial, and residential opportunities for the land are being pursued, with the tourism-oriented businesses of the leeward side of the island (West and South Maui) coming to dominate the economy and job market.

Currently, the county has a resident population of some 140,000 persons, more than doubled the 1980 total of 62,823, and equating to a compounded annual growth rate of four percent over the past 18 years. Outside the Wailuku/Kahului urban enclave, Kihei and Lahaina are the largest settlements, both of which have undergone dramatic growth in recent decades due to tourism economics and land use demands.

State of Hawaii population projections call for an increasing population for the county over the next three decades, reaching 199,500 full-time residents by 2030. This would represent an expansion of 42.5 percent and a growth rate of 1.43 percent compounded annually.

The island of Maui has a current resident population of about 125,000; a figure expected to increase by almost half during the next 25 years. Most of this growth is forecast to occur in the three "major" *Community Plan* regions of the island--West Maui, Wailuku-Kahului, and Kihei-Makena.

Attracted by a thriving tourism plant, some 40,000-plus non-residents additionally populate the island each day--about 43 percent (17,200) in the Lahaina-Kapalua study corridor. The capital expenditures associated with the development and operation of visitor-oriented facilities and services now comprise some 70 percent of the total island economy, and has a ripple effect throughout all governmental and private finances.

Notwithstanding a few minor stagnant periods focused in several submarkets during the early 1980s and from 1991 through late 1994, the Maui economy has generally "boomed" over the last two decades, growing at a long-term rate which places it among the more vibrant regions in the country. As Oahu before it, the island has successfully been transformed from a simple agrarian-based structure to a diversified service model founded on a widely recognized and well-established tourism industry.

Vast potentially habitable areas of the island and significant water resources have been devoted to sugar cane cultivation. Until the past

decade, the long-term viability of the sugar industry was unquestioned, and the business remained a major employer and tax payer. As a result, cane land was re-classified for alternative (urban) uses only after lengthy public agency reviews and negotiation with unions.

The impact of this policy, in the face of unmet resident housing needs and off-island capital driven, visitor-oriented land use demands, was large-scale appreciation in real estate prices (due to limited supply) and major dysfunction in the residential sector since the early 1970s.

Maui boasts the world's largest sugar plantation, which apparently remains economically productive and viable. However, there has been a shrinking of the Maui sugar industry over the past 15 years, with the announced closing of the Pioneer Mill and fields in West Maui in mid-1999 being the latest casualty. Discussions and testing are progressing on alternative agricultural crops, and mixed-urban uses for large tracts of now feral land are the source of public debate. Diversified crops (macadamia nut, coffee, cocoa, floral products and others) are viewed as potential sources of agricultural land use and employment. Yet, developing consistent yields, secure markets and product acceptance requires many years; and absorption of sugar lands by other crops has proceeded slowly. Over the long term on a per acre basis, diversified crops offer significantly more employment and return potentials than sugar, benefit more from the Hawaii "name," and are less prone to outside destabilization. But it will take generations to absorb the vast plantation lands by alternative agricultural products.

The county has had one of the lowest unemployment rates in the nation, ranging from 2.2 to 7.6 percent over the last 20 years, and one of the highest incidence of multi-job workers. Only at the depths of the recession in 1992-1994 (when the unemployment rate rose to a record 7.6 percent) has the figure been above six percent during the last 15 years.

The evident movement from "rapid" to "slow" growth stances in the community in the past several years is the latest continuation of a periodic cycle dating back to the "discovery" of Maui by tourists in the early 1970s. Since that time, economic considerations have driven the conflict.

In heated economic periods (such as the late 1970s and late 1980s), rapid development, low unemployment, and large in-migration fuels slow growth sentiment. Conversely, during recessionary episodes, as the job market weakens and capital investment wanes, the community has shown greater support for further and expedited growth.

Overall, we remain optimistic as to the extended prospects for the Maui economy and resident population base, with a generally sustained growth forecast (though moderate by historic standards).

The investment value represented by the existing resort, industrial, commercial and residential components of the real estate market is many billions of dollars, and serves as a strong foundation for the island's economy far exceeding the other neighbor islands and most tropical resort locales around the world. Base historical indicators support long-term conclusions favoring a vital and growing Maui economy. Further, Maui has a superior natural appearance and attraction which portends well for future growth.

Regional Description - Upcountry

The focus of our study is the "Upcountry" area of Maui, a vast region on the lower northwesterly slopes of Haleakala, overlooking the central valley of the island, containing the communities of Pukalani, Makawao, Kula, Hailiimaile, and Olinda. The first two villages, comprising the majority of population and urban/suburban land uses in the area, are located approximately four miles apart, between the 1000 and 1800 foot elevation levels. The others are smaller outlying communities, stretching from the 700 foot to 3500 foot elevations, based mainly on rural housing and agricultural uses with limited supporting commercial types.

The area is generally defined by Hailiimaile Road (downslope), the lower boundary of the Haleakala National Park (upslope), the easterly edge of Makawao Town, and the westerly extent of the Kula community. Primary access is provided by Haleakala Highway, a three-laned, modern high-speed thoroughfare, which extends from the Hana Highway up-mountain through the heart of the region. The roadway has been significantly upgraded, and a bypass constructed around Pukalani, during the past decade. Several secondary roads also lead down from Upcountry, most notably Baldwin Avenue in Makawao. While access into/out of the area has been improved, traffic congestion remains a community concern; although, a proposed Kula-Makena road would mitigate the issue by providing direct access to the South Maui resort areas.

A full-range of public utility systems service Upcountry, including electricity, water, telephone and cable television. Sanitary sewers are limited to the more urbanized neighborhoods. Emergency services are available in Pukalani and Makawao, and there are numerous public and private school facilities in the area. Water supply is an on-going issue due to limited source development relative to population growth, and on-going drought conditions.

Historically, the region has been agriculturally-oriented, with ranching, sugar and pineapple being the primary activities. Over the past three decades, the region (specifically Kula) has also become known for its floral and other diversified crops. Yet, because of its favorable climate, superior views, limited housing opportunities on the island and relative proximity to Central Maui, there has been significant urbanization pressure during the past 20 years.

According to the year 2000 United States Census, the study area had approximately 14,602 persons, up 20.4 percent from 1990 and nearly double the total of 1980. The region is trending towards typical suburban status, with lowering household sizes (in persons), increasing income levels, and an escalating average age. Additionally, an estimated 1.7 million tourists pass-through/visit the area each year.

While the character of the region remains founded on agricultural uses and a rural environment which area residents desire to retain, there are increasing demands for urban uses being created by an expanding population and economic base, particularly in Pukalani and Makawao. As the number of residents increases, so will the demand for neighborhood-serving development offering a greater ease of access to local consumers along with proximate job and business opportunities.

Neighborhood Description -- Pukalani

The subject property lies on the northerly or downslope edge of Pukalani Town, one of several urban villages located in the Makawao District of Maui County. This expanding community is situated on the slopes of Haleakala approximately eight miles from Wailuku, and is essentially comprised of residential (urbanized) areas extending along both sides of Haleakala Highway between Aeloa Road and the Kula Highway. The urbanized pod of the town is virtually surrounded by extensive agricultural, cultivation and ranchlands.

The topography is generally gently to moderately sloping, with the cultivated fields and grasslands scored by steep sided gulches and bluff formations. Economic activity within this area has primarily been tied to agriculture, although the region is undergoing a transition from agrarian to service-based uses as seen throughout the neighbor islands. Pineapple is the principle production crop; however, there are numerous "truck" farms cultivating a variety of produce (notably onions) and ornamental flowers. Cattle ranching is also common.

Realistically, agriculture is becoming a secondary land use in the district, which is evolving into a series of suburban (or bedroom) communities housing workers employed elsewhere on Maui.

Pukalani's existing residential development is primarily comprised of residential and agricultural subdivisions containing more than 2,700 square feet to one-half acre single-family lots. Among the major projects are Mountain View, Pukalani Lots, Haleakala View, Kua'aina, Ho'olako and Kulamalu. The community's commercial (retail and service) facilities are located in strip developments fronting Haleakala Highway and Makawao Avenue.

Recreational uses include the Pukalani Park and Community Center, and the Pukalani Country Club Golf Course. Educational institutions within Pukalani include a new high school and a single elementary school, other private and public schools are within close proximity, including Makawao Elementary, Haiku Elementary, Kula Elementary, Paia Elementary, Kalama Intermediate School, St. Joseph School, and Seabury Hall.

THE UPCOUNTRY RESIDENTIAL MARKET

Our analysis of the Upcountry residential market is divided between two perspectives:

- Macro Analysis -- Assessing the overall, long-term demand and supply trends in the competitive sector; and
- Micro Analysis -- Focusing on the current demand/supply levels in the subject segment.

The study opens with a brief overview of residential development in the study area followed by an analysis quantifying the demand for additional housing units in Upcountry based on population, buyer demographic, and real estate trends. Existing and proposed inventory

supply is then identified in regards to number of units, development timing and product type. To the extent mid to long-term demand exceeds supply in the study area, the general (or macro) climate for the proposed subject development is favorable.

The second part of the study reviews current market activity in the region, including the status of the market cycle, availability of inventory, pricing and appreciation levels, and exposure time required for sale. This aids in determining whether sufficient near to mid-term demand exists relative to potential supply to support a new project and successfully absorb the initial phases. If the market cycle is up, rapidly absorbing available units, and inventory is limited, the micro conditions are favorable for Kauhale Lani.

Historically, the Upcountry residential sector has been dominated by single family development, ranging from smaller plantation-style subdivisions (as at Hailiimaile) to bulk acreage ranch and agricultural lots (in Olinda and Kula). Prices cover a similar spectrum, from entry level homes to upscale farms. The generally low density "country" ambience and housing alternatives have been major attractions of the region.

As a result of the increasing urbanization of the island, limited housing opportunities in Wailuku/Kahului, and the relative proximity of Upcountry to Maui economic centers, the study region is evolving into a bedroom community offering a variety of unit types typical of suburban development. The movement has gained inertia in recent years as the ease of commute has been enhanced through the expansion of the Haleakala Highway and completion of the Pukalani Bypass. As a result, several commercial and public-oriented developments are being designed to address the emerging retail, service and medical needs associated with this on-going transformation (specifically the Upcountry Town Center).

Escalating residential densities are a by-product of Upcountry modernization; an effort to provide greater supply within a high demand area having limited infrastructure and zoned land resources. The average size of house lots in the region has decreased meaningfully in recent years, and multifamily units are slowly entering the market. Given the maturation of the community, its desirable lifestyle, proximity attributes, and cost factors, we believe there is accepted recognition that certain areas in the region (notably near

Pukalani and Makawao) will be improved with more intense residential product in coming years.

Despite strong evidence of demand, the study region has experienced subdued development in recent years; limited to less than 200 new home sites in the last three years. However, more than 500 additional units/lots have been proposed, and the Upcountry is acknowledged by government agencies and private interests as a meaningful suburban growth area. And, though envisioned as having lesser development than in the primary urban zones on the island (Wailuku/Kahului, Kihei, West Maui), the study area is expected to service larger populations of residents on the island over the coming decades resulting from:

- Providing a quality, less intense, more rural-like lifestyle;
- A scarcity of alternative, entitled acceptable development areas throughout the island;
- Proximity to good, services, and support uses in Central Maui;
- Relative ease of access to employment centers and other areas of the island (which will be enhanced by construction of Upcountry/Makena road);
- A cool, generally dry climate considered highly desirable by many residents, offering excellent gardening/farming opportunities; and
- Superior view panoramas.

Over the past two decades, the supply of housing units in Upcountry has failed to keep pace with resident demand segments; the development on the island being focused in the Central Maui, Kihei and destination resort communities. These areas offer entitled lands, existing intense urban environments, and greater potential returns. However, there is a need to spread the housing inventory loads throughout the central areas of the island within infrastructure-serviced nodes, as well as provide the location alternatives desired by the market.

Macro Analysis

Projecting the probable mid to long-term regional demand for the residential units in the study area is a three-step process:

1. Quantification of Upcountry Housing Unit Demand -- Estimating the need for additional housing units in the study area based on population, demographic, vacancy and income characteristics.

2. Identification of Current and Proposed Projects -- Overview of recent/in-sales and proposed/potential residential development in the study area units in regards to unit types and sales activity.

3. Indicated Conclusions -- Correlation of quantified market demand and supply indicators.

We have assumed the subject lots would be priced at general market levels consistent with other new lot/housing product in the study area, and attract a typical spectrum of buyers. It is our understanding the developer will meet affordable housing criteria established/negotiated with State and County planning agencies. To the extent any below-market, affordable-priced units are offered on-site, the expected rate of absorption would increase given the island-wide shortage of such product.

Quantification of Upcountry Housing Unit Demand

We have projected the demand for residential units in the identified Upcountry area using standardized formulae employing population forecasts, household size trends, and other market-based factors as follows:

RP/AHS = TRUR X (1 + (VA + NRPA)) = TMUD

Where:

RP is the Resident Population
AHS is the Average Household Size
TRUR is the Total Resident Units Required
VA is a Vacancy Allowance
NRPA is a Non-Resident Purchaser Allowance
TMUD is a Total Market Unit Demand

Each of the variables in the formula is based on historic statistics compiled by the Federal Home Loan Bank, U.S. Census Bureau, State of Hawaii DBEDT, other recognized governmental sources, and researched market data.

These past and current indicators were translated into estimates based on temperate trending interpretations. Our emphasis was on letting the data "speak for itself" through our projections, as opposed to making large-scale adjustments for subjectively anticipated lifestyle or market evolutions.

In this regard, our forecasts are representative of moderate future housing requirements, and could be understated if some movements continue as strongly as in recent years; such as the trend towards smaller household sizes and an increasing influx of non-resident purchasers into the market.

The "Total Market Unit Demand" conclusions resulting from equation application are intended to quantify the total number of residential housing units of all types which will be needed in the study region over a 16-year projection period (2005 through 2020) in order to manifest a reasonably stable market with all purchaser/tenant demand segments served.

Currently, the Upcountry housing market is in a moderately to strongly undersupplied condition. Development in the area has been slowly paced during the last several decades, which coupled with very low vacancy rates, low mortgage rates and high market interest, has resulted in rapidly appreciating prices in recent years. The outcome has been a dysfunctional local housing sector.

Governmental policy has been to seek alleviation of the unit shortage, while maintaining local character, by permitting selected residential development of centrally-located, vacant, feral or nominal agricultural lands at as rapid a pace as the infrastructure and community will bear.

The factors comprising our housing demand equation can be summarized as follows:

> Resident Population (RP) -- This variable utilizes population and distribution forecasts made by the State, County and ourselves for the island and/or study area. Specifically, we have employed the projections made by SMS in their June

2002 report "*Maui Community Plane Update Program: Socio Economic Forecast*" which was commissioned and adopted by the County for use in its periodic general Plan updating process.

The SMS baseline models forecast a resident population of 28,974 persons in the Makawao-Pukalani-Kula study area by 2020; an increase of some 26 percent and nearly 6,000 persons over the current estimate of 23,000, and equivalent to a compounded annual growth rate of 1.55 percent. These projections served as the foundation of our "Scenario One" modeling alternative.

The DBEDT 2030 series of forecasts calls for the resident population of Maui County to increase by 43 percent and nearly 60,000 persons over the coming quarter of a century (1.43 percent compounded annual growth rate), with the daily tourist population to be up by more than 85 percent and 34,500 visitors (2.52 percent escalation annually).

We have also tested an alternative subject region resident population forecast as part of the "Scenario Two" model which estimates the 2020 Upcountry community at 33,026 persons, equal to a compounded annual growth rate of 2.29 percent. The projection, representing a maximum/upper-end estimate, is reflective of the type of supportable growth in the area were sufficient land and infrastructure resources made available to better support evident market demand.

Average Household Size (AHS) -- This factor was calculated using the data as provided by the above-cited sources and census figures. The 2000 US census indicators for the study area were at 2.81 persons per resident household, moderately below the island-wide figure of 2.9 persons. Currently, the Upcountry AHS is estimated at 2.77 persons.

SMS forecasts household sizes in Upcountry will trend downward over the study period, declining to 2.66 persons by 2020. This is in keeping with national statistics. Most Hawaii-oriented sociologists contend the movement to smaller household sizes will continue into the future; forecasting longer life-spans, the influx of single persons attracted to the climate and employment opportunities, and the tendency towards fewer children.

We have again used the SMS baseline projections in the Scenario One model.

However, we believe the AHS of the study area will not necessarily decline as swiftly as the SMS trending suggests during the model time frame (down 0.25 percent compounded annually), but will hold closer to steady as more, larger single family homes are built in Upcountry attracting growing Maui households.

We project the average household size level in the study area will stabilize by the Year 2020 at about 2.73 persons, a decline of 0.09 percent compounded per year. These estimates were used in the Scenario Two model.

Total Resident Units Required (TRUR) -- This figure is arrived at by dividing the subject area resident population (RP) by the average household size (AHS). It is indicative of the minimum number of residences which would be required to meet basic market needs, assuming there were no vacant units, none uninhabitable due to on-going repair or deleterious conditions, and none occupied by non-resident persons.

For a market to be considered stable (and nominally operative) with acceptable appreciation rates and quality lifestyle opportunities, allowances for such factors must be made.

Vacancy Allowance (VA) – Governmental agencies are on record during the past 20 years calling Maui one of the tightest residential markets in the nation, expressing fears of a deteriorating economy and community structure unless major steps are taken over the long-term to address the shortage. The undersupply condition is a primary reason Maui housing prices are on average among the highest of any locale in the country.

According to HUD, the Urban Institute, and other sources, a "healthy" market has a minimum vacancy level of five to six-plus percent of the total number of units in the inventory. This allows for uninhabitable units, units under repair, seasonal fluctuations, a transitional housing margin, a degree of

mobility potential, and the ability to service periodic unanticipated population increases. A "slack" in unit occupancy also serves as a margin to cushion against hyper-appreciation during strong demand periods.

Given the history of the Maui housing market and its inability to keep an acceptable vacancy pool available, we believe it will be exceptionally difficult for the desirable vacancy allowance of more than five percent to be achieved on the island during the foreseeable future.

In its forecasts, SMS employs an effective vacancy rate allowance of 5.25 percent of the total residential unit demand, which was applied in Scenario One.

In the Scenario Two formula, we have tested a vacancy rate allowance of five percent of the Total Resident Units Required figure.

Non-Resident Purchaser Allowance (NRPA) -- While some non-resident purchasers of non-resort housing units are investors who seek to rent them to residents to cover debt service obligations, an increasing number are buying Hawaii residential units for personal (family and friends) second-home use, business reasons, or other non full-time residential use.

These units are not available to meet resident housing demands and are effectively withdrawn from the inventory pool. An allowance must be made for these residences in the general community, which are not to be confused with those specifically intended for tourist-oriented transient rentals (i.e., within a condominium/hotel project in a resort-classified area).

On the neighbor islands and in Waikiki, there are many units in complexes or subdivisions designed for general residential use, which often sit vacant the vast majority of the time.

Our research indicates most projects in neighbor island vacation (non-resort) communities such as Kailua-Kona, Kihei and Poipu have upwards of 30 percent non-resident, investor-owned units/homes. In some in-resort developments (particularly Hualalai, Mauna Kea Beach, Mauna Lani, and

Kapalua), up to 90-plus percent of selected complexes are so held.

Most neighbor island subdivisions and multifamily projects, no matter where they are located, have some level of non-resident ownership/use. This is particularly true in newer developments which are highly attractive to off-island buyers informed via the internet. Further, Maui has an increasing number of oft-returning visitors who are comfortable away from the beachside communities and drawn to alternative "more local" areas.

The impact of these buyers on the market must be taken into consideration when projecting a region's housing unit needs, given the widespread interest in Hawaii real estate and typically greater financial resources of non-resident buyers. Failure to adequately account for their demand places extreme stress on island towns.

Well removed from the leeward resort communities and most tourist/vacation oriented development, the demand for non-resident units in Upcountry is not as significant as in South, West and even Central Maui. However, the excellent views, good climate and easy access to most Maui amenities, does attract some non-resident purchasers to the area, focused on upper-end homes and units near the golf-course.

SMS did not incorporate this factor into its housing demand models. We believe this results in an inherent understatement of demand and inevitably leads to major market dysfunction. The non-resident purchaser is typically wealthier, equity richer, and not as time or price sensitive. They will always find a way to express their purchase desires by out-competing many local buyers.

Historically, the NRPA in Upcountry was low (less than five percent), but the ratio is rapidly growing based on the experiences of recent projects, and will continue to do so, particularly as resort real estate price appreciation outpaces Upcountry values. We contend an appropriate NRPA should be at a minimum of ten to fifteen percent in the study area over the coming two decades.

We have, therefore, tested a non-resident allowance of 12 percent of total resident household demand in the maximum projections Scenario Two model, with no allowance made in Scenario One (reflective of SMS).

Total Market Unit Demand (TMUD) -- The solution to our demand formula is quantified by adding the Vacancy Allowance (VA) and Non-Resident Purchaser Allowance (NRPA) to the Total Resident Units Required (TRUR) figure. This is the total number of units which will be needed in the study region in order to meet all reasonable market demands.

The application of the housing demand formula to the subject region using the SMS-based and maximum forecasts are shown on Table 1.

Extrapolation of 2000 census figures indicates there are currently some 8,200 existing housing units in the study area.

Based on our analysis, the actualization of a healthy and stable housing market in the study area will require the construction of between 3,264 (SMS baseline estimates/Scenario One) to 5,954 (Scenario Two) additional housing units in the Upcountry area by the Year 2020. The mid-point demand would be for 4,609 units, or 56 percent more than the in-place inventory.

Conversion of this estimate of gross demand into pricing equivalents was completed using available data from the U.S. Census, Maui Board of Realtors, and the U.S. Dept. of HUD.

Table 2 illustrates the striation of Upcountry regional housing requirements through 2020 into probable percentile demand by sales prices at current dollar levels. The figures correlate both historic actual buying trends and theoretical "affordability" quotients derived using government pricing criteria.

Table 3 displays the calculations of housing price affordability for Maui residents based on HUD/State/County and conventional financing guidelines.

Using the governmental criteria, households in the "Low Income" grouping, earning 80 percent or less of the island median income, can afford a sales price, or rental equivalent, of $205,000 (rounded) or less. "Low to Moderate Income" households, earning 80 to 120

TABLE 2

STRIATED PROJECTIONS OF HOUSING UNIT DEMAND BY SELLING PRICE IN UPCOUNTRY MAUI 2005 TO 2020

Market Study of the Proposed Kauhale Lani
Pukalani, Upcountry Maui, Hawaii

Period	Periodic Demand (1) 2005	2006 to 2010	2011 to 2015	2016 to 2020	Total Demand 2005-2020
1. Using SMS Demand Forecasts					
Less Than $205,000 (1)	62	296	284	275	917
Percent of Total Demand	30.00%	29.00%	28.00%	27.00%	28.13%
$206,000 to $380,000 (2)	41	194	183	173	591
Percent of Total Demand	20.00%	19.00%	18.00%	17.00%	18.13%
$380,000 to $650,000	52	255	254	255	815
Percent of Total Demand	25.00%	25.00%	25.00%	25.00%	25.00%
$650,000 to $900,000	31	163	173	184	550
Percent of Total Demand	15.00%	16.00%	17.00%	18.00%	16.87%
Over $900,000	21	112	122	133	387
Percent of Total Demand	10.00%	11.00%	12.00%	13.00%	11.87%
Total Market Demand	206	1,020	1,015	1,020	3,261
	100.00%	100.00%	100.00%	100.00%	100.00%
2. Using Maximum Demand Forecasts					
Less Than $205,000 (1)	185	506	500	487	1,678
Percent of Total Demand	30.00%	29.00%	28.00%	27.00%	28.20%
$206,000 to $380,000 (2)	123	332	321	307	1,083
Percent of Total Demand	20.00%	19.00%	18.00%	17.00%	18.20%
$380,000 to $550,000	154	436	446	451	1,488
Percent of Total Demand	25.00%	25.00%	25.00%	25.00%	25.00%
$550,000 to $800,000	93	279	303	325	1,000
Percent of Total Demand	15.00%	16.00%	17.00%	18.00%	16.80%
Over $800,000	62	192	214	235	703
Percent of Total Demand	10.00%	11.00%	12.00%	13.00%	11.80%
Total Market Demand	617	1,745	1,785	1,805	5,952
	100.00%	100.00%	100.00%	100.00%	100.00%

Note: The median household income for Maui for 2004 was estimated at $60,700 (HUD & Maui County sources).

(1) This price is considered "affordable" for households earning 80% of the median county household income ("Low Income").
(2) This price is considered "affordable" for households earning from 80% to 140% of county median (includes "Low-Median" to "Gap Group" categories).

Source: SMS, Various and The Hallstrom Group, Inc.

TABLE 1

QUANTIFICATION OF HOUSING UNIT DEMAND FOR THE UPCOUNTRY STUDY AREA 2003 to 2020 (1)

Market Study of the Proposed Kauhale Lani
Pukalani, Upcountry Maui, Hawaii

	Year-End 2004	2005	2010	2015	2020	Additional Units Required by 2020 (2)
Scenario One: SMS "Baseline" Projections (Rounded)						
Resident Population	23,000	23,369	25,327	27,123	28,974	
Average Household Size	2.77	2.76	2.73	2.69	2.66	
Total Resident Units Required	8,303	8,467	9,277	10,083	10,892	
Vacancy Allowance	436	445	487	529	572	
(circa 5% of resident unit demand)						
Non-Resident Purchaser Allowance	0	0	0	0	0	
(0% of resident unit demand)						
TOTAL MARKET UNIT DEMAND	8,739	8,912	9,764	10,612	11,464	3,264
Scenario Two: Maximum Projections Using Higher Population Growth						
Resident Population (3)	23,000	24,150	27,048	30,023	33,026	
Average Household Size	2.77	2.76	2.75	2.74	2.73	
Total Resident Units Required	8,303	8,750	9,836	10,957	12,097	
Vacancy Allowance	415	438	492	548	605	
(5% of resident unit demand)						
Non-Resident Purchaser Allowance	996	1,050	1,180	1,315	1,452	
(12% of resident unit demand)						
TOTAL MARKET UNIT DEMAND	9,715	10,238	11,508	12,820	14,154	5,954

CONCLUDED HOUSING UNIT DEMAND RANGE

	Existing	2005	2006-2010	2011-2015	2016-2020	Totals
MINIMUM DEMAND						
Periodic	539	172	853	848	852	3,264
Cumulative	539	206	1,227	2,244	3,264	
Average Annual Demand (4)		206	204	203	204	
MAXIMUM DEMAND						
Periodic	1,515	523	1,270	1,312	1,334	5,954
Cumulative	1,515	617	2,361	4,147	5,954	
Average Annual Demand (4)		617	349	357	361	
MID-POINT DEMAND						
Periodic	1,027	348	1,061	1,080	1,093	4,609
Cumulative	1,027	412	1,794	3,195	4,609	
Average Annual Demand (4)		412	276	280	283	

(1) The study region includes the Upcountry Planning Area, and the primary towns of Pukalani, Makawao, Kula,.
(2) There are an estimated 8,200 housing units in the Upcountry study area as of year-end 2004 (extrapolated from 2000 census figure of 7,305 units).
(3) Population growth equivalent to 2.29 percent compounded annually during projection period.
(4) Existing (or latent) demand is assumed absorbed evenly throughout study period.

Source: US Census, SMS "Maui Community Plan Update Program", Various and The Hallstrom Group, Inc.

percent of median income, can afford home prices up to $258,000. And, "Moderate-Gap Group (or "low market") Income" households can afford prices up to $378,000. Above this level, prices are considered to be outside the "affordable" pricing segment and in the "market" price range.

Using conventional financing criteria, the affordable housing prices for the respective groups increases by about 15 to 18 percent.

Inherently, a large portion of the demand is generated by lower- to middle-income groups who can have difficulty competing in the high-priced Maui marketplace. Upper-middle and above income households have more meaningful purchase alternatives.

About 46 percent of the regional units required through 2020 should be priced below a current level of $380,000, which would be generally affordable to the "low" and "low-moderate" income groups; 25 percent of demand will have price limits between $380,000 and $650,000 (gap group to lower market categories); 17 percent of demand will be oriented towards homes having prices of $650,000 to $900,000 (moderate market pricing); and, 12 percent will seek properties having a price above $900,000.

The subject inventory will be oriented towards the 29 percent of the purchasers seeking homes at moderate and above market price levels (more than $650,000).

Given land, subdivision and construction costs, it will be difficult to meet anticipated regional housing demands solely through single family development. Multi-family projects must be pursued in order to keep the Upcountry housing sector in balance.

As shown on Table 4, we forecast that multi-family units will increase meaningfully in overall proportion to single-family homes in new projects over the next 16 years. While still remaining a minor inventory component, this segment will expand owing to increasing urban densification pressures; moving upwards from the current level of circa two percent of market additions to 10 percent by 2020.

Single family lots will remain the focus of Upcountry development, although we expect it will decline from the current level of comprising some 90-plus percent of the sector to 70 percent by 2020. The drop-off is a function of the increasing number of multifamily units and the

TABLE 3

ESTIMATE OF HOUSING PRICE AFFORDABILITY FOR MAUI RESIDENTS
Market Study of the Proposed Kauhale Lani
Pukalani, Upcountry Maui , Hawaii

1. Based on HUD/Maui County Criteria

Grouping	**Low Income**	**Low-Moderate Income**	**Moderate-Gap Group Incom**
Household Income as a Percent of County Med	**80% or less**	**80% to 100%**	**100% to 140%**
Gross Household Monthly Income	$4,047	$5,058	$7,082
Maximum Allowable Housing Expense (1)	$1,335	$1,669	$2,337
Less Tax and Insurance Reserve (2)	($150)	($150)	($150)
Less Mortgage Insurance Payment (2)	($50)	($90)	($90)
Net Amount Available for Debt Service	$1,135	$1,429	$2,097
Maximum Mortgage Amount (3)	$194,491	$244,871	$359,338
Down payment at 5% of Sales Price (2)	$10,236	$12,888	$18,913
Total Affordable Purchase Price	**$204,727**	**$257,759**	**$378,251**

2. Based on Conventional Financing Criteria

Grouping	**Low Income**	**Low-Moderate Income**	**Moderate-Gap Group Incom**
Gross Household Monthly Income	$4,047	$5,058	$7,082
Maximum Allowable Housing Expense (4)	$1,133	$1,416	$1,983
Maximum Mortgage Amount (5)	$194,149	$242,643	$339,080
Down payment at 20% of Sales Price (5)	$48,537	$60,661	$84,770
Total Affordable Purchase Price	**$242,686**	**$303,304**	**$423,850**

(1) Based on HUD/Maui County affordability criteria at 33%.
(2) As established by Maui County Department of Housing and Human Concerns for housing affordability formula.
(3) Assuming 5.75% annual interest and 30 year mortgage (Hula Mae rate), per Maui County Department of Housing and Human Concerns.
(4) Conventional financing with maximum monthly mortgage payment at 28% of gross income. No reserves of mortgage insurance required.
(5) Assuming 5.75% annual interest and 30 year mortgage.
(6) Conventional financing standard.

Source: State of Hawaii, Maui County and The Hallstrom Group, Inc.

trend towards "spec" and "tract" homes seen throughout the neighbor islands, which will inevitably occur in the study area.

The total mid-point demand for multi-family development over the next two decades is estimated at 311 units. For single-family types the demand will be for 638 houses and 3,659 building lots.

Identification of Upcountry Single Family Residential Projects

Existing and Recent/In-Sales Supply

Based on extrapolation of 2000 census data and County planning figures, we estimate the total number of habitable housing units in the Upcountry study area as of year-end 2004 was approximately 8,200 units. Of these, approximately 6,000, or 91 percent, were constructed prior to 1970.

As Kauhale Lani will compete in the single family segment of the market, our focus in regards to analysis of supply is similarly toward existing and proposed single family development.

A listing of the most recent projects (since 2002) is shown on Table 5. Also shown are two recent subdivisions in Haiku, located just east of the study area, but sharing similar market characteristics.

All of the product have been house lots/acreage ranging in size from 10,000 square feet to over five acres; a total of 142 potential home sites. All of the subdivisions achieved rapid absorption at then high prices that have since been well-eclipsed by the surging Maui real estate market.

Discussions with study area realtors indicate that if new product were available (at virtually any price point), it would quickly be absorbed.

Proposed Supply

Apart from Kauhale Lani, there are five major projects (10 lots or more) approved or proposed in the general study area at this time. Two additional subdivisions are pending just outside the study areas.

These potentially competitive developments are summarized on Table 6. We are aware of no other major single family developments preliminarily proposed, announced or otherwise making headway in the entitlement process at this time. The major multifamily project

TABLE 4

DIVISION OF PROJECTED DEMAND BY UNIT TYPE
FOR HOUSING UNITS IN UPCOUNTRY MAUI 2005 TO 2025
Market Study of the Proposed Kauhale Lani
Pukalani, Upcountry Maui, Hawaii

	Periodic Demand (1) 2005 to 2010	2011 to 2015	2016 to 2020	Total Demand 2005-2020	Comments
1. Using Minimum Demand Projections					
Single Family Homes	98	152	204	454	Most homes are "customs" built on individually purchased lots. However "spec" builder homes becoming larger segment over time, and contractors are attempting to purchase blocks of lots in new subdivisions. Given profits associated with building, more finished homes over time.
Percent of Total	8%	15%	20%	14%	
Single Family Lots	1,079	792	714	2,585	Historic primary residential development type in Upcountry. Will continue to dominate market during study period, but greater number of "finished" units likely.
Percent of Total	88%	78%	70%	79%	
Multifamily Units	49	71	102	222	A minor component of the regional inventory, with only circa 100 units built to date. But will become increasing factor as lots become scarce and development more intense (as a Upcountry Town Center) and is only feasible option for many low/moderate and senior households.
Percent of Total	4%	7%	10%	7%	
Total	1,226	1,015	1,020	3,261	
	100%	100%	100%	100%	
2. Using Maximum Demand Projections					
Single Family Homes	189	268	361	818	
Percent of Total	8%	15%	20%	25%	
Single Family Lots	2,079	1,392	1,264	4,734	
Percent of Total	88%	78%	70%	145%	
Multifamily Units	94	125	181	400	
Percent of Total	4%	7%	10%	12%	
Total	2,362	1,785	1,805	5,952	
	100%	100%	100%	183%	
Mid-Point					
Single Family Homes	144	210	283	636	
Single Family Lots	1,579	1,092	989	3,659	
Multifamily Units	72	98	141	311	
Total	1,794	1,400	1,413	4,607	

Source: The Hallstrom Group, Inc.

TABLE 6

SUMMARY OF IN-DEVELOPMENT/PROPOSED MAJOR UPCOUNTRY SINGLE FAMILY RESIDENTIAL DEVELOPMENTS
Market Study of the Proposed Kauhale Lani
Pukalani, Upcountry Maui, Hawaii

Development/Project	Location	No. of Lots	Comments
Kualono	Pukalani	49	Recently approved. Strong interest at prices circa $350,000-plus.
Village Expansion	Hailiimaile	150	Pending. Infrastructure emplacement expected to begin in late 2006.
Pueo Hills	Kula	10	Pending. All lots reportedly reserved w/o major pre-sale effort.
Omalumalu	Kula	25	Pending. No reservation data avail.
Piiholo Farms	Makawao	10	Pending. No reservation data avail.
Kauhale Lani	Pukalani	165	Pending. Subject Property.
TOTAL PROPOSED LOTS		409	
Nearby Subdivisions			
Kauhikoa Hill	Haiku	16	Pending. Most reported reserved.
Maunaolu Plantation	Haiku	39	Pending. Strong interest reported.

Source: Maui Planning Commission records,, Maui Board of Realtors, Various, and The Hallstrom Group, Inc.

TABLE 5

SUMMARY OF IN-SALES/RECENT MAJOR UPCOUNTRY SINGLE FAMILY RESIDENTIAL DEVELOPMENTS
Market Study of the Proposed Kauhale Lani
Pukalani, Upcountry Maui, Hawaii

Development/Project	No. of Lots	Average Lot Size	Offering Date	Original Price Range	Status	Absorption
Kulamalu Subdivision Pukalani	57	1/2 acre	3/02	$170,000 to $200,000	Sold Out	13 month sales period = 4 lots/mo.
Kula Meadows Kula	16	5 acres	10/02	$410,000 to $575,000	Sold Out	10 month sales period = 1.6 lots/mo
The Ridge at Kulamalu Kula	57	1/4 acre	8/03	$180,000 to $225,000	Sold Out	4 month sales period = 14 lots/mo.
Kulamalu Hilltop Kula	12	1/4 acre	9/03	$225,000 to $300,000	Sold Out	3 month sales period = 4 lots/mo.
Nearby Subdivisions						
West Kuiaha Meadows Haiku	16	2 to 5 acres	1/01	$230,000 to $310,000	Sold Out	8 month sales period = 2 lots/mo.
Maunaolu Plantation Haiku	39	2 acres	3/02	$260,000 to $345,000	Sold Out	13 month sales period = 3 lots/mo.

Source: Hawaii Information Service, Maui Board of Realtors, Various, and The Hallstrom Group, Inc.

being discussed is as a component within the proposed Upcountry Town Center, with upwards of 100 units.

The five non-subject developments shown on the top of the table are moving forward at varying speeds. Kualono (Dowling Co.) has been substantially approved and should begin development within 18 months, and the Hailiimaile Village Expansion (Alexander & Baldwin) is pointing towards a late 2006 start date. The others are still pending.

The single-family projects, including the subject, will provide a total of 343 house lots.

Comparison of Demand and Supply Indicators

The demand for new housing opportunities in the Upcountry study area over the coming 16 years, 2005 through 2020, is estimated at 4,609 total new units (mid-point), of which 4,295 will be oriented toward single family inventory.

The currently planned level of new single-family product additions during the same time frame will be 343, if all pending subdivisions are approved and built to maximum densities, including the 165 subject lots.

Therefore, announced/pending/approved supply will fall short of projected demand by more than 3,900 single family housing units during the 16 year modeling period.

Micro Analysis

The Upcountry area single family residential real estate market, like most sectors throughout the state, is currently in the midst of a major up-cycle. The increasing activity began in the late 1990s, was set back briefly by 9/11, and has reached near-record levels during the past two years.

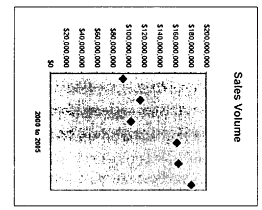
Sales volumes are well up, market times are way down, appreciation is meaningful, and realtors report exceptional interest levels. However, due to the limited inventory available in the region, the number of sales has remained relatively static resulting in rapidly escalating per unit prices.

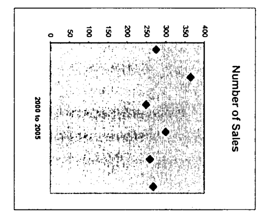
Single family residential market activity data in the study area from 2000 to 2005 are summarized on Table 7. During this period sales

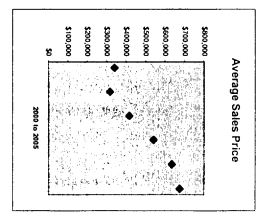
TABLE 7

SUMMARY OF SUBJECT AREA SINGLE FAMILY RESIDENTIAL MARKET ACTIVITY
Market Study of the Proposed Kauhale Lani
Pukalani, Upcountry Maui, Hawaii

Year	2000	2001	2002	2003	2004	2005 (1)
Sales Volume	$93,528,165	$115,410,577	$103,614,680	$162,157,905	$164,262,898	$180,857,800
Percent Annual Change		23.4%	-10.2%	56.5%	1.3%	10.1%
Number of Sales	275	364	249	300	259	268
Percent Annual Change		32.4%	-31.6%	20.5%	-13.7%	3.5%
Average Sales Price	$340,102	$317,062	$416,123	$540,526	$634,220	$674,843
Percent Annual Change		-6.8%	31.2%	29.9%	17.3%	6.4%







Note: Includes Maui Board of Realtor defined areas: "Kula/Ulupalakua/Kanaio", "Makawao/Olinda/Hailiimaile" and "Pukalani"

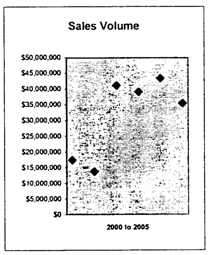
(1) Year-end estimate based on extrapolation of data through March.

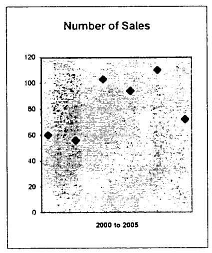
Source: Hawaii Information Service. Maui MLS and The Hallstrom Group, Inc.

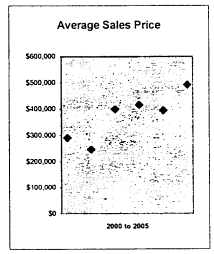
TABLE 8

SUMMARY OF SUBJECT AREA RESIDENTIAL/AGRICULTURAL LOT MARKET ACTIVITY
Market Study of the Proposed Kauhale Lani
Pukalani, Upcountry Maui, Hawaii

Year	2000	2001	2002	2003	2004	2005 (1)
Sales Volume	$17,391,000	$13,716,700	$41,105,352	$39,059,500	$43,382,950	$35,462,000
Percent Annual Change		-21.1%	199.7%	-5.0%	11.1%	-18.3%
Number of Sales	60	56	103	94	110	72
Percent Annual Change		-6.7%	83.9%	-8.7%	17.0%	-34.5%
Average Sales Price	$289,850	$244,941	$399,081	$415,527	$394,390	$492,528
Percent Annual Change		-15.5%	62.9%	4.1%	-5.1%	24.9%







Note: Includes Maui Board of Realtor defined areas: "Kula/Ulupalakua/Kanaio", "Makawao/Olinda/Hailiimaile" and "Pukalani"

(1) Year-end estimate based on extrapolation of data through March.

Source: Hawaii Information Service. Maui MLS and The Hallstrom Group, Inc.

volumes have nearly doubled to $180.9 million annually (based on extrapolation of indicators through March) and average sales prices have nearly doubled to $674,843, an effective appreciation rate of 14.7 percent compounded annually over the past five years.

Residential/agricultural lot activity for the same period is displayed on Table 8. The trends are generally similar as for finished homes, with the sale volume just more than doubling during the past five years to $35.5 million, and prices, now averaging $492,528 per lot, showing a compounded annual appreciation rate of 11.2 percent.

We uncovered no indicators in our research and interviews which demonstrated anything other than the subject area being in the midst of a significant up-cycle. The primary concerns expressed were lack of product and rising mortgage rates (which still remain near generationally-low levels).

We conclude the micro analysis perspective also provides strong market support for the proposed Kauhale Lani project.

SUBJECT SITE APPROPRIATENESS AND ABSORPTION CONCLUSIONS

Appropriateness of the Subject Site for the Proposed Use

The 59-acre subject property presents a quality opportunity to meet the existing and projected shortfall in residential real estate in the Upcountry region, specifically addressing the acute community need for local resident housing. It has/is:

- The necessary physical traits (size, shape topography) to support large-scale competitive residential development.
- Direct access onto the main arterial in the Pukalani community (Old Haleakala Highway) and ready access to the newer bypass road.
- Adjacent to (northerly abutting) the existing suburban development node of Pukalani, in close proximity to the village core.

- Access to nearby existing utility systems.
- An expanding number of long-time regional families with maturing children seeking area housing.
- A natural in-fill location between existing homes and the Hamakua Ditch, the fundamental downslope boundary of Pukalani.
- It is within blocks of the primary existing retail/restaurant/service development in the community.

The proposed Kauhale Lani master plan embodies characteristics that will prove desirable to a wide range of residential purchasers seeking house lots in the subject study area. It maximizes the utilization of urban in-fill/expansion lands by combining residential use-types, permitting varying densities, and implementing planning and architectural guidelines.

Subject Absorption Estimates

Given the evident level of support for the proposed subject inventory as demonstrated by our market study, and that the underlying site is highly appropriate for the envisioned development, it can be concluded the 165 house lots units of Kauhale Lani will achieve reasonable market success upon offering.

This opinion can be demonstrated through summary application of several techniques, as discussed following.

- The Gross Analysis Method. This is both the simplest and most fundamentally insightful method. It is a mere comparison between demand (for additional units) and supply (proposed units) indicators. If there is more potential demand than potential units, it can be asserted there will be sufficient demand to absorb portions or all of the proposed subject units.

  As our market analysis demonstrated, the supply of residential units in the Upcountry area will be insufficient to meet forecast regional requirements. The estimated mid-point demand for study area dwelling units over the next 16 years (through 2020) is some 4,609 units; with 93.2 percent oriented toward the single family sector, or some 4,295 houses/lots. If all currently

  proposed single family inventory is built, including the subject, the total number would be a maximum of 408 home sites; some 3,800 less than demand.

  The Upcountry single family sector will be underserviced by hundreds of lots during the projection period.

  This gross analysis indicates the subject units could be absorbed within a several year period, regardless of any additional competitive advantage the inventory may have.

- The Residual Method. In this technique, all of the identified competitive approved/pending single family residential projects in the Upcountry study area are placed on a time-line depicting the sales absorption anticipated by the developers, as evidenced by our market survey, or as can be reasonably assumed through historic activity. To the extent these projects fall short of the forecast periodic demand for units in the study region, or exceed the total demand, an undersupply or oversupply situation respectively exists.

  By accounting for the total of the units likely to be built in the competitive market during the projection period, it can be asserted the subject development will "capture" a significant portion of any residual demand. This approach is generally conservative, as it assumes the subject will capture only what is leftover after the other projects garner their anticipated share.

  The tabular presentation of this method for the subject lots is shown on Table 9.

  Each of the identified sources of competitive additional supply are shown at the top of the table along with the anticipated number of lots we consider likely to be constructed, and their periodic absorption over the projection period timeframe. The total demand forecast is shown at the bottom of the respective table, with the resulting over/under supply totals for each period and the residual demand level for the subject product under several capture rate assumptions.

  In no single period is there an oversupply situation. In every period during the sixteen-year projection time-frame demand will exceed supply without the subject inventory.

TABLE 9

PROJECTION OF SUBJECT UNIT ABSORPTION USING THE RESIDUAL METHOD BASED ON TOTAL DEMAND FOR RESIDENTIAL LOTS/HOMES IN THE UPCOUNTRY STUDY AREA

Market Study of the Proposed Kauhale Lani

Pukalani, Upcountry Maui Hawaii

Approved/Announced Units Only, Assuming Mid-Point Demand Trends

Project	TOTAL UNITS	2005-2010	2011-2015	2016-2020
Kualono	49	49		
Market Share Percentage		17%		
Village Expansion	150	150		
Market Share Percentage		51%		
Pueo Hills	10	10		
Market Share Percentage		3%		
Omalumalu	25	25		
Market Share Percentage		9%		
Piiholo Farms	10	10		
Market Share Percentage		3%		
Other Minor Projects/In-Fill	150	50	50	50
Market Share Percentage		17%	100%	100%
Totals	**394**	**294**	**50**	**50**
Regional SF Lot/Home Demand	**4,297**	**1,723**	**1,302**	**1,272**
Shortage or (Excess) Supply	**3,903**	**1,429**	**1,252**	**1,222**
Potential Kauhale Lani Residual Subject Demand				
at 97.5% Capture Rate	3,805	1,393	1,221	1,191
at 95% Capture Rate	3,708	1,358	1,189	1,161
at 92.5% Capture Rate	3,610	1,322	1,158	1,130

Source: Maui County, Developers/Agents, & The Hallstrom Group, Inc.

This method indicates the 165 subject lots will require one to three years to be absorbed.

- The Market Shares Method accounts for the probable competitiveness of the subject residential product regardless of the total level of other inventory being offered. In essence, it is an estimate of how much of the total single family residential demand in Upcountry the subject could expect to achieve on an annual basis in light of locational, pricing, and amenity characteristics.

  This "pure competitiveness" technique is generally moderate to optimistic in application and requires some subjective variables, but is perhaps the most appropriate and "classic" approach.

  Given the type, location and amenities of the proposed subject product and competitive market, we believe Kauhale Lani could readily achieve an annual market share of 20 to 30-plus percent of the total competitive demand. This capture rate is reasonable given historic sales standards and the qualities of the limited alternatives.

  However, given the shortage of competitive inventory, the subject will be fully absorbed before it has the opportunity to "ramp up" the sales program and achieve market stabilization before selling-out.

  Table 10 displays the subject lot market capture absorption forecasts from conservative and optimistic perspectives. The abbreviated sell-out mid-point would equate to a 15.7 percent share during a mid-point 3.4-year sell-out period. This equates to an average absorption of 48.6 lots annually (4.05 lot sales per month).

  We consider the stabilized market share rate to be moderate based on the availability of competitive inventory and their anticipated sales rates. As shown in the residual method, during the subject sales period, there will be only a handful of projects competing for market shares, and just achieving a "fair split" of the demand (regardless of the favorable trait of the subject inventory) will generate capture rates at or above the projected levels.

TABLE 10

SUMMARY OF SUBJECT PROJECTED DEMAND LEVELS
USING THE MARKET SHARES METHOD
Market Study of the Proposed Kauhale Lani
Pukalani, Upcountry Maui, Hawaii
Assuming 149 Total Single Family Homesites
With Sales to Begin in 2007

Scenario One: Using Conservative Assumptions

Sales Year	Total Regional Residential Demand	Effective Subject Share	Indicated Total Subject Absorption
1 (2007)	196	15.00%	29
2	196	18.00%	35
3	196	22.00%	43
4	196	21.00%	41
5	188	8.50%	16
Totals	972	16.97%	165
4.4 year absorption period			

Scenario Two: Using Optimistic Assumptions

Sales Year	Total Regional Residential Demand	Effective Subject Share	Indicated Total Subject Absorption
1 (2007)	378	16.00%	60
2	378	20.00%	76
3	378	7.70%	29
Totals	1,134	14.57%	165
2.4 year absorption period			

ANALYSIS MID-POINT			
3.4 year absorption period	1,053	15.68%	165

Source: The Hallstrom Group, Inc

Based on our analysis, we forecast the 165 single residential subject will be absorbed in a circa three-year timeframe from initial offering.

These conclusions based on mid to long-term forecasting models are understated relative to the existing vibrancy of the Maui real estate market. Certainly, the current up-cycle could more rapidly absorb the subject inventory if the pre-sale program is timed correctly.

ECONOMIC IMPACT OF THE PROPOSED DEVELOPMENT

The development of the Kauhale Lani will generate significant efforts and expenditures that will favorably impact the Maui economy on both a direct and indirect basis, increasing the level of capital investment, capital growth and capital flow in the region. The project will pump millions of dollars into Upcountry and Central Maui, expanding the economy, widening the tax base and creating stable long-term employment opportunities.

From a direct perspective, the proposed 165-lot residential project will create numerous construction, equipment operator and specialty trade jobs on- and off-site during the planning and emplacement of the infrastructure, and building of the improvements. It is estimated the infrastructure including the park/community center facility will require about 18 months. The completion of the finished homes will take another six years.(2) There will be significant additional employment positions created via the buildings themselves; landscape, service, maintenance, and renovation needs in the course of their use.

Numerous local businesses will enjoy significant profit opportunities arising for contracting companies constructing the improvements, and for local businesses which would supply a substantial portion of the materials needed in the building efforts.

The general island economy also will benefit from the subject development and its employees, which will spend large amounts of

(2) Given there are still vacant lots in many older Upcountry subdivisions, it may take many years before the subject is completely built out. We have utilized a six-year period for reasonable modeling purposes. A longer built-out would not affect stabilized impact levels.

TABLE 11

CONSTRUCTION COSTS AND CONTRACTOR AND SUPPLIER PROFIT ESTIMATES
Market Study of the Proposed Kauhale Lani
Pukalani, Upcountry Maui Hawaii
In Constant Year 2005 Dollars

Development Year	1	2	3	4	5	6	7	8	9	10	Totals
	Infrastructure Emplacement 18 Months (to Mid-Year 2)										
	Lot Sales Three Years (Mid-Year 1 to Mid-Year 3)										
	Begin Pre-Sale (Mid-Year 1)	First Lots Close (Mid 2)	Homes are Built on Lots								
Construction Costs											
Infrastructure/Sitework/Park (1)	$5,962,980	$3,927,020									$9,890,000
SF Construction – 149 homes (2)			$13,050,000	$13,050,000	$13,050,000	$13,050,000	$13,050,000	$6,525,000			$71,775,000
TOTAL CONSTRUCTION COSTS	$5,962,980	$3,927,020	$13,050,000	$13,050,000	$13,050,000	$13,050,000	$13,050,000	$6,525,000	$0	$0	$81,665,000
CONTRACTOR'S PROFIT	$596,298	$392,702	$1,305,000	$1,305,000	$1,305,000	$1,305,000	$1,305,000	$652,500	$0	$0	$8,166,500
SUPPLIER'S PROFIT	$238,519	$157,081	$522,000	$522,000	$522,000	$522,000	$522,000	$261,000	$0	$0	$3,266,600

(1) Estimated at $60,000 per lot based on costs of recent regional subdivisions. Includes allowances for any off-site improvements. Park/Community Center cost estimated at $950,000 (Year 2). Subdivision infrastructure period estimated at 18 months, commencing at beginning of model and completing by middle of Year 2.
(3) Assuming average home construction budget of $435,000 based on 2,200 square foot house at $175/SF cost plus $50,000 site work and landscaping. First homes begin construction early in Year 3 and are finished by year-end

Source: The Hallstrom Group, Inc.

wage income in off-site shops, restaurants, and service establishments throughout Maui, and in purchasing goods and services.

Indirectly, as these wages, profits, and expenditures move through the regional economy, they will have a ripple, or "multiplier," effect--increasing the amount of capital flowing to the entire community as a result of the subject.

Construction, maintenance and other workers earning wages from Kauhale Lani and associated off-site efforts will spend the majority of their income on living and entertainment expenses while supporting and patronizing other island businesses, as will the moderate to upper income residents and guests of the community. Much of this spending would then be re-directed by these businesses to other island industries, with significant portions of these secondary profits in turn being put back through the region's economic and tax structure.

These substantial direct and indirect economic impacts associated with the proposed subject project, as quantified in the following sections, are all the result of the capital investment and entrepreneurship necessary to convert a vacant, feral, unused holding into a meaningful residential community. The Maui economy will be meaningfully stimulated by the capital investments and maintenance requirements of the homes and their owners.

Capital Investment and Construction Costs

The subject development will bring an estimated $81.7 million in direct construction capital into Maui over the seven-year site build-out period forecast for the project. A breakdown of the basic expense items, their respective costs and expenditure over time is summarized on Table 11. As with all our models, a ten-year total projection timeframe is used depicting the development, absorption and stabilized use of the community over the initial decade.

Also shown are anticipated contractor and supplier profits flowing to local businesses as a result of the project. All costs are estimates by The Hallstrom Group, Inc., based on recent neighbor island residential project costs, endorsed by the development team; as cited on the table.

Infrastructure sitework expenses were projected at $60,000 per lot (including any off-site improvements required), or $8.94 million total

2005 dollars. The emplacement would require approximately 18 months, concluding by the middle of the second year of the model.

Also included in the figure is an allowance of $950,000 for completion of the park/community center, which will include a large pavilion, restrooms, picnic areas, hard courts, childrens playground and ball fields. The facility will be constructed in year two, timed to coincide with closing of the initial lot sales and commencement of home construction.

<u>Building construction costs</u> were estimated at a total of $71.8 million in current dollars.

The single-family homes were estimated to have a current average construction cost of $435,000 each, based on a 2,200-square-foot house at $175 per square foot with an additional $50,000 per lot in sitework and landscaping.

Not included in the totals are indirect costs such as marketing and sales expenses, developer fees, loan interest and other non-real property items. The inclusion of these "soft cost" could result in a total capital investment undertaking of more than $85 million.

The direct costs of subject development will infuse an anticipated $10.2 million annually into the Maui building industry on average over the build-out period. This is the equivalent of a nearly 10 percent boost over recent yearly construction levels. Indirect expenditures could reach an additional $2 million-plus per year.

Employment Opportunities Created

Based on indicators provided by the construction of comparable sized projects and Hawaii industry averages, we have estimated the demand for on- and off-site, full-time equivalent employment positions associated with laying of initial infrastructure systems, building of the finished homes, and in providing continuing services to the occupied buildings.

The employment opportunities created by the construction of the subject and long-term maintenance, landscaping and renovations will not all be "new" jobs but will be enhanced opportunities for construction trade workers, youths reaching employment age, and existing local businesses.

It is assumed the off-site/indirect work created will be steered towards existing Maui supply, equipment providers, and other service companies.

The subject will provide employment opportunities in the construction sector, and supply and building support industries during an estimated seven-year planning, site development and building construction period.

Our employment estimates on are based on full-time equivalent "worker/years," although one worker/year (or circa 2,000 working hours) may be comprised of many employees involved in specialized tasks of a much shorter duration.

Estimates are based on a 10-year modeling period of project construction (eight years) followed by stabilized use (two years). The associated number of employment opportunities created are displayed on the top of Table 12.

Included in our projections on the table are the full-time equivalent (FTE) off-site and support employment opportunities which will be provided to Maui businesses as a result of the project. Also shown are the total number of maintenance/landscaping workers which will be required to service the project improvements and grounds over time.

The projections are founded on examples provided by various residential developments undertaken on the neighbor islands over the past decade, and via formulae expressing relationships between total worker wages/benefits and construction/operating tasks and costs.

<u>Infrastructure</u> and <u>building construction</u> employment forecasts are taken from discussions with the developer, review of project budgets and ratios of direct costs to job creation (assuming an average wage of $60,000/year plus benefits equal to 25 percent of wages). Our analysis assumes one worker/year per $225,000 in construction contract spending for infrastructure, and one worker year per $175,000 in home construction finish positions.

<u>Operations/maintenance</u> workers associated with the completed homes, including maintenance, landscaping and renovations efforts, were estimated at one full-time equivalent position per 12 units. The average overall pay for these workers is estimated at $27,000 per year.

Off-site employees were estimated at 40 percent of on-site workers, and are comprised of three groups:

- Numerous off-site building industry positions will also be enhanced by the Kauhale Lani development, including such jobs as administration, office help, material providers, equipment maintenance and specialty tasks. Analysis of Maui County labor trends from 1980 through 2004 demonstrate a linkage equal to about 20 to 30 percent between the creation of on-site construction positions and direct off-site employment.

- Off-site support businesses, including contractor/retail/counter sales, fuel providers, shipping, storage and professional services will also benefit. A conservative job creation relationship of five to ten percent relative to on-site positions was used (or, one off-site support worker/year for each ten to 20 on-site worker/years).

- Extrapolation of state Department of Business Economic Development and Tourism (DBEDT) data, along with indicators provided by other state agencies and First Hawaiian Bank studies, demonstrate that each Hawaii worker creates demand for services (and related employment) during and directly attributable to the work day at up to a ten percent ratio. These positions include food businesses, providers of tools and trade goods, payroll/financial and insurance businesses, medical requirements and other secondary indirect/off-site employment.

During the 10-year building and use modeling period of the project, the number of worker/years created on- and off-site by the development varies from 24 to 119 positions annually, totaling 731 worker/years over the entire projection timeframe. Of this total, 455 worker/years (an annual average of 57 positions during the eight-year construction period) are direct construction-oriented, 67 are on-going maintenance/operating positions; and 209 are off-site worker requirements.

On a stabilized basis after the modeling timeframe, the project will generate some 21 permanent full-time equivalent and/or enhanced employment opportunities—15 directly related to on-site activities, and 6 indirect positions throughout the island.

TABLE 12

EMPLOYEE JOB COUNT AND WAGE ESTIMATES
Market Study of the Proposed Kauhal Lani
Pukalani, Upcountry Maui Hawaii
In Constant Year 2005 Dollars

Development Year	1	2	3	4	5	6	7	8	9	10	Total 1 Through 10	Stabilized
Worker Requirements (1)												
Infrastructure/Sitework (2)	27	17									44	
SF Home Construction (3)			75	75	75	75	75	37			411	
Maintenance/Landscaping (4)				3	5	8	10	12	15	15	67	15
Off-Site Employees (5)	11	7	30	31	32	33	34	20	6	6	209	6
TOTAL EMPLOYMENT CREATED	37	24	105	108	112	115	119	70	21	21	731	21

Development Year	1	2	3	4	5	6	7	8	9	10	Total 1 Through 10	Stabilized
Worker Wages												
Infrastructure/Sitework (6)	$1,590,128	$1,047,205									$2,637,333	
Home & Unit Construction (6)			$4,482,000	$4,482,000	$4,482,000	$4,482,000	$4,482,000				$22,410,000	
Maintenance/Landscaping (7)				$67,500	$135,000	$202,500	$270,000	$335,250	$405,000	$405,000	$1,820,250	$405,000
Off-Site Employees (9)	$339,227	$223,404	$956,160	$988,160	$1,020,160	$1,052,160	$1,084,160	$637,013	$192,000	$192,000	$6,684,444	$192,000
TOTAL ANNUAL WAGES PAID	$1,929,355	$1,270,609	$5,438,160	$5,537,660	$5,637,160	$5,736,660	$5,836,160	$972,263	$597,000	$597,000	$33,552,028	$597,000

(1) All job counts expressed as "full-time" equivalent positions.
(2) Estimated at one worker/year per $225,000 in contract spending.
(3) Estimated at one worker/year per $175,000 in contract spending, or 2.49 worker/years for each single family homes.
(4) Estimated at one worker/year for each 12 houses/units. Includes workers doing landscaping, repair, renovation, and condominium management.
(5) Includes all off-site jobs created by work efforts at the project; direct and indirect. Estimated at 0.4 off-site positions per on-site position.
(6) Average annual wage of $60,000/worker year.
(7) Average annual wage of $27,000/worker year.
(8) Average annual wage of $32,000/worker year.

Source: Various, and The Hallstrom Group, Inc.

The average annual on-site job count during the 10-year subject study period of 73 positions represents about a 0.23 percent increase from the total jobs presently available in Maui County (73 additional jobs per year to the average in February 2005 job count of 31,350). This number can be readily absorbed by the currently available employment pool.

Wage Income Generated

In accordance with data compiled by the state Department of Labor and Industry Relations, PBR Hawaii and Maui Land & Pineapple, we have estimated the personal income (in the form of wages) which will flow to Maui workers as a result of the Kauhale Lani project.

The average wage of a full-time infrastructure construction worker is estimated at $60,000 per year based on DLIR data for early 2005. For finished building construction workers, the average annual pay will also be about $60,000. Operating and maintenance personnel are forecast to be paid an average of $27,000 per year on average ($13.50 per hour). Off-site building and support industry jobs were estimated to receive an average pay of $32,000 annually.

Overall project average wages are equal to $48,933 per worker/year created during the model period, and $29,070 on a stabilized basis.

Application of these wage estimates to the employment forecasts generates personal income (wage) projections directly resulting from subject development, which were shown at the bottom of Table 12. The wage figures are all presented in constant 2005 dollars, and will undoubtedly escalate over time in accordance with inflationary pressures.

In the first year of development, the "Total Annual Wages Generated" by the subject development effort would be $1,929,000, increasing to a high of $5.8 million, as the number of construction workers peak and maintenance positions are created in year 7. After completion of all construction, the on-going maintenance, off-site/indirect and other employment would result in average annual wages of $597,000 thereafter.

Over the first 10 years of the development and operation period, on- and off-site, direct and indirect worker wages would total $33.6 million.

Development Costs as Profit Income

While the significant majority of the materials needed to build the subject industrial and commercial structures must be imported to Maui, a portion of the construction costs spent in the development will flow to local businesses in the form of contractor profits and supplier profits.

Typically, within the industry net contractor profit margins are expected to be at 8 to 20 percent of total construction costs. We have used a conservative ten percent figure. Supplier profits were extrapolated at four percent of total costs; generally supplies/materials equate to 50 to 60 percent of total cost, with a profit margin for the supplier of six to eight percent.

Application of these estimates to the forecast development parameters of the subject project was shown on Table 11.

The total Contractor's Profit ranges from $393,000 to $1.3 million per year, with a cumulative profit of $8.2 million over the three-year construction period. The total annual Supplier's Profit ranges from a low of $157,000 to a high of $522,000, and equates to $3.3 million over the development time-frame.

Population, Income and Expenditures

The 165 subject units will be purchased by a variety of local residents, second homeowners and in-migrants. Together these groups and guests will contribute to the Maui economy during the use of the subject units in the form of discretionary expenditures and (for full-time residents) household income levels.

Table 13 displays our population, discretionary expenditures, and household income estimates for the subject project.

For the single-family homes, it was estimated that 90 percent would be used by full-time residences and 10 percent by part-time/second home users. For the full-time component, an average household size of 3.2 persons was assumed. For the part-time users, it was estimated the homes would be occupied 20 percent of the time with an average party size of 3.4 persons.

At built-out, the stabilized de facto population of the project would be some 548 persons, comprised of 475 full-time residents, 56 second-home owners, and a guest allowance of 17 persons (one per every 10 finished homes).

It is estimated that about 119 of the full-time resident population (25 percent) will be juveniles of school age, of which 78 (or 16.5 percent of the total resident population) would attend public schools.

The population of the project will place significant discretionary expenditure dollars into the Maui economy. In light of the cost of the finished homes, the residents and other users will be in the moderate to upper household income brackets with substantial available income for such spending. The second/vacation home and guest users will further contribute to the high amount of discretionary funds.

We estimate that full-time resident households will spend about 60 percent of their total income on local discretionary items based on the most recent data. The daily per capita spending by second-home users, and guests in the Maui economy will be on average $100, which is moderately below what the typical Maui visitor spends daily on non-lodging purchases (commensurate with the subject suburban location and project quality). This pays for all food, entertainment, household goods, locally purchased fixtures and furnishings, utilities, clothing and other daily items.

By build-out, the total resident owner/guest discretionary expenditures made by subject project users in the local market will be at $18.9 million annually on a stabilized basis, in 2005 dollars. During the 10-year development and operation model period, the total sum of these expenditures will be $108.1 million.

The total full-time resident income amount was quantified for use in estimating discretionary expenditures and state income taxes to be paid. In order to conventionally qualify for a home with prices likely for the subject product, a household income of upwards of two times the island wide average (or $121,400) per year is minimally necessary. We recognize this amount could range widely upwards, and consider this projection moderate.

On a stabilized basis after build-out, the total annual full-time taxable resident income at the subject would be some $27.0 million. Some of the resident and virtually all of the second-home and guest

TABLE 13

DE FACTO POPULATION, DISCRETIONARY EXPENDITURES AND RESIDENT HOUSEHOLD INCOMES
Market Study of the Proposed Kauhale Lani
Pukalani, Upcountry Maui, Hawaii
In Constant Year 2005 Dollars

Development Year	3	4	5	6	7	8	9	Stabilized 10
Cumulative Residential Development								
SF Home Construction	30	30	30	30	30	15		
Total Finished Homes	30	60	90	120	150	165	165	165
Average Daily Resident/Guest Population								
SF Full-Time Residents (1)	86	173	259	346	432	475	475	475
SF Part-Time Residents (2)	10	20	31	41	51	56	56	56
Guests (3)	3	6	9	12	15	17	17	17
Total De Facto Population	100	199	299	398	498	548	548	548
Total Full-Time Resident Population	86	173	259	346	432	475	475	475
Estimated School Age Children (4)	22	43	65	86	108	119	119	119
Estimated Public School Children (5)	14	29	43	57	71	78	78	78
RESIDENT DISCRETIONARY (TAXABLE) EXPENDITURES (6)	$3,431,820	$6,863,640	$10,295,460	$13,727,280	$17,159,100	$18,875,010	$18,875,010	$18,875,010
Total Years 3 -10	$108,102,330							
FULL-TIME RESIDENT INCOME (7)	$4,916,700	$9,833,400	$14,750,100	$19,666,800	$24,583,500	$27,041,850	$27,041,850	$27,041,850
Total Years 3 -10	$154,876,050							

(1) 90 percent of homes estimated to be used as full-time residences, with average household size of 3.2 persons.
(2) 10 percent of homes estimated to be used as part-time (second home) residences, occupied 20% of time with average party size of 3.4 persons
(3) Estimated average guest population (not included in full-time or part-time categories) of 1 guest per 10 finished homes.
(4) Persons between the ages of three and 19 enrolled in public and private schools, estimated at 25% of total full-time resident population.
(5) Persons enrolled in public schools, estimated at 16.5 percent of the full-time resident population.
(6) Estimated at 60% of full-time resident household income, and at $100 per capita daily for part-time residents and guest populations.
(7) Estimated at $121,400 annually per full-time resident household., twice the 2004 Maui average

Source: Various, and The Hallstrom Group, Inc.

TABLE 14

SUMMARY OF ECONOMIC IMPACTS ASSOCIATED WITH DEVELOPMENT
Market Study of the Proposed Kauhale Lani
Pukalani, Upcountry Maui, Hawaii
In Constant Year 2005 Dollars

Development Year	1	2	3	4	5	6	7	8	9	10	Total Years 1 Through 10	Stabilized
ANNUAL WAGES GENERATED	$1,929,355	$1,270,609	$5,438,160	$5,537,660	$5,637,160	$5,736,660	$5,836,160	$972,263	$597,000	$597,000	$33,552,028	$597,000
CONTRACTOR'S PROFIT	$596,298	$392,702	$1,305,000	$1,305,000	$1,305,000	$1,305,000	$1,305,000	$652,500			$8,166,500	
SUPPLIER'S PROFIT	$238,519	$157,081	$522,000	$522,000	$522,000	$522,000	$522,000	$261,000			$3,266,600	
HOME MAINTENANCE, REPAIRS AND UPGRADES (1)				$360,000	$720,000	$1,080,000	$1,440,000	$1,800,000	$1,980,000	$1,980,000	$9,360,000	$1,980,000
DISCRETIONARY EXPENDITURES			$3,431,820	$6,863,640	$10,295,460	$13,727,280	$17,159,100	$18,875,010	$18,875,010	$18,875,010	$108,102,330	$18,875,010
TOTAL BASE ECONOMIC IMPACT	$2,764,173	$1,820,392	$10,696,980	$14,588,300	$18,479,620	$22,370,940	$26,262,260	$22,560,773	$21,452,010	$21,452,010	$162,447,458	$21,452,010
Multiplier Effect Ratio	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
TOTAL OVERALL IMPACT	$5,528,345	$3,640,784	$21,393,960	$29,176,600	$36,959,240	$44,741,880	$52,524,520	$45,121,547	$42,904,020	$42,904,020	$324,894,916	$42,904,020

(1) Estimated at $1,000 per unit per month, beginning in Year 4.

Source: Various, and The Hallstrom Group, Inc

expenditures will be "new" dollars on Maui, providing a true economic expansion.

Summary of Direct, Local Economic Impacts

The various direct, local economic impacts which will flow to the subject region as a result of the subject development are summarized on Table 14.

The wages, profits and discretionary expenditures figures are taken from previously presented tables. The home maintenance, repairs and upgrades revenues were calculated based on an estimated average of $1,000 per unit monthly beginning in year 4, or $2.0 million total annually on a stabilized basis.

The annual Total Base Economic Impact increases from $2.8 million in year 1 of the development effort to a high of $26.2 million in year 7 (in 2005 dollars). Over the decade long development and operation modeling period, the total is $162.4 million. Fueled by home maintenance and resident/guest expenditures, the estimated stabilized annual base impact thereafter is $21.5 million.

These dollars will be spent, then re-spent, on goods and services on the island, diminishing in impact on the local economy with each turnover as a portion flows off Maui for goods, services and financing commitments. First Hawaiian Bank studies have concluded the appropriate economic multiplier rates in Hawaii are from 1.2 to 3.5 times (or 20 to 250 percent) of the base impact amount. Mainland studies (by the Urban Institute and others) tend toward the upper end of this range, and reach multipliers as high as 4.0.

Due to the need to import more than 85-plus percent of supplies/goods used on Maui, the multiplier impact for the island is not as great as for mainland locales, particularly for construction-based expenditures. We have therefore tested multiplier rates at the mid-point of the market spectrum, ranging from 1.5 to 3.5 times.

On a conservative basis, using a relatively low-end multiplier effect ratio of 2.0, the total overall direct impact on the Maui island economy resulting from the Kauhale Lani project would be $324.9 million over the 10-year projection period (in constant 2005 dollars). On a stabilized annual basis thereafter, the overall impact would be at $42.9 million.

PUBLIC COSTS/BENEFITS ASSESSMENT

The purpose of this analysis is to delineate the direct areas in which the proposed subject residential development will potentially impact the sphere of public agency resources, and quantify (where possible) the costs of providing expanded services to the project, versus the economic benefits that accrue to the community through an increase in local and state tax payments.

For most developments, potential direct costs to governmental services and programs include:

-- Police Protection
-- Fire Protection
-- Public Oversight Agencies
-- Infrastructure Services
-- Recreational Demands
-- Educational Needs
-- Infrastructure Costs
-- Various Other Services and Financial Commitments

However, as a privately built master planned residential community many of these costs will not be increased on the state or county levels as a direct result of the proposed Kauhale Lani. There will be minorly increased educational or recreational needs directly attributable to the subject development; the major off-site public infrastructure items (roadways and primary water/sewer mains) are already in place; and the development will require no specific public subsidies, welfare services, bonding or capital improvements.

Direct tax benefits to the state and county coffers will primarily flow from the project and its operation over time from three major sources:

-- Real Property Taxes
-- Gross Excise Tax Receipts
-- State Income Taxes

Some cost/benefit issues are considered as off-setting, or "a wash," as the cost of the services to the government is theoretically directly reimbursed in the form of user fees. Building permits and utility hook-up fees are two prime examples. Other such items include workers compensation premiums and benefits, utility operations and associated

use billing rates, and business oversight/registration verses licensing fees. These items are excluded from this study.

A concern of this analysis is the integration of the subject project into the overall state and Maui governmental services plan on both an actual and pro rata perspective.

From an actual public service cost perspective to Maui and state agencies, the subject will represent only a fraction of the county and state resort plant and overall urban lands in use. Given the vast number of housing units, resorts, businesses, and agricultural lands on the island, it is difficult to assert that of themselves the subject users will create the need for meaningful expansion of existing public services.

No new schools, parks, highways, recreational facilities, service agencies, hospitals, or other public enterprises will be required specifically because of this project. The impact on the total regional land base will be minimal. Public safety facilities in Pukalani and Makawao are reasonably proximate, generally have the personnel and equipment to service the businesses and buildings in the subdivision, and will expand with overall community growth over the next decade as the project is built.

However, the need for additional services is a cumulative effect, each project, each resident, tourist and, to a lesser degree, business adds a little bit to the community base until increased "need thresholds" are reached.

In regard to some services, the effective actual impact may not be apparent from a cost perspective, merely creating nominally greater demands which can be readily met through existing agencies and facilities without the need for additional workers or funds.

Our analysis of Maui County and state budgets indicate the actual effect of governmental services relating to the subject would not create the need to expand county and state services in and of itself.

As an alternative to actual cost estimates, which are often disparate as they inherently cannot provide for unexpected and/or atypical items, it is most common to project public costs on a per capita allocation.

This approach is generally appropriate for residential developments, as the substantial portion, but not entirety of public costs and services generally accrue to where a person lives.

Government services are holistic in nature, providing a foundation throughout a community, regardless of actual, specific impact on any given land holding. A resort development or business may not have a need for parks or schools, but they are essential to the patrons and workers and create the climate in which the resort or business operates. Similarly, government administration, capital projects and public welfare items may have no direct relation to a particular project, but provide the economic underpinnings that enhances overall economic success.

In order to meaningfully quantify public costs that may be associated with the subject development, we have therefore looked at the issue from both perspectives, on an actual cost basis and on a per capita allocation basis.

Public Costs

Actual Costs

Maui County will directly incur several areas of cost increases as a result of the Kauhale Lani, primarily in regards to emergency services. Based on analysis of response frequencies, time/cost data, and past discussions with affected agencies, we have made general allowances for these items as summarized below.

Police/Enforcement -- Using a base cost of $140 per hour for a responding officer (wages and benefits for responding/support/ administrative personnel, overhead, capital costs, and amortized equipment), we estimate the annual additional police/enforcement cost to Maui County on a stabilized basis after project build-out will be about $102,480.

This is comprised of:

- Three miscellaneous calls per week at an average of two total officer hours each. (2 hrs. x $140/hr. x 3 x 52 = $43,680)
- Three "minor" incidents/traffic accidents each month requiring on average five hours of officer time. (5 hrs. x $140 x 3 x 12 = $25,200)

- One "major" incidents/traffic accident each month requiring on average of 20 hours of officer time. (20 hrs. x $140 x 12 = $33,600)

This demand of 732 hours is the equivalent to 36.6 percent of one new officer position (2,000 total hours).

Fire Protection -- Our forecasts are based on a crew cost of $800/hour (four to five firemen, wages, benefits, overhead and amortized equipment). Using this method, we estimate that at build-out, the yearly additional costs at $105,600 per year.

This is comprised of:

- One "minor" fire/rescue event per month requiring one crew for a total of three hours (response and/or clean-up). (3 hrs. x $800/hr. x 12 = $28,800)
- One "major" fire/rescue event every two months requiring two crews for a total of eight hours each. (2 crews x 8 hrs. x $800/hr. x 6 = $76,800)

Emergency Medical Response -- This is based on average cost per response of $500, with an average of two calls per month. The total cost to the county would be $12,000 per year on a stabilized basis after build-out. ($500/response x 2 per month x 12 = $12,000)

Road Maintenance -- An allowance of $40,000 per year was made for this item to provide maintenance to Old Haleakala Highway, nearby roads and drainage systems.

The total annual "actual" cost to the county on a stabilized basis at build out of the subject development is estimated at $260,000. This cost would be reached on an escalating basis over time, beginning in year 3 and increasing as the community is finished and populated.

State of Hawaii costs would include nearby bypass highway frontage work, inspections and other minor oversight duties. An allowance of $75,000 per year was made for these items, increasing to the stabilized level as the project is built out.

Additionally, it is possible that up to 78 resident children (the count projected by the demographic formula) could enter the public school system. The cost per student in public schools statewide is presently at about $7,500 per year. We have used a stabilized allowance of $8,000 per potential student, or $624,000 in maximum student costs to the state each year.

The total state costs on an "actual" stabilized basis would be about $699,000 annually.

Per Capita Costs

An alternative method for determining public costs is through per capita expenditures incurred by the State of Hawaii and Maui County in accordance with the de facto population area of the jurisdiction. This is founded on the principal that each individual on the island equitably benefits from all governmental costs, regardless of type or focus throughout the day, with each new member of the community (whether resident or visitor) creating a proportionate new cost burden in their daily home and working life.

As previously noted, this is the standard method for resort and residential application as the majority of costs are viewed as accruing to the housing or lodging aspects of a persons lifestyle and land use. We have included it as a means of demonstrating the overall public fiscal impact potential of the proposed subject project even when viewed from this maximum potential cost perspective. We consider this approach as setting the absolute upper limit on all public costs (actual, indirect and inferred).

However, not all public costs accrue solely to a persons place of residence. Government services and oversight are also a vital component of the commercial community, and industrial, resort and retail/service land uses must also bear a proportionate share of their operational and consumer-related public expenses.

We have therefore estimated that two-thirds of each persons per capita governmental services impact (whether resident or tourist) is attributable to their dwelling place; the other third to the non-residential uses they patronize.

According to the state Department of Budget and Finance database, the state expects to spend a total of $8.0 billion on services, salaries, infrastructure, and financing in fiscal 2005. The total de facto population in the state on an average daily basis at year-end 2004 was about 1,450,000 persons, including residents, tourists, and military personnel.

The per capita expenditure by the state will thus be about $5,520 for 2005, a nominal increase from 2004. From 1979 through 2004, state government expenditures increased at a rate of just under five percent annually compounded.

The stabilized average de facto population on-site at the subject at build-out will be 548 persons, a figure reached in year 8 of the development model. Using the allocated state cost per de facto "resident" of $3,698 per year in allocated costs ($5,520 in total per capita costs times a 67 percent allocation to the dwelling unit), the total annual "costs" to the state purse at stabilization by the project using the per capita allowance method would be $2.03 million in constant year 2005 dollars.

Analyzed on a similar basis, Maui County's budget for the local government in fiscal year 2005 is $393,312,908, which represents an escalation over time of more than four percent compounded annually since 1995.

The current de facto population in Maui County is some 180,000 persons. The resulting de facto per capita county expenditure for this year is therefore $2,185. Applying the 67 percent allocation attributable to the residential land use for each subject de facto resident, results in a per capita allocated county government cost of $1,464 per person.

Per capita, Kauhale Lani, at build out, would represent about $802,000 annually in costs to the county government on a stabilized basis (548 de facto residents x $1,464).

Total Public Costs -- On a per capita allowance cost basis, the state and county expenses associated with the subject development would range from $514,175 in year 3 of the project (the first year of home occupancy) to a stabilized maximum of $2,828,000 at build-out in year 8 and beyond, in constant 2005 dollars.

On an actual cost basis, which we acknowledge may be an atypical perspective and a minimized accounting of direct expenditures, the total governmental costs at build-out to the state and county would be $959,000 annually.

Public Fiscal Benefits

Real Property Taxes -- Property taxes paid by landowners in the subject project were calculated using the 2005 tax rates for both land and buildings, improved or unimproved.

The assessed values for the improvements were based upon the estimated direct costs for each home, plus an allowance of 25 percent for indirect, financing, profits and other costs which would inure to the structures. The total estimated assessed values of the 165 finished homes upon completion is $89.7 million.

The assessed values for the land component were estimated at $5.9 million (59 acres at $100,000 per acre) for the site in its pre-developed state during year 1 of our model. This equates to an underlying assessed land value equal to $39,600 per proposed unit.

As an entitled vacant site in year 1, it was assumed the tract would be taxed as single-family residential at the rate of $5.86 per $1,000 assessed valuation. After subdivision, the house lots, with an estimated value of $350,000 each, would be taxed at the same rate.

The single-family homes were assumed taxed at a rate of $5.86 per $1,000 in value.

All real property value of the subject holding is assumed to be vested in the completed "salable" and operating components, with no assessment placed against open spaces, roads, or other systems.

The total real property tax to be paid to Maui County in 2005 dollars ranges from $34,574 in year 1 of development, to a stabilized level of $864,000 at build-out in year 8 and beyond. The aggregate real property taxes paid over the 10-year study time-frame will be $6.1 million.

State Income Tax -- The state will receive income taxes from three sources:

- the wages of the workers associated with the construction, maintenance, and operation of the Kauhale Lani components;
- the household incomes of full-time residents in the community; and

- the corporate profits from contractors and suppliers serving the construction phase of the development, and as generated by on-going maintenance and use.

According to DBEDT data, individual State of Hawaii income tax liability as a ratio to gross income has ranged from 5.5 to 5.9 percent during the past decade, with the more current figures tending toward the mid to upper-end of the range. We have employed an effective tax rate of 5.80 percent of gross income for individual workers and full-time residents.

The effective tax rate for the corporate income is estimated at 2.00 percent of gross operating profits, based on available DBEDT statistics.

The total income tax revenues to be received by the state are projected at $120,251 in the first year of construction increasing to a maximum level at year 7 of $1.8 million annually in constant 2005 dollars.

On a stabilized basis, after build-out, the permanent maintenance workers, off-site workers, and full-time project residents would pay an annual state income tax of $1.6 million. Over the 10-year modeling period, the cumulative income taxes paid are estimated at $11.3 million.

We have not included any corporate income or other taxes which will be paid by the developers as a result of their profits from undertaking the subject development, or from the secondary jobs created by the discretionary spending of workers and businesses. Such items have the potential to be substantial contributions to the state coffers.

State Gross Excise Tax -- This 4.166 percent of expenditures tax was applied against:

- the total estimated construction contract costs;
- the total allocated gross sales maintenance, landscaping and renovations operations; and
- the discretionary expenditures of the de facto resident and worker populations of the subject.

TABLE 15

PUBLIC COST/BENEFIT SUMMARY TABLE
Market Study of the Proposed Kauhale Lani
Pukalani, Upcountry Maui, Hawaii
In Constant Year 2005 Dollars

Development Year	1	2	3	4	5	6	7	8	9	10	Total Years 1 Through 10	Stabilized
PUBLIC BENEFITS (Revenues)												
1. REAL PROPERTY TAXES												
Cumulative Assessed Values (1) (2)												
Improvements			$16,312,500	$32,625,000	$48,937,500	$65,250,000	$81,562,500	$89,718,750	$89,718,750	$89,718,750		$89,718,750
Land	$5,900,000	$57,750,000	$57,750,000	$57,750,000	$57,750,000	$57,750,000	$57,750,000	$57,750,000	$57,750,000	$57,750,000		$57,750,000
Total Assessed Value	$5,900,000	$57,750,000	$74,062,500	$90,375,000	$106,687,500	$123,000,000	$139,312,500	$147,468,750	$147,468,750	$147,468,750		$147,468,750
TOTAL REAL PROPERTY TAXES	**$34,574**	**$338,415**	**$434,006**	**$529,598**	**$625,189**	**$720,780**	**$816,371**	**$864,167**	**$864,167**	**$864,167**	**$6,091,433**	**$864,167**
2. STATE INCOME TAXES												
Taxable Personal Income	$1,929,355	$1,270,609	$10,354,860	$15,371,060	$20,387,260	$25,403,460	$30,419,660	$28,014,113	$27,638,850	$27,638,850	$188,428,078	$27,638,850
Taxable Corporate Profits	$417,409	$274,891	$1,256,682	$1,628,664	$2,000,646	$2,372,628	$2,744,610	$2,488,251	$2,045,901	$2,045,901	$17,275,583	$2,045,901
Personal Taxes Paid	$111,903	$73,695	$600,582	$891,521	$1,182,461	$1,473,401	$1,764,340	$1,624,819	$1,603,053	$1,603,053	$10,928,829	$1,603,053
Corporate Taxes Paid	$8,348	$5,498	$25,134	$32,573	$40,013	$47,453	$54,892	$49,765	$40,918	$40,918	$345,512	$40,918
TOTAL STATE INCOME TAXES	**$120,251**	**$79,193**	**$625,716**	**$924,095**	**$1,222,474**	**$1,520,853**	**$1,819,232**	**$1,674,584**	**$1,643,971**	**$1,643,971**	**$11,274,340**	**$1,643,971**
3. STATE GROSS EXCISE TAX												
Taxable Transactions												
Construction Contracts	$5,962,980	$3,927,020	$13,050,000	$13,050,000	$13,050,000	$13,050,000	$13,050,000				$75,140,000	
Disposable Income Purchases	$1,157,613	$762,365	$6,694,716	$10,186,236	$13,677,756	$17,169,276	$20,660,796	$19,458,368	$19,233,210	$19,233,210	$128,233,547	$19,233,210
Home Maintenance				$360,000	$720,000	$1,080,000	$1,440,000	$1,800,000	$1,980,000	$1,980,000	$9,360,000	$1,980,000
Total Taxable Transactions	$7,120,593	$4,689,385	$19,744,716	$23,596,236	$27,447,756	$31,299,276	$35,150,796	$21,258,368	$21,213,210	$21,213,210	$212,733,547	$21,213,210
TOTAL STATE EXCISE TAX	**$296,644**	**$195,360**	**$822,565**	**$983,019**	**$1,143,474**	**$1,303,928**	**$1,464,382**	**$885,624**	**$883,742**	**$883,742**	**$8,862,480**	**$883,742**
TOTAL GROSS PUBLIC REVENUES												
To Maui County (Item #1)	$34,574	$338,415	$434,006	$529,598	$625,189	$720,780	$816,371	$864,167	$864,167	$864,167	$6,091,433	$864,167
To State (Items #2 & 3)	$416,895	$274,553	$1,448,280	$1,907,114	$2,365,948	$2,824,781	$3,283,615	$2,560,207	$2,527,714	$2,527,714	$20,136,820	$2,527,714
AGGREGATE TAX REVENUES	**$451,469**	**$612,968**	**$1,882,287**	**$2,436,711**	**$2,991,136**	**$3,545,561**	**$4,099,986**	**$3,424,374**	**$3,391,881**	**$3,391,881**	**$26,228,253**	**$3,391,881**
PUBLIC COSTS (Expenses)												
By Maui County			$145,814	$291,628	$437,443	$583,257	$729,071	$801,978	$801,978	$801,978	$4,593,147	$801,978
By State of Hawaii			$368,361	$736,721	$1,105,082	$1,473,443	$1,841,803	$2,025,984	$2,025,984	$2,025,984	$11,603,360	$2,025,984
TOTAL PUBLIC COSTS			**$514,175**	**$1,028,350**	**$1,542,525**	**$2,056,699**	**$2,570,874**	**$2,827,962**	**$2,827,962**	**$2,827,962**	**$16,196,508**	**$2,827,962**
TOTAL NET PUBLIC BENEFITS												
To Maui County	$34,574	$338,415	$288,192	$237,969	$187,746	$137,523	$87,300	$62,189	$62,189	$62,189	$1,498,286	$62,189
To State of Hawaii	$416,895	$274,553	$1,079,920	$1,170,393	$1,260,866	$1,351,339	$1,441,811	$534,224	$501,730	$501,730	$8,533,460	$501,730
AGGREGATE NET BENEFITS	**$451,469**	**$612,968**	**$1,368,112**	**$1,408,362**	**$1,448,612**	**$1,488,862**	**$1,529,112**	**$596,412**	**$563,919**	**$563,919**	**$10,031,745**	**$563,919**

Source: The Hallstrom Group, Inc.

The anticipated state excise tax receipts arising from the subject development grow from an estimated $296,600 in the first year of development to a peak of $1.5 million. Over the 10-year study period, the receipts total $8.9 million and stabilize at circa $884,000 per year.

We have not included any excise tax revenues associated with the direct, local "multiplier effect" expenditures on Maui, or those created in the secondary market by the suppliers to the maintenance operating or secondary worker expenditures.

Total Public Benefits (Revenues) -- In constant 2005 dollars, the aggregate annual tax revenues flowing from the subject development at full project build-out range from:

- $34,574 to $864,000 per year for Maui County, stabilizing over time at the higher figure, totaling $6.1 million over the 10-year development projection model;
- $275,000 to $3.3 million annually for the State of Hawaii, stabilizing at $2.5 million per year, and cumulatively at $20.1 million over the 10-year forecast period; and
- $451,000 to $4.1 million per year for total tax receipts (county and state), totaling $26.2 million for the initial 10 years of the Kauhale Lani community, and stabilizing at $3.4 million per year.

Correlation

Our public cost/benefit assessment model is displayed on Table 15, depicting the correlation of public service costs (per capita allocation basis) with the anticipated tax revenue benefits.

Table 16 summarizes our costs/benefits findings on both an actual cost and per capita allowance basis for the subject development.

As can be seen, regardless of the cost methodology adopted, in no single year do public coffers suffer a net loss.

CERTIFICATION

The undersigned do hereby certify that, to the best of our knowledge and belief, the statements of fact contained in this report are true and correct. It is further certified that the reported analyses, opinions, and conclusions are limited only by the reported assumptions and limiting conditions, and are our personal, impartial, and unbiased professional analyses, opinions, and conclusions. We further certify that we have no present or prospective interest in the property that is the subject of this report, and have no personal interest with respect to the parties involved. We have no bias with respect to the property that is the subject of this report or the parties involved with this assignment. Our engagement in this assignment was not contingent upon developing or reporting predetermined results. Our compensation for completing this assignment is not contingent upon the development or reporting of a predetermined value or direction in value that favors the cause of the client, the amount of the value opinion, the attainment of a stipulated result, or the occurrence of a subsequent event directly related to the intended use of this appraisal. The appraisal analyses, opinions, and conclusions were developed, and this report has been prepared, in conformity with the requirements of the Code of Professional Ethics and Standards of Professional Appraisal Practice of the Appraisal Institute, and the Uniform Standards of Professional Appraisal Practice. The use of this report is subject to the requirements of the Appraisal Institute relating to review by duly authorized representatives. The undersigned certify that they have made personal inspections of the property that is the subject of this report. No other persons provided significant real property appraisal assistance other than the undersigned.

The Appraisal Institute conducts programs of continuing education for their designated members. As of the date of this report, James E. Hallstrom, Jr. has completed the requirements of the continuing education program of the Appraisal Institute.

James E. Hallstrom, Jr., MAI, CRE
Hawaii State Certified
General Appraiser, CGA-178
Exp. Date December 31, 2005

Tom W. Holliday

/as

3674SR01

TABLE 16

SUMMARY OF ANNUAL PRIMARY GOVERNMENTAL TAX RECEIPTS AND PUBLIC SERVICE COSTS
Market Study of the Proposed Kauhale Lani
Pukalani, Upcountry Maui, Hawaii
In Constant Year 2005 Dollars

State of Hawaii

On Stabilized Basis At Build-Out	Actual Cost Comparison: Receipts	-	Costs	=	Net Benefits or (Costs)	Per Capita Allocation Comparison: Receipts	-	Costs	=	Net Benefits or (Costs)
Amount per Year	$2,527,714		($699,000)		$1,828,714	$2,527,714		($2,025,984)		$501,730

Maui County

On Stabilized Basis At Build-Out	Actual Cost Comparison: Receipts	-	Costs	=	Net Benefits or (Costs)	Per Capita Allocation Comparison: Receipts	-	Costs	=	Net Benefits or (Costs)
Amount per Year	$864,167		($260,000)		$604,167	$864,167		($801,978)		$62,189

Source: The Hallstrom Group, Inc.

THE HALLSTROM GROUP INC.
REAL ESTATE CONSULTANTS & APPRAISERS

April 29, 2005

Mr. Robert M. McNatt
Maui Land & Pineapple Company, Inc.
120 Kane Street
Kahulu, Hawaii 96732

Market Study and Economic Impact Analysis of the Proposed Kauhale Lani Pukalani, Maui, Hawaii

Dear Mr. McNatt:

At your request, we have completed a defined-scope market study and economic assessment of the Kauhale Lani master plan, a 59-acre residential community proposed for the rectangular site stretching westerly from Old Pukalani Highway, at the makai entrance to Pukalani Town, Upcountry, Maui, Hawaii. The project will include 165 single-family home sites, as well as a neighborhood park/recreational facility, walk/bike trail, and landscaped parkways.

The subject property, identified on State of Hawaii Tax Maps as Second Division Tax Map Key 2-3-09, Parcels 1, 7 and 69, is a gently to moderately sloping site located between the existing community and Hamakua Ditch, approximately eight miles upslope from Kahului Airport. It is a natural urban in-fill area of an expanding rural town.

The focus of our assignment was embodied in seven tasks:

1. To quantify the demand for residential inventory (single-family homes and lots) in the subject area and the competitive Upcountry market using demographic, economic and other analytical techniques.
2. To identify the existing inventory of single-family product in the effective market area, and their marketing and absorption histories.
3. To identify current and proposed competitive inventory additions, in regard to timing, likelihood of actualization, and other relevant traits.
4. To assess the appropriateness of the subject holding for the proposed use and ascertain whether it has sufficient attributes to obtain a competitive market share.
5. To estimate the speed of absorption for the lots in the subject project.

ARBITRATION
VALUATION AND
MARKET STUDIES

PAUAHI TOWER
SUITE 1350
1001 BISHOP STREET
HONOLULU
HAWAII 96813

(808) 526-0444
FAX (808) 533-0347
email@hallstromgroup.com
www.hallstromgroup.com

6. To estimate the direct and indirect, on and off-site benefits flowing to the local economy as a result of undertaking the subject development, including job and wage creation, business operations and profits, and owner/guest discretionary expenditures.
7. To quantify the impact of the project on the public purse over time in regards to revenues generated (real property, income, excise and accommodations taxes) and costs of providing governmental services.

The function of our assignment was to provide market data, analysis of market supply/demand factors, and an informed opinion of the anticipated level of market success the subject inventory can expect to achieve, for use in the entitlement petitioning process and other land use regulatory submittals.

The pertinent results from our study are contained in the following summary report, focusing on tabular presentation with brief narrative conclusions.

In completing this assignment, we visited the subject property, environs, and competitive projects in the study area; interviewed knowledgeable developers, brokers and other parties regarding current sales and market conditions; utilized published and on-line databases; reviewed governmental land use designations, entitlements and policies in the region; and, identified proposed competitive developments and their attributes.

This study was prepared for Maui Land & Pineapple Company, Inc. and PBR Hawaii, with Leilani Pulmano and Tom Schnell as its respective representatives, being the primary client contacts. The purpose of this assignment was to provide market analysis and conclusions regarding the proposed subject development for use in land use entitlement petitions for the property, and for internal planning purposes. The effective date of the study is April 1, 2005.

All conclusions presented herein are subject to the identified limiting conditions, assumptions and certifications of The Hallstrom Group, Inc., in addition to any others set forth in the text or tables. All work has been completed in conformance with the Code of Professional Ethics and Standards of Professional Appraisal Practice of the Appraisal Institute, and the Uniform Standards of Professional Appraisal Practice (USPAP).

Based on our investigation and analysis we conclude:

- The Maui residential market is in a strong demand cycle, with high interest in the Upcountry/Pukalani study area, marked by rapid absorption and escalating prices for the limited product available. All recently developed (scarce) competitive inventory in the primary region has been absorbed and market exposure times are short.
- An estimated 4,600-plus dwelling units (mid-point estimate) will be required in the study area during the next 16 years, an increase of 56 percent above the existing regional inventory. Approximately 94 percent, or more than 4,200 of the units would need to be single-family product. And fewer than 500 home sites are currently proposed.
- The property is well-suited for the proposed development and the master plan will achieve market acceptance by providing high quality, centrally located, home site purchase opportunities for resident buyers.

- Complete market absorption of the 165 single-family lots/homes will require up to three years from the commencement of presale offerings.

- The construction of Kauhale Lani and its on-going use will create some 731 "worker years" of employment on Maui during the first decade of its construction and use, with wages of circa $33.6 million. On a stabilized basis, home and unit maintenance will support about 15 full-time equivalent on-site jobs and contribute to another 6 off-site, with total wages of $597,000 annually.

- The average daily de facto population of the project is projected at 548 persons, 87 percent, or 475 of which will be full-time residents, with annual discretionary expenditures of $18.9 million per year. The project will infuse $81.7 million in development capital and $2.0 million in annual business operations into the Maui economy.

- The State of Hawaii will receive $20.1 million in primary tax receipts during the first decade of subject development and use, and a stabilized amount of $2.5 million annually. The county of Maui will receive $6.1 million during the first ten years of the project, and $864,000 per year thereafter. In no year does the state or county suffer a revenue shortfall (costs exceeding receipts) relative to the project.

We appreciate the opportunity to be of service in regards to this holding. Please contact us if further detail or discussion in the matter covered herein is required.

Respectfully submitted,

THE HALLSTROM GROUP, INC

James E. Hallstrom, Jr., MAI, CRE

/as

THE HALLSTROM GROUP INC.
REAL ESTATE
CONSULTANTS
& APPRAISERS

PROFESSIONAL BACKGROUND AND SERVICES

The Hallstrom Group, Inc. is a Honolulu based independent professional organization that provides a wide scope of real estate consulting services throughout the State of Hawaii with particular emphasis on valuation studies. The purpose of the firm is to assist clients in formulating realistic real estate decisions. It provides solutions to complex issues by delivering thoroughly researched, objective analyses in a timely manner. Focusing on specific client problems and needs, and employing a broad range of tools including after-tax cash flow simulations and feasibility analyses, the firm minimizes the financial risks inherent in the real estate decision making process.

The principals and associates of the firm have been professionally trained, are experienced in Hawaiian real estate, and are actively associated with the Appraisal Institute and the Counselors of Real Estate, nationally recognized real estate appraisal and counseling organizations.

The real estate appraisals prepared by The Hallstrom Group accomplish a variety of needs and function to provide professional value opinions for such purposes as mortgage loans, investment decisions, lease negotiations and arbitrations, condemnations, assessment appeals, and the formation of policy decisions. Valuation assignments cover a spectrum of property types including existing and proposed resort and residential developments, industrial properties, high-rise office buildings and condominiums, shopping centers, subdivisions, apartments, residential leased fee conversions, special purpose properties, and vacant acreage, as well as property assemblages and portfolio reviews.

Market studies are research-intensive, analytical tools oriented to provide insight into investment opportunities and development challenges, and range in focus from highest and best use determinations for a specific site or improved property, to an evaluation of multiple (present and future) demand and supply characteristics for long-term, mixed-use projects. Market studies are commissioned for a variety of purposes where timely market information, insightful trends analyses, and perceptive conceptual conclusions or recommendations are critical. Uses include the formation of development strategies, bases for capital commitment decisions, evidence of appropriateness for state and county land use classification petitions, fiscal and social impact evaluations, and the identification of alternative economic use/conversion opportunities.

ARBITRATION
VALUATION AND
MARKET STUDIES

PAUAHI TOWER
SUITE 1350
1001 BISHOP STREET
HONOLULU
HAWAII 96813

(808) 526-0444
FAX (808) 533-0347
email@hallstromgroup.com
www.hallstromgroup.com

PROFESSIONAL QUALIFICATIONS OF JAMES E. HALLSTROM, JR., MAI, CRE

Business Background

President	The Hallstrom Group, Inc. Honolulu, Hawaii (1980 - Present)
Former Senior Vice President and Treasurer	Hastings, Martin, Hallstrom and Chew, Ltd., Honolulu, Hawaii (1972-1980)
Former Real Property Appraiser and Analyst	Administration, Inc., a subsidiary of C. Brewer and Company, Limited Honolulu, Hawaii (1971-1972)
Former Senior Real Property Appraiser and Analyst	Opitz Realty, Madison, Wisconsin (1969-1971)

National Designations and Memberships

- CRE Designation (1998) - The Counselors of Real Estate
- MAI Designation (1976) - American Institute of Real Estate Appraisers
- SRPA Designation (1975) - Society of Real Estate Appraisers

The American Institute of Real Estate Appraisers (AIREA) and the Society of Real Estate Appraisers (SREA) consolidated in 1991, forming the Appraisal Institute (AI).

Education

- M.S. (Real Estate Appraisal and Investment Analysis) 1971, University of Wisconsin at Madison
- B.A. (Economics) 1969, Brigham Young University at Provo
- Additional numerous specialized real estate studies in connection with qualifying for national professional designations, and uninterrupted Continuing Education.
- Completed Continuing Education requirements with the Appraisal Institute through 2004.

Professional Involvement

- Former President and Officer for Hawaii AIREA and SREA Chapters
- Instructor for Society of Real Estate Appraisers Course 101, "Introduction to Appraising Real Property" and Course 201, "Principles of Income Property Appraising"
- Contributing author to the "Hawaii Real Estate Investor"
- Lecturer at many professional seminars and clinics.
- Appointed numerous times as an Arbitrator and Mediator.

Qualified Expert Witness

Federal and State Courts
State Land Use and County Hearings
Arbitration Proceedings

State of Hawaii Certification

Certified General Appraiser, License Number CGA-178, Exp. Date December 31, 2005

Community Service

Active registered member of the Boy Scouts of America; former Director of Le Jardin Academy; former Advisory Board Member of the School of Business, Brigham Young University, Hawaii Campus; Director of Hawaii Reserves, Inc.

PROFESSIONAL QUALIFICATIONS OF THOMAS W. HOLLIDAY

Business Background

Supervisor/ Senior Analyst	The Hallstrom Group, Inc. Honolulu, Hawaii
Former Staff Appraiser	Davis-Baker Appraisal Co. Avalon, Santa Catalina Island, California

Education

- B.A. (Communications/Journalism) 1978 California State University at Fullerton
- SREA Course 201- Principles of Income Property Appraising
- Expert witness testimony before State of Hawaii Land Use Commission and various state and county boards and agencies since 1983.
- Numerous professional seminars and clinics
- Contributing author to <u>Hawaii Real Estate Investor</u>, Honolulu Star Bulletin

On January 1, 1991, the American Institute of Real Estate Appraisers (AIREA) and the Society of Real Estate Appraisers (SREA) consolidated, forming the Appraisal Institute (AI).

Recent Maui Assignments (since 2000)

- Market Study, Economic Impact Analyses and Public Costs/Benefits Assessments
  - -- Wailea Ranch (Master Planned Community)
  - -- Palauea Bay (Resort/Residential)
  - -- Upcountry Town Center (Mixed-Use Planned Development)
  - -- Maui Lani (Residential and Industrial Components of Master Planned Community)
  - -- Maui Business Park, Phase II (Industrial/Commercial)
  - -- Four Seasons Private Estates and Residences Club (Resort/Residential)
  - -- Kualono Subdivision (Residential)
  - -- Kapalua Mauka (Master Planned Community)
  - -- Hailiimailii (Commercial)
- Major Valuation Assignments
  - -- Sheraton Maui Hotel
  - -- Outrigger Wailea Resort Hotel
  - -- Maui Lu Hotel
  - -- Coconut Grove Condominiums
  - -- Palauea Bay Holdings
  - -- Wailea Ranch
  - -- Maui Coast Hotel
  - -- Westin Maui Hotel
  - -- Maui Marriott Hotel
  - -- Waihee Beach

J

Water Supply and Management Plan

WATER SUPPLY AND MANAGEMENT PLAN

FOR

KAUHALE LANI COMMUNITY
Pukalani, Maui, Hawaii

T.M.K.: (2) 2-3-09:07

Prepared For:

Maui Land & Pineapple Company, Inc.
1000 Kapalua Drive
Kapalua, Hawaii 96761

Prepared By:

Engineering Solutions, Inc.
98-1268 Kaahumanu Street, Suite C-7
Pearl City, Hawaii 96782

May 2005

TABLE OF CONTENTS

WATER SUPPLY AND MANAGEMENT PLAN
FOR
KAUHALE LANI
Pukalani, Maui, Hawaii

I. INTRODUCTION & BACKGROUND

Kapalua Land Company, a subsidiary of Maui Land & Pineapple Company, Inc. (ML&P) is proposing to subdivide a 49.99 acre site, TMK 2-3-09:07, at the corner of Haleakala Highway and Old Haleakala Highway, just below Lower Pukulani Terrace Subdivision. Kauhale Lani is located on the lower slopes of Haleakala and is bordered by the Old Haleakala Highway to the east, Alexander and Baldwin (A&B) irrigation ditch to the north and west, and Aeloa Road to the south. See Figure 1 and 2.

The Kauhale Lani site is fallow pineapple fields. The elevation on the site ranges from 1,088 feet at the northern portion of the site to 1,186 feet at the southeast corner of the site.

Proposed improvements include 165 residential units, paved roadways, alleyways, a community park/recreation area, bike/pedestrian trail and landscaping. Associated improvements include underground water, sewer, drainage, electrical, telephone, and cable television systems.

There is also a 39-acre parcel, TMK 2-3-09:64, between Old Haleakala Highway and Haleakala Highway that will contain open space and community trails.

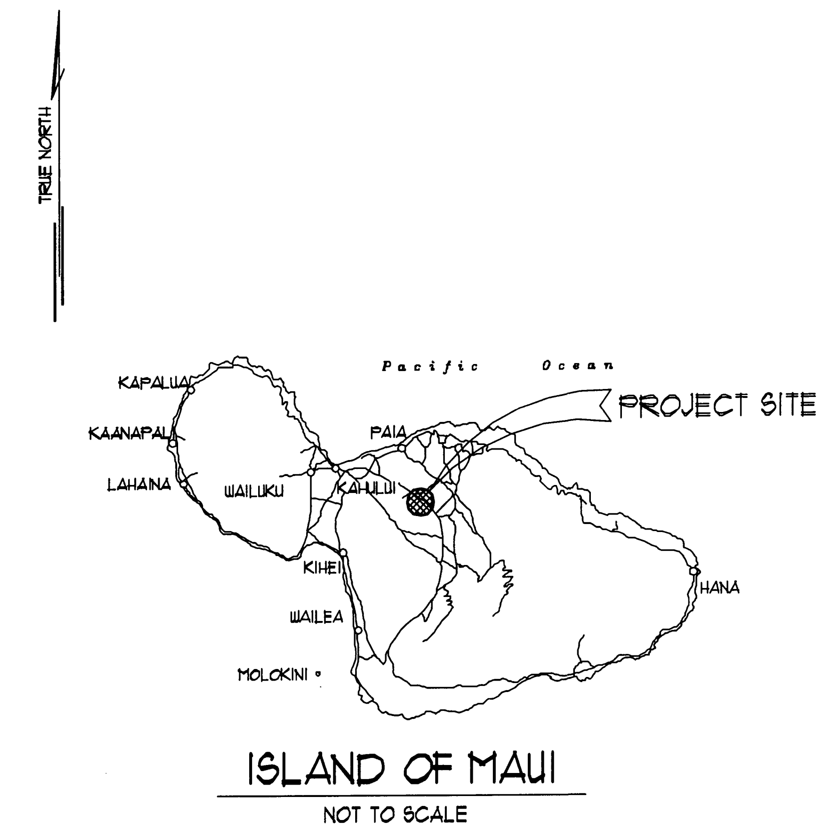
II. EXISTING WATER INFRASTRUCTURE

A. Source

Potable water service in the Pukalani area is currently provided from the County of Maui, Department of Water (DWS), Pukalani-Makawao Water System. The distribution system is fed from a 1.0 million gallon (MG) concrete reservoir located off Kula Highway near Makawao Avenue. The top and bottom tank elevations are 1704 feet and 1684 feet, respectively.

B. Transmission

The transmission mains servicing the area range from 6-inch to 16-inch diameter pipes of various material. The nearest connection points to the existing water system include a 6-inch main within Old Haleakala Highway that terminates on Ikea Place, approximately 200 feet away. This line

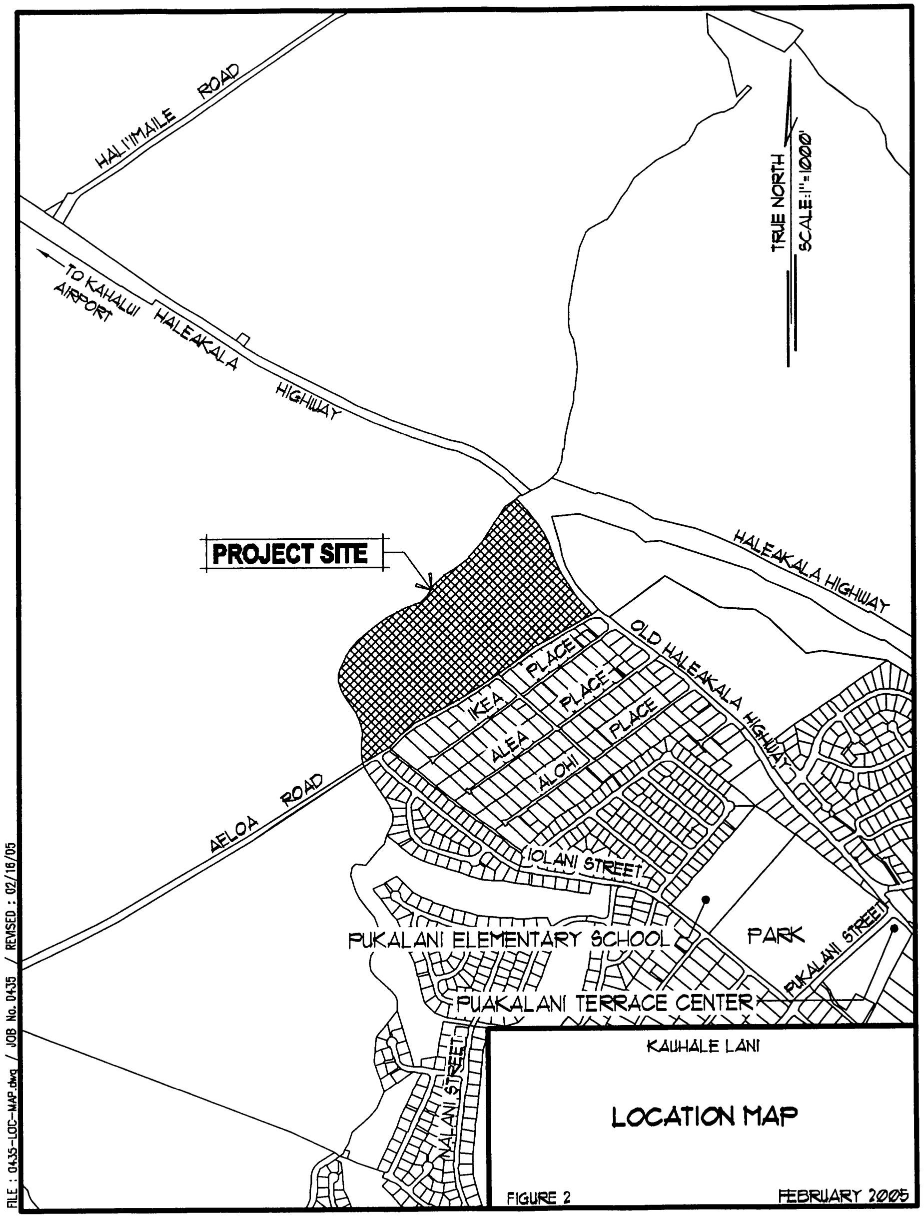


KAUHALE LANI

VICINITY MAP

FIGURE 1 FEBRUARY 2005

FILE : 0435-VIC-MAP.dwg / JOB No. 0435 / REVISED : 02/16/05



services the Lower Pukalani Terrace subdivison. There is also a second 8-inch water main in Old Haleakala Highway, which services the properties east of the highway and terminates at fire hydrant no. 497 at Mauna Street, approximately 2,200 feet mauka of the subdivision.

Properties southwest of Kauhale Lani are serviced by an 8-inch water main that terminates in Iolani Street at fire hydrant no. 170, just south of Aeloa Road. The existing County DWS water system network and location of the nearest connection point is shown in Figure 3.

III. PROJECTED WATER DEMANDS

Based on the Water System Standards, the proposed average daily demand for 165 single family residences and community park is 149,970 gallons. The maximum daily demand is 224,955 gallons. The peak hour demand is 449,910 gallons.

IV. PROPOSED WATER SYSTEMS

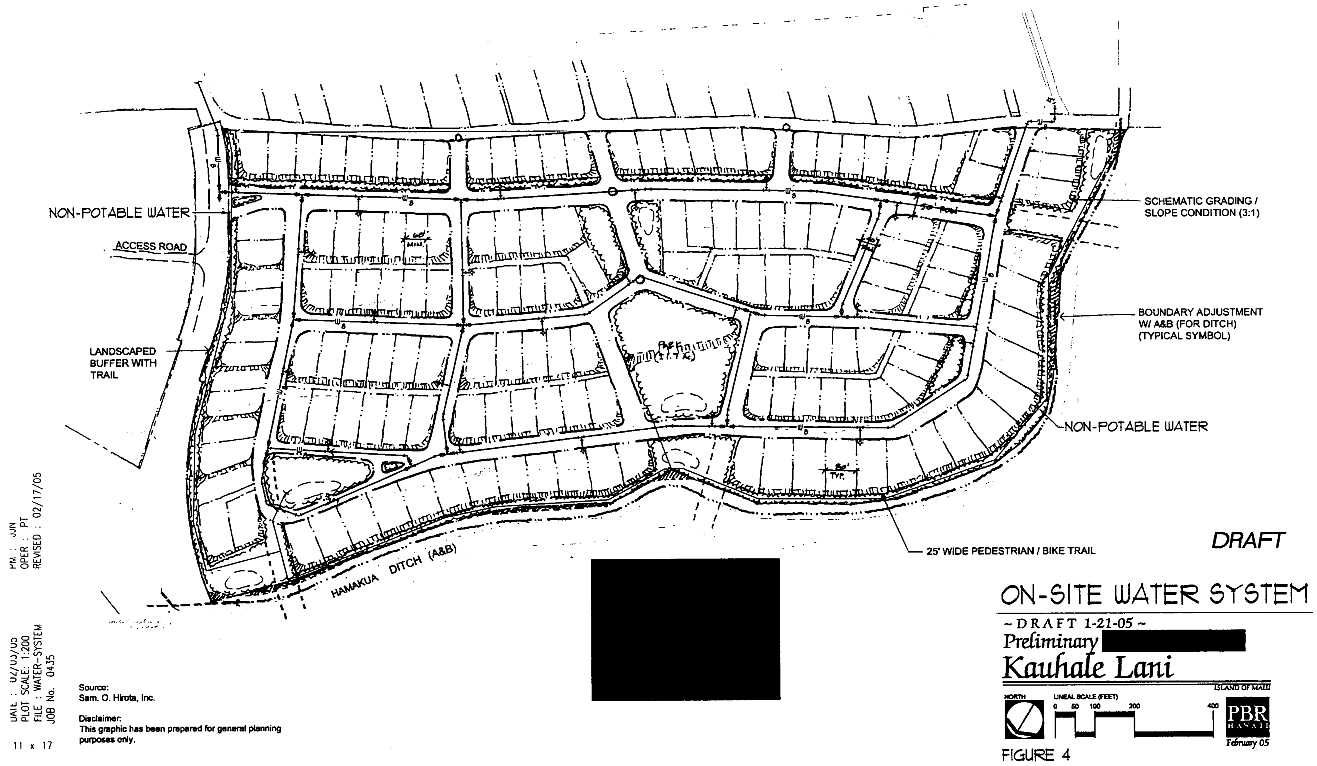
A. Source

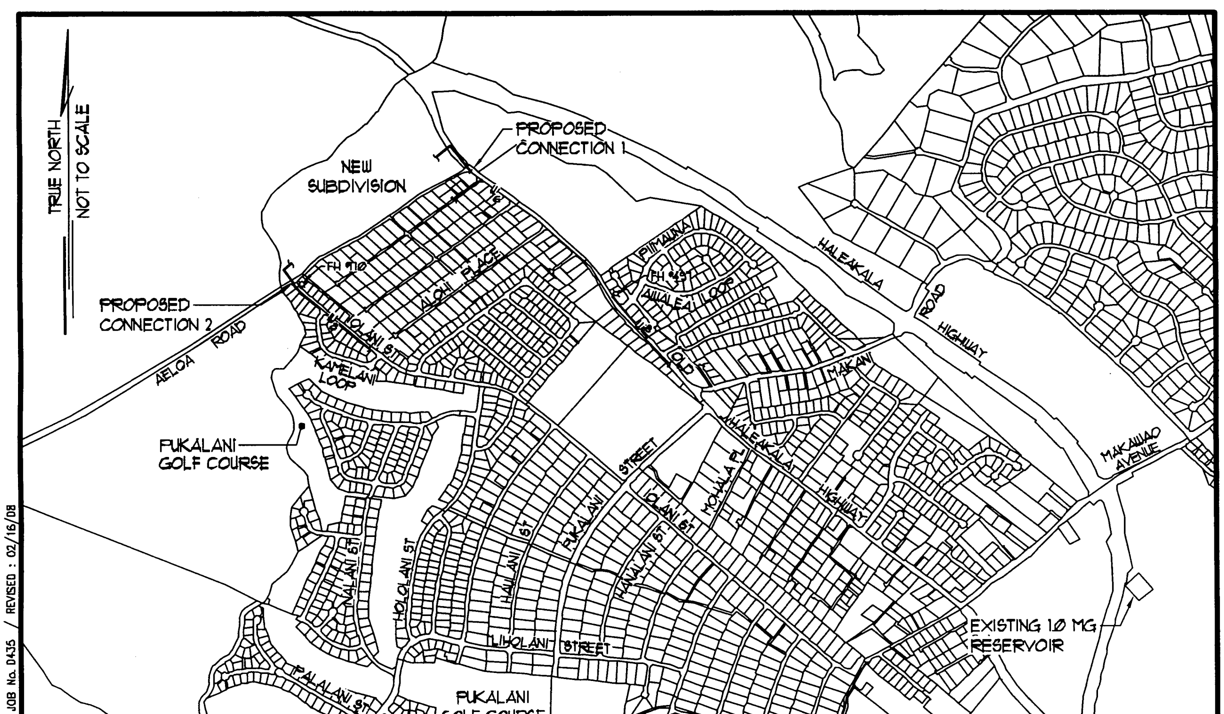
To obtain drinking water allocation for its proposed Kauhale Lani Community, Maui Land & Pineapple Company, Inc., is proposing to construct a new well at about the 1800-foot elevation along Piiholo Road above Makawao, on Maui Land & Pineapple Company, Inc., property, TMK: 2-4-12:06. The well will be constructed and outfitted with a 700 gallon per minute (gpm) pump, in accordance with the design requirements of the Maui County DWS and dedicated to DWS for incorporation into the DWS system. The anticipated yield of the well is 0.67 MGD of which 45%, or 301,500 gallon per day (gpd) will be allocated to Maui Land & Pineapple Company, Inc.

B. Transmission

The proposed on-site water system will consist of 8-inch water mains with valves, fire hydrants and water meter connections, appropriately provided and designed in accordance with the Water System Standards. Figure 4 provides a schematic layout of the proposed system.

Connection to the existing water system is proposed at two locations. On Old Haleakala Highway, the 6-inch water main at Ikea Place would be extended with an 8-inch line to the site and on Iolani Street the 8-inch line at fire hydrant no. 170 would be extended to the property. This would provide a looped system within the Kauhale Lani community, as well as provide residences


NON-POTABLE WATER
ACCESS ROAD
LANDSCAPED BUFFER WITH TRAIL
SCHEMATIC GRADING / SLOPE CONDITION (3:1)
BOUNDARY ADJUSTMENT W/ A&B (FOR DITCH) (TYPICAL SYMBOL)
NON-POTABLE WATER
25' WIDE PEDESTRIAN / BIKE TRAIL
HAMAKUA DITCH (A&B)
DRAFT
ON-SITE WATER SYSTEM
~ DRAFT 1-21-05 ~
Preliminary [redacted]
Kauhale Lani
ISLAND OF MAUI
NORTH
LINEAL SCALE (FEET)
0 50 100 200 400
PBR HAWAII
February 05
FIGURE 4
Source:
Sam. O. Hirota, Inc.
Disclaimer:
This graphic has been prepared for general planning purposes only.
PM : JJN
OPER : PT
REVISED : 02/17/05
DATE : 02/03/05
PLOT SCALE: 1:200
FILE : WATER-SYSTEM
JOB No. 0435
11 x 17


TRUE NORTH
NOT TO SCALE
NEW SUBDIVISION
PROPOSED CONNECTION 1
PROPOSED CONNECTION 2
AELOA ROAD
KAMELANI LOOP
PUKALANI GOLF COURSE
HALEAKALA HIGHWAY
MAKAWAO AVENUE
EXISTING 1.0 MG RESERVOIR
LILIHOLANI STREET
PUKALANI STREET
PALALANI ST
KALIALANI CIR
LAINA LANI DR
PUKALANI GOLF COURSE
LEDGEND
PROPOSED WATER
EXISTING WATER
EXISTING FIRE HYDRANT
KAUHALE LANI
OFF-SITE WATER SYSTEM MAP
FIGURE 3
FEBRUARY 2005
FILE : 0435-OFF-SITE-WTR.dwg / JOB No. 0435 / REVISED : 02/16/08

mauka of the Lower Pukulani subdivision with reliability and redundancy to their water systems. Pressure regulator/reducers will be added at the connections, as required.

An alternative water connection could be made to the 8-inch water main at the intersection of Haleakala Highway and Mauna Street instead of the 6-inch water main.

C. Non-potable Water

To reduce and conserve the consumption of potable water, non-potable water for irrigation of common areas will be obtained from the proposed reclamation wastewater facility. A separate water system of smaller piping will be provided.

V. POTENTIAL IMPACTS AND MITIGATIONS

With the proposed Kauhale Lani community, additional water sources will be developed and made available within the Pukalani/Makawao area. The proposed water connections will also provide additional benefits to the adjacent residents by the installation of a looped system for redundancy and reliability.

VI. CONSTRUCTION ESTIMATE

The estimated construction cost for the water system is $2,160,000. This does not include any County DWS water facility charges that may be incurred.

APPENDIX A

WATER DEMAND CALCULATIONS

ENGINEERING SOLUTIONS, INC.
Civil / Sanitary / Structural Engineers

PROJECT NO. 435
PROJECT Kauhale Lani
PREPARED BY LCA DATE 2/11/2005
CHECKED BY ____ DATE ____
SHEET ____ OF ____

98-1268 Kaahumanu Street, Suite C-7 • Pearl City, Hawaii 96782 • Phone: (808) 488-0477 • Fax: (808) 488-3776

PROPOSED WATER DEMAND

1. References
   A. Water System Standard, State of Hawaii, 2002

2. Water Demand

Average Daily Demand	=	3,000 gal/acre	(Table 100-18, Single Family Residential)
Lot Size	=	49.99 acre	
Average Daily Demand	=	149,970 gallons	
Maximum Daily Demand	=	1.5 x Average Day	
	=	224,955 gallons	(Table 100-20, Maui)
Peak Hour	=	3.0 x Average Day	
	=	449,910 gallons	(Table 100-20, Maui)

K

Basis of Design - Wastewater Treatment Plan

BASIS OF DESIGN – WASTEWATER TREATMENT PLANT

FOR

KAUHALE LANI COMMUNITY

Pukalani, Maui, Hawaii

T.M.K.: (2) 2-3-9:007

Prepared For:

KAPALUA LAND COMPANY, LTD.
1000 Kapalua Drive
Kapalua, Hawaii 96761

Prepared By:

Engineering Solutions, Inc.
98-1268 Kaahumanu Street, Suite C-7
Pearl City, Hawaii 96782

March 2005

BASIS OF DESIGN – WASTEWATER TREATMENT PLANT

FOR

KAUHALE LANI COMMUNITY

Page

TABLES

FIGURES

APPENDICES

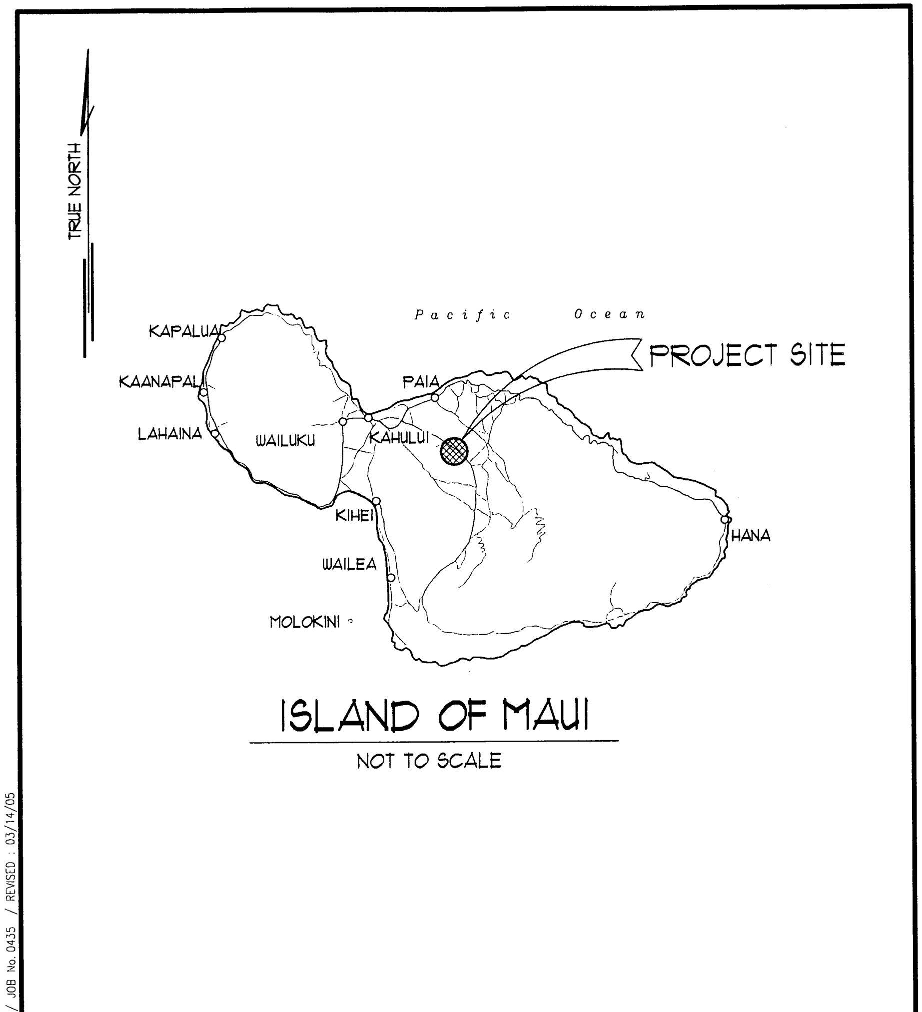
1.0 GENERAL

The Kapalua Land Company, Ltd. (Kapalua) plans to develop a parcel of land (TMK 2-3-9:007) into a residential community with recreational fields in Keahua, Kula, Maui. The proposed community will be makai of the existing Pukalani development, between Old Haleakala Highway, and Iolani Street. The 50 acre lot will be developed into a residential community consisting of approximately 165 residential lots varying in size, including a 2.7 acre community park. See Figures 1-1 and 1-2.

The community will be located along Haleakala Highway at elevations ranging from approximately 1,100 to 1,200 feet above mean sea level.

There are no public sewer systems in the vicinity of this proposed development, and the County of Maui Department of Public Works and Environmental Management, Wastewater Reclamation Division, has indicated that it does NOT have plans to provide collection and treatment facilities to service the area within the next twenty five years. The County has also indicated that constructing and dedicating such facilities to the County is not an option.

In order for the community to move forward, suitable wastewater collection, treatment and disposal systems will need to be developed. This report presents and evaluates three wastewater treatment and disposal alternatives for the proposed community, and identifies the most attractive alternative. This engineering report is being submitted to the State Department of Health (DOH), to obtain conceptual approval of a wastewater treatment system before commencing with the preliminary engineering report and ultimate design of the proposed community.

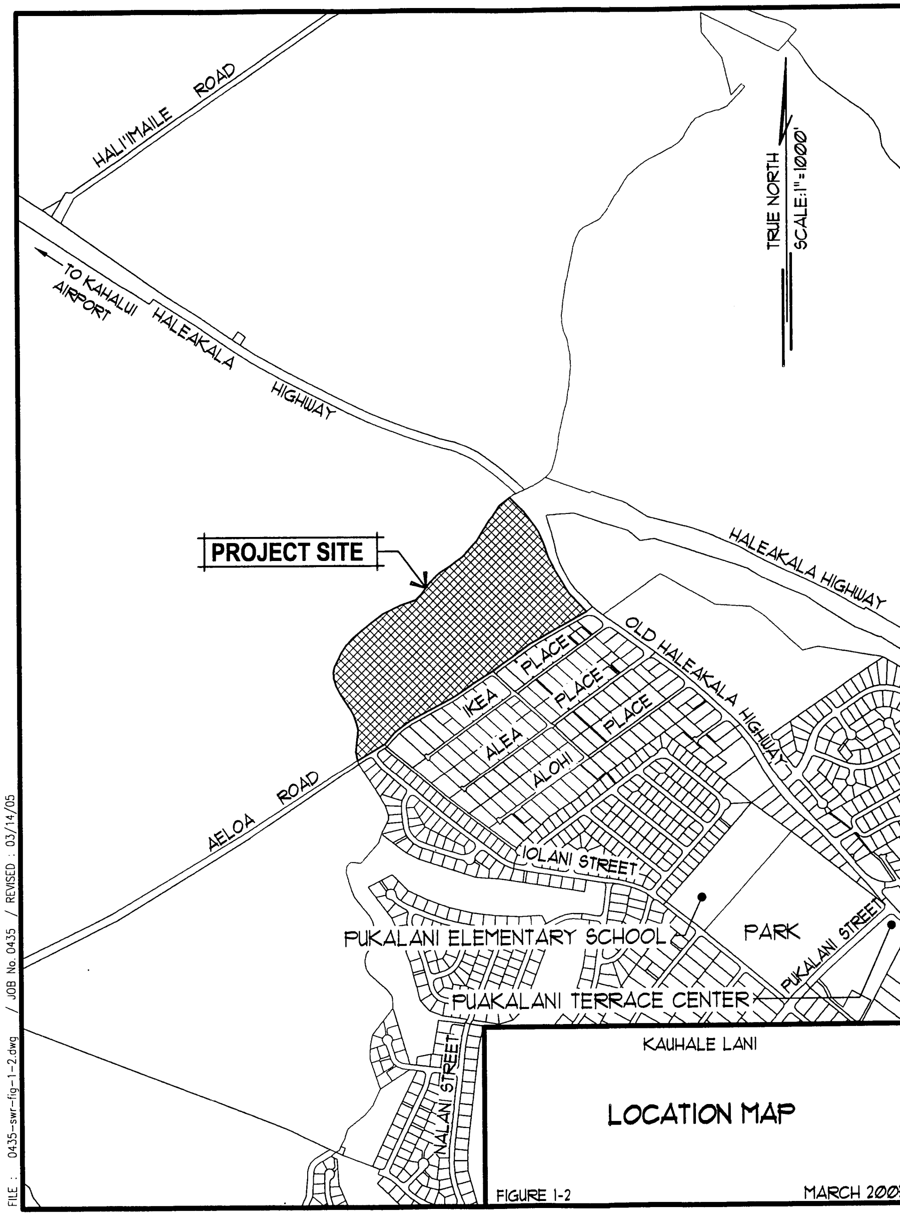


KAUHALE LANI

VICINITY MAP

FIGURE 1-1 MARCH 2005

FILE : 0435-SWR-FIG-1-1.dwg / JOB No. 0435 / REVISED : 03/14/05



KAUHALE LANI

LOCATION MAP

FIGURE 1-2 MARCH 2005

FILE : 0435-swr-fig-1-2.dwg / JOB No. 0435 / REVISED : 03/14/05

2.0 GENERAL REQUIREMENTS

Under Subchapter 1 of Chapter 62 of the Hawaii Administrative Rules (HAR) DOH sets forth certain criteria that must be followed in the design requirements of a treatment process, disposal and re-use of wastewater. DOH desires to ensure that wastewater or wastewater sludge does not impact or "contaminate water resource, does not give rise to public nuisance, and does not become a hazard or potential hazard to public health safety and welfare". The need for treatment is imposed by Chapter 62 (11-62-05), which sets up critical wastewater disposal areas (CWDA). The development lies within CWDA, and above the Underground Injection Control (UIC) Line as established by HAR DOH Chapter 23. This CWDA is based on the protection of groundwater resources. In short, the interpretation of the regulation indicates that septic tank liquid wastes cannot be disposed of directly into the soil within this area because of the possibility of ground water contamination. Because of these requirements, a feasible alternative to dispose of the wastewater generated from the community must be evaluated.

3.0 PROJECT OBJECTIVES

In light of the County's plan not to provide public facilities in the area as previously described, three alternatives were conceptualized which include:

1) A decentralized wastewater system
2) A conventional centralized wastewater treatment and disposal facility
3) An alternative centralized wastewater treatment and disposal facilities

To accomplish this goal, the following tasks were performed:

- Search of plan files and library for previous studies, as-built drawings, specifications, and other records.
- Conduct literature search to identify potential treatment options. These alternatives must meet the treatment and disposal requirements set forth by DOH and the US Environmental Protection Agency (EPA).
- Conduct a preliminary evaluation of the options to determine those that are most appropriate for the project.
  - Provide in depth evaluations of three (3) of the most appropriate options identified in the preliminary evaluation. Preliminary site layout and costs should be included in the evaluation.

4.0 WASTEWATER GENERATION AND CHARACTERISTICS

The wastewater flows generated by the residential lots was estimated in accordance with the HAR DOH, Chapter 62 Title 11, Wastewater Systems, and the City and County of Honolulu (CCH) Design Standards of the Department of Wastewater Management (DWWM), July 1993. Wastewater flow from the community park was estimated using the CCH Parks Individual Wastewater System (IWS) Design Standards, January 2000. As generally described previously, commercial and industrial facilities are not planned for this development. No further development of the proposed community is planned.

4.1 Population and Residential Flows

For residential areas, wastewater flow rate is commonly determined on the basis of population density and the average flow per capita contribution of wastewater.. In accordance with Chapter 62 of the DOH regulations, for proposed treatment works where capacity is equal or larger than 100,000 gallons per day (gpd), the wastewater flow generation is based on CCH Design Standards of the DWWM, since Maui County does not have design standards.

Based on these standards, it is assumed that each residence will contain four persons, and for the purposes of this report, wastewater flow calculations assume that each residence is 100 percent occupied. Therefore, if 165 parcels are developed with dwellings, the anticipated future population is 660 persons.

Based on these design standards and assumptions, the average wastewater flow is estimated to be about 56,100 gpd (at 80 gallons per day per person). See Calculations in Appendix A.

4.2 Infiltration and Inflow (I/I)

In addition to the wastewater flows generated by the population, additional flows have to be considered. These flows are also known as Infiltration and Inflow. Infiltration is a result of groundwater entering the sewer system through cracks in the piping system or poorly fitted or loose pipe joints. Inflow is surface runoff that typically enters the system through manhole covers, illegal connections, and misuse of property cleanouts.

The quantity of I/I depend on many factors including length of sewers, soil and topographic conditions, and somewhat the population and its influence on the length of sewers and number of house connections. The fluctuating elevation of the ground water table also affects the quantity of I/I as rain percolates into the ground, and into the sewers.

In accordance with CCH Design Standards, Dry Weather I/I can be estimated with the following factors:

1. 5 gallons per capita per day (gpcd) if the sewer is laid above the ground water table; and
2. 35 gpcd if the sewer is laid below the ground water table.

In accordance with CCH Design Standards, Wet Weather I/I can be estimated with the following factors:

1. 1,250 gallons per acre per day (gad) if the sewer is laid above the ground water table; and
2. 2,750 gad if the sewer is laid below the ground water table.

It was assumed that all sewers will be laid above the ground water table. Based on this assumption, the dry weather I/I is estimated to be 3,300 gpd, and the wet weather I/I is 62,500 gpd.

4.3 Community Park Flows

Based on the CCH Parks IWS Design Standards, the maximum wastewater flow can be estimated by using the number of fixtures (i.e. toilets and urinals) and assuming its use every five minutes over a specified period. It is assumed that the park will be open for 12-hours a day. Under these assumptions and design standards, the maximum wastewater flow from the community park was estimated to be 6,050 gpd. See Calculations in Appendix A.

4.4 Peaking Factors

In calculating the residential maximum wastewater flow, a peaking factor of 5.0 was obtained from the Babbit curve. Applying this peaking factor to the average wastewater and I/I flow results in a maximum residential flow of 267,300 gpd. Therefore, the total maximum wastewater flow was calculated by the summation of the maximum community park, residential flows and I/I flows, equivalent to 273,350 gpd.

In accordance with CCH design standards, the Design Average Flow is the sum of the average wastewater flow and the applicable dry weather infiltration/inflow (I/I). The definition of the Design Average Flow is the average wastewater flow over a 24-hour period, during a dry weather period. The definition of the Design Maximum Flow is the highest average wastewater flow rate during a one-hour period, during a dry weather period. The Design Maximum Flow can be calculated by the summation of the maximum wastewater flow and the applicable dry weather I/I. The definition of the Design Peak Flow is the highest instantaneous wastewater flow rate, during a period of wet weather. The Design Peak Flow is calculated by taking the sum of the Design Maximum Flow and the Wet Weather I/I. Design flows are summarized below:

1. Design Average Flow = 56,100 gpd
2. Design Maximum Flow = 273,350 gpd
3. Design Peak Flow = 329,800 gpd

4.5 Organic Loading

The wastewater from the community is anticipated to be of typical domestic composition. Based on HAR Chapter 62, the anticipated wastewater strength is expected to be composed of liquefied organic solids with a Biochemical Oxygen Demand 5-day (BOD_5) of 282 milligrams per liter (mg/L). The Total Suspended Solids (TSS) is expected to be approximately 282 mg/L.

5.0 ALTERNATIVE DISCUSSION

In light of the present and future state of a non-existing public wastewater system, Kapalua has taken the initiative in developing its own wastewater collection, treatment and disposal system for the proposed community. The three alternatives under consideration are:

1) A decentralized wastewater system
2) A conventional centralized wastewater treatment and disposal facility
3) An alternative centralized wastewater treatment and disposal facilities

5.1 Alternative 1 – Decentralized Wastewater Treatment System

Individual wastewater systems (IWS) are not an option for this development due to the parcel size and the number of lots. However, consideration was given to a decentralized wastewater system that would treat wastewater for reuse within clusters. However, due to the available land use space and the back up storage and disposal requirements, this was not an option. In light of these findings, a decentralized treatment system was eliminated from further consideration.

5.2 General discussion of Centralized Treatment Plant

A centralized approach consists of a collection system that conveys the wastewater to a single location for treatment. This approach takes advantage of economics of scale to reduce capital and in some cases operations and maintenance costs. This approach also facilitates beneficial reuse of the treated effluent when compared with IWS.

For the purposes of this report, the treatment plant has been located in a parcel (TMK 2-3-009:064) across Haleakala Highway, also owned by Kapalua.

The collection system consists of two submersible pump stations along with a gravity sewer system with 8-inch piping and sewer manholes. A schematic layout is provided on Figure 5-1. The capital cost of the sewer collection system is approximately $2,600,000.

Kapalua understands the environmental and economic benefits in conserving the State's natural resources by using properly treated recycled water and biosolids. Therefore, it is desirable to treat the wastewater to a high level of quality to promote reuse and sustainability in their design.

DOH's regulations define three levels of recycled water quality, the highest category being R-1 water. R-1 water has more extensive treatment requirements but these requirements are offset by the flexibility and the range of applications that the recycled water may be used. R-1 water is the recommended treatment level in this evaluation of alternatives.

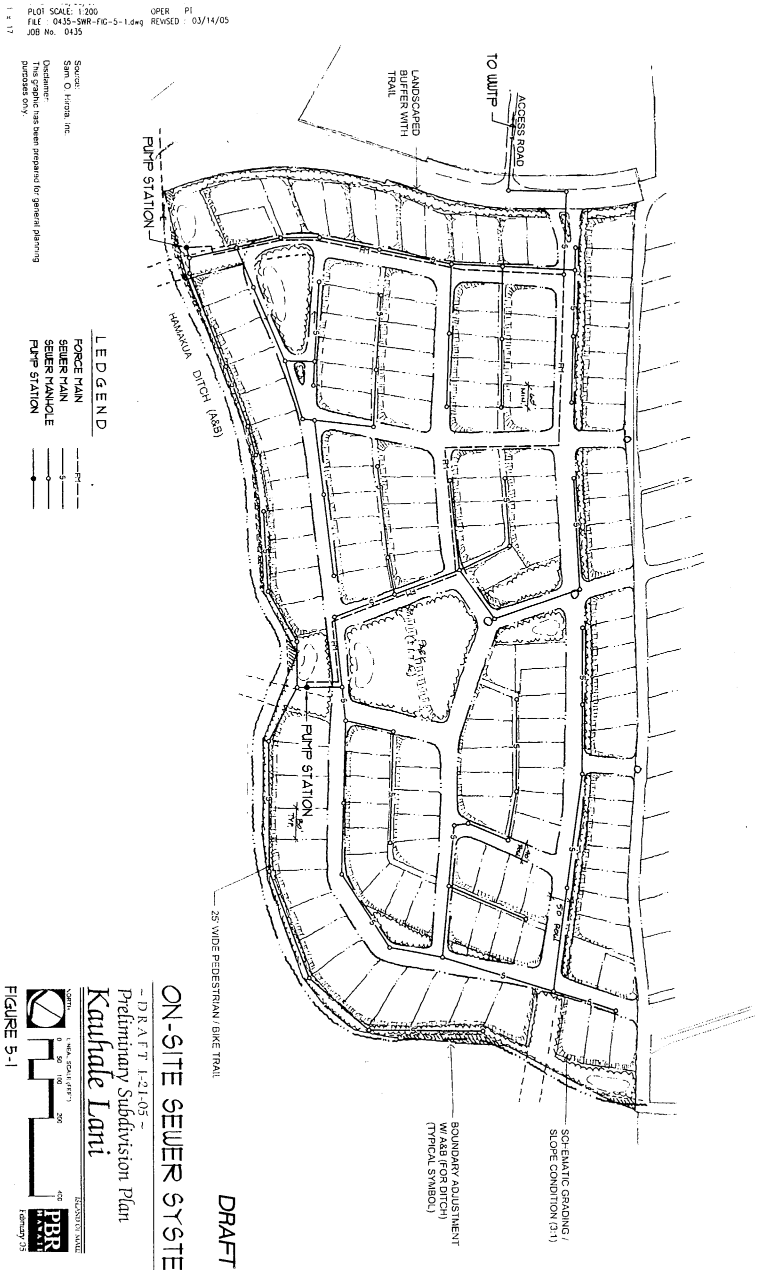


FIGURE 5-1

There are a number of processes that can be used for secondary treatment. Given that the system is small in capacity, it likely will not be manned full-time. Therefore, it is desirable to have robust systems that are capable of handling variations in waste strength and flow, are resistant to biological upsets, and is consistent with the desire to produce R-1 water for reuse. Based on these criteria, a conventional treatment system, extended aeration, and a new, innovative treatment system, membrane bioreactors, are recommended for further evaluation.

5.3 Alternative 2 - Centralized Treatment Plant – Extended Aeration

5.3.1 Preliminary Treatment

Preliminary treatment refers to the initial treatment of wastewater as it enters the treatment plant. The primary goal of preliminary treatment is to remove materials from the influent plant flow that can harm or impair downstream processes or equipment. Preliminary treatment typically consists of bar screens and grit removal.

5.3.1.1 Bar Screens

Coarse bar screens will be provided to intercept oversized material from the raw wastewater that may damage pumps and process equipment. The bar screens will be cleaned with a rake matching the bar screen slots. Screenings shall be removed from the racks, and stored in a sealed container. Two coarse bar screen units, including one standby unit, sized to handle peak flow will be provided.

5.3.1.2 Grit Chamber

An aerated grit chamber will be provided following the bar screen. The grit chamber will remove grit – particulate matter such as sand, egg shells, and coffee grounds – that can be abrasive to downstream mechanical equipment.

TABLE 5-1
TYPICAL AERATED GRIT CHAMBER DESIGN PARAMETERS[a]

PARAMETER	RANGE OF VALUES
Detention Time at peak flow	2 – 5 minutes
Width to Depth Ratio	1:1 to 5:1
Length to Width Ratio	3:1 to 5:1
Air supply per unit length	3 – 8 ft^3 / min-ft
Grit Generation	0.5 – 27 ft^3 / million gallons

[a]Source: Metcalf & Eddy, 2003 and Water Environment Federation 1998

Based on these values, it was estimated that the grit chamber will need to be 3 feet wide, 12 feet long, and 1.5 feet deep.

5.3.2 Flow Equalization Basin

An in-line Flow Equalization Basin (FEB) will be provided to balance flow and loading variations into the plant. Discharge from the basin will be designed to be relatively constant, which will enable downstream processes to operate in a more stable flow range. The FEB shall be sized to handle the peak flows. Mechanical mixers will provide the necessary aeration of the basin to prevent the basin from going septic.

Additional FEB Capacity
In accordance with the State of Hawaii Guidelines for the Treatment and Use of Recycled Water, May 2002 (Reuse Guidelines), plant effluent that does not meet the guidelines and requirements of R-1 water should not be discharged into the reuse system. Discussions with DOH indicate an acceptance of the concept to routing "reject" water back to the head of the plant, and stored in the FEB for re-treatment. In accordance with the reuse guidelines, this capacity should be equal to one day's average daily flow. This capacity governs the size of the FEB.

5.3.3 Primary Treatment

Primary treatment typically involves the use of a clarifier, before secondary treatment to reduce suspended solids loading on the secondary clarifier. However, due to the high mixed liquor suspended solids concentrations in the aeration tank, shock loadings can be handled without affecting the microbiological process. Therefore, primary treatment is typically not provided.

5.3.4 Extended Aeration

Description
Extended aeration is a suspended growth process that utilizes naturally occurring microorganisms in the wastewater to convert biodegradable organic and certain inorganic compounds into energy used in cellular respiration and reproductive processes. Air is used to mix the wastewater and provides the oxygen necessary for the microorganisms to convert the nutrients.

Extended aeration does not require primary clarification (although grit removal is still desirable), has long mean cell residence times, and has large basins to accommodate longer hydraulic retention times. Extended aeration is typically a very stable process and is used extensively in package plant systems.

TABLE 5-2
TYPICAL EXTENDED AERATION DESIGN PARAMETERS[a]

PARAMETER	RANGE OF VALUES
Sidewater depth	15 to 25 feet
Freeboard allowance	1 to 2 feet
Mixed liquor suspended solids (MLSS)	2,000 to 5,000 mg/l
Mean cell residence time	20 to 40 days
Hydraulic retention time	20 to 30 hours
Food to mass ratio	0.04 to 0.10 lbs BOD_5/lb of MLVSS/day
Volumetric organic loading rate	5 to 15 lbs BOD_5/day/1000 ft^3
Recycle rate	50 to 150 percent of influent rate

[a]Source: Metcalf & Eddy, 2003 and Water Environment Federation 1998

Smith & Loveless, a manufacturer of extended aeration systems was contacted regarding the project. Smith & Loveless recommended a rectangular configuration with an integrated extended aeration-clarification system. The proposed extended aeration system would consist of two structures, 106 feet long, 12 feet wide, and a side water depth of 10.5 feet, and an overall tank height of 11.5 feet. The clarifier was 12 feet square with the same side water depth and overall tank height. Aeration would be provided by blowers.

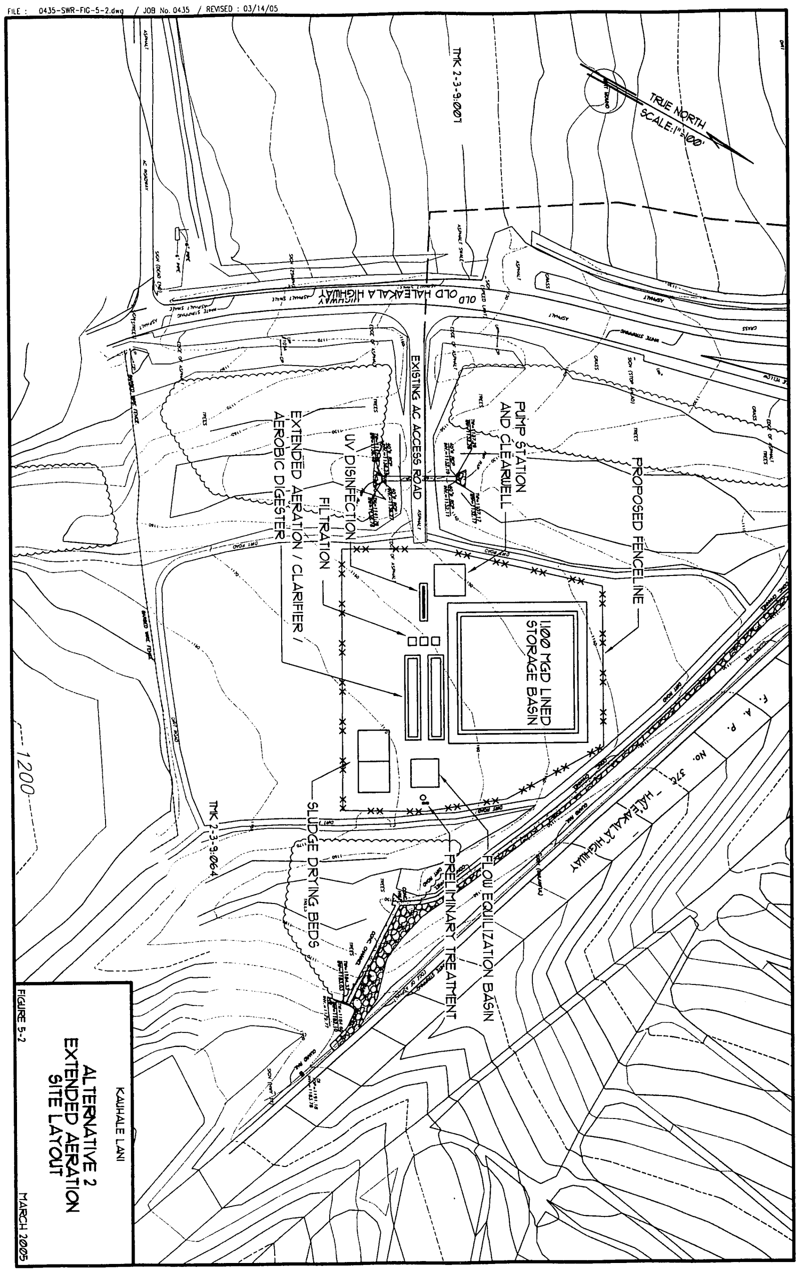
In order to provide better operability, two units are proposed, each rated at 51,000 gpd, is recommended. Figure 5-2 shows a projected layout for this alternative. This alternative will require approximately 2.3 acres.

5.3.5 Tertiary Treatment - Coagulation, Filtration, and Disinfection

Tertiary treatment typically consists of a filtration process to improve solids removal (both suspended and those associated with biological contaminants) above and beyond what is typically accomplished in secondary clarifiers. In order to achieve R-1 quality, the extended aeration process will require coagulation, filtration, and disinfection facilities to satisfy the requirements of R-1 water.

Coagulation is typically defined as the destabilization of colloidal particles found in the secondary effluent, which in turn promotes flocculation, or particle growth as a result of particle collisions. Polymers are high molecular weight compounds that are added to the secondary effluent to stabilize the colloidal particles. Polymers are typically introduced into the secondary effluent in a concrete tank with a high rapid mixer. Coagulation has been found to enhance the performance of filtration.

Suspended particulate material is removed from the liquid by passing it through a bed comprised of granular sand or a compressible filter medium, resulting in the deposition of solids. The major mechanisms in the removal of biological floc in the filter include straining, sedimentation, impaction, interception, adhesion, and flocculation. Filtration is



a conditioning step which will assist in effective disinfection. Three granular filters are provided, each able to satisfy peak flow conditions, in accordance with the Reuse Guidelines.

Disinfection refers to the partial deactivation of organisms that cause disease. Disinfection is commonly accomplished by the use of chemicals (i.e. chlorine, bromine, ozone), physical agents (i.e. heat, light, and sound waves), mechanical means, and radiation (i.e. electromagnetic, acoustic and particle). In consideration of costs, potential formation of toxic disinfection by products, operator safety, and effectiveness as a disinfectant, UltraViolet Radiation disinfection was selected.

Typical design parameters for coagulation/flocculation, filters, and disinfection are provided in Table 5-3.

TABLE 5-3
TERTIARY TREATMENT DESIGN PARAMETERS

PARAMETER	RANGE OF VALUES
Coagulation/Flocculation	
G Values (mixing requirement)	2,500 – 7,500 s^{-1}
Polymer dose	1 mg/l
Filtration	
Filter loading rate	<5 gallons per minute per square foot
UV Disinfection	
Required dose w/ sand filtration (55% UVT)	100mJ/cm^2
Required dose w/ membrane filtration (65% UVT)	80mJ/cm^2

5.3.6 Biosolids Treatment and Handling

5.3.6.1 Aerobic Digester

Biosolid stabilization will be achieved through the use of an aerobic digester. Microbiological activity is stimulated through aeration, where the limited food source is depleted, which leads to oxidation of cellular material and resulting in carbon dioxide, water, and ammonia which converts to nitrate. The biosolids will need to undergo digestion for 40 days to meet 40 CFR Part 503 Class B biosolids, where pathogen reduction is accomplished.

TABLE 5-4
TYPICAL AEROBIC DIGESTER DESIGN PARAMETERS[a]

PARAMETER	RANGE OF VALUES
Solids Retention Time	40 days
Volatile solids loading	0.1 to 0.3 lb/ft^3-day
Oxygen Requirements	2.3 lbs O_2 / lb VSS
Energy Requirements for mixing: - Mechanical aerators - Diffused air mixing	 0.75 – 1.5 hp / 1000 ft^3 ft^3 / 1000 ft^3-min
Dissolved oxygen residual in liquid	1 -2 mg/L
Reduction of volatile suspended solids	38 – 50%

[a]Source: Metcalf & Eddy, 2003 and Water Environment Federation 1998

5.3.6.2 Sludge Beds

Two sludge drying beds are proposed for the primary drying of sludge. Sludge beds function on the principle of drainage through the sludge and evaporation of moisture on the sludge surface. The drying bed cells will be constructed of sand, and supported by gravel. Underdrains will be provided and routed back to the treatment plant. Dried sludge can be removed from the bed using shovels and wheel barrows or trucks.

In accordance with CCH design standards, drying beds will require an impervious subsurface liner to eliminate potential ground water contamination. The beds will be designed with accessibility for vehicle access.

5.4 Alternative 3 - Centralized Treatment Plant – Membrane Bio Reactors

Membrane bioreactors (MBRs) are a relatively recent development that is generating a lot of interest in the wastewater industry. MBR is a variation of the conventional activated sludge process where biological organisms are used for reducing the concentration of organic pollutants in wastewater (Water Environment Federation, 2002).

The MBR plant will still require preliminary treatment and the FEB as discussed in the previous section on the extended aeration. Also, biosolids handling and UV disinfection are required. Therefore, the following discussion is specifically on primary treatment and secondary treatment process required for the Membrane BioReactor process.

5.4.1 Primary Treatment

Fine screens can be used to replace primary treatment at small wastewater treatment plants up to 3 million gallons per day (MGD) in design capacity (Metcalf & Eddy, 2003). Screenings will removes small rags, paper, plastic materials, razor blades, grit, undecomposed food waste, feces, etc, which could extensively damage the MBR system.

5.4.2 Secondary Treatment

MBR is a suspended growth process that utilizes naturally occurring microorganisms in the wastewater to convert biodegradable organic and certain inorganic compounds into energy used in cellular respiration and reproductive processes. Air is used to mix the wastewater and provides the oxygen necessary for the microorganisms to convert the nutrients. MBRs use microfiltration or ultrafiltration membranes to separate the effluent from the mixed liquor whereas the activated sludge process uses secondary clarifiers. In essence, the system replaces the solids separation function of secondary clarifiers and sand filters in a conventional activated sludge system. Because the membranes are very efficient at this separation process, the aeration basins are designed to operate at a much higher mixed liquor suspended solids concentration than conventional activated sludge basins. MBRs can be used with or without primary treatment. Blowers and vacuum pumps are the principal pieces of equipment required for this process in addition to the reactor itself. The effluent from the MBRs is tertiary quality and would only require minimal disinfection to meet R-1 quality criteria with no additional filtration required. The process combines the unit operations of aeration, secondary clarification and filtration into a single process, producing a high quality effluent, simplifying operation and greatly reducing space requirements.

TABLE 5-5
TYPICAL MEMBRANE BIOREACTOR DESIGN PARAMETERS

PARAMETER	RANGE OF VALUES
Mixed liquor suspended solids	10,000 – 20,000 mg/l
Mean cell residence time	10 – 50 days
Hydraulic retention time	6 to 12 hours
Flux	15 to 27 gallons/ft^2-day
Dissolved oxygen	0.5 – 1.0 mg/l

Because MBR units are relatively new, there are no established standards for these types of treatment systems. Current pilot testing at the Honouliuli Wastewater Treatment Plant on the island of Oahu showcases five manufacturer's MBR units with distinctive differences in the footprints and types of membranes being used. As such, all five manufacturers were consulted and asked for preliminary sizing and budgetary pricing.

5.4.3 Space Requirements and Constructability

The following items would be required for an MBR installation to treat a 0.051 mgd flow:

- Fine Screens
- Aeration tank
- Membrane modules
- Permeate vacuum pumps
- Mixing and/or sludge wasting pumps
- Permeate storage tank (for backwashing, depending on the MBR system)
- Blowers
- Chemical cleaning systems

Because the liquid-solid separation stage is combined into a single stage process, the overall plant footprint is smaller than that of a conventional tertiary wastewater treatment plant. MBR replaces the need for a secondary clarifier and granular sand filter.

Ionics, Enviroquip, and Zenon responded with rough layouts for their equipment. Zenon's layout was the largest, roughly 62 feet by 72 feet. Ionics and Enviroquip response illustrated a smaller footprint. For the purposes of this report, Zenon's layout will be conservatively used. One aeration basin and two 56,100 gpd MBR units will be provided to allow one unit out of service and still provide full treatment capacity. Figure 5-3 shows a projected layout for this alternative. This alternative will require approximately 1.828 acres of area.

5.5 Capital Costs

The screening process for alternatives will include rough cost calculations at this initial stage. To develop these rough cost estimates, *Innovative and Alternative Technology Assessment Manual, 1980*, was used with appropriate escalation factors for work in Hawaii and for current construction costs. These estimates were supplemented with cost information from manufacturers where appropriate.

It should be noted that recently the polyvinyl chloride (PVC) pipe and steel industries have shown marked increases in the price of their products. These increases have resulted from significant demand increases originating in China. Inquiries to suppliers for cost information on other projects have revealed that some suppliers are unwilling to guarantee prices beyond two weeks due to the volatility in the market. It is unclear at the present time if the market will return to normal levels or if it will continue to be volatile. Due to the preliminary nature of this study, an allowance was added into the estimate for each alternative to account for this.

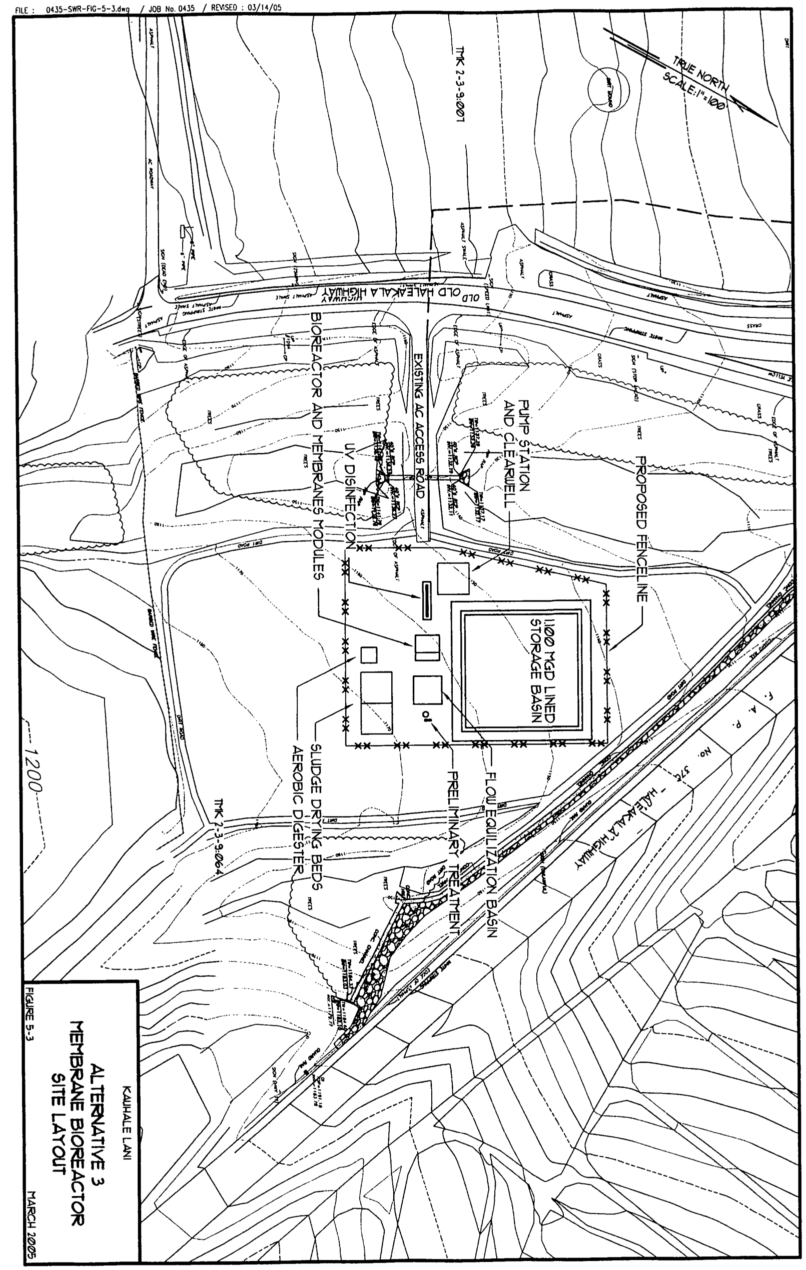


TABLE 5-6
ALTERNATIVE 2 – EXTENDED AERATION CAPITAL COSTS

ELEMENT	COST
Preliminary Treatment (Manual Bar Screens / Grit Removal)	$200,000
Flow Equalization Basin	$200,000
Extended Aeration / Clarifier / Digester	$800,000
Sand Filter	$500,000
UV Disinfection	$600,000
Sludge Beds	$100,000
Subtotal	**$2,400,000**
Electrical (@ 15%)	$360,000
Site Work (@ 15%)	$360,000
Subtotal	**$3,120,000**
Contingency (@ 25%)	$780,000
Total Capital Costs	**$3,900,000**

TABLE 5-7
ALTERNATIVE 3 – MEMBRANE BIOREACTOR CAPITAL COSTS

ELEMENT	COST
Preliminary Treatment (Manual Bar Screens / Grit Removal)	$200,000
Flow Equalization Basin	$200,000
Membrane Bioreactor and Fine Screens	$1,150,000
UV Disinfection	$400,000
Aerobic Digester	$200,000
Sludge Beds	$100,000
Subtotal	**$2,250,000**
Electrical (@ 15%)	$337,500
Site Work (@ 15%)	$337,500
Subtotal	**$2,925,000**
Contingency (@ 25%)	$731,250
Total Capital Costs	$3,656,250
SAY	**$3,700,000**

5.5.1 Selection of Alternative

Both alternative 2 and 3 is capable of producing R-1 effluent. However, in consideration from an operation and maintenance view, the extended aeration process requires additional treatment facilities that include the secondary clarifier (packaged with extended air plant), coagulation and sand filter. This alternative also requires a higher dose of UV radiation. Therefore, based on these additional operation and maintenance tasks in addition to a higher capital cost than MBR, the MBR process is the selected alternative.

6.0 R-1 DISPOSAL OPTIONS

Once treated, the effluent from the treatment plant must be disposed of. Primary consideration was given to providing a safe and reliable disposal system. Other considerations include costs and effects on the receiving environment.

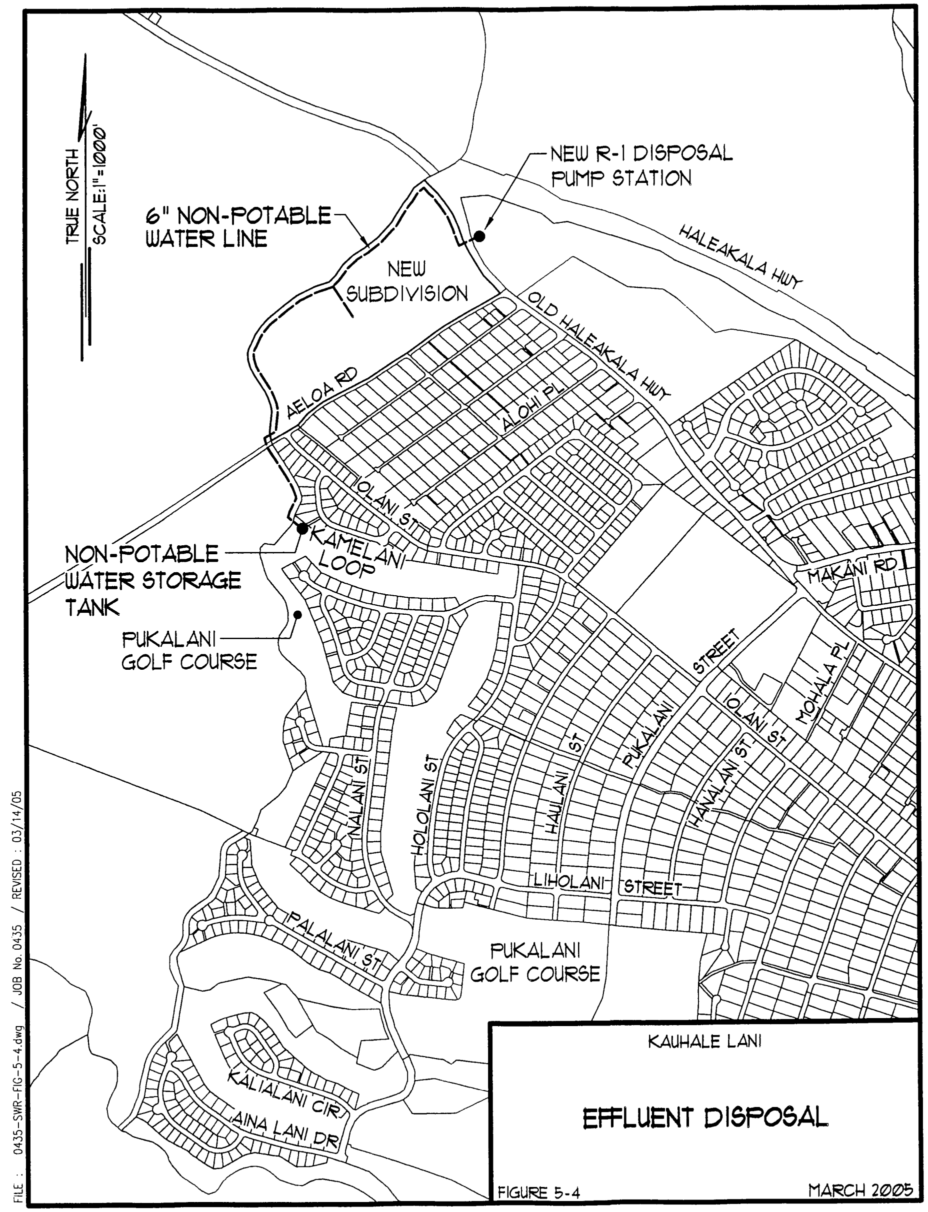
In line with the State's vision and effort to increase awareness and re-use of wastewater, it is Kapalua's desire to treat the wastewater to a high level of quality to provide for reuse and sustainability in their design as well as be environmentally conscientious.

Landscape irrigation within the development is the preferred method because it would minimize construction of an extensive offsite disposal system. However, the irrigation demand of the proposed development is not sufficient for complete disposal. The largest potential user of recycled water within the development is the community park, with additional smaller demands from the landscaped areas next to the community bike paths. The total irrigation demand for the development is estimated at 10,000 gpd, which is lower than the average plant effluent discharge of 51,000 gpd.

Therefore, the R-1 irrigation demand of the community is unable to utilize all of the average daily plant effluent. The potential recycled water demand for the open area above the treatment plant was evaluated. Based on preliminary information, it was determined that a 25 acre parcel would be needed at minimum, to dispose of the average day plant effluent. Since the area was intended to be kept in a relatively natural state, irrigating the parcel is neither cost-effective nor practical.

In accordance with the Reuse guidelines, irrigation of golf courses with R-1 water is an acceptable means of use and disposal. Conversations with the General Manager (GM) at the Pukalani Golf Course have indicated that they are open to the idea of receiving recycled water for irrigation of their 150 acre golf course, if it becomes available. Additionally, he noted that the irrigation demand of the golf course is approximately 600,000 gallons per day. The GM provided monthly demands of the golf course for September 2003 through September 2004 and an average monthly water demand for irrigation was approximately 15.5 million gallons per month.

Pukalani Golf Course is approximately 1 mile away. In order to serve the golf course, a pump station and force main would be required. Golf course personnel indicated that they currently have storage capacity to accept additional flows, however, future plans of the golf course are not known. The available storage capacity is not known. For the purposes of this report, it was assumed that improvements will be needed for additional storage capacity at the golf course. The non-potable 6-inch force main can be aligned through the community bike path area on the lower end of the property, cross the Alexander and Baldwin (A&B) irrigation ditch, into an easement through A&B property, and into a storage tank on the Pukalani Golf Course. See Figure 5-4.



Given the limited disposal options, it is recommended that the developer contact the owners of Pukalani Golf Course regarding this option. Proper disposal of the plant effluent is the critical component to the entire wastewater system. Other potential users that should be contacted include Maui County Department of Transportation for the irrigation of their highways.

6.1 Additional Disposal / Storage Issues

In accordance with the Reuse Guidelines, adequate storage facilities should be provided when the volume of plant effluent, or supply, exceeds the demand of recycled water. In accordance with these requirements, twenty (20) days storage of average daily flows is required.

Therefore, it is the intention of the developer to develop a wetlands and a meandering stream. Plant effluent, will be pumped to a 100,000 gallon storage tank, at the high elevation of the parcel (TMK 2-3-009:064). Overflow of the tank will be gravity fed into an authentic stream, which will be designed to meander through the property, ultimately discharging into a clay lined pond of 1,100,000 gallons, at the lower elevation of the parcel. The combined capacity of the storage tank and pond was designed to satisfy the twenty day effluent storage requirement during periods of low recycled water demand.

The parcel is surrounded on each side by intermittent streams. Due to these natural water courses, the developable land or land which can be irrigated becomes limited. Provisions shall be made to prevent R-1 from entering into the intermittent streams.

TABLE 6-1
DISPOSAL SYSTEM CAPITAL COSTS

ELEMENT	COST
Pump Station / Clearwell	$500,000
6-inch forcemain	$325,000
100,000 gallon storage tank	$200,000
100,000 gallon storage tank at Pukalani Golf Course	$200,000
1.1 million gallon lined pond	$1,100,000
Meandering Stream	$400,000
Subtotal	**$2,725,000**
Contingency (@ 25%)	$681,250
Total Capital Costs	$3,406,250
SAY	**$3,500,000**

7.0 SUMMARY

Table 7-1 is a summary of capital cost for the wastewater collection, treatment, and disposal system.

TABLE 7-1
SUMMARY OF CAPITAL COSTS

ELEMENT	COST
Wastewater Collection System	$2,600,000
Wastewater Treatment System (MBR)	$3,700,000
R-1 Effluent Disposal System	$3,500,000
Total Capital Costs	**$9,800,000**

APPENDIX A

CALCULATIONS, COST ESTIMATE, AND DESCRIPTIVE LITERATURE

ENGINEERING SOLUTIONS, INC.
Civil / Sanitary / Structural Engineers
98-1268 Kaahumanu Street, Suite C-7 · Pearl City, Hawaii 96782 · Phone: (808) 488-0477 · Fax: (808) 488-3776

PROJECT **KUAHALE LANI SUBDIVISION**
PROJECT NO. 435
PREPARED BY KO DATE 3/9/2005
CHECKED BY ____ DATE ____
SHEET 1 OF 1

Residential Wastewater Generation

Development Area	50	acres
Number of Parcels	165	
Number of Dwellings per Parcel	1	
Number of Bedrooms per Dwelling	2	
Number of persons per Bedroom	2	
Calculated Number per Dwelling	4	(2 per bedroom minimum per DOH, 4 per dwelling per CCH)
Calculated number of People	660	persons

Wastewater Generation Rate
USE: 80 gpcd per CCH
100 gpcd per DOH

Wastewater Flow (gallons per person per day)	80	gpcd	
Calculated Average Flow	52,800	gallons per day	
Babbit Flow Factor	5	from City and County of Honolulu Design Standard Manual	
Calculated Maximum Wastewater Flow	264,000	gallons per day	

Dry Weather Infiltration/Inflow Factor
USE: 35 gpcd sewer below the normal ground water table
5 gpcd sewer above the normal ground water table

Dry Weather Infiltration/Inflow Factor	5	gpcd	
Calculated Dry Weather I / I Flow	3,300	gallons per day	
Calculated Design Average Flow	56,100	gallons per day	
Calculated Design Maximum Flow	267,300	gallons per day	(DOES NOT INCLUDE PARK FLOW)

Wet Weather Infiltration/Inflow Factor
USE: 2,750 gpad sewer below ground water table
1,250 gpad sewer above ground water table

Wet Weather Infiltration/Inflow Factor	1,250	gallons per acre per day, gpad
Calculated Wet Weather I / I Flow	62,500	gallons per day
Calculated Design Peak Flow	329,800	gallons per day

Summary

Design Average Flow	**56,100**	**gpd**	
Design Maximum Flow	**267,300**	**gpd**	(DOES NOT INCLUDE PARK FLOW)
Design Peak Flow	**329,800**	**gpd**	

Design Average Flow is the average wastewater flow over a 24-hour period, during a dry weather period
Design Maximum Flow is the highest average wastewater flow rate during a one hour period, during a dry weather period
Design Peak Flow is the highest instantaneous wastewater flow rate, during a period of wet weather

ENGINEERING SOLUTIONS, INC.
Civil / Sanitary / Structural Engineers

PROJECT	KUAHALE LANI SUBDIVISION		
PROJECT NO.	435		
PREPARED BY	KO	DATE	2/12/2005
CHECKED BY		DATE	
SHEET	1	OF	1

98-1268 Kaahumanu Street, Suite C-7 • Pearl City, Hawaii 96782 • Phone: (808) 488-0477 • Fax: (808) 488-3776

COMMUNITY PARK WASTEWATER FLOWS

1. ASSUMED INVENTORY OF PARK FACILITIES

Year Constructed: 2005	Water Closet (EA)	Urinal (EA)	Lavatory (EA)	Drinking Fountain (EA)	Service Sink (EA)	Total
Men's Restroom	4	2	2			
Women's Restroom	6		2			
Janitor's Room						
Other						
TOTAL	10	2	4	0	0	16

Maximum No. of Campers 0

2. WASTEWATER FLOW CALCULATIONS (Per City Park Standard unless otherwise noted.)

Day Fixture Flow, Qf
12 fixture x 3.5 gal/fixture/use x 144 uses/day = 6,048 gpd
Night Camper Flow, Qc
0 persons x 25 gal/person/day x (1/3) = - gpd
Maximum Daily Flow , Q
6,048 gpd + 0 gpd = 6,048 gpd

BASED ON CITY AND COUNTY OF HONOLULU PARKS, INDIVIDUAL WASTEWATER SYSTEMS, DESIGN STANDARDS, JANUARY 2000

Subject: Maui, Hawaii - PISTA grit chamber
Date: Fri, 21 Jan 2005 10:07:55 -0600
From: Stuart Marschall <smarschall@smithandloveless.com>
To: "Engineering Solutions, Inc." <engineering@engrsol.com>
CC: Michael Elhoff <mike@hiengineering.com>, Martin Paredes <mparedes@smithandloveless.com>

I am faxing (11) pages of drawings and tables for the Model 0.5A PISTA.
a. plan & elevation drawing 67D168 with table 67A156; unit is 6' in diameter, 7'-6 7/8" deep
TMTP hp depends on head, and could be 5,7.5, 10 hp (I priced 5 hp)
b. Design data tables 1, 6,7,9,10 are applicable
1 - steel tank basics
6- 4", 250 gpm TMTP
7- 6", 250 gpm PGC
9/10 - dewatering methods possible, screen or dewatering grit cart. I think the cart makes a cleaner installation
c. PGC drawing - 67C175
d. grit cart drawings- 67C177 & 67C141
e. grit screen drawings - 67C180, 67C178 & 67B175

Budget price for all steel unit Model 0.5 PISTA system and accessories, including start up, ex works.
$70,000 with grit cart; add $8,000 for screen

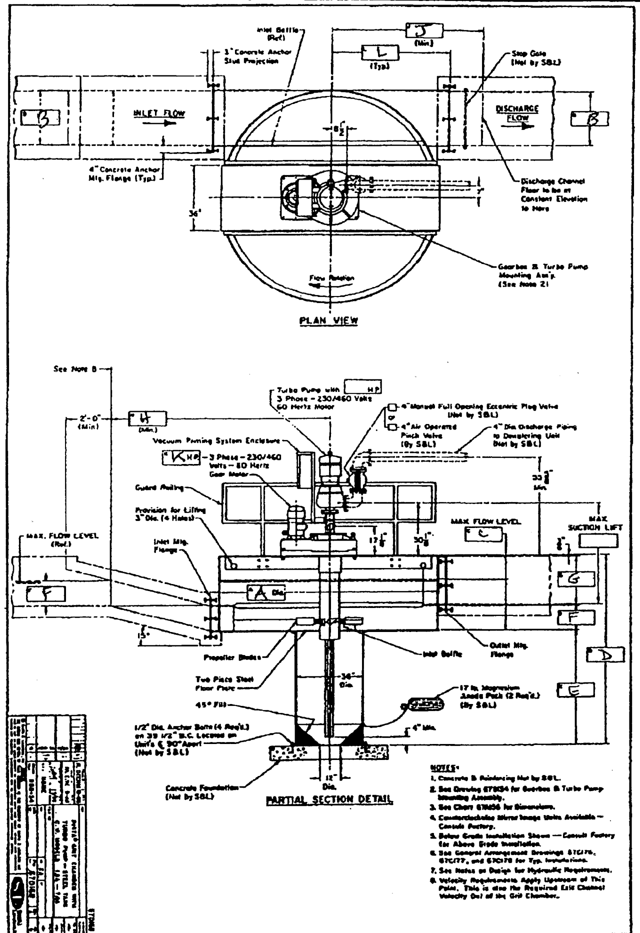
Let us know if we maybe of further assistance.

Best regards,
Stuart B. Marschall
President,
International Division
Smith & Loveless Inc.
(Phone) 913.888.5201
(Fax) 913.888.4230
(e) smarschall@smithandloveless.com
http://www.smithandloveless.com/global.htm

ENGINEERING DATA

Smith & Loveless, Inc.
14040 W. Santa Fe Trail Dr.
Lenexa, Kansas 66215

Water & Wastewater Treatment Systems
Pista® Grit Chamber
Outline Drawings
Page 1
April, 1991



Water & Wastewater Treatment Systems
PISTA® Grit Chamber
Outline Drawing 67D168
Page 2
December, 2001

ENGINEERING DATA

Smith & Loveless, Inc.®
14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

PISTA® GRIT CHAMBER DIMENSIONS FOR STEEL TANK
DRAWING 67D168
MODELS 0.5A – 7.0A
CHART NUMBER 67A156

MODEL NUMBER	A		B		C		D		E	
	English	Metric (m)	English	Metric (m)	English	Metric (m)	English	Metric (m)	English	Metric (m)
0.5A	6'-0"	1.83	0'-6"	0.15	1'-0¼"	0.31	7'-6⅞"	2.31	5'-0¼"	1.53
1.0A	6'-0"	1.83	1'-0"	0.30	1'-0¼"	0.31	7'-6⅞"	2.31	5'-0¼"	1.53
2.5A	7'-0"	2.13	1'-6"	0.46	1'-10¼"	0.57	8'-4⅞"	2.56	5'-0¼"	1.53
4.0A	8'-0"	2.44	2'-0"	0.61	2'-0⅜"	0.62	8'-7"	2.62	5'-0¼"	1.53
7.0A	9'-10¼"	3.00	2'-6"	0.76	2'-4⅜"	0.72	9'-5"	2.87	5'-6¼"	1.68

MODEL NUMBER	F		G		H		J		K	
	English	Metric (m)	English	Metric (m)	English	Metric (m)	English	Metric	English (hp)	Metric (kw)
0.5A	0'-6"	0.15	2'-0"	0.61	5'-3"	1.60	9'-0"	2.74	¾	0.56
1.0A	0'-6"	0.15	2'-0"	0.61	5'-3"	1.60	9'-0"	2.74	¾	0.56
2.5A	0'-11"	0.28	2'-5"	0.74	7'-5"	2.26	11'-0"	3.35	¾	0.56
4.0A	1'-0"	0.30	2'-6"	0.76	8'-4"	2.54	11'-0"	3.35	1	0.75
7.0A	1'-2"	0.36	2'-8"	0.81	9'-10"	3.00	13'-0"	3.96	1	0.75

MODEL NUMBER	L	
	English	Metric (m)
0.5A	3'-3"	1.00
1.0A	3'-3"	1.00
2.5A	3'-10¾"	1.19
4.0A	4'-5¾"	1.37
7.0A	5'-4¼"	1.63

ENGINEERING DATA

Smith & Loveless, Inc.®
14040 W. Santa Fe Trail Dr.
Lenexa, Kansas 66215-1284

The following 10 Tables will assist you in sizing your **PISTA®** Grit Removal System. Table 1 details the **PISTA®** Grit Chamber utilizing a steel chamber. Tables 2 & 3 detail the straight through or Model A **PISTA®** Grit Chamber utilizing concrete for the chamber. Table 4 is the 270-degree **PISTA®** Grit Chamber utilizing concrete for the chamber. Table 5 covers the **PISTA®** grit storage volume, Table 6 the Turbo **PISTA®** Grit Pump, Table 7 the **PISTA®** Grit Concentrator, and Tables 8, 9 and 10 are three final dewatering **PISTA®** systems to select from. Starting on Page 5, you will find Tables that contain the design date in metric units.

Table 1
PISTA® GRIT CHAMBER DESIGN DATA – STEEL TANK - 360° UNITS

Model	0.5A	1.0A	2.5A	4.0A	7.0A
Maximum Flow (MGD)	0.5	1.0	2.5	4.0	7.0
Chamber Diameter	6'-0"	6' – 0"	7' – 0"	8' – 0"	9' – 10 ¼"
Chamber Depth	2' – 6 5/8"	2' – 6 5/8"	3' – 4 5/8"	3' – 6 ¾"	3' – 10 ¾"
Grit Hopper Diameter	3' – 0"	3' – 0"	3' – 0"	3' – 0"	3' – 0"
Grit Hopper Depth	5' – 0"	5' – 0"	5' – 0"	5' – 0"	5' – 6"
Drive: HP	¾	¾	¾	1	1
Input RPM	54	54	54	54	54
Output RPM	20	20	20	20	20
Estimated Shipping Wt. (Lbs.)	4000	4000	4500	5500	7000

Table 2
PISTA® GRIT CHAMBER DESIGN DATA – CONCRETE TANK - 360° UNITS

Model	0.5A	1.0A	2.5A	4.0A	7.0A	12.0A	20.0A
Maximum Flow (MGD)	0.5	1.0	2.5	4.0	7.0	12.0	20.0
Chamber Diameter	6' – 0"	6' – 0"	7' – 0"	8' – 0"	10' – 0"	12' – 0"	16' – 0"
Chamber Depth	3' – 8"	3' – 8"	4' – 6"	4' – 8"	5' – 0"	6' – 8"	7' – 6"
Grit Hopper Diameter	3' – 0"	3' – 0"	3' – 0"	3' – 0"	3' – 0"	5' – 0"	5' – 0"
Grit Hopper Depth	5' – 0"	5' – 0"	5' – 0"	5' – 0"	5' – 6"	6' – 8"	6' –10"
Drive: HP	¾	¾	¾	1	1	1 – ½	1 – ½
Input RPM	54	54	54	54	54	54	54
Output RPM	20	20	20	20	20	20	20
Estimated Shipping Wt. (Lbs.)	2000	2000	2000	2000	2500	2500	3000

Table 3
PISTA® GRIT CHAMBER DESIGN DATA – CONCRETE TANK - 360° UNITS

Model	30.0A	50.0A	70.0A	100.0A
Maximum Flow (MGD)	30.0	50.0	70.0	100.0
Chamber Diameter	18' – 0"	20' – 0"	24' – 0"	32' – 0"
Chamber Depth	9' – 2"	11' – 6"	12' – 8"	12' – 8"
Grit Hopper Diameter	5' – 0"	5' – 0"	6' – 0"	8' – 0"
Grit Hopper Depth	7' – 0"	8' – 0"	8' – 0"	10' – 0"
Drive: HP	2	2	2	2
Input RPM	54	54	54	54
Output RPM	20	20	20	20
Estimated Shipping Wt. (Lbs.)	3000	3700	4000	5000

ENGINEERING DATA

Smith & Loveless, Inc.®
14040 W. Santa Fe Trail Dr.
Lenexa, Kansas 66215-1284

The following **PISTA®** Grit Removal System components will provide the end-user with the best removal and dewatering efficiencies in the market. In order to provide periodic pump out of the grit chamber, Smith & Loveless recommends the use of the Top Mounted Turbo **PISTA®** Grit Pump or Remote Mounted Turbo **PISTA®** Grit Pump (Table 6). Smith & Loveless then recommends the use of the **PISTA®** Grit Concentrator (Table 7) and one of three **PISTA®** Grit Dewatering devices (Tables 8, 9, & 10). This total grit removal system will produce some of the best grit removal efficiencies and dewatering capabilities on the market today.

Table 6
RECOMENDED FOR ALL PISTA® GRIT CHAMBER MODELS
GENERAL INFORMATION
TURBO PISTA® GRIT PUMP

Pump Rate, GPM	250	500
Casing Suction Size	4"	6"
Discharge Nozzle	4"	6"
Impeller Max.	10"	12"
Diameter Min.	7"	9"
Shaft Size for Mechanical Seal	1 – 7/8"	2-1/8"
Shaft	Stainless Steel	Stainless Steel
Seal Holder	Bronze	Bronze
Seal	Carbon and Ceramic	Carbon and Ceramic
Shaft Overhang (Lowest Bearing to Top of Impeller)	6" Max.	6" Max.
Motor Insulation	Class F	Class F
Casing	Cast Iron	Cast Iron
Impeller Design/Material	Recessed 5-Vane Turbo/Ni-Hard	Recessed 5-Vane Turbo/Ni-Hard
Estimated Shipping Weight – Lbs. (Including Motor)	750	970

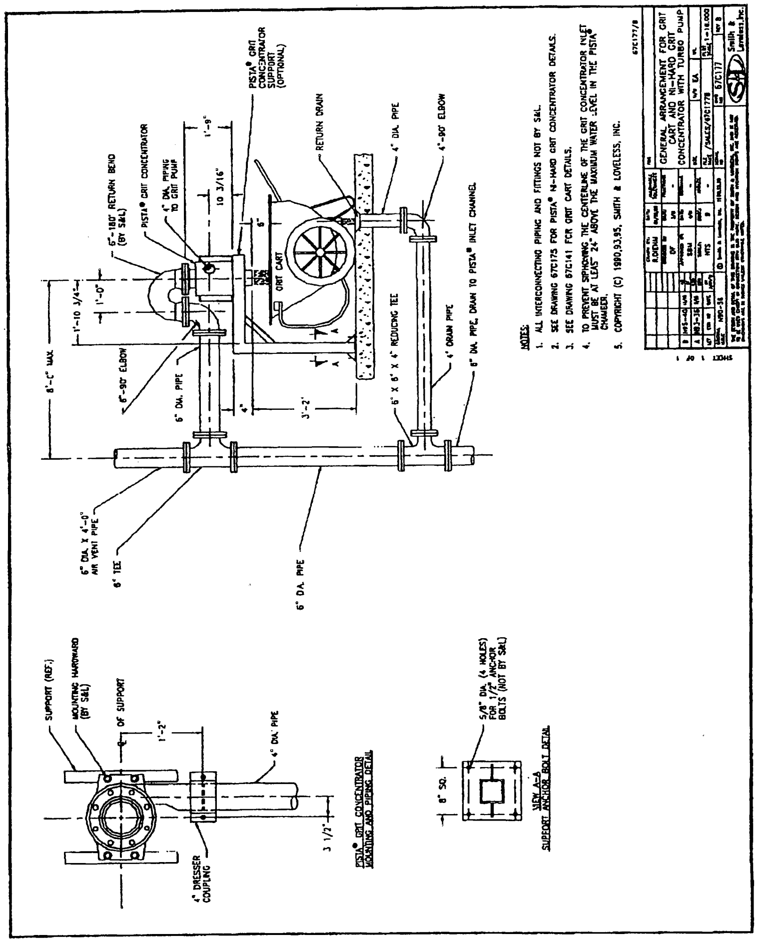
Table 7
RECOMENDED FOR ALL PISTA® GRIT CHAMBER MODELS
GENERAL INFORMATION
PISTA® GRIT CONCENTRATOR

Pump Rate, GPM - Inlet	250	500
Headloss through Concentrator, FT @ Design Pump Rate	12	20
Underflow, GPM @ Design Pump Rate	20	30
Inlet Diameter (outer diameter), Inches (plain end)	4-1/2	4-1/2
Underflow Outlet Diameter (outer diameter), Inches (plain end)	5-1/2	4-3/4
Drain Outlet Diameter, Inches (flanged)	6	6
Material – Nickel Hardened Iron, Brinell Hardness	550+	550+

ENGINEERING DATA

Smith & Loveless, Inc.®
14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Water & Wastewater Treatment Systems
PISTA® Grit Chamber
Arrangement Drawings 67C177
Page 12
December, 2001



ENGINEERING DATA

Smith & Loveless, Inc.®
14040 W. Santa Fe Trail Dr.
Lenexa, Kansas 66215-1284

Design Data Tables
PISTA® Grit Chamber
December, 2001
Page 4

Table 8
PISTA® GRIT SCREW CONVEYOR WITH PARALLEL PLATE SEPARATOR RECOMMENDED FOR ALL PISTA® GRIT CHAMBER MODELS

Model	15	17
Drawing Number	67C168	67B202
Dewatering Trough Length	15' – 0"	17' – 0"
Dewatering Screw Diameter	9"	14"
Angle of Inclination	22°	22°
Overall Length	18' – 8"	20' – 9"
Inlet Separator:		
Length	5' – 0"	6' – 8"
Width	2' – 6"	4' – 0"
Height	4' – 8"	5' – 6"
Approximate Shipping Weight (LBS)	2000	3000
Maximum Capacity (GPM)	50	100

Table 9
SEPARATOR SCREEN WITH PISTA® GRIT CONCENTRATOR

HEIGHT	WIDTH	DEPTH	INLET	OUTLET	ESTI. WT.	RECOMMENDED PISTA® MODELS
80 – 7/8"	39 – 3/4"	49"	4"	6"	660 LBS.	1.0, 2.5, 4.0, 7.0
80 – 7/8"	39 – 3/4"	49"	4"	6"	660 LBS.	0.5A, 1.0A, 2.5A, 4.0A, 7.0A

Table 10
PISTA® GRIT CART

APPROXIMATE OVERALL DIMENSIONS			APPROX. SHIP. WT.	RECOMMENDED
LENGTH	WIDTH	HEIGHT	POUNDS	PISTA® GRIT CHAMBER MODELS
55"	35"	32"	200	1.0, 2.5, 4.0
55"	35"	32"	200	0.5A, 1.0A, 2.5A, 4.0A

ENGINEERING SOLUTIONS, INC.

Civil / Sanitary / Structural Engineers

PROJECT NO. 0435
PROJECT PUKALANI
PREPARED BY K. OKANO DATE FEB 11 2005
CHECKED BY ______ DATE ______
SHEET 1 OF 1

98-1268 Kaahumanu Street, Suite C-7 • Pearl City, Hawaii 96782 • Phone: (808) 488-0477 • Fax: (808) 488-3776

DETERMINE:
TYPICAL AERATED GRIT CHAMBER SIZE

AT QPEAK = ~~311,550 GPD~~ 329,800 GPD
≈ ~~217 GPM~~ 229 GPM

ASSUME: DETENTION TIME ≈ 3 MIN

3 X ~~217~~ 229 GPM = ~~651~~ 687 GALLONS
≈ ~~87~~ 92 FT³

ASSUME: WIDTH TO DEPTH RATIO : 1.5:1 ; W:D = 1.5, D = W/1.5
LENGTH TO WIDTH RATIO : 4:1 ; L:W = 4, L = 4W

V = L x W x D
= 4W x W x W/1.5

92 ~~87~~ FT³ = 2.67 W³
W³ = ~~32.58~~ FT3 34.40 FT³
W = 3.2 FT ✓
DEPTH = 1.5 FT ✓
LENGTH = 12 FT

REVISED: 3/9/2005

Engineering Solutions, Inc.

From: "Stuart Marschall" <smarschall@smithandloveless.com>
To: "Engineering Solutions, Inc." <engineering@engrsol.com>
Cc: "Mike" <mike@hiengineering.com>; "Martin Paredes" <mparedes@smithandloveless.com>
Sent: Tuesday, March 08, 2005 9:06 AM
Subject: Extended Aeration for Maui

Sorry for the delayed reply, due to vacation.

We changed the flows, but note we had used a BOD / TSS value previously of 288 mg/l.

For and average flow of 56,100 gpd, influent BOD @ 282 mg/l, 5.9 peak to average ration, we have sized a FBAdigest WWTP. It is 105.2' long x 12' wide x 10'-6" swd, 11'-6" total height.

FE zone - 22.7' long
Aeration zone - 53.8' long
AD/SS zone - 13.7' long
Cl2 contact zone - 3'
Clarifier - 12' (square) long

Rough estimate $210,000 ex works.

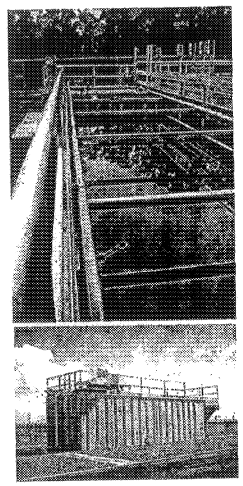
Best regards,

Stuart B. Marschall
President,
International Division
Smith & Loveless Inc.
(Phone) 913.888.5201
(Fax) 913.888.4230
(e) smarschall@smithandloveless.com
http://www.smithandloveless.com/global.htm

Products & Services

We found 1 matching item. Now displaying the final item.

Item: **Factory-Built ADDIGEST®**
Category: **Featured Pre-Engineered Systems**



☐ Add/Remove from Checklist

E-mail this to a friend!

The ADDIGEST® Treatment Plant

The **ADDIGEST** is an aerobic wastewater treatment system designed for both municipal and industrial applications. The trade name **ADDIGEST** is derived from "add-on-digestion" and attests to the versatility of this system. It offers treatment from basic BOD and TSS removal to nutrient removal and advanced treatment.

The **ADDIGEST** Treatment Plant is available in both a Factory-Built **ADDIGEST** system and a larger Field-Erected **ADDIGEST** system. Both treatment systems offer infinite flexibility to meet varying treatment volumes and design parameters.

Design Flexibility

1. Customize the system for any level of treatment -ranging from basic BOD removal to advanced treatment suitable for water reuse.

2. Provide treatment for extended aeration loadings to 56,000 gpd (212 m3/d) in a single manufactured tank.

3. Add either hopper bottom type clarifiers or all steel circular clarifiers with rotating sludge collectors easily.

4. Choose either above or below grade installation.

5. Meet space requirements with end-to-end or side-by-side installation, ensuring an efficient footprint for multiple tank installations.

6. Simplify restrictive shipping limitations with the availability of component and weld together units.

The Benefits

1. Design offers virtually unlimited capacity and wastewater treatment capabilities.

2. V-crimped walls provide greater rigidity and economy in manufacturing, while minimizing weight.

3. Design makes the Factory-Built **ADDIGEST** easy to install and operate with little routine maintenance. There are virtually no moving parts.

4. Inspection occurs on every Factory-Built **ADDIGEST** prior to shipment, ensuring quality.

5. V-crimped structural walls create greater volume per unit-dimension than a circular cross section, reducing corrosion compared to plants with I-beams for structural reinforcement.

6. **VERSAPOX®** coating on all surfaces ensures the best resistance against corrosion and abrasion.

7. Electrical controls and instrumentation, air blowers, walkways, grating, access ladders and other accessories are readily available to provide a complete installation.

8. Installation ready, the Factory-Built **ADDIGEST** can be installed upon arrival, reducing standard delivery time, erection time and installation costs.

9. Smith & Loveless provides single-source responsibility, from design and process engineering to manufacturing and installation.

Applications
The **ADDIGEST** is typically utilized for secondary treatment of residential or commercial/industrial wastewater. The system features capacities up to 200,000 gpd and BOD removal up to 340 #/D. These larger capacities are facilitated by longer plant lengths. In comparison to the factory-built models, the Field-Erected **ADDIGEST** offers greatly increased volume per unit of length. Additional equipment can also be added, which also expands the **ADDIGEST** capabilities to treat a wide variety of substances.

Add-On-Digestion
Flexibility is the key to the Factory-Built **ADDIGEST** . The basic unit is equipped with an aeration tank and a clarifier. To this basic unit, several components can be added to meet effluent requirements including:
Flow Equalization
Clarification
Sludge Storage
Filtration
Disinfection (Chlorination or UV)
Post Aeration
Dechlorination

Nutrient Removal (Nitrogen and Phosphorus)
Nitrification
Denitrification

Field Erection Capabilities
Smith & Loveless is no stranger to building on site. With more than 500 field-erection installations to its credit, Smith & Loveless knows how to get the job done right, at the right price. Smith & Loveless' field subcontractors are proven, skilled technicians, familiar with the intricacies of Smith & Loveless equipment. This level of expertise translates into minimal service problems and negligible downtime. Additionally, field-erection saves money in the form of shipping expenses.

Project Inquiry? Want More Information? Please click below to e-mail your question, or order available S&L literature.

Municipal Inquiries
Industrial Inquiries
International Inquiries
Retrofit Inquiries
Parts Inquiries
Services Inquiries
Literature Requests

New Search

<< Go Back

Search Items | Auto-Notify | My Checklist | Login / Signup

Sections Wastewater Treatment Equipment Go!

Terms of Use | Privacy Statement | Tell Your Friends

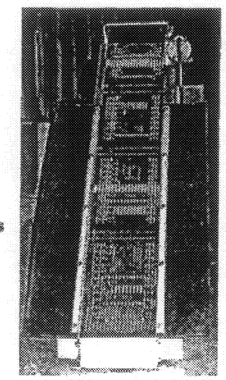
Please send your questions, comments, or bug reports to the Webmaster.

Contact Us | Corporate Profile | Help

ENVIROQUIP

Automatic Fine Opening Bar Screen

Product Profile

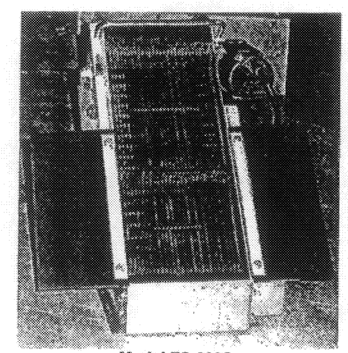


Model FS-1100S
5mm openings

- Simple operation, non-corrosive materials of construction, maintenance free
- Standard openings: 1, 2, 2.5, 5, 9 and 14mm
- Can be installed in a stainless steel box or in concrete channels
- Built-in seals allow installation in new and existing channels
- All non-corrosive components:
  - Screen frame is type 304 stainless steel
- De-watering of screenings occurs automatically as material is removed up the screen
- All weather proof drive unit

APPLICATIONS:

- Membranes
- Screening domestic waste
- Screening industrial wastes such as food and beverage processing
- Scum separation

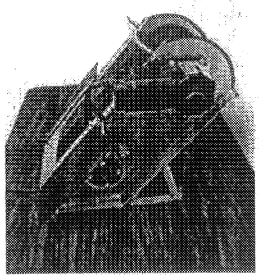


Model FS-600S
2mm openings

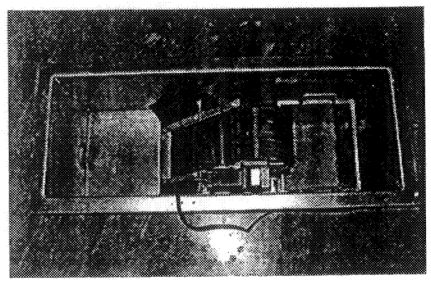
Model FS	Flow range 100 gpm to 1,050 gpm (up to 16" wide)
Model FM	Flow range 220 gpm to 4,000 gpm (up to 32" wide)
Model FL	Flow range 570 gpm to 14,400 gpm (up to 55" wide)

ENVIROQUIP, Inc. • 2404 Rutland Drive • Suite 200 • Austin, Texas 78758
Tel: 512-834-6007 • Fax: 512-834-6039 • Email: Barscreens@enviroquip.com • Website: www.enviroquip.com

ENVIROQUIP



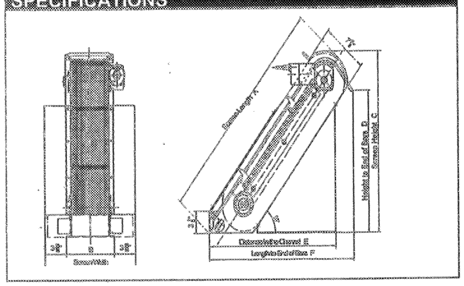
Model FS-600S



Model FS-600S in 304 SS Box

- 25w waterproof geared motor is coupled directly to the screen
- 3/60/220v or 460v power
- It is lightweight
- Easy to handle
- Maintenance free
- Two Year Warranty

SPECIFICATIONS



Dimensions

Model	FS-600S					FS-800S					FS-1100S				
Clear Openings (mm)	2	2.5	5	9	14	2	2.5	5	9	14	2	2.5	5	9	14
Max Flow Rate (gpm)	150	180	250	320	400	300	330	450	600	750	450	500	700	850	1050
Weight (lbs.)	33					49					88				
A	1'-10 1/2"					2'-10 1/4"					3'-8 1/4"				
B	9"					9"					9"				
C	1'- 5"					2'-2"					2'-9 1/2"				
D	11 1/4"					1'-7 1/4"					2'-3"				
E	1'-1 3/4"					1'-8"					2'- 1 1/2"				
F	1'-6 3/4"					2'-3 1/8"					2'-9 5/8"				

4.2 Budgetary System Price

Design Flow	
Average Daily Flow	51,000 gpd
Maximum Month Flow	80,000 gpd
Maximum Daily Flow	187,000 gpd
Peak Hourly Flow	250,000 gpd

Budgetary System Price **$578,500.00 USD**

Adder Price for Inc. Screens **$71,450.00 USD**

The pricing herein is for budgetary purposes only and does not constitute an offer of sale. No sales, consumer use or other similar taxes or duties are included in the above pricing. Any such taxes and duties shall be for the account of the Purchaser. No Performance or Maintenance Bonds are included in the above pricing. Bonds can be provided on request but will be at additional cost.

4.3 Payment Terms

The pricing quoted in this proposal is based on the following payment terms (all payments are net 30 days):

- 15% with Purchase Order;
- 10% on Submission of Shop Drawings;
- 70% on Shipment of Equipment (partial shipments permitted);
- 5% on Completion of Commissioning.

4.4 Standard Terms and Conditions

ZENON's Standard Terms and Conditions apply.

ZENON Water for the World

Water for the World

ZEEWEED® MEMBRANE BIOREACTOR WASTEWATER TREATMENT SYSTEM FOR MAUI, HAWAII

0.06 MGD Design Capacity

Submitted to:

Engineering Solutions, Inc.
98-1268 Kaahumanu Street, Suite C-7
Pearl City, Hawaii 96782-3257

Attention: Mr. Kyle Okino

Submitted by:

Zenon Environmental Corporation

3236 Dundas Street West
Oakville, ON L6M 4B2

Mr. Paul J. Schuler
Regional Manager
(503) 471-1450
(503) 471-1401
pschuler@zenon.com

Local Representation by:

Berkley Engineers

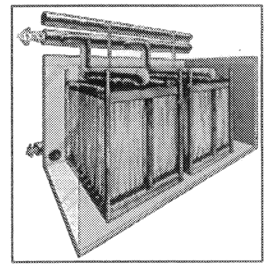
944 Akepo Lane
Honolulu, Hawaii 96817

Mr. Curtis Lee
Technical Support Manager
(808) 845-9377
(808) 845-9370
curtis@berkley-engineering.com

March 10, 2005

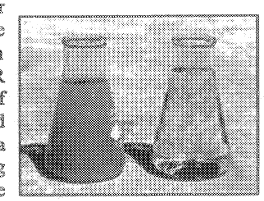
1.0 THE ZEEWEED® MEMBRANE BIOREACTOR (MBR) SYSTEM

The ZeeWeed® MBR process is a ZENON technology that consists of a suspended growth biological reactor integrated with an ultrafiltration membrane system, using the ZeeWeed® hollow fiber membrane. Essentially, the ultrafiltration system replaces the solids separation function of secondary clarifiers and sand filters in a conventional activated sludge system.



ZeeWeed® ultrafiltration membranes are immersed in an aeration tank, in direct contact with mixed liquor. Through the use of a permeate pump, a vacuum is applied to a header connected to the membranes. The vacuum draws the treated water through the hollow fiber ultrafiltration membranes. Permeate is then directed to disinfection or discharge facilities. Intermittent airflow is introduced to the bottom of the membrane module, producing turbulence that scours the external surface of the hollow fibers. This scouring action transfers rejected solids away from the membrane surface.

ZeeWeed® MBR technology effectively overcomes the problems associated with poor settling of sludge in conventional activated sludge processes. ZeeWeed® MBR technology permits bioreactor operation with considerably higher mixed liquor solids concentrations than conventional activated sludge systems that are limited by sludge settling. The ZeeWeed® MBR process is typically operated at a mixed liquor suspended solids (MLSS) concentration in the range of 8,000 to 10,000 mg/L. Elevated biomass concentrations allow for highly effective removal of both soluble and particulate biodegradable material in the waste stream. The ZeeWeed® MBR process combines the unit operations of aeration, secondary clarification and filtration into a single process, producing a high quality effluent, simplifying operation and greatly reducing space requirements.



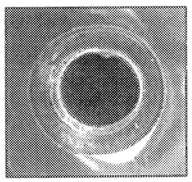
Water for the World

2.0 FEATURES & BENEFITS OF THE ZEEWEED® MBR SYSTEM

Experience

ZENON has over 20 years of MBR experience and has immersed ZeeWeed® MBR systems operating since 1993 ranging in size from a few thousand gallons per day to over 10 MGD of average day flow. ZENON's immersed membrane technology was originally developed for wastewater bioreactors and is ideally suited to such high solids applications. With over 220 wastewater installations globally, including numerous large scale installations and over ten years of operating experience of immersed MBR's, ZENON provides the security and assurance to our Clients of a proven and reliable membrane system.

Effluent Quality and Reuse Potential

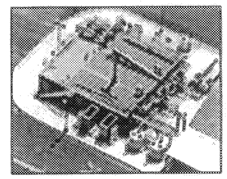


Depending on the specific application and design requirements, a ZeeWeed® MBR plant can achieve either high quality nitrified effluent or, with the addition of an anoxic zone, high quality denitrified effluent. Phosphorus removal is readily achieved through biological means and/or the addition of metal salts to the feed wastewater or mixed liquor. High quality effluent from the ZeeWeed® MBR system meets California Title 22 and similar regulatory requirements and is ideally suited for reuse applications such as golf course and park land irrigation, aquifer recharge and urban reuse. ZeeWeed® MBR systems are capable of achieving the following effluent qualities.

BOD	< 5 mg/L	
TSS	< 5 mg/L	
TN	< 3 mg/L < 10 mg/L	*Warm Climates* *Cool Climates*
TP	< 0.1 mg/L	
Turbidity	< 1 NTU	

The information provided in this section of the proposal is general and intended only to indicate what the ZeeWeed® MBR Membrane Wastewater Treatment Technology is capable of achieving. For the specific design treated wastewater qualities, based on the consideration of specific raw wastewater characteristics and the required discharge criteria for the treated effluent, refer to Section 3.0.

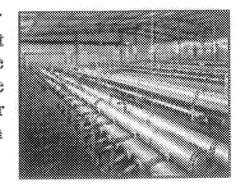
Compact Plant



The ZeeWeed® MBR process typically operates at mixed liquor suspended solids (MLSS) concentrations in the range of 8,000 to 10,000 mg/L, which is substantially greater than conventional activated sludge processes. The increased MLSS concentration allows for conventional organic loading rates to be achieved with much lower hydraulic residence times. Compression of the wastewater treatment process into a single stage process results in an overall plant footprint substantially smaller than that of conventional tertiary wastewater treatment plants. Additionally, the compact footprint allows for the expansion of plant capacity within existing conventional plant basins in many instances.

Expandability

The ZeeWeed® MBR equipment is modular in nature and therefore allows for plant construction or expansion that can be completed in phases over the life of the facility. Civil works can be designed for ultimate flow while membranes are added in phases as plant operating capacity dictates.



ZeeWeed® is modular in nature; ideal for phased plant expansion.

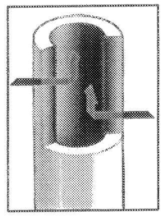
Simple Operation

The ZeeWeed® MBR process uses membranes to perform solid/liquid separation, and therefore there is no requirement for sludge to settle. Thus there is no need for a secondary clarifier or polishing filters. Sludge is wasted directly from the aeration tank at a solids concentration in the range of 0.8 – 1.0 percent solids. The result is a single system, that is simple to operate.

Process Reliability

Since the ZeeWeed® MBR plant is typically operated at low organic loading rates, and the membrane provides a barrier to particulate discharge, ZeeWeed® MBR effluent quality is not susceptible to hydraulic or organic surges which can negatively affect effluent quality in conventional activated sludge and fixed film plants. At periods of low flow (and organic load), the sludge within the reactor basin simply digests itself without affecting the effluent quality.

Resistance to Fouling



The ZeeWeed® membrane is an "Outside-In" membrane where the flow of water is from the outside of the membrane to the inside of the hollow fiber, meaning that the inside only sees clean, membrane-filtered water. The bacteria and inert solids removed from the wastewater remain outside the membrane and never enter the membrane to cause fouling.

Exceptional Membrane Durability

The ZeeWeed® membrane has been designed for exceptional durability and resistance to breakage. To achieve this high level of membrane durability ZENON utilizes a patented internal support to which the membrane is bonded. This support strengthens the membrane and protects it against tearing and breakage without reducing its flux capacity.

3.0 PROPOSED SYSTEM DESIGN PARAMETERS

3.1 Design Flow

Design Flow	
Average Day Flow Note 1	56,100 gpd

Note 1: The proposed membrane filtration system is designed to treat a constant flow of 56,100 gpd. All flows above the design flow are to be equalized upstream of the membranes in a separate EQ basin (by Others).

3.2 Physical Parameters

Design Flow	Raw Water	Treated Water
Wastewater Temperature	15 – 25 °C	-
Turbidity	-	≤ 2.0 NTU
BOD	282 mg/L	≤ 5 mg/L
TSS (based on ADF)	282 mg/L	≤ 5 mg/L
TKN	30 mg/L	n/a
TN	-	n/a
NH_3-N	21 mg/L	≤ 1 mg/L
TP	8 mg/L	n/a
Alkalinity (as $CaCO_3$)	220 mg/L	n/a
MLSS	8,000 – 10,000	mg/L

3.3 Preliminary Process Design

Number of Membrane Tanks	2
Number of Cassettes Per Tank	1
Number of Modules Per Cassette	6 in a 8-module cassette
Membrane Tank Dimensions L x W x H	7.4 x 3.0 x 7.4 ft
Membrane Tank Volume (per tank)	1,221 US gallons
Average Membrane Design Flux	9.35 gfd
Capacity with one train off-line	56,100 gpd

* Please refer to the attached drawing for exact system dimensions.

4.0 COMMERCIAL

4.1 Scope of Supply

Membranes and Tankage Equipment

- Membrane Cassette Support Frames
- Steel Membrane Tanks
- ZeeWeed® 500a Membrane Cassettes
- Permeate Collection Header Pipes
- Air Scour Distribution Header Pipes

Permeate Pump System Equipment

- Permeate Pumps, complete with required Isolation Valves
- Trans-Membrane Pressure Transmitters
- Permeate Pump Pressure Gauges
- Permeate Flowmeters
- Turbidimeter

Membrane Air Scour Blower Equipment

- Membrane Air Scour Blowers
- Membrane Air Scour Blower Flow Switches
- Membrane Air Scour Blower Pressure Gauges

Backpulse System

- Backpulse Pumps
- Backpulse Water Storage Tank
- Backpulse Water Storage Tank Level Transmitter
- Backpulse Tank Inlet Fill Valve

Membrane Cleaning Systems

- Sodium Hypochlorite Chemical Feed System, including Chemical Feed Pumps and Chemical Storage Tank
- Citric Acid Chemical Feed System, including Chemical Feed Pumps and Chemical Storage Tank

Recirculation Pumping System

- Sludge Recirculation Pumps

Electrical and Control Equipment

- PLC system for equipment integral to the ZeeWeed® Membrane Filtration System. PLC System shall be Koyo DirectLogic
- Motor Control Center & VFDs

Miscellaneous

- One (1) equipment skid for the entire Ultrafiltration System (see drawing)

General

- Equipment General Arrangement and Layout Drawings
- Operator Training
- Operating & Maintenance Manuals
- Two weeks of Field Service and Process Start-up Assistance
- Equipment Delivery FCA Project Site, Hawaii
- 8 Year Pro-Rated Membrane Warranty

4.2 Budgetary System Price

Design Flow	
Average Day Flow	56,100 gpd

Budgetary System Price	**$426,500.00 USD**

The pricing herein is for budgetary purposes only and does not constitute an offer of sale. No sales, consumer use or other similar taxes or duties are included in the above pricing. Any such taxes and duties shall be for the account of the Purchaser. No Performance or Maintenance Bonds are included in the above pricing. Bonds can be provided on request but will be at additional cost.

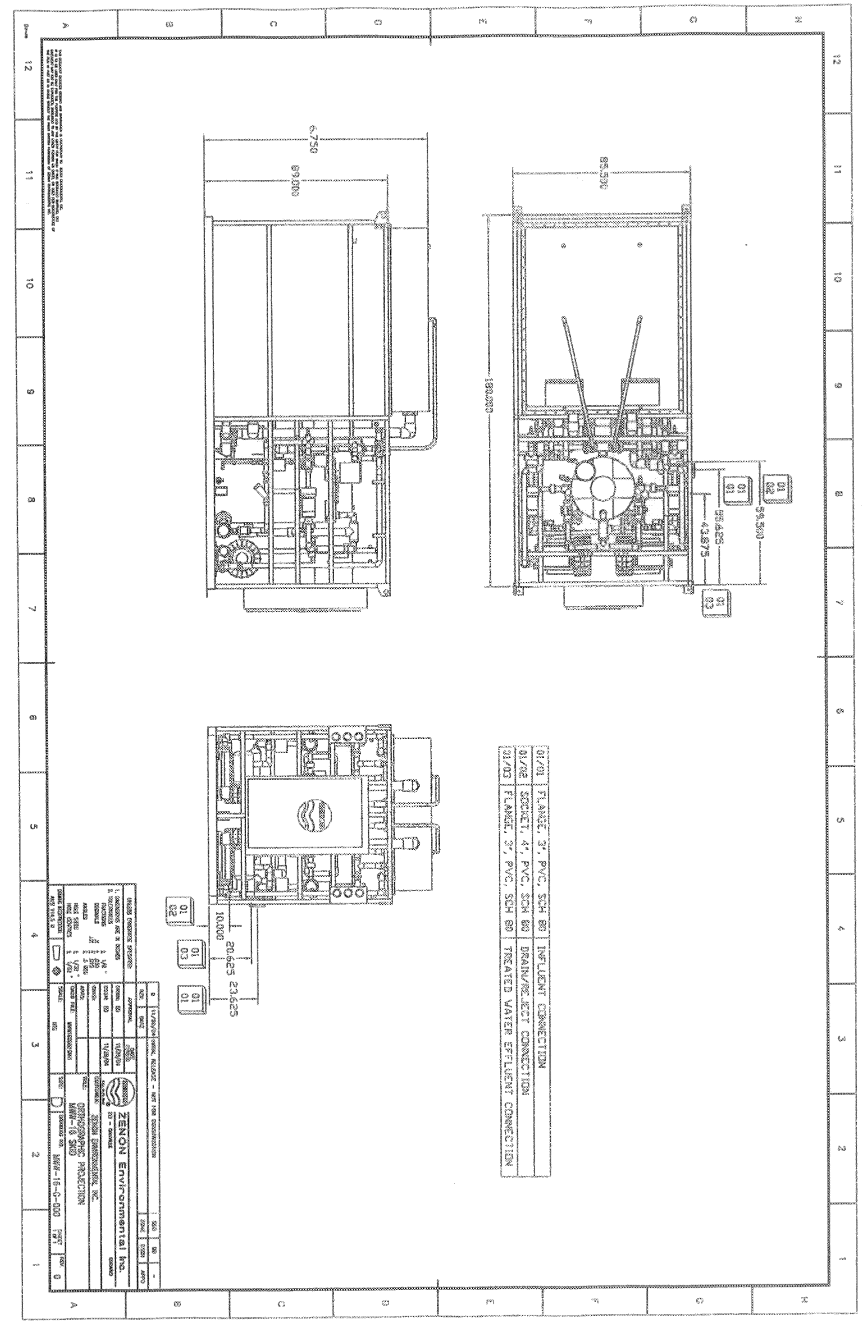
4.3 Payment Terms

The pricing quoted in this proposal is based on the following payment terms (all payments are net 30 days):

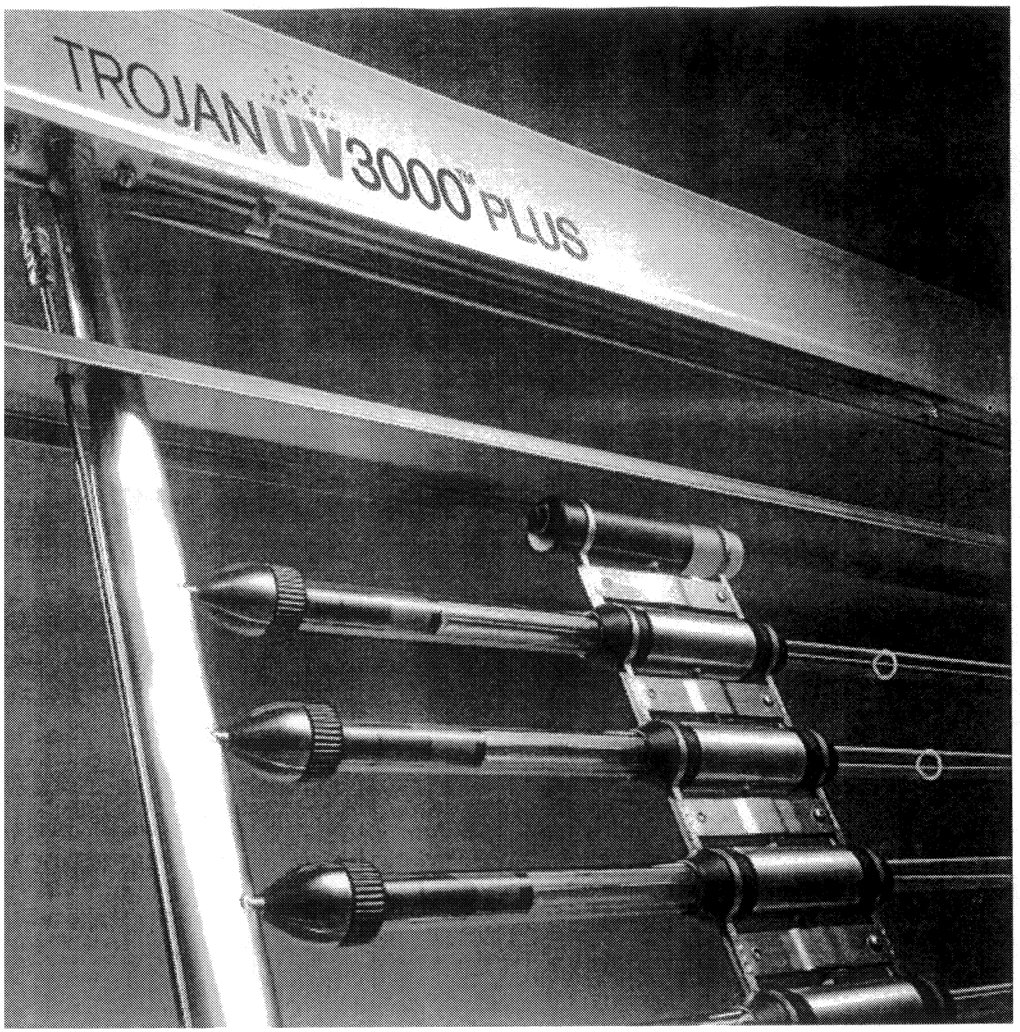
- 15% with Purchase Order;
- 10% on Submission of Shop Drawings;
- 70% on Shipment of Equipment (partial shipments permitted);
- 5% on Completion of Commissioning.

4.4 Standard Terms and Conditions

ZENON's Standard Terms and Conditions apply.



Water for the World



TROJAN UV3000™ PLUS

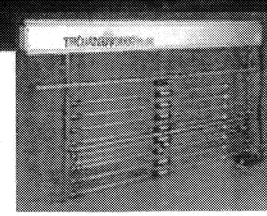
Trojan Technologies

Trojan UV3000™Plus

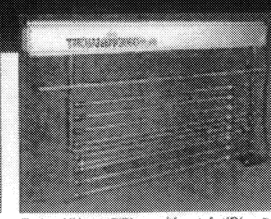
Technology you can trust from the industry leader

Trojan Technologies Inc. is an ISO 9001 registered company and for more than 25 years has set the standard for proven UV technology and ongoing innovation. With unmatched scientific and technical expertise, and a global network of specialists, representatives and technicians, Trojan is trusted more than any other firm as the best choice for municipal UV solutions – worldwide.

The Trojan UV3000™Plus is one of the reasons why. This highly flexible system is well suited for wastewater disinfection projects including challenging applications such as combined sewer overflows, primary effluent, and tertiary wastewater reclamation and reuse. It's engineered and built for reliable performance, simplified maintenance, and reduced costs with innovations such as variable-output electronic ballasts and optional ActiClean™ automated chemical-mechanical cleaning.



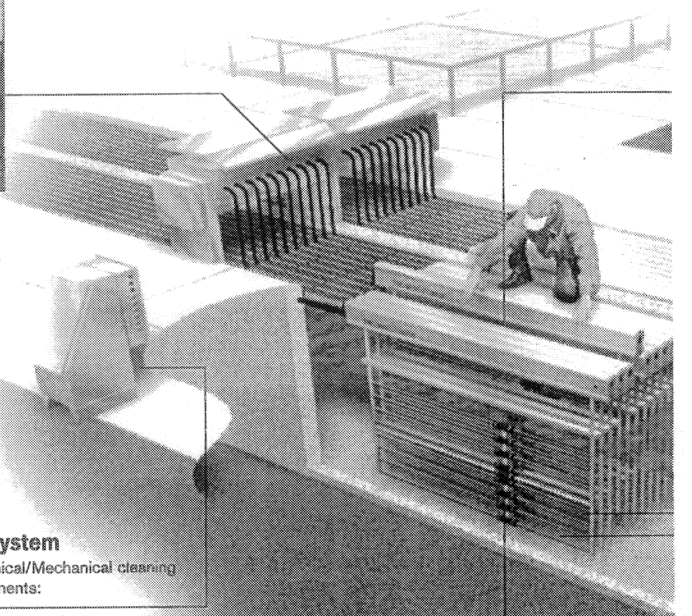
Trojan UV3000™Plus *with ActiClean™*

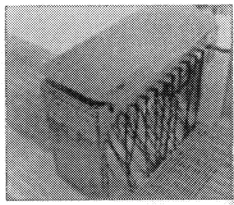


Trojan UV3000™Plus *without ActiClean™*

TROJANUV3000™PLUS

Designed for maximum performance



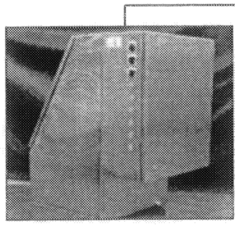


Power Distribution Center (PDC)

Powers each bank of modules. Heavy-gauge stainless steel enclosure mounted across the channel. Consists of a service entrance and a bus bar power distribution system for incoming power. Power is relayed from the bus bar to individual UV modules through stainless steel receptacles. All UV modules are individually ground-fault and overload protected for safety. Like all Trojan UV3000™Plus components, the PDC can be installed outdoors and requires no shelter or air-conditioning.

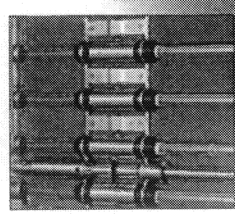
Automatic Cleaning System

The optional ActiClean™ Chemical/Mechanical cleaning system consists of two components:



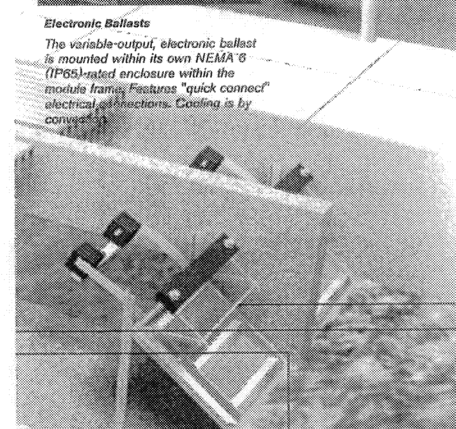
1. Hydraulic System Center (HSC)

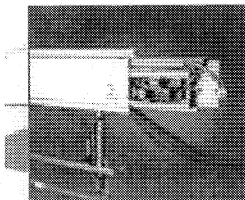
The Hydraulic System Center (HSC) actuates the cleaning system. Located close to the channel in a stainless steel enclosure, it contains the pump, valves and ancillaries for the cleaning system. Hydraulic fluid is pumped to manifolds located on the underside of the power distribution center (PDC). Extend and retract hoses run from the manifolds to the wiper drive on each module and complete the hydraulic loop.



2. ActiClean™ Wiper Assembly

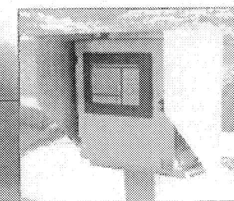
A submersible wiper drive on each UV module drives the wiper carriage assembly along the module. Attached wiper canisters surround the quartz sleeves, and are filled with Trojan's ActiClean™ Gel, which utilizes food grade ingredients, contacts the lamp sleeves between the two wiper seals. Cleaning takes place while the lamps are submerged and while they are operating.





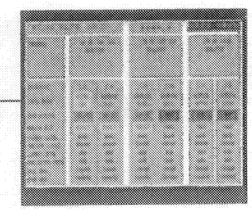
Electronic Ballasts

The variable-output, electronic ballast is mounted within its own NEMA 6 (IP65)-rated enclosure within the module frame. Features "quick connect" electrical connections. Cooling is by convection.



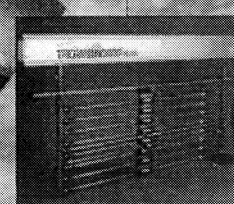
System Control Center (SCC)

Monitors and controls all UV functions and dose pacing. Consists of a PLC or microprocessor-based controller, operator interface, input/output connections and communications hardware mounted in a stainless steel enclosure. On-line RMI System™ (RMI: Remote Monitoring Interface) allows Trojan service technicians to monitor lamp operating status, power levels, hours of operation, and other parameters from remote locations. The dose pacing program conserves power and extends lamp life by varying lamp intensity and controlling bank on/off status according to flow variations.



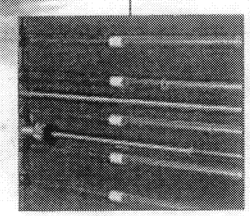
Alarms

Extensive alarm reporting system ensures fast, accurate diagnosing of system process and maintenance alarms. Programmable control software can generate unique alarms for individual applications.



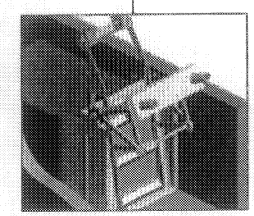
UV Modules

UV lamps are mounted on modules installed in open channels. The lamps are enclosed in quartz sleeves, and positioned horizontally and parallel to water flow. A bank is made up of multiple modules placed in parallel positions. All ballast, lamp and sensor wiring runs inside the module frame.



UV Intensity Sensor

The UV-intensity sensor continually monitors UV lamp output to ensure specified UV-dose levels are maintained. The optional ActiClean™ system automatically cleans the sensor sleeve every time lamp sleeves are cleaned.



Water Level Controller

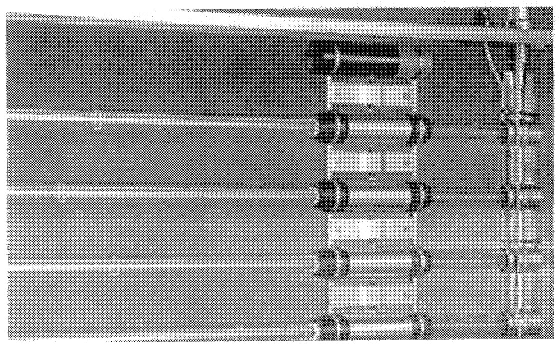
A weir, or automatic level control gate (ALC), is required in the channel to maintain the appropriate water level over the lamps. Trojan engineers will work with you to select the appropriate level control device for your application.

ActiClean™ Dual-Action Automatic Cleaning System

Optional chemical-mechanical cleaning system eliminates fouling factor

Benefits:

- **Cleans more effectively than mechanical wiping alone**
- **Improves lamp performance for more reliable dose delivery**
- **Fewer lamps needed versus competitive systems**
- **Elimination of fouling factor reduces equipment sizing requirements and power consumption**
- **Automatic, online cleaning reduces O & M costs associated with manual cleaning**

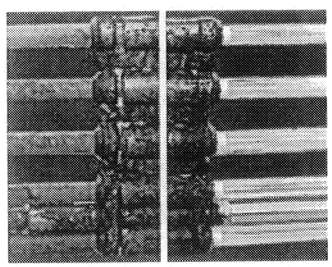


The dual-action, chemical-mechanical cleaning with the ActiClean™ system provides superior cleaning and reduces maintenance costs.

- Combination of chemical and mechanical cleaning action removes deposits on quartz lamp and sensor sleeves much more effectively than mechanical wiping alone
- Innovative wiper design incorporates a small quantity of ActiClean™ Gel for superior, dual-action cleaning
- Cleans automatically while the lamps are disinfecting. There's no need to shut down the system or bypass lamp modules for routine cleaning
- Trojan's ActiClean™ system has been proven effective in hundreds of systems around the world, including use in plants where heavy fouling had previously prohibited the use of UV disinfection technology
- ActiClean™ can be retrofitted to a Trojan UV3000™ Plus system after installation

ActiClean™ Gel Utilizes Food Grade Ingredients and is Safe to Handle

- ActiClean™ Gel utilizes Food Grade Ingredients
- Quick connect coupling on cleaning system allows for easy refill of gel solution
- Lubricating action of ActiClean™ Gel maximizes life of wiper seals



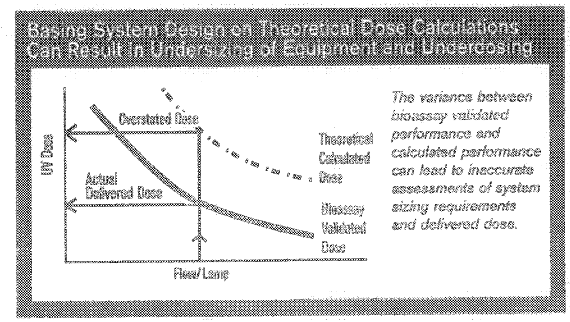
Before cleaning, fouling and residue builds up on quartz sleeves and reduces system efficiency. After cleaning with ActiClean™ (right), sleeves are cleaned providing accurate dosing while reducing power consumption.

EPA-Endorsed Bioassay Validated Performance

Real world testing ensures accurate dose delivery

Benefits:

- **Performance data is generated from real-world testing over a range of flows, effluent quality, and UVTs**
- **Provides physical verification that system will perform as expected; ensures public and environmental safety**
- **Provides accurate assessment of equipment sizing needs**



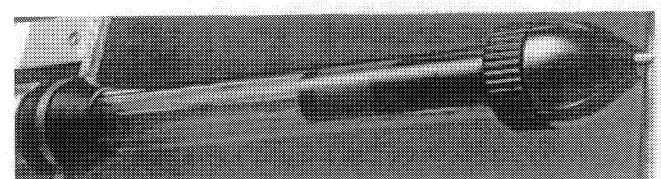
- The Trojan UV3000™ Plus has been thoroughly validated through real-world bioassay testing under a wide range of operating conditions
- In-field bioassay testing offers the peace of mind and improved public and environmental safety of verified dose delivery, not theoretical calculations
- The U.S. Environmental Protection Agency (EPA) has endorsed bioassays as the standard for assessment and comparison of UV technologies
- The disinfection performance ratings for the Trojan UV3000™ Plus are proof that what you see is what you actually get

Amalgam Lamps Require Less Energy

Requires fewer lamps and reduces O & M costs

Benefits

- **Draw less energy than competitive high output systems - only 250 Watts per lamp**
- **Fewer lamps are required to deliver the proper dose, which reduces O & M costs**
- **Can treat lower quality wastewater such as primary effluents, combined sewer overflows, and storm water**
- **Fewer lamps allow systems to be located in compact spaces, reducing installation costs**



Trojan's amalgam lamps generate stable UV output in a wide range of water temperatures, and use energy very efficiently

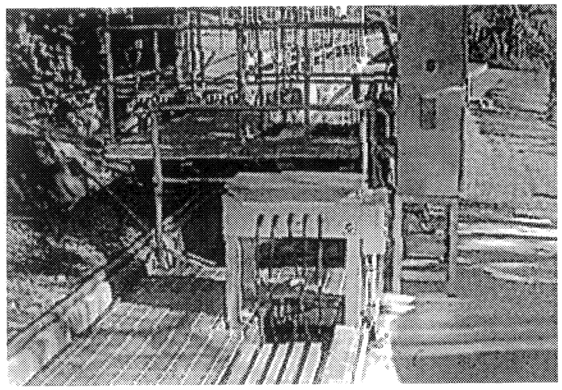
- Trojan's amalgam lamps produce significantly higher UV output than conventional low output lamps
- Trojan's UV3000™ Plus lamps have a 58" (147 cm) effective arc length and are assembled in modules of four, six, or eight lamps
- The lamps are sealed inside heavy-duty quartz sleeves by Trojan's multi-seal system, maintaining a watertight barrier around the internal wiring while individually isolating each lamp and the module frame
- Fast and simple lamp changeouts, replacing a 50-lamp system takes less than 2 hours and requires no tools
- Lamps are pre-heated for reliable startup.

Open-Channel Architecture Designed for Outdoor Installation

Cost-effective to install and expand

Benefits:

- **Compact, open channel design allows cost-effective installation in existing effluent channels and chlorine tank basins**
- **Gravity-fed design eliminates costs of pressurized vessels, piping and pumps**
- **System can be installed outdoors to reduce capital costs – no building, shelter or air-conditioning is required**
- **Scalable architecture allows precise sizing - reduces capital and O&M costs associated with oversizing**
- **Modular design is readily expandable to meet new regulatory or capacity requirements**



The Trojan UV3000™Plus system delivers flexibility and cost savings through its simple installation in existing channels and chlorine contact tanks. The system is totally stand-alone and can be situated outdoors with no additional building, shelter or cooling requirements.

- Trojan's thorough design approach, ensures that effluent quality upstream treatment processes, and O&M needs, are addressed in system configuration
- Horizontal lamp mounting delivers optimal hydraulic performance. This induces turbulence and dispersion and maximizes wastewater exposure to UV output

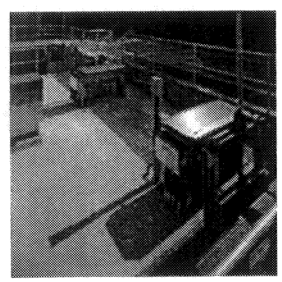
High Efficiency, Variable-Output Electronic Ballasts

Conserve energy and prolong lamp life

Benefits:

- **Match UV output to effluent quality and flow rates**
- **Conserve energy and prolong lamp life**
- **Banks of UV lamps can be turned off to conserve energy when flow rate drops below a preset level**
- **Electronic ballasts are more compact, generate less heat, and are more efficient than electromagnetic ballasts**

- The electronic ballast acts as a regulator to control the amount of power the lamp receives and to keep the lamp operating within design parameters



A two bank system allows one bank to be turned off to conserve energy during periods of low flow

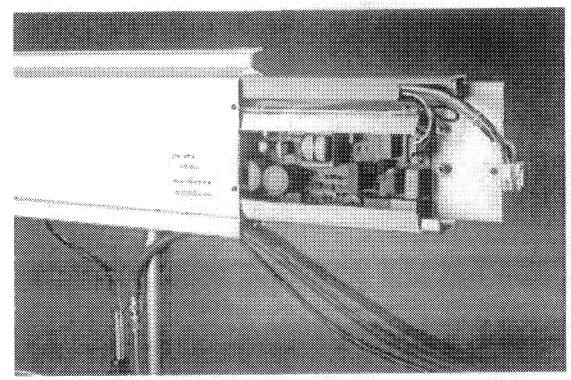
Advanced, Self-Contained UV Module

Dramatically reduces footprint size and eliminates costs of air-conditioning

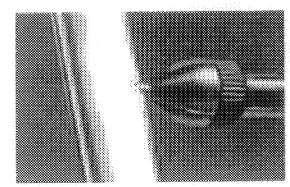
Benefits:

- **Lamps are protected in a fully submersible, 316 stainless steel frame**
- **Waterproof module frame protects cables from effluent and UV radiation**
- **Space-saving electronic ballasts are housed right in the module, separate external cabinets are not required**

- Module leg and lamp connector have a hydrodynamic profile to reduce headloss
- Ballasts are housed on the module, reducing footprint size, and minimizing installation time and costs
- The variable-output, electronic ballast is mounted within its own NEMA 6 (IP65)-rated enclosure within the module frame
- Cooling ballasts by convection eliminates costs associated with air-conditioning and forced air-cooling
- Wiring is pre-installed and factory-tested



Module-mounted ballasts allow for compact installation, convection cooling, and protect wires and cables from effluent and UV light



Module leg and lamp connector have a hydrodynamic profile to reduce headloss

Trojan's Innovative Ballasts and Enclosures Provide Significant Advantages

Trojan UV3000™Plus ballasts are housed on the module, rather than in external cabinets	• This takes up less space and footprint, reducing installation time and costs
Trojan UV3000™Plus utilizes convection cooling	• Housing the ballasts in the module allows for convection cooling to dissipate the heat of the ballasts into the air • The ballasts are kept sealed and protected • No air-conditioning or forced air-cooling required
Trojan UV3000™Plus ballast enclosure provides a clean, protected environment	• Some suppliers use external cabinets, with forced air-cooling. This introduces dust and moisture onto circuit boards and other electronic components greatly reducing the life of these components • Internal housing in the module keeps all components dry and clean
Trojan UV3000™Plus utilizes internal cabling	• All lamp-ballast wiring is contained within the module frame. This configuration protects wires and cables from exposure to effluent and UV light • Internal cabling allows all electrical connections within the module to be factory tested

Key Benefits of the TrojanUV3000™Plus

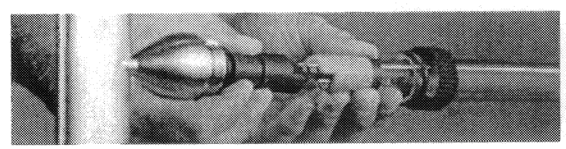
- **Most efficient UV system** available vs competitive Low Pressure High Output (LPHO) or amalgam lamps.
- **Reduces operating costs by as much as 30%** per year versus competitive systems.
- **Improved lamp performance and reduced labor costs** with the optional automatic ActiClean™ chemical-mechanical cleaning system.
- **Bioassay validated dose delivery provides peace of mind.** Trojan's bioassay testing demonstrates the system's disinfection performance in real-world conditions; you don't have to rely on theoretical calculations.
- **Reduced installation costs.** The entire Trojan UV3000™Plus can be installed outdoors, eliminating the need for a building, shelter or air conditioning.
- **Installation in existing chlorine tanks** is made possible by its compact, flexible design.
- **Reduced power consumption.** Variable output ballasts tailor UV output to meet wastewater conditions.
- **Easy expansion** as your needs grow thanks to its modular design.
- **Reduced maintenance and smaller space requirements** are the benefits of using amalgam lamps.
- **Increased Operator safety and no disinfection by-products.** Trojan's UV3000™ Plus uses environmentally safe ultraviolet light – not chlorine.
- **Comprehensive warranty protection** for your investment.

TROJAN UV3000™ PLUS

System Specifications

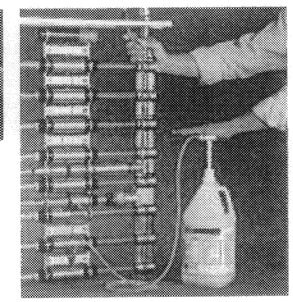
Model #	UV3000Plus™
System Characteristics:	
Typical Applications	Small & medium sized Wastewater treatment plants
Lamp Type	Low pressure, amalgam
Ballast Type	Electronic, variable output
Input power per lamp	250 Watts
Lamp configuration	Horizontal, parallel to flow
Level Control Device Options	Weir or ALC gate
Enclosure ratings:	
All enclosures	Type 4X, minimum; Type 6 for ballast enclosure
Ballast cooling method	Convection, no air conditioning or forced air required
Installation location	Indoor or outdoor
Cleaning System Details:	
ActiClean™ System	Optional Automatic chemical/mechanical cleaning
Recommended fouling factor	1.0
System Control Center	
Controller	Microprocessor based
Inputs required	4 – 20 mA flow signal
Typical Outputs provided	Bank status, common alarms and SCADA communication
Location	Indoor or outdoor
Maximum distance from UV channel	500 feet (152m)
Electrical Requirements:	
Power Distribution Center(s)	277/480V, 3 phase, 4 wire
System Control Center	120V, single phase, 2 wire
Hydraulic System Center (for ActiClean™)	120V, single phase, 2 wire
Water Level Sensor	120V, single phase, 2 wire

Designed for Easy Maintenance



Trojan UV lamps are easily replaced in minutes without the need for tools

- Lamps are available from more than one source
- UV 3000 Plus lamps are warranted for 12,000 hours of use
- Multiple bank design allows for service work to be carried out on one bank without disrupting disinfection performance
- Individual panels for power distribution and system control provide an electrically independent and operator-friendly operation
- Maintenance limited to replacing lamps and cleaning solution
- Optional automated ActiClean™ system reduces manual labor associated with cleaning



Quick connect coupling allows for easy refill of ActiClean™ Gel solution approximately every 12 months

Find out how your wastewater treatment plant can benefit from Trojan UV3000™Plus – call us today.

Trojan Technologies Inc.

Head Office (Canada)
3020 Gore Road
London, Ontario
Canada N5V 4T7
Telephone: (519) 457-3400
Fax: (519) 457-3030

www.trojanuv.com

Trojan Technologies is a publicly traded company on the Toronto Stock Exchange under the symbol TUV.

OA-W-M48-5.2-BR-CA0003-0902

TROJANUV
WATER CONFIDENCE™

UV3000™Plus PROPOSAL

February 9, 2005

HAWAII ENGINEERING SERVICES
2308 Pahounui Dr
Honolulu, HI. 96819
USA

Attention: Michael Elhoff
Reference: Maui, HI
Quote No: LJLR1115

In response to your request, we are pleased to provide the following **Trojan System UV3000™Plus** proposal for the **Maui** project. Since Trojan introduced the open channel approach to disinfection in 1982, many municipalities have selected ultraviolet as the preferred method for pathogen destruction at their facilities.

The **Trojan System UV3000™Plus** utilizes low pressure high intensity amalgam lamp technology that reduces the total number of lamps required, compared to conventional low pressure lamp systems. All of Trojan's UV systems are modular in design, with each system customized in response to the effluent criteria. The lamps are oriented in a horizontal configuration parallel to the flow and incorporate a fully automated mechanical/chemical cleaning system that eliminates the need for manual sleeve cleaning. In addition, the **Trojan System UV3000™Plus** utilizes a variable output power supply so that power draw is optimized based on continuous effluent monitoring.

Please review carefully our design criteria for peak flow rate, total suspended solids, disinfection limit, and UV transmittance to ensure that the criteria used match actual project parameters. When detailed project design commences, please contact our office for a review of all design parameters, including dimensions and equipment requirements. In addition, Trojan is able to provide analytical services to quantify effluent quality and confirm design criteria.

Trojan's price for the attached design is **$196,700** (in US$). This quoted price includes the equipment as described, freight to site and start-up by qualified personnel. This quote **excludes** any taxes that may be applicable. The above information is to be used for budget estimates and is valid for 90 days from this date and is in accordance with Trojan's unconditional lifetime performance guarantee.

Please do not hesitate to call us if you have any questions or would like additional information. Thank you for the opportunity to quote the **Trojan System UV3000™Plus** on this project.

With best regards,
Trojan Technologies Inc.

Jackie Leinberger

Jackie Leinberger
Municipal Systems Engineer
Encl.

TROJAN TECHNOLOGIES INC.
3020 GORE ROAD, LONDON, ONTARIO, CANADA N5V 4T7 T 519.457.3400 F 519.457.3030 WWW.TROJANUV.COM

DESIGN CRITERIA

Current Peak Design Flow:	**0.25 US_MGD**
UV Transmittance:	**65 %, minimum**
Total Suspended Solids:	**5 mg/l** (Maximum; grab samples)
Max Average Particle Size	**30 microns**
Disinfection Limit:	**2.2 Fecal Coliform** per 100 ml, based on a 7 day Median of consecutive daily grab samples
Design Dose:	**80,000 µWs/cm²**, Bioassay Validated per NWRI Title 22 Guidelines (R-1)
End of Lamp Life Factor:	**0.82** (CA DHS Approved)
Fouling Factor:	**0.95** (CA DHS Approved)

DESIGN SUMMARY

Based on the above design criteria, the Trojan System UV3000™Plus proposed consists of:

Number of Channels:	**1**
Total Number of Banks:	**3 (2 – duty, 1 – redundant)**
Number of Modules per Bank:	**2**
Number of Lamps per Module:	**4**
Total Number of UV Lamps:	**24**
Number of Power Distribution Centers:	**3**
Number of System Control Centers:	**1**
Number of Level Controllers:	**1**
Type of Level Controller:	**Serpentine Weir**
Automatic Chemical/Mechanical Cleaning:	**Included**
UV Module Lifting Device:	**Not Included**
Stainless Steel Channel:	**Included**
On-Line UVT Monitor:	**Included**

EFFLUENT CHANNEL DIMENSIONS

L =	Channel length (maximum):	**40 ft**
W =	Channel width based on number of UV modules:	**7 in**
D =	Channel depth for UV Module:	**34 in**

Dimensions are given for reference only. Consult Trojan Technologies for detailed system dimensions.

ELECTRICAL REQUIREMENTS

1. The UV System Control Center requires an electrical service of one (1) 120 Volts, 1 phase, 2 wire (plus ground), 15 Amps.
2. Each Power Distribution Center requires an electrical service of one (1) 277/480 Volts, 3 phase, 4 wire (plus ground), 2.1 kVA.
3. The Hydraulic Systems Center requires an electrical service of one (1) 120 Volts, 1 phase, 2 wire (plus ground), 2 kVA.
4. The low water level sensor requires an electrical service of one (1) 120 volts, 1 phase, 2 wire (plus ground), 5 Amps.
5. The On-Line UVT Monitor requires an electrical service of one (1) 120 volts, 1 phase, 2 wire (plus ground), 5 Amps.

NOTES

1. UV Disinfection Equipment specification is available upon request.
2. If there are site-specific hydraulic constrains that must be applied, please consult the manufacturer's representative to ensure compatibility with the proposed system.
3. Standard spare parts and safety equipment are included with this proposal.
4. The weighted gate (automatic level controller) is not designed to handle periods of no flow.
5. Electrical disconnects required as per local state code are not included in this proposal.
6. Trojan Technologies Inc. warrants all components of the system (excluding UV lamps) against faulty workmanship and materials for a period of 12 months from date of start-up or 18 months after shipment, which ever occurs first.
7. Payment Terms: 10% after approved submittal, 80% upon delivery of equipment to site, 10% after equipment acceptance

OPERATING COSTS FOR TROJAN SYSTEM UV3000™Plus

Design Criteria

Average Flow:	0.05 US_MGD
Yearly Usage:	8750 hours
UV Transmission:	65 %, minimum

Power Requirements

Total Power Draw:	6 kW
Average Power Draw:	1.2 kW
Annual Operating Hours:	8750 hours
Cost per kW Hour:	$0.12
Annual Power Cost:	***$1,260***

Replacement Lamp Costs

Number of lamps replaced per year:	3
Price per lamp:	$175
Annual Lamp Replacement Cost:	***$525***

Total Annual Operation and Maintenance Costs are: $1,785

Over time, the quartz sleeves that house the UV lamps become fouled as charged particles adhere to the surface of the sleeve. These fouled sleeves need to be cleaned in order to maintain the delivered UV dose. Manufacturers offer various types of cleaning systems.

Type of Cleaning System	Additional Annual Costs
1. Chemical/Mechanical cleaning	None (with UV3000™Plus System with ActiClean™ option)
2. Mechanical wiping only	Chemical Cleaning Cost: labor and chemicals
3. Manual cleaning	Chemical Cleaning Cost: labor and chemicals

NOTES

1. O&M costs are based on system flow-pacing using a 4-20 mA signal from a flow meter (supplied by others).
2. All costing has been based on the system operating at the average flow conditions.

Engineering Solutions, Inc.

From: "Mike" <mike@hiengineering.com>
To: "Engineering Solutions, Inc." <engineering@engrsol.com>
Cc: "Leinberger, Jackie" <JLeinberger@trojanuv.com>
Sent: Tuesday, March 01, 2005 1:51 PM
Subject: RE: Kyle - Maui MBR

Kyle,

As discussed, here are some budget UV numbers for your changes. I increased average KW:

MBR w/ UV: Increase UV by 30%, therefore cost $230,000 Power 9KW Average 3.6KW

Conventional EA w/ UV: Increase UV another 30%, therefore cost $300,000 Power 12KW Average 5.4KW

These are in the ballpark - if you need a specific quote, please let me know.

Regards, Mike

Mike Elhoff
Hawaii Engineering Services Inc.
(808)841-0033
www.hiengineering.com

DRYING BEDS, SLUDGE

FACT SHEET 6.3.2

Description - Drying beds are used to dewater sludge both by drainage through the sludge mass and by evaporation from the surface exposed to the air. Collected filtrate is usually returned to the treatment plant. Drying beds usually consist of 4 to 9 inches of sand which is placed over 8 to 18 inches of graded gravel or stone. The sand typically has an effective size of 0.3 to 1.2 mm and a uniformity coefficient of less than 5.0. Gravel is normally graded from 1/8 to 1.0 inch. Drying beds have underdrains that are spaced from 8 to 20 feet apart. Underdrain piping is often vitrified clay laid with open joints, has a minimum diameter of 4 inches, and has a minimum slope of about 1 percent.

Sludge is placed on the beds in an 8 to 12 inch layer. The drying area is partitioned into individual beds, approximately 20 ft wide by 20 to 100 ft long, of a convenient size so that one or two beds will be filled by a normal withdrawal of sludge from the digesters. The interior partitions commonly consist of two or three creosoted planks, one on top of the other, to a height of 15 to 18 inches, stretching between slots in precast concrete posts. The outer boundaries may be of similar construction or earthen embankments for open beds, but concrete foundation walls are required if the beds are to be covered.

Piping to the sludge beds is generally made of cast iron and designed for a minimum velocity of 2.5 ft/s. It is arranged to drain into the beds and provisions are made to flush the lines and to prevent freezing in cold climates. Distribution boxes are provided to divert sludge flow to the selected bed. Splash plates are used at the sludge inlets to distribute the sludge over the bed and to prevent erosion of the sand.

Sludge can be removed from the drying bed after it has drained and dried sufficiently to be spadable. Sludge removal is accomplished by manual shoveling into wheelbarrows or trucks or by a scraper or front-end loader. Provisions should be made for driving a truck onto or along the bed to facilitate loading. Mechanical devices can remove sludges of 20 to 30 percent solids while cakes of 30 to 40 percent generally require hand removal.

Paved drying beds with limited drainage systems permit the use of mechanical equipment for cleaning. Field experience indicates that the use of paved drying beds results in shorter drying times as well as more economical operation when compared with conventional sandbeds because, as indicated above, the use of mechanical equipment for cleaning permits the removal of sludge with a higher moisture content than in the case of hand cleaning. Paved beds have worked successfully with anaerobically digested sludges but are less desirable than sandbeds for aerobically digested activated sludge.

Common Modifications - Sandbeds can be enclosed by glass. Glass enclosures protect the drying sludge from rain, control odors and insects, reduce the drying periods during cold weather, and can improve the appearance of a wastewater treatment plant.

Wedge wire drying beds have been used successfully in England. This approach prevents the rising of water by capillary action through the media and the construction lends itself well to mechanical cleaning. The first United States installations have been made at Rollinsford, New Hampshire, and in Florida. It is possible, in small plants, to place the entire dewatering bed in a tiltable unit from which sludge may be removed merely by tilting the entire unit mechanically.

Technology Status - Over 6,000 plants use open or covered sandbeds.

Applications - Sandbeds are generally used to dewater sludges in small plants. They require little operator attention or skill.

Limitations - Air drying is normally restricted to well digested or stabilized sludge, because raw sludge is odorous, attracts insects, and does not dry satisfactorily when applied at reasonable depths. Oil and grease clog sandbed pores and thereby seriously retard drainage. The design and use of drying beds are affected by weather conditions, sludge characteristics, land values and proximity of residences. Operation is severely restricted during periods of prolonged freezing and rain.

Typical Equipment/No. of Mfrs. (83) - Front-end loader/16; Scraper/42.

Performance - A cake of 40 to 45 percent solids may be achieved in two to six weeks in good weather and with a well digested waste activated, primary or mixed sludge. With chemical conditioning, dewatering time may be reduced by 50 percent or more. Solids contents of 85 to 90 percent have been achieved on sand beds, but normally the times required are impractical.

Design Criteria - Open bed area = 1.0 to 1.5 ft^2/capita (primary digested sludge); 1.75 to 2.5 ft^2/capita (primary and activated sludge); 2.0 to 2.5 ft^2/capita (alum or iron precipitated sludge). Experience has shown that enclosed beds require 60 to 75 percent of the open bed area. Solids loading rates vary from 10 to 28 lb/ft^2/yr for open beds and 12 to 40 lb/ft^2/yr for closed beds. Sludge beds should be located at least 200 ft from dwellings to avoid odor complaints due to poorly digested sludges.

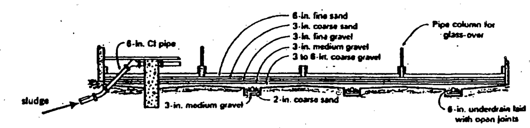
Environmental Impact - Land requirements are large. Odors can be a problem with poorly digested sludges and inadequate buffer zone areas.

References - 3, 7, 8, 22, 83

DRYING BEDS, SLUDGE

FACT SHEET 6.3.2

FLOW DIAGRAM -



ENERGY NOTES (4) - $E_T = E_{mechanical\ scraping} + E_{sand\ replacement} + E_{pumping}$ (when required)

E_{ms} is estimated to be 3.2 X 10^6 Btu/yr/Mgal/d plant flow @ 900 lb dry solids/Mgal plant flow.
E_{sr} is estimated to be 10 percent of the mechanical scraping or .32 X 10^6 Btu/Mgal/d plant flow.

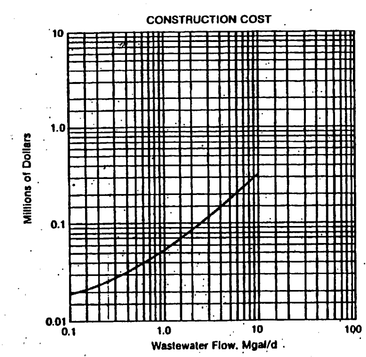
$$E_{pumping} = \frac{1140\ (Mgal/d \times TDH)}{\text{Wire to Water Efficiency}}$$

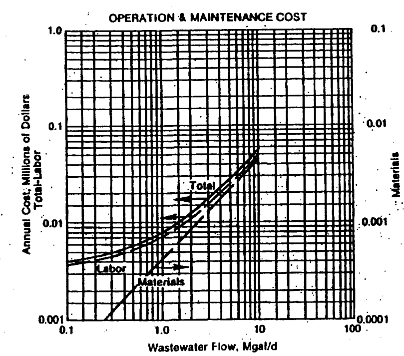
With a sludge flow of 0.5 X 10^6 gal/d, a TDH of 40 ft and a wire-to-water efficiency of 60 percent, the pumping energy requirement would be 38,000 kWh/yr.

COSTS* - Service Life: 20 years. ENR = 2475
1. Construction costs include: sand beds, sludge inlets, underdrains, cell dividers, sludge piping, underdrain return, and other structural elements of the beds. All costs are in mid-1976 dollars.
2. Bed loading: 900 lb of sludge/Mgal; 20 lb/ft^2/yr.

Adjustment Factor - To adjust costs for bed loading rates, sludge quantities, or characteristics, enter curve at effective flow (Q_E).

$$Q_E = Q_{DESIGN} \times \frac{\text{New Design Sludge Mass}}{900\ lb/Mgal} \times \frac{20\ lb/ft^2/yr}{\text{New Design Bed Loading}}$$





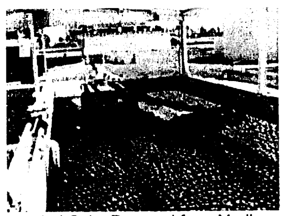
REFERENCES - 3, 4

*To convert construction cost to capital cost see Table A-2.

HOME WHAT'S NEW CONTACT US COMPANY INFO WEDGEWATER™ FILTER BED SYSTEM WEDGEWATER™ SIEVE LATERAL FLOW™ THICKENER

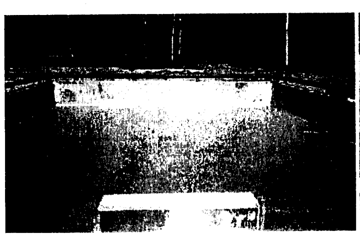
Gravity Flow Systems Southwest, Inc.

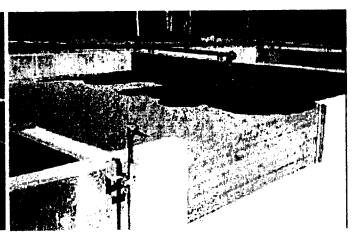
Wedgewater™ Filter Bed System

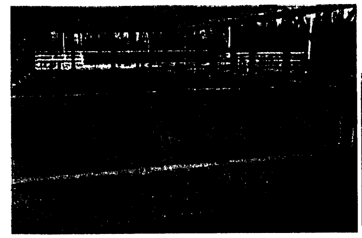

Dried Cake Removal from Media

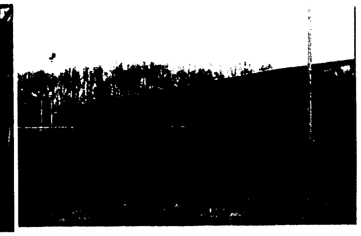
The Wedgewater™ Filter Bed Systems is the result of intensive research, rigorous field testing and years of experience in screen and filter design and manufacture.

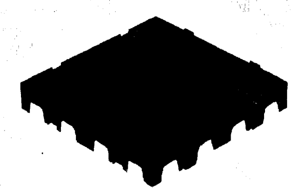
Gravity Flow Systems developed this unique concept in the early 1980's as an alternative method to slow, inefficient drying beds and expensive, complicated mechanical dewatering devices. Flocculated solids are placed on top of a bed containing the Wedgewater™ media. Typical water and wastewater treatment plant sludges can be dewatered to a liftable, truckable state in only a few days, compared to weeks or months with the normal sand drying beds. The system provides high capture rates and extremely clean filtrate. Dried solids removal can be accomplished using a small front-end loader.










Wedgewater™ interlocking high-strength polyurethane module

The Wedgewater™ media is constructed of either stainless steel wedgewire panels or interlocking high-strength polyurethane modules. Both medias are practically indestructible, and feature a special non-clogging design, easy maintenance, and near perfect reliabilty. The Wedgewater™ system only requires a mere 1/6 to 1/10 the space of sand drying beds. No specialized skills are required of personnel for operation. The system functions by force of gravity without supervision, and the only energy costs are the minor requirements of the auxiliary pumping and polymer equipment. And with the Wedgewater™ Filter Bed system, there is no ongoing media loss.

Gravity Flow Systems Southwest, Inc. is the expert in the field of media dewatering bed equipment. We have the expertise to stand behind our product and make sure your installation functions exactly as it is supposed to. Our team of experts would be happy to show you how the Wedgewater™ Filter Bed system could save you time and money. For more information, please contact us.

Home

What's New at GFS Southwest
Wedgewater™ Filter Bed Dewatering System
Lateral Flow™ Thickeners
Wedgewater™ Sieves
Company Info
Contact Us

Description - Dual media filtration-gravity is one of the most economical forms of granular media filtration. Granular media filtration involves the passage of water through a bed of filter media with resulting deposition of solids. Eventually, the pressure drop across the bed becomes excessive or the ability of the bed to remove suspended solids is impaired. Cleaning is then necessary to restore operating head and effluent quality. The time in service between cleanings is termed the run length. The head loss at which filtration is interrupted for cleaning is called the terminal head loss, and this head loss is maximized by the judicious choice of media sizes.

Dual media filtration involves the use of both sand and anthracite as filter media, with anthracite being placed on top of the sand. Gravity filters operate by either using the available head from the previous treatment unit, or by pumping to a flow split box after which the wastewater flows by gravity to the filter cells. Pressure filters utilize pumping to increase the available head.

Normally filter systems include multiple filter compartments. This allows for the filtration system to continue to operate while one compartment is being backwashed.

A filter unit generally consists of a containing vessel, the filter media, structures to support the media, distribution and collection devices for influent, effluent and backwash water flows, supplemental cleaning devices (see "Common Modifications"), and necessary controls for flows, water levels and backwash sequencing.

Common Modifications - Filtration systems can be constructed out of concrete or steel, with single or multiple compartment units. Steel units can be either horizontal or vertical and are generally used for pressure filters. Systems can be manually or automatically operated.

Backwash sequences can include air scour or surface wash steps. Backwash water can be stored separately or in chambers that are integral parts of the filter unit. Backwash water can be pumped through the unit or can be supplied through gravity head tanks.

Technology Status - Has been used for many years in the potable water industry, and has been used in the wastewater treatment field for 10 to 15 years.

Typical Equipment/No. of Mfrs. (23) - Dual media filters/20; blowers/7; controls/29.

Applications - Removal of residual biological floc in settled effluents from secondary treatment and removal of residual chemical-biological floc after alum, iron, or lime precipitation in tertiary or independent physical-chemical waste treatment.

In these applications filtration may serve both as an intermediate process to prepare wastewater for further treatment (such as carbon adsorption, clinoptilolite ammonia exchange columns, or reverse osmosis) or as a final polishing step following other processes.

Limitations - Economics are highly dependent on consistent pretreatment quality and flow modulations. Increasing suspended solids loading will reduce run lengths, and large flow variations will deleteriously effect effluent quality in chemical treatment sequences.

Performance -

Filter Influent	Filter Effluent mg/l
High Rate Trickling Filter	10 to 20
2-Stage Trickling Filter	6 to 15
Contact Stabilization	6 to 15
Conventional Activated Sludge	3 to 10
Extended Aeration	1 to 5

Chemicals Required - Alum and iron salts, and polymers can be added as coagulant aids directly ahead of filtration units. This, however, will generally reduce run lengths.

Residuals Generated - Backwash water, which generally approximates two to ten percent of the throughput. Backwash water can be returned to the head of the plant.

Design Criteria (99) -
Filtration rate 2 to 8 gal/min/ft^2; bed depth 24 to 48 inches (depth ratios of 1:1-4:1 sand to anthracite); backwash rate 15 to 25 gal/min/ft^2; air scour rate 3 to 5 stdft^3/min/ft^2; filter run length 8 to 48 hours; terminal head loss 6 to 15 ft.

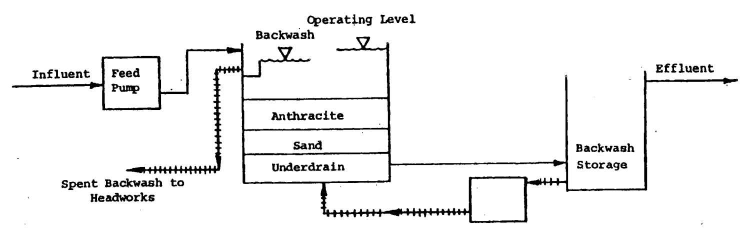
Unit Process Reliability - Dual media filtration systems are very reliable from both a process and unit standpoint.

Environmental Impact - Requires relatively little use of land. Backwash water will need further treatment, with an ultimate production of solids which will need disposal. Air scour blowers usually need silencers to control noise. No air pollution generated.

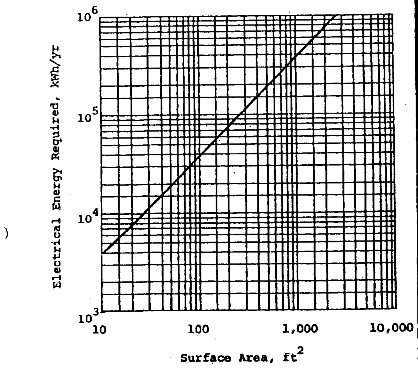
References - 23, 26, 39, 44, 99

FILTRATION, DUAL MEDIA FACT SHEET 3.1.7

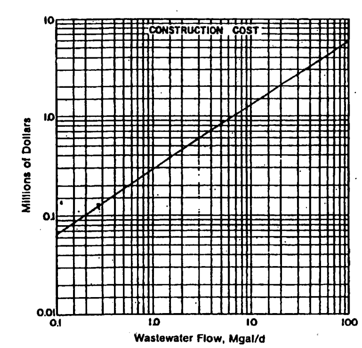
FLOW DIAGRAM -

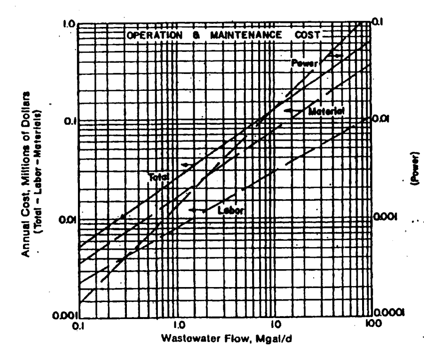


ENERGY NOTES - If sufficient head available, no influent pumping required. However, usually a feed pump is employed to provide necessary head.
Assumptions:
1. Gravity filters @ 4 gal/min/ft^2
   a. TDH for backwash and feed pumps 14 ft
   b. Run length = 12 h; 15 min backwash @ 15 gal/min/ft^2
   c. Pump efficiency 70%; motor efficiency, 93%
2. Centrifugal pumps



COSTS* - Assumptions: ENR Index = 2475
1. Same as above, with air scour assist for backwash
2. Backwash holding tank = capacity of two backwash cycles.
3. Construction cost includes facilities for backwash storage, all feed and backwash pumps, piping, and building.
4. Power at $.02/kWh.
5. Labor at $7.50/h, including fringe benefits.





REFERENCES - 3, 4, 39

*To convert construction cost to capital cost see Table A-2.

ENGINEERING SOLUTIONS, INC.
Civil / Sanitary / Structural Engineers

PROJECT NO. 0435
PROJECT PUKULANI
PREPARED BY KOKINO DATE 11 FEB 2005
CHECKED BY ______ DATE ______
SHEET 1 OF 1

98-1268 Kaahumanu Street, Suite C-7 • Pearl City, Hawaii 96782 • Phone: (808) 488-0477 • Fax: (808) 488-3776

TERTIARY FILTRATION

FROM EPA COST CURVES, FACT SHEET 3.1.7

COST = $65,000 @ Q = 100,000 GPD

USE $\left(\frac{Q_1}{Q_2}\right)^{0.6} = \frac{C_1}{C_2}$

$\left(\frac{100,000}{51,000}\right)^{0.6} = \frac{\$65,000}{C_2}$

$C_2 = \$43,397$

ENR INDEX : 2475

PRESENT ENR INDEX : 7118

HAWAII COST FACTOR = 1.7

COST = $\$43,397 \times \frac{7118}{2475} \times 1.7 = \$212,171$ / UNIT

ENGINEERING SOLUTIONS, INC.
Civil / Sanitary / Structural Engineers

PROJECT NO. 0435
PROJECT PUKALANI - KUAHALE LANI
PREPARED BY K. OKINO DATE 14 JAN 2005
CHECKED BY ______ DATE ______
SHEET ______ OF ______

98-1268 Kaahumanu Street, Suite C-7 • Pearl City, Hawaii 96782 • Phone: (808) 488-0477 • Fax: (808) 488-3776

DETERMINE
IRRIGATION DEMAND OF KUAHALE LANI SUBDIVISION COMMUNITY PARK

ASSUME:
~ 2.5 AF/ACRE·YR TYPICAL RECYCLED WATER DEMAND FOR PARKS IN CALIFORNIA

CALCULATE

AREA OF COMMUNITY PARK ≈
300 FT × 400 FT ≈ $120,000\ FT^2 \times \frac{ACRE}{43560\ FT^2}$ ≈ 2.8 ACRES

≈ 0.363 ACRES

$2.8\ ACRES \times 2.5 \frac{ACRE \cdot FT}{ACRE \cdot YR} \times \frac{43560\ SQ\ FT}{ACRE} \times \frac{7.48\ GAL}{FT^3} = 2,300,000 \frac{GAL}{YR}$

$\approx 6,250 \frac{GAL}{DAY}$

+ GRASSING AROUND BIKE PATH

TOTAL ≈ 10,000 GPD

ENGINEERING SOLUTIONS, INC.
Civil / Sanitary / Structural Engineers

PROJECT NO. 0435
PROJECT PUKALANI
PREPARED BY F. OKINO DATE 2/09/05
CHECKED BY ______ DATE ______
SHEET 1 OF 1

98-1268 Kaahumanu Street, Suite C-7 • Pearl City, Hawaii 96782 • Phone: (808) 488-0477 • Fax: (808) 488-3776

DETERMINE: 20 DAY STORAGE REQUIRED DURING PERIODS OF LOW R-1 DEMAND

IN ACCORDANCE WITH THE "GUIDELINES FOR TREATMENT AND USE OF RECYCLE WATER, MAY 2002" PAGE 42

REQUIRE: 20 DAYS

20 DAYS X 62,200 GPD = 1,244,000 GALLONS

ASSUME: 200,000 GALLON TANK (ASSUME: IRRIGATION DEMAND OF COMMUNITY PARK IS ≈ 7,000 GPD + BIKE PATH (3,000 GPD). TOTAL 10,000 GPD ≈ 20 DAY DETENTION)

THEREFORE POND CAPACITY

1,244,000 − 200,000 = 1,044,000

$1{,}044{,}000 \text{ GALLONS} \times \frac{FT^3}{7.48\,GAL} = 139{,}573\ FT^3$

ASSUMING 8 FT DEEP; LINED

RESULT WITH POND 132 FT^2

ENGINEERING SOLUTIONS, INC.
Civil/Sanitary/Structural Engineers

98-1268 Kaahumanu Street • Suite C-7 • Pearl City, Hawaii 96782 • Telephone (808)488-0477 • FAX (808) 488-3776

Project No. 0435

May 11, 2005

Kapalua Land Company, Ltd.
1000 Kapalua Drive
Kapalua, Maui, Hawaii 96761
Attention: Ms. Leilani Pulmano, Development Coordinator

SUBJECT: Kauhale Lani Community and WWTP

Dear Ms. Pulmano:

As discussed, odors generated from the wastewater treatment plant is always considered during the design process and odor systems will be designed to alleviate any potential issues. For the past 5 years, we have been part of a team of engineering consultants assisting the City and County of Honolulu with master planning and addressing their odor control problems from wastewater systems under their ROSE program. We have investigated the traditional physical and chemical processes as well as pilot tested biofilters, using various native material media, and tested an innovative, air ionization system recently on the market.

In any case, odors from the wastewater system and treatment plant will be addressed during design.

If you have any questions, please do not hesitate to call me.

Sincerely,

ENGINEERING SOLUTIONS, INC.

June J. Nakamura, P.E.
President

L

Preliminary Drainage Report

PRELIMINARY DRAINAGE REPORT

FOR

KAUHALE LANI COMMUNITY

Pukalani, Maui, Hawaii

T.M.K.: (2) 2-3-09:07

Prepared For:

Maui Land & Pineapple Company, Inc.
1000 Kapalua Drive
Kapalua, Hawaii 96761

Prepared By:

Engineering Solutions, Inc.
98-1268 Kaahumanu Street, Suite C-7
Pearl City, Hawaii 96782

May 2005

TABLE OF CONTENTS

PRELIMINARY DRAINAGE REPORT
FOR
KAUHALE LANI
Pukalani, Maui, Hawaii

I. INTRODUCTION

The purpose of this report is to examine both the existing and proposed drainage conditions for Kauhale Lani.

II. DESCRIPTION

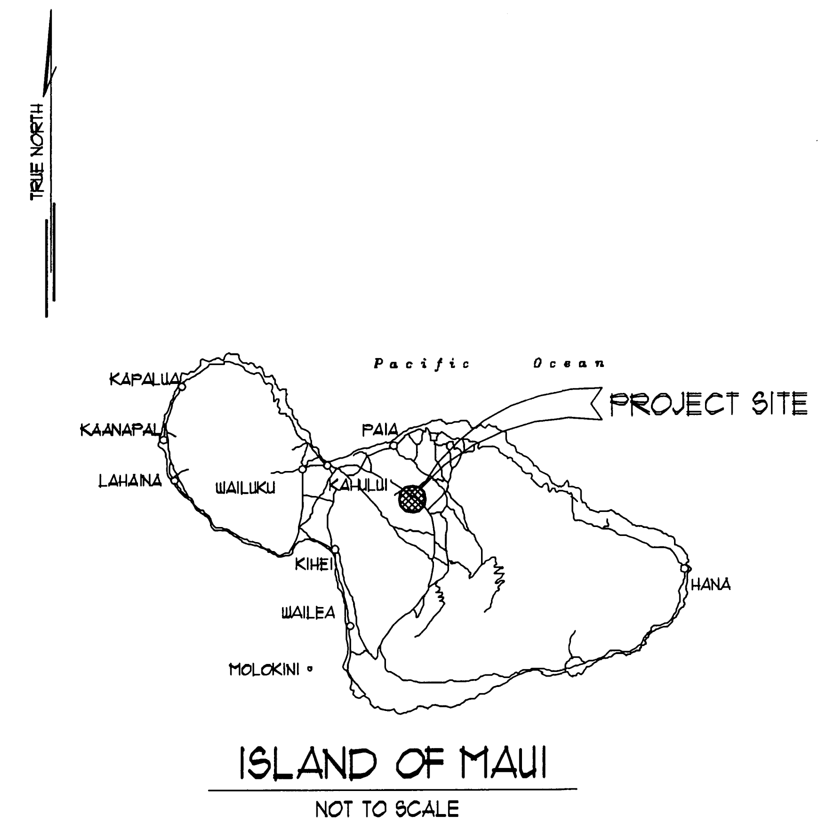
A. Existing Conditions

The subject property is identified as T.M.K.: (2) 2-3-09:07 and contains an area of approximately 49.95 acres. The Kauhale Lani community site is located on the lower slopes of Haleakala and is bordered by the Old Haleakala Highway to the east, Alexander and Baldwin (A&B) irrigation ditch to the north and west, and Lower Pukulani Terrace subdivision to the south. See Figure 1 and 2. There is also a 39-acre parcel, T.M.K.: (2) 2-3-009:64, between Old Haleakala Highway and Haleakala Highway that will contain open space and community trails.

The majority of the site is fallow pineapple fields. The elevation ranges from 1,088 feet at the northern portion of the site to 1,186 feet at the southeast corner of the site. The site is gradually sloped with an average slope of 7%.

According to the "Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii (August, 1972)," prepared by the United States Department of Agriculture Soil Conservation Service, the soils within the project site are classified as Haliimaile silty clay, 3 to 7 percent slope (HhB), Haliimaile silty clay, 7 to 15 percent slope (HhC), and Keahua silty clay loam, 7 to 15 percent slope (KnC). Haliimaile silty clay, 3 to 7 percent, is characterized as having moderate permeability, slow runoff and a slight erosion hazard. Haliimaile silty clay, 7 to 15 percent, is characterized as having medium runoff and moderate erosion hazard. Keahua silty clay loam, 7 to 15 percent, is characterized as having slow to medium runoff and slight to moderate erosion hazard. See Figure 3.

According to Panel No. 1500030195 and 1500030260B of the Flood Insurance Rate Maps, dated June 1, 1981, the project site is situated in Flood Zone X, which is designated as areas of minimal flooding.

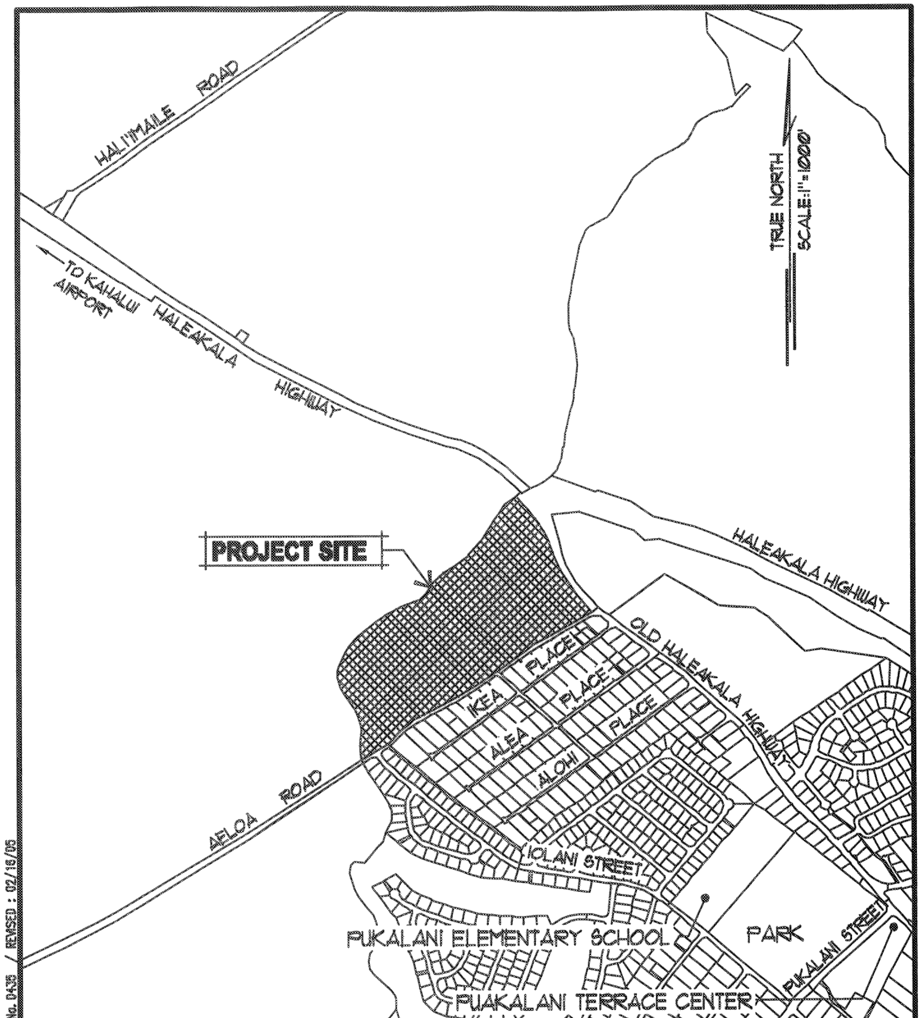


KAUHALE LANI

VICINITY MAP

FIGURE 1 FEBRUARY 2005

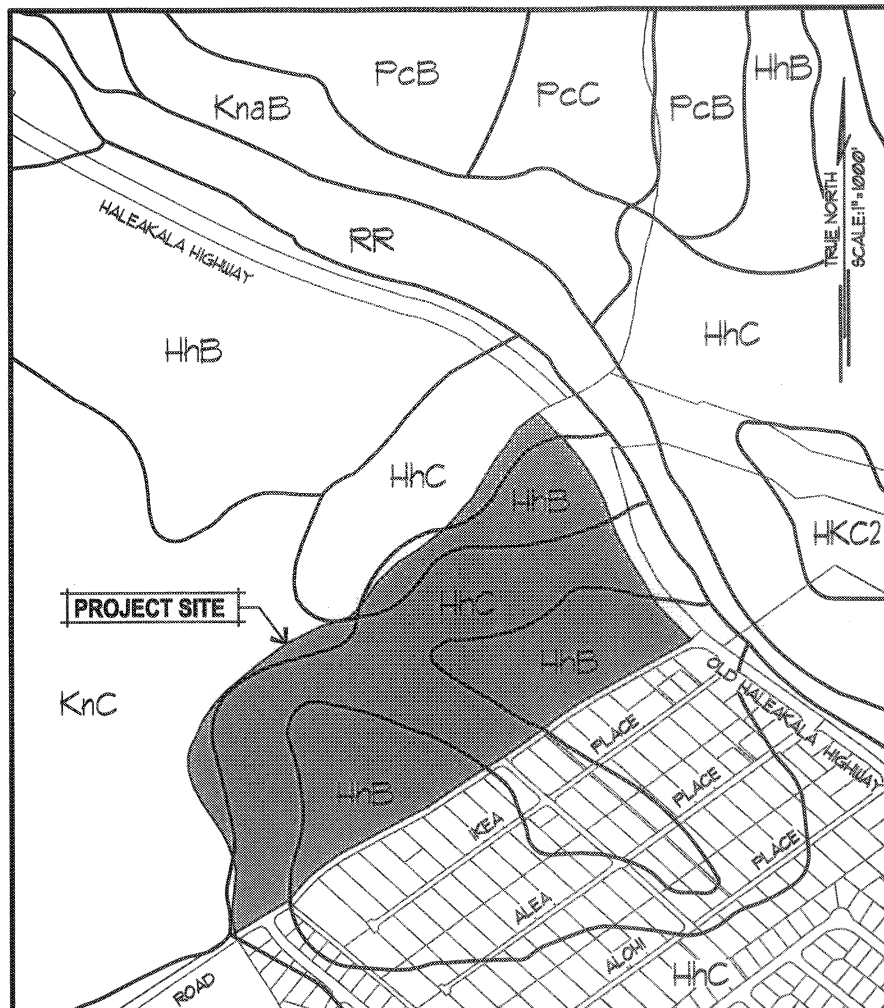
FILE : 0435-VIC-MAP.dwg / JOB No. 0435 / REVISED : 02/16/05



KAUHALE LANI

LOCATION MAP

FIGURE 2 FEBRUARY 2005



KAUHALE LANI

SOIL SURVEY MAP

FIGURE 3 FEBRUARY 2005

FILE : 0435-LOC-MAP.dwg / JOB No. 0435 / REVISED : 02/16/05

B. Proposed Improvements

Proposed improvements include 165 residential units, paved roadways, alleyways, a community park/recreation area, bike/pedestrian trail and landscaping. Associated improvements include underground water, sewer, drainage, electrical, telephone, and cable television systems.

III. DRAINAGE ANALYSIS

A. Methodology

This storm drainage analysis has been prepared in accordance with the "Drainage Master Plan for the County of Maui." The drainage area is less than 100 acres and not located in a sump area, therefore the Rational Formula and a storm recurrence interval (Tm) of 10 years will be used to calculate the estimated runoff from the site.

- Rational Formula:

$$Q = CIA$$

Where,
- Q = Flow rate in cubic feet per second (cfs)
- C = runoff coefficient
- I = rainfall intensity in inches per hour for a duration equal to the time of concentration
- A = Drainage area in acres

See Appendix A for Hydrologic Calculations.

B. Existing Conditions

There are two drainage ways that bound the project site. The A&B irrigation ditch traverses along the northern and western boundary of the project site. On the eastern boundary, a drainage swale adjacent to Old Haleakala Highway discharges to the irrigation ditch. The existing drainage pattern from the project site is generally for runoff to sheet flow from the south to the north toward and into the irrigation ditch.

It is estimated that the present 10-year, 1-hour runoff from the project site is 108.7 cfs.

C. Proposed Conditions

Onsite runoff will be collected by drain inlets, located at approximate intervals along the project roadways and diverted by drain lines to the onsite detention basins. The detention basins will be located within the park and open space

areas. See Figure 4. The post development 10-year runoff from the project site is estimated to be 152.2 cfs.

No additional runoff will be released into the existing drainage ways or onto Old Haleakala Highway. The net result of the proposed drainage improvements will be no increase in runoff from Kauhale Lani.

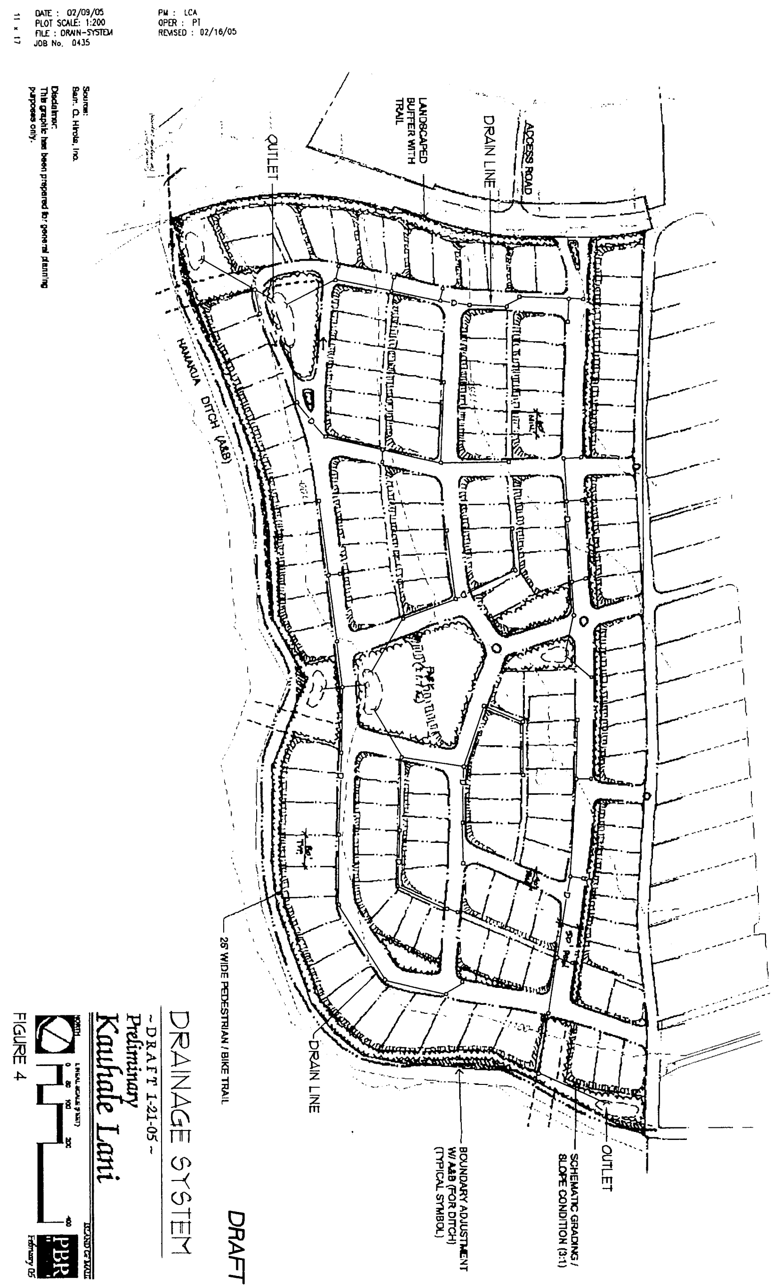
IV. CONCLUSION

Kauhale Lani is expected to generate a 10-year storm runoff of 152.2 cfs, with an increase of 43.5 cfs. The increase in onsite runoff will be diverted and detained in on-site detention basins located within the park and other open areas.

Onsite runoff will be intercepted by grated drain inlets and conveyed to on-site detention basins. The detention basins will be sized to accommodate the increase in runoff from Kauhale Lani. There will be no increase in runoff from the site flowing toward the makai properties or onto Old Haleakala Road. This is in accordance with Chapter 4, Rules for the Design of Storm Drainage Facilities in the County of Maui.

Therefore, it is our professional opinion that Kauhale Lani will not have an adverse effect on the adjoining or downstream properties.

The estimated construction cost for the drainage system is $2,670,000.



V. REFERENCES

A. Soil Survey of Island of Kauai, Oahu, Maui, Molokai and Lanai, State of Hawaii, prepared by U.S. Department of Agriculture, Soil Conservation Service, August, 1972.

B. Erosion and Sediment Control Guide for Hawaii, prepared by U.S. Department of Agriculture, Soil Conservation Service, March, 1981.

C. Rainfall-Frequency Atlas of the Hawaiian Islands, Technical Paper No. 43, U.S. Department of Commerce, Weather Bureau, 1962.

D. Flood Insurance Rate Maps of the County of Maui, June, 1981.

E. Chapter 4, Rules for the Design of Storm Drainage Facilities in the County of Maui, prepared by the Department of Public Works and Waste Management, County of Maui, 1995.

Engineering Solutions, Inc.
98-1268 Kaahumanu Street, Suite C-7
Pearl City, HI 96782
Phone: (808) 488-0477 Fax: (808) 488-3776

Project: Kauhale Lani
Job No.: 0435
Prepared by: LCA **Checked by:**
Date: 02/11/05

DRAINAGE CALCULATIONS (Existing and Developed Conditions)

Runoff Flow rate (Rational Method) - Q = CIA:
Q = Flowrate, cfs
C = Runoff Coefficient
I = Rainfall Intensity, in/hr for a duration equal to the time of concentration
T(c) = Time of Concentration
A = Drainage Area, acres

Assumptions:
10-yr 1-hr rainfall = 2.5 inches (Plate 4)
minimum T(c) = 5 minutes

Q Value for Designated Areas

Drainage Area No.	*Q (cfs)*	C*	T(c) *(min.)*	Corrected I**	A *(min.)*	Description	Discharges to:	Allowed
EXISTING CONDITIONS								
1	108.8	0.32	5.00 ***	6.80	49.99	Entire project site	A&B Irrigation Ditch	yes
TOTAL	**108.8**				**49.99**			
DEVELOPED CONDITONS								
1	44.0	0.53	8.00	5.60	14.80	Portion closest to Old Haleakala Hwy	A&B Irrigation Ditch	yes
2	77.2	0.53	7.40	5.80	25.09	Middle of the site, including the community center	A&B Irrigation Ditch	yes
3	31.1	0.53	7.40	5.80	10.10	Portion farthest from Haleakala HWY	A&B Irrigation Ditch	yes
TOTAL	**152.3**				**49.99**			

* Weighted C calculations
** Drainage Standards, Plate 2
***Worst case - use minimum T(c)= 5 minutes

Off-site runoff is assumed not to enter site; roadway between project property and the Old Pukulani Subdivision diverts off-site runoff towards the east and west boundaries of the project property.

APPENDIX A
HYDROLOGIC CALCULATIONS

Engineering Solutions, Inc.
98-1268 Kaahumanu Street, Suite C-7
Pearl City, HI 96782
Phone: (808) 488-0477 Fax: (808) 488-3776

Project:	**Kauhale Lani**		
Job No.:	**0435**		
Prepared by:	**LCA**	**Checked by:**	
Date:	**02/11/05**		

DRAINAGE CALCULATIONS

Determination of "C" Value *(Drainage Standards, Table 1)*

EXISTING CONDITIONS

Infiltration	0.07	(medium)
Relief	0.03	(rolling)
Vegetal Cover	0.07	(none)
Development Type	0.15	(agriculture)
Total "C" Value	0.32	

DEVELOPED CONDITIONS

Infiltration	0.07	(medium)
Relief	0.03	(rolling)
Vegetal Cover	0.03	(none)
Development Type	0.4	(agriculture)
Total "C" Value	0.53	

Engineering Solutions, Inc.
98-1268 Kaahumanu Street, Suite C-7
Pearl City, HI 96782
Phone: (808) 488-0477 Fax: (808) 488-3776

Project:	**Kauhale Lani**		
Job No.:	**0435**		
Prepared by:	**LCA**	**Checked by:**	
Date:	**02/11/05**		

DRAINAGE CALCULATIONS

Determining Time of Concentration

EXISTING CONDITIONS *(Drainage Standard, Plate 3)*

longest length	1020
top elevation	1158
bottom elevation	1088
H (diff in elevation)	70

Tc = 0.0078*(K^0.77) (Little or no cover)
where, K= ((L^3)/H))^(1/2)

Tc = 4.60

DEVELOPED CONDITIONS *(Drainage Standard, Plate 1)*

AREA	Longest Length ft	Top Elevation ft	Bottom Elevation ft	Elev. Diff ft	Slope %	Cover Type	Tc min
1	1115	1174	1104	70	6.3%	paved	8
2	1005	1166	1088	78	7.8%	paved	7.4
3	800	1128	1088	40	5.0%	paved	7.4

M

Preliminary Electrical Engineering Report

FINAL KAUHALE LANI SUBDIVISION PRELIMINARY ELECTRICAL ENGINEERING REPORT
Prepared by MK Engineers, Ltd.
For Engineering Solutions, Inc.
March 21, 2005

GENERAL

This due diligence report addresses the electrical, telecommunications and cable television system facilities. A new residential community is being considered for development in Pukalani. The property appears to be former agricultural land and is located near the fork formed by Haleakala Highway and the Old Haleakala Highway on the makai side of Pukalani. The northwest-southeast or Paia side border of the community site is bounded by the Old Haleakala Highway, the northeast-south west or mauka border is bounded by an existing residential subdivision, the southeast-northwest or Wailuku and the southwest-northeast or makai side of the border is bounded by agricultural land.

The Kauhale Lani community will consist of approximately 165 single family homes and a neighborhood park consisting of recreational courts/fields.

EXISTING SYSTEMS AND POSSIBLE POINTS OF CONNECTION

Electrical System

A Maui Electric Company, Inc. (MECO) primary electrical distribution overhead pole-line is routed along the Old Haleakala Highway on the side opposite the community site. MECO will serve the community with a new underground line extension originating from the existing overhead line.

Telecommunications System

Verizon Hawaii, Inc. telephone service in the area of the community is also overhead. The telephone lines are on joint poles on the southwest or Wailuku side of the old Haleakala Highway. The cable system serves the residential subdivision located mauka of the project site. The telephone cables presently end at the makai end of the existing subdivision (mauka of the Kauhale Lani site). The Pukalani area is served by the Makawao Central Office and Verizon presently has fiber optic lines extending to Pukalani Street. It is anticipated that telephone service will be extended to the Kauhale Lani community by extending the fiber optic cable on poles to "pair-gain" equipment at the site. Service to the site will be from a pole. A telephone equipment lot approximately 15' X 20' will be required for the pair gain equipment. Verizon will probably require a perpetual easement in their favor for the lot.

Cable Television System

Oceanic Time Warner Cable (TW Cable) CATV system in the area of the Kauhale Lani community is also overhead. The CATV cable shares the same poles as the telephone and electrical distribution system. CATV cable presently ends at the makai side of the

existing subdivision (mauka of the Kauhale Lani site). TW Cable has indicated that CATV service will be extended to the community from the existing overhead pole-line.

PROBABLE OFF-SITE IMPROVEMENTS

Electrical System

No off-site electrical improvements are anticipated. MECO has indicated that they will serve the community from existing primary electrical lines that go past the site. MECO indicated that upgrades to their transmission and distribution systems will not be required.

Telecommunications System

Verizon Hawaii may have to install fiber optic cables from Pukalani Street to the community site. They will probably be installed on the existing joint poles and follow existing cable routing. Typically, Verizon offsite work costs are not passed on to the developer.

Cable Television System

No significant off-site CATV system improvements are anticipated.

Lighting

Off site lighting for new intersections will comply with Illuminating Engineering Society (IES) Standards.

ON-SITE DEVELOPMENT

Electrical System

Electrical distribution system will consist of underground duct lines with manholes, hand holes and pull boxes. There will be one or two pad mounted switches (1 each 9' X 15' or 2 each smaller sized easements) and several transformer pads (6' X 7' easements). These will require perpetual easements in favor of MECO. Underground primary distribution and secondary distribution cables will be installed in duct systems. The developer will be required to install the ducts, manholes, hand holes, pull boxes and equipment pads. MECO will install their cables and equipment to serve the new housing units. MECO will require payment of a customer contribution for installation of the underground facilities.

Telecommunications System

The on-site telecommunications system will consist of underground duct lines, manholes, hand holes and pull boxes. There may be a requirement for a 15' X 20' easement in favor of Verizon Hawaii, Inc. for installation of "pair gain" equipment to serve the new development. The developer will be required to install the ducts, manholes, hand holes, pull boxes and equipment pads. Verizon Hawaii, Inc. will install their cables and equipment to serve the new housing units. There will probably be no charges for the telecommunications system installation.

Cable Television System
The on-site CATV system will consist of underground duct lines, manholes, hand holes and pull boxes. There will probably be a requirement for a 4'X 4' easement in favor of Oceanic Time Warner Cable for installation of a power supply pedestal for this development. TW Cable has indicated that there will be no charge for cable installation assuming that the developer provides the underground facilities for the CATV system.

Public Street Lighting Systems
Illuminating Engineering Society recommendations for lighting roadways will be used in development of illumination concepts for the development.

Private Roadway or Alley Lighting System
It is proposed that the private roadways or alleys be illuminated with building mounted lighting fixtures that are controlled by photo switches. The lighting fixtures will be powered from the individual resident's home electrical system. Pole or other lighting fixtures may be utilized if building layouts and locations do not lend themselves to use of building mounted lighting fixtures. The illumination system selected must be carefully coordinated between designers of the roadways and infrastructure and the designers of the homes.

Neighborhood Park
Electrical, telephone and CATV service to the neighborhood park will be underground. It is proposed that a room in the community center facility be dedicated for the electrical, telephone and CATV equipment. If the play courts are illuminated, switching and lighting controls may be installed in the room.

Photovoltaic (PV) Power Systems
If photovoltaic power systems are utilized, it is recommended that the photo-voltaic cell array be installed on the pavilion roof, and that inverter and other controls be installed in a dedicated room. The PV system may be connected using appropriate metering and interface devices to the MECO power system. (Web link to PV system supplier - http://www.solarsupply.com/HOME1.htm)

Wastewater Pumping Stations
The proposed wastewater pumping stations will be powered from the commercial power source and a back-up diesel -generator. Sound attenuation features for the generator will be included. A monitoring system to signal pump or power failure will be included. The monitor could consist of an automatic dialer that calls certain telephone numbers under alarm conditions. In some instances, monitoring by the county may be required. These requirements will be determined as the design progresses.

Wastewater Treatment Plant
The proposed wastewater treatment plant will be powered from the commercial power source and a back-up diesel -generator. Sound attenuation features for the generator will be included. Supervisory, Control, and Data Acquisition System (SCADA) will be provided for monitoring and control.

Electrical Demand
The estimated electrical demand for the Kauhale Lani community, including the wastewater pumping stations and wastewater treatment plant, is 1,250 kVA. Following is a preliminary load tabulation:

Project Electrical Loads	Qty	Unit	Unit Load (kVA)	Total Load (kVA)
Single Family Dwellings	165	EA	7.0	1,155
Neighborhood Park and Community Center	1	EA	30.0	30
Sewage Lift Stations	2	EA	25.0	50
Roadway Lighting	82	EA	0.1	8
Total Load				1,243

This calculation assumes that dwellings will have all-electric appliances, solar water heating, limited air conditioning consisting of up to two window units or localized split systems.

Pre-Design Estimate of Electrical, Telecom and CATV Systems Infrastructure:
Estimated electrical, telephone and CATV system infrastructure and roadway lighting construction cost will be in the $500,000 to $600,000 range. MECO has provided an informational letter indicating that the approximate charges to developer will be $250,000.

END

Kauhale Lani Subdivision
Preliminary Electrical Engineering Report
March 21, 2005