DRAFT ENVIRONMENTAL ASSESSMENT

Prepared in Accordance with Chapter 343, Hawai‘i Revised Statutes

Makawao Avenue and Makani Road Improvements (Eddie Tam Gym to Kalama Intermediate School) STP-0900(72) Makawao, Maui, Hawai‘i

TMK 2-4-06, 2-4-18, 2-4-22, 2-4-34 Various Parcels

September 25, 2009

Department of Public Works
County of Maui

DRAFT ENVIRONMENTAL ASSESSMENT

Makawao Avenue & Makani Road Improvements (Eddie Tam Gym to Kalama Intermediate School) STP-0900(72) Makawao, Maui, Hawai‘i

TMK 2-4-06, 2-4-18, 2-4-22, 2-4-34 Various Parcels

September 25, 2009

PREPARED FOR:
Department of Public Works
County of Maui
200 South High Street
Kalana O Maui Bldg 4th floor
Wailuku, Hawai‘i 96793

PREPARED BY:

R.M. Towill Corporation
2024 North King Street, Suite 200
Honolulu, Hawai‘i 96819
1-20875-0P

TABLE OF CONTENTS

Appendices

A. List of Properties Abutting the Project Area

B. Cultural Surveys Hawai‘i, Inc., (2008). “An Archaeological Literature Review and Field Inspection Report for the Proposed Makawao Avenue and Makani Road Improvements, Hāmākua Poko Ahupua‘a Makawao District, Maui Island.”

C. Detailed Listing of Grants Grouped by County, April 2009
United States Department of the Interior, National Park Service Land and Water Conservation Fund, (2009). “Detailed Listing of Grants Grouped by County”.
http://waso-lwcf.ncrc.nps.gov/public/index.cfm

D. Environmental Noise Assessment Report Makawao Avenue/Makani Road Improvements, May 2008

E. Makani Road – Makawao Avenue Traffic Study, September 2007.

LIST OF FIGURES

LIST OF TABLES

PROJECT SUMMARY

Project:	Makawao Avenue and Makani Road Improvements (Eddie Tam Gym to Kalama Intermediate School) STP-0900(72)
Proposed Action:	Roadway widening and associated improvements
Applicant and Proposing Agency:	Department of Public Works, Engineering Division, County of Maui. Contact: Cary Yamashita, Engineering Division Chief
Agent:	R.M. Towill Corporation 2024 N. King Street, Suite 200 Honolulu, Hawai‘i 96819-3494 Contact: Mr. Chester Koga, Phone: (808) 842-1133 Email: chesterk@rmtowill.com
Project Cost:	$10 million
Project Location:	Makawao, Maui
Recorded Fee Owner:	County of Maui and various landowners (land acquisition required for wider roadway right-of-way)
Tax Map Key:	TMK 2-4-006, 2-4-018, 2-4-022, 2-4-034 Various Parcels
Land Area:	App. 180,000 square feet (4.1 acres)
Present Use:	Roadway, park and residential
State Land Use District:	Agricultural, Rural & Urban
Zoning:	RU-.5, R-1, R-2, R-3, P-1, and PK-2
Special Management Area:	No
Permits Required:	Grading and Grubbing Permit, Perform Work on County Highway Permit, NPDES (Dewatering) Permit, Street Usage Permit, Plan Review - Department of Water Supply and Maui Planning Department, Community Noise Control, Disability and Communication Access Board
Anticipated Determination:	Finding of No Significant Impact (FONSI)

Section 1 Background and Purpose

1.1. Project Overview

The Department of Public Works, County of Maui, proposes to improve a portion of Makawao Avenue and Makani Road for the purpose of improving capacity along both roadways to accommodate existing and projected traffic demand. Currently these two roads do not have designated turning lanes, nor facilities for pedestrians, thus presenting potentially hazardous conditions for pedestrians and roadway congestion during peak periods. The proposed project will enhance the flow of traffic along both roadways by creating in-bound and out-bound turning lanes at the intersection of the two roads, as well as establishing dedicated left turn-in lanes along the project length of both roadways. The creation of bicycle lanes and pedestrian sidewalks will increase safety of non-motorized users along the two roadways. The project will include increasing the existing right-of-way (ROW) to accommodate roadway widening, installation of curbs, gutters, landscaping, bicycle lanes and sidewalks on both sides of the roadway, installation of street lights, relocation of utilities, and drainage improvements.

The initial development and planning of the proposed project has resulted in several studies of the area, including a noise assessment, traffic assessment, archaeological study, and ongoing consultations with federal, state, and county agencies to ensure compliance with established plans, policies, and guidelines applicable to this area of Maui. This Environmental Assessment addresses potential physical, social, environmental, and economic impacts of the proposed project on the Island of Maui, fulfilling the requirements of Chapter 343, Hawai‘i Revised Statutes (HRS), and all applicable legislation.

1.2. Project Description

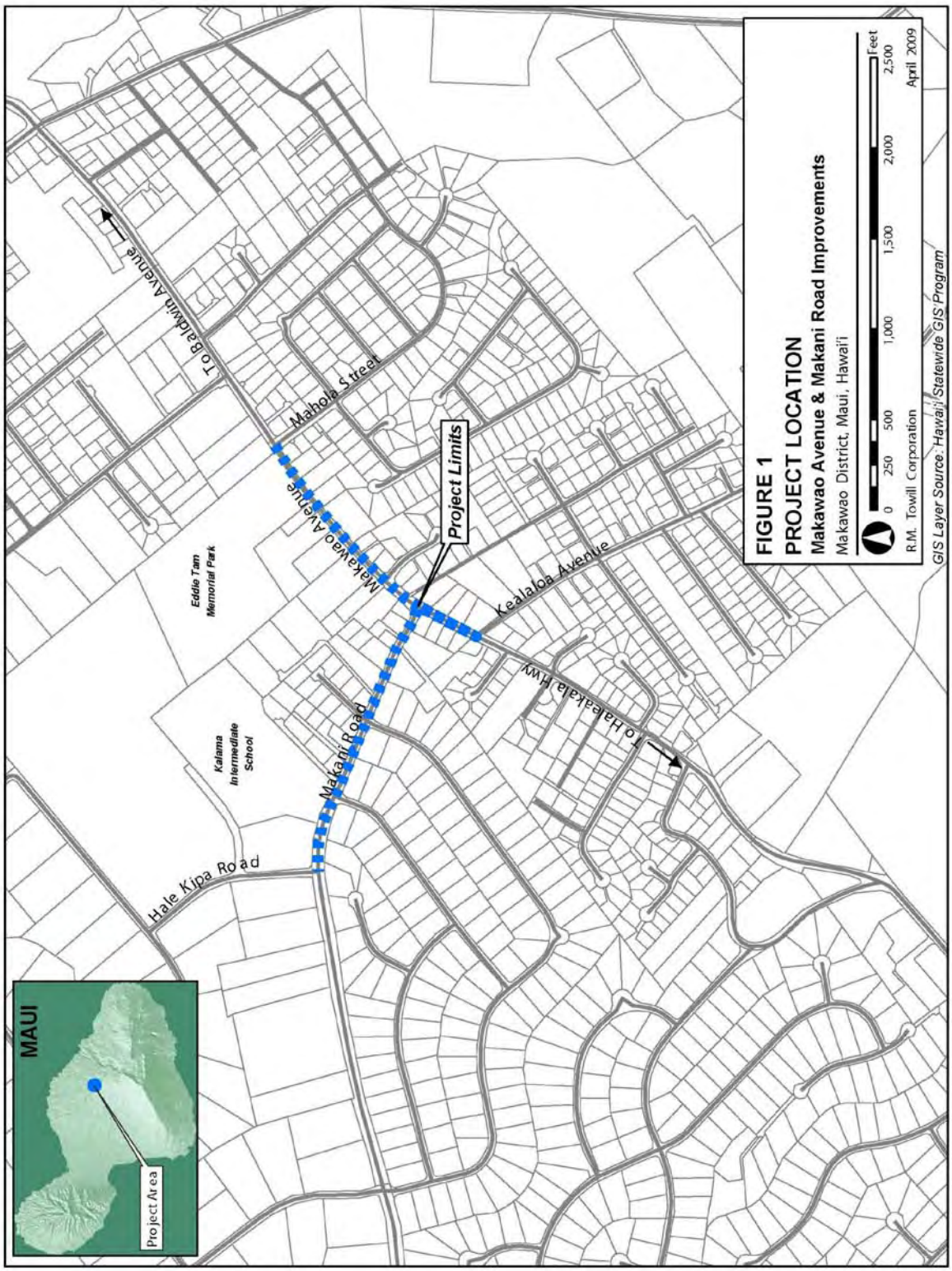
1.2.1. Project Location and Site Characteristics

Makawao Town, where the proposed project will take place, is located approximately 10 miles southeast of Kahului Airport on the northern slope of Mount Haleakalā in Maui’s Makawao district. The town is north of Haleakalā Highway and is bordered to the southwest by Pukalani Town. Makawao Avenue is a 3.2 mile long two-lane collector road connecting Makawao Town’s residential district to Pukalani and Haleakalā Highway (**Figure 1**). The posted speed limit for Makani Road in the project area is currently 20 miles per hour (mph). The Makawao Avenue speed limit is 30 mph (20 mph from 7 a.m. to 6 p.m. on school days near the intersection with Makani Road).

The Upcountry towns of Maui were previously farming and ranching communities that have grown over the years as rural areas where residents could settle down and still be within commuting distance from employment centers, such as Kahului and Wailuku. With the population expected to rise in the next 20 years (Maui County General Plan Update, 2008), Makawao Town and Pukalani Town (collectively known as “Upcountry”) are poised for development as infrastructure capacity to accommodate this increase.

.

Figure 1 Project Location



At the intersection of Makani Road and Makawao Avenue, the existing road section includes a single lane on each approach with no turning lanes to accommodate in-bound and out-bound travelers along the two roads. The roadways currently have 10-foot travel lanes with no dedicated turning lanes, which causes congestion problem during peak traffic hours of the day. **Figure 2A** and **2B** show recent images of the project area along Makawao Avenue and Makani Road, including where the two roadways intersect. As is evident by the photos, the roads have minimal to no areas designated for inbound and outbound maneuvering of motor vehicles.

1.2.2. Proposed Project Activities

The County of Maui proposes to make roadway improvements along an approximate length of 1,560 linear feet of Makawao Avenue, 1,580 linear feet of Makani Road and improvements to the intersection of the two roadways. Two main sections have been identified in the project scope and together form the "project area." The first section begins at the intersection of Makawao Avenue and Mahola Street and continues southwest along Makawao Avenue until it intersects Kealaloa Avenue (**Figure 1**). The second section includes the intersection of Makawao Avenue and Makani Road and continues northwest along Makani Road to its intersection with Hale Kipa Road in front of Kalama Intermediate School (**Figure 1**).

The existing ROW of the two roads will be widened to accommodate additional dedicated turning lanes as well as wider travel lanes and non-motorist (bicycle and pedestrian) lanes. Consequently, the County of Maui must acquire portions of properties abutting the roadways. The distance from such areas to the existing ROW boundary ranges from one to nine feet. Once the Roadway Plan is finalized, addressing county zoning issues and providing equitable share of costs to lot owners, all affected parties along the two roadways will be notified and a formal property appraisal and acquisition process will begin. A list of all properties abutting the existing project area ROW is provided in **Appendix A**. Construction work of the widened motorized travelways will proceed as follows: resurfacing of existing asphalt pavement, removal of utility structures, grading of roadway surfaces, paving of roadways, reinstallation of utility lines on the edge of the ROW and repainting of roadway markings.

In addition to improving motor travelways along the road sections, the preferred alternative for the project will establish dedicated 4-foot wide bicycle lanes and 5-foot wide pedestrian walkways along both sides of each roadway. The progression of construction work for the new bicycle and pedestrian facilities will be as follows: removing impediments within the newly-acquired ROW areas, grading and filling of the surface to match roadway grades, installing drainage lines, constructing curbs and gutters, paving of the pedestrian sidewalks, and painting of bicycle lane markings.

Figures 3A, 3B and 3C show the proposed roadway cross-sections along with the proposed ROWs.

Figure 2A Site Photographs

Figure 2B Site Photographs

Figure 3A Typical Roadway Sections on Makawao Avenue

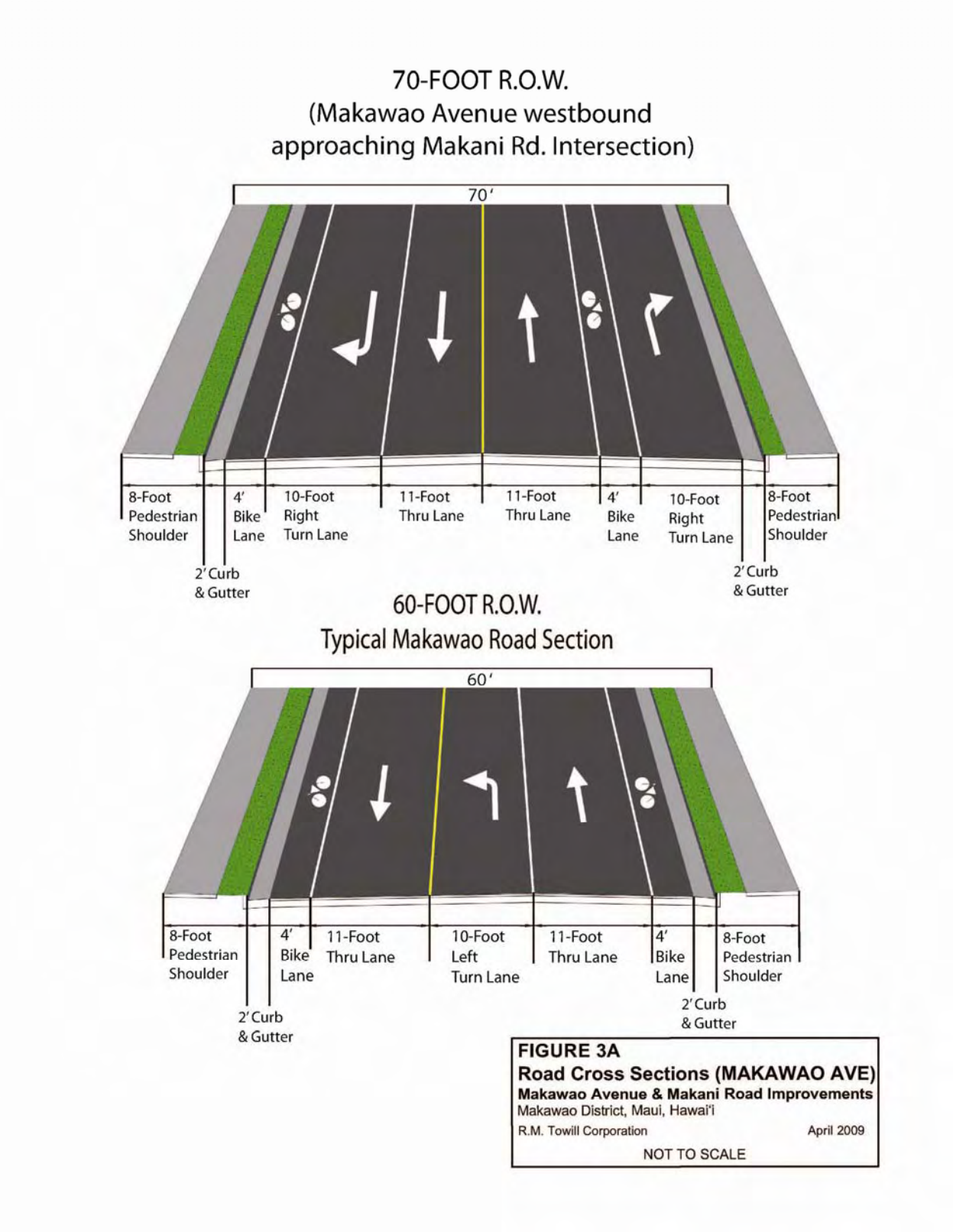


Figure 3B Typical Roadway Sections on Makani Road

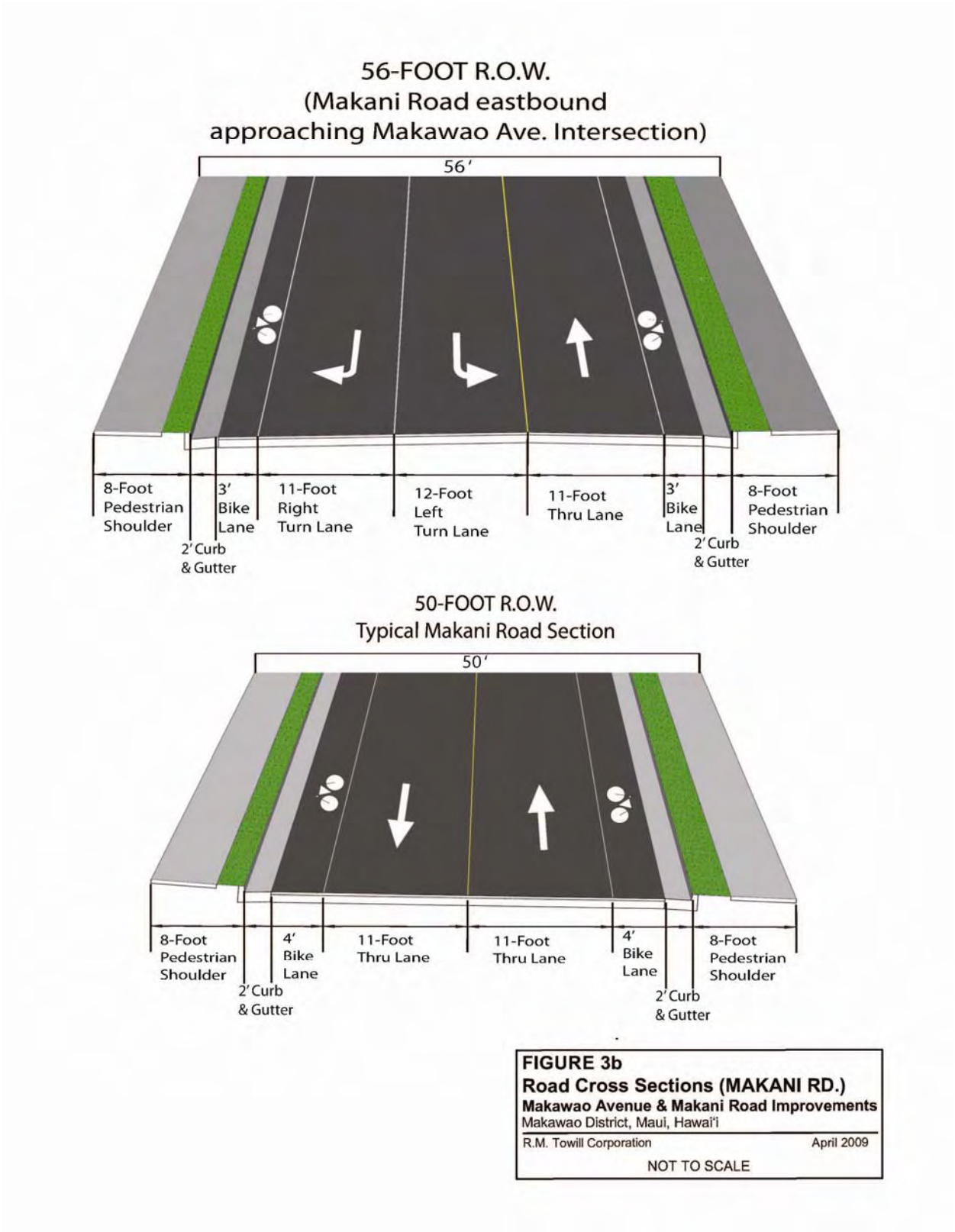
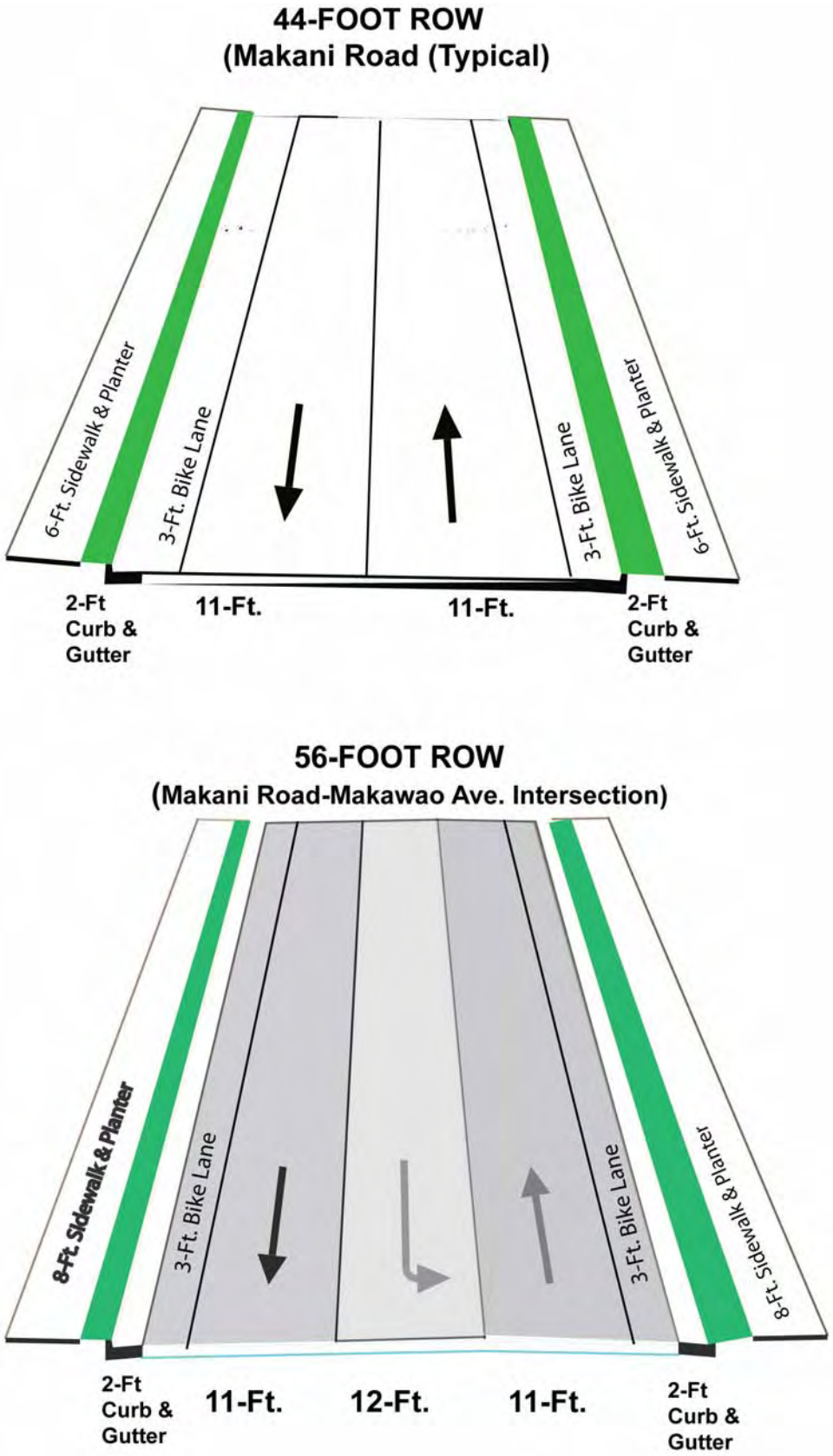


Figure 3C Typical Roadway Sections on Makani Road



1.2.3. Project Schedule and Cost

The proposed project is estimated to begin in June 2011 and last approximately one year from the beginning of construction to completion of all project-related activities. The total cost is estimated to be $10 million. Funding for the project will be provided through County of Maui capital improvement funds, as well as a federal grant from the State Department of Transportation, Highways Division.

Section 2 Alternatives and Preferred Plan

Several design and construction alternatives were identified and evaluated during the planning phase of this project. Major factors under consideration included existing properties and new ROW requirements, potential historic sites and public road safety. One alternative was to construct the road without designated bicycle lanes (see Figure 3C). Another proposed to shift the roadway ROW as needed to avoid existing structures that were identified by the archaeological assessment as potentially historic sites. Additional alternatives proposed were delaying construction of the roadway altogether while further alternatives were developed and halting the project altogether.

After evaluating project issues and factoring in concerns voiced by all project stakeholders, a preferred alternative was developed that would provide mitigation of impacts and benefit both the Upcountry community and roadway users. The following subsections outline alternatives evaluated throughout the planning stages of the proposed project. Each alternative addresses the potential issues that arose as a result of consultation and discussions with community and agency officials and stakeholders. Additionally, reasons for rejecting each proposed alternative are provided.

2.1. Road Widening Without Bicycle Lanes

During consideration of possible project alternatives, the design concept featuring the widening the two roadway ROWs raised an important issue regarding the lots abutting the roadways, and whether these lot owners would be losing portions of their property as a result. To completely avoid this issue, while still retaining the objective of widening the roadways, an alternative was evaluated that excluded bicycle lanes between the pedestrian walkways and the new roadways in favor of a shared roadway (see Figure 3C).

With this alternative, the existing ROW width would be retained. The 8-foot shoulder, used to establish pedestrian walkways between the planned bicycle lanes and the ROW boundary, would be reduced from 8 feet to 6 feet allowing the travelway to be increased from 11 feet to 14 feet allowing the creation of a shared roadway on Makani Road. This configuration would consequently require the removal of the designated 4-foot bicycle lanes and reconfiguring the proposed roadway sections to include pedestrian walkways throughout the proposed project length.

This alternative, which excludes designated bicycle lanes on Makani Road, was evaluated in a series of discussions in which identified one drawback. Although this alternative avoids possible need for acquisition of lot portions alongside the roadways, it would fall short of fulfilling several policies and plans. Specifically, the Maui General Plan and the Makawao-Pukalani-Kula Community Plan which seek to expand and enhance the network of bike paths and bikeways throughout the island and its communities. Further, Hawai‘i State Department of Transportation plans call for multi-modal transportation infrastructure to support diversified means of travel. Excluding the bicycle lanes from the project design would require the signing the roadway as a bike route to meet the stated goal of modal diversity and to share a common travelway.

2.2. Shifting of Roadway Sections

A second alternative would be to shift the road, one side or another, to avoid disturbance of potential historic sites documented during an archaeological assessment of the proposed project area (Cultural Surveys Hawai‘i, 2008). Under this scenario, the new roadway would be shifted approximately 10 feet toward the opposite side of the location of the three structures identified as potential historic sites (see **Section 3.5**) to accommodate the wider ROW. Due to the locations and positions of these sites, shifting the roadways to avoid the sites would ultimately require the acquisition of existing residential structures and taking of park land, which would incur additional costs and potentially rendering the project unfeasible.

Even if all structures were avoided, another consideration is roadway design, which requires following safety guidelines pertaining to road curvature and site distances. Because the sites are close to each other, and on opposite sides of Makawao Avenue, the planned shifting and redesigning of the road would ultimately incur much higher overall costs. These would include expense of displacing existing residences in addition to the cost of construction. Finally, there is the possibility of creating substandard lots during the process of shifting the road alignment to avoid the structures. For these reasons, this alternative was rejected from further consideration.

2.3. Delayed Action

A third alternative considered during planning of the project was to delay activities indefinitely until an alternative was identified that would address all issues and concerns surrounding the proposed project. Under this alternative, construction activities would not commence until a suitable alternative was found. However, in this case, alternatives are limited, as it is a simple widening of the road and establishment of pedestrian pathways. If it were an issue of doubling the capacity of this current road, the alternative of delaying action until other designs were considered might be feasible.

Delaying action on the roadway project would only prevent the timely realization of beneficial community infrastructure. Another consideration is the timeline in which federal funds are available for a project. Most federally-funded projects have time limits in which the funds must be spent on project-related activities, or be returned to the grantor. The combination of these issues indicated that delaying the project would not result in a better project, and might even result in the loss of a funding source. Therefore, this alternative was rejected from further consideration.

2.4. No Action

Another alternative considered was to completely halt all project-related activities and retain the roadways in their current conditions. With this alternative the potentially historical finds that were discovered during the archaeological site assessment would be left as-is. On the other hand, the expenditure of human, monetary, and energy resources relating to this project would be diverted elsewhere, while the traffic congestion as well as traffic and pedestrian safety would not improve. Additionally, since federal funds intended for road improvements cannot be redirected to other capital improvement projects once they have been earmarked for a project.

Capital improvement projects are intended to better the lives of the communities in which they are proposed. The no-action alternative is inconsistent with the overall objectives of the community as a whole, as well as those of the County of Maui and the State of Hawai‘i. Lack of action in the project would only result in a loss of potential improvement of the community’s infrastructure. Based on all of these considerations, this alternative was rejected.

2.5. Preferred Alternative

It is likely that the most significant aspect of the proposed project is the widening of the existing roadway ROW of both Makawao Avenue and Makani Road. The significance of the widening aspect is that ROW widening will require the acquisition of small sections of lots abutting both roadways. The proposed widening of the roadways will result in the increase of the width of the Makawao Avenue ROW from the existing 44 feet to 60 feet, and the increase of the Makani Road ROW from the present 44 feet to 50 feet. Additionally, under the Preferred Alternative the ROW at the intersection of the two roadways will be increased to 70 feet (Makawao Avenue) and 56 feet (Makani Road).

Both roads have requirements for widening and will call for acquisitions ranging from 1 to 9 feet to increase the ROW (see **Figure 4**A-D). Mitigation measures for these required actions are discussed in Section 3 of this document. The final roadway configuration conforms to strict roadway standards required of all federally-funded road projects, and would support the objectives and policies outlined in state, county, and Community Plans. Also, it would increase the safety of all travelers along the roadways, whether motorized or non-motorized. Traffic congestion would be eased by establishing dedicated turn-in lanes, while bicyclers, pedestrians, and joggers would feel safe traveling within their dedicated pathways.

Figure 4A Tax Map Plan 2-4-006

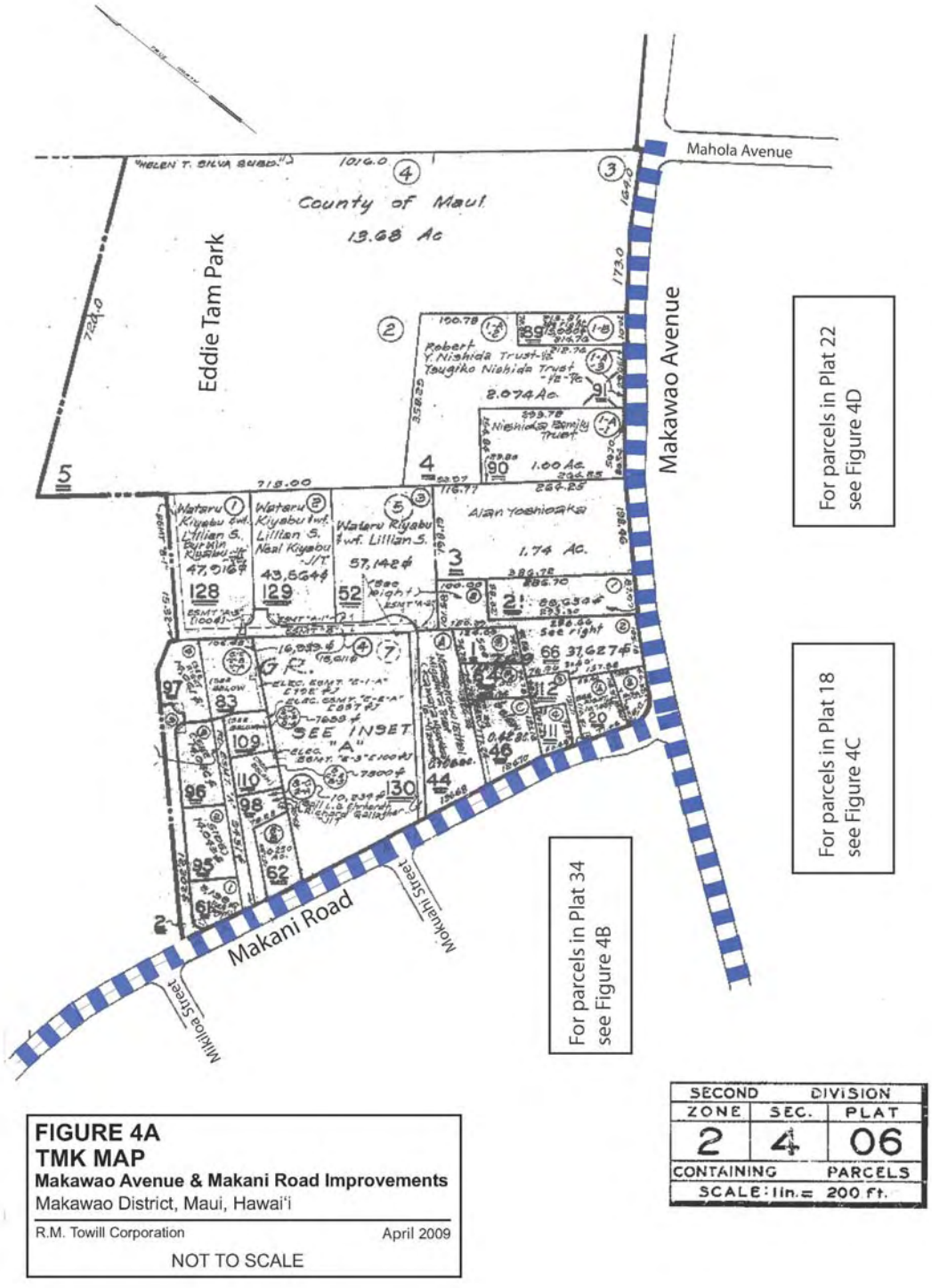


FIGURE 4A
TMK MAP
Makawao Avenue & Makani Road Improvements
Makawao District, Maui, Hawai'i

R.M. Towill Corporation April 2009

NOT TO SCALE

Figure 4B Tax Map Plan 2-4-034

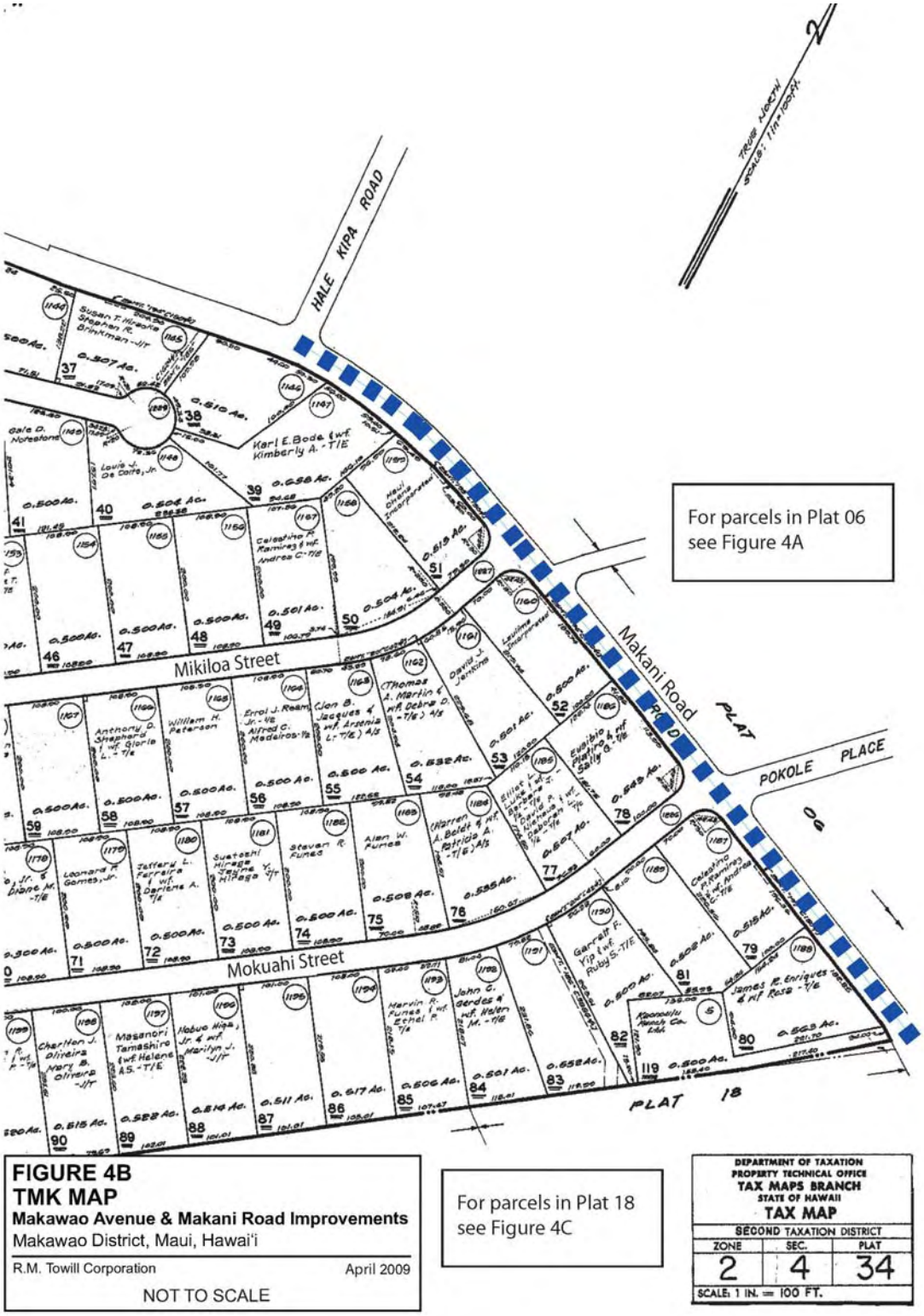


Figure 4C Tax Map Plat 2-4-018

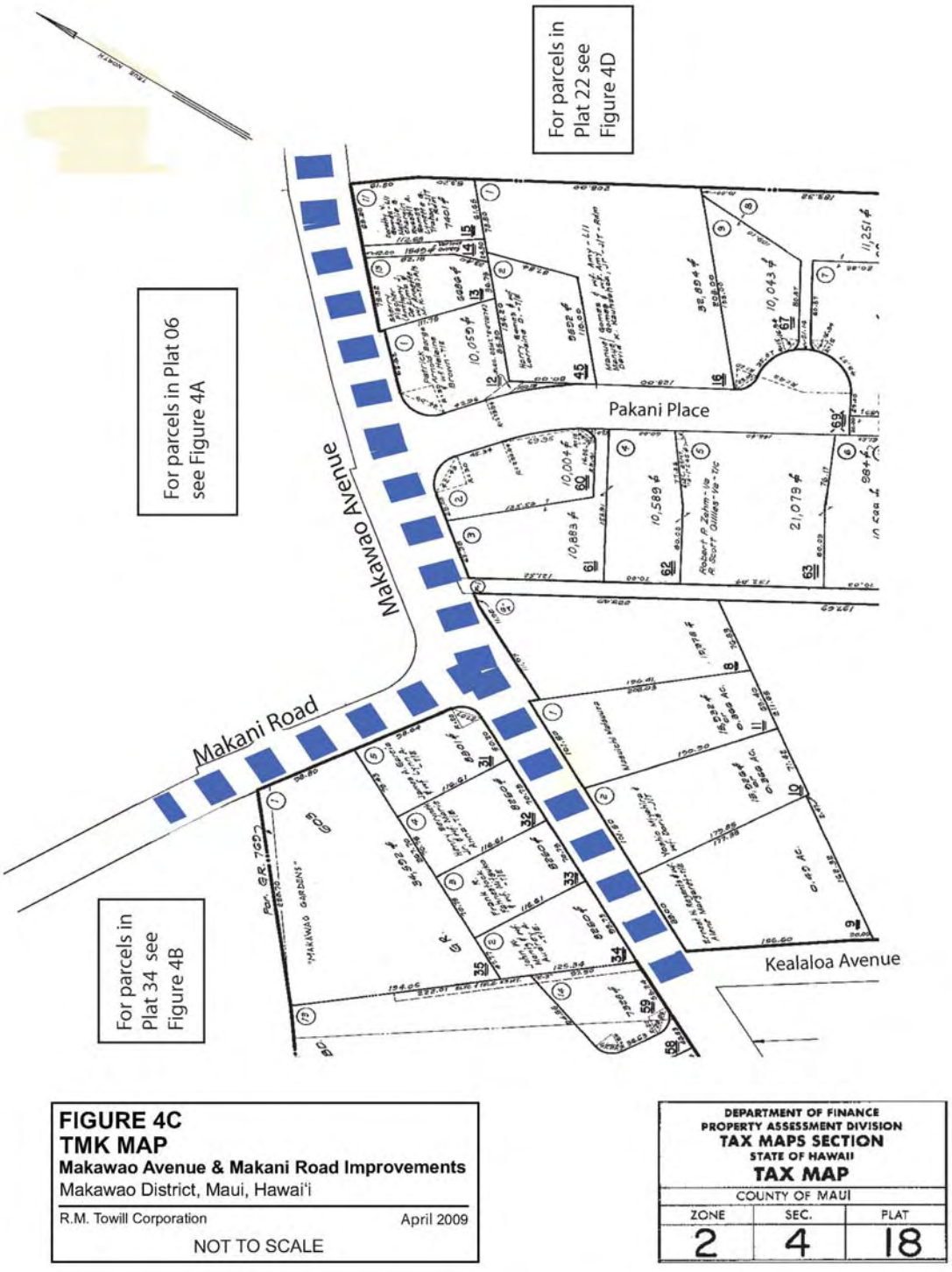


Figure 4D Tax Map Plat 4-2-022

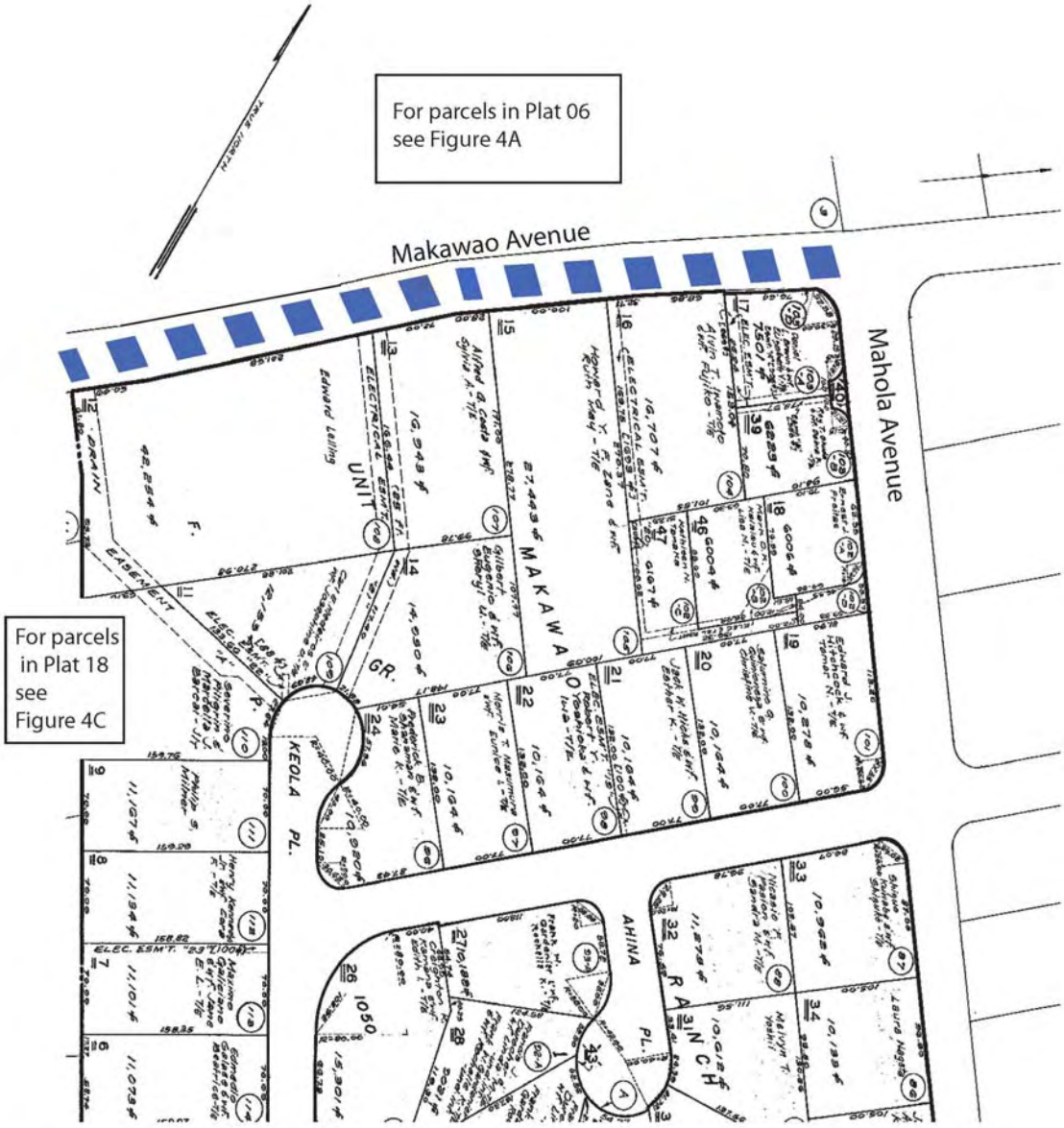


FIGURE 4D
TMK MAP
Makawao Avenue & Makani Road Improvements
Makawao District, Maui, Hawai'i

R.M. Towill Corporation — April 2009

NOT TO SCALE

DEPARTMENT OF TAXATION
PROPERTY TECHNICAL OFFICE
TAX MAPS BRANCH
STATE OF HAWAII
TAX MAP

SECOND TAXATION DISTRICT

ZONE	SEC.	PLAT
2	4	22

Section 3
Existing Conditions, Environmental Consequences, and Mitigation of Impacts

3.1. Climate and Geology

Existing Conditions

Rainfall accumulation within the project area averages between 40 and 60 inches per year with the heaviest rainfall occurring during the winter months and with moderate rainfall during the summer months (Atlas of Hawai‘i, 1998). Average temperatures in the project area range from the mid 50’s to the mid and high 70 degrees Fahrenheit. Winds are generally northeasterly trades with southerly Kona storm winds occurring from October to April.

The project area is located along the westward-facing slope of Mount Haleakalā at an average elevation of 1,600 feet above mean sea level (amsl), and consists mainly of soils of the Hāli‘imaile (HgB & HhC) and Makawao Series (MfC). These soil series are found on the uplands on the Island of Maui, mainly within elevations between 500 and 2,000 feet amsl (Soil Survey, 1972). **Figure 5** shows the distribution of soil types in the immediate area.

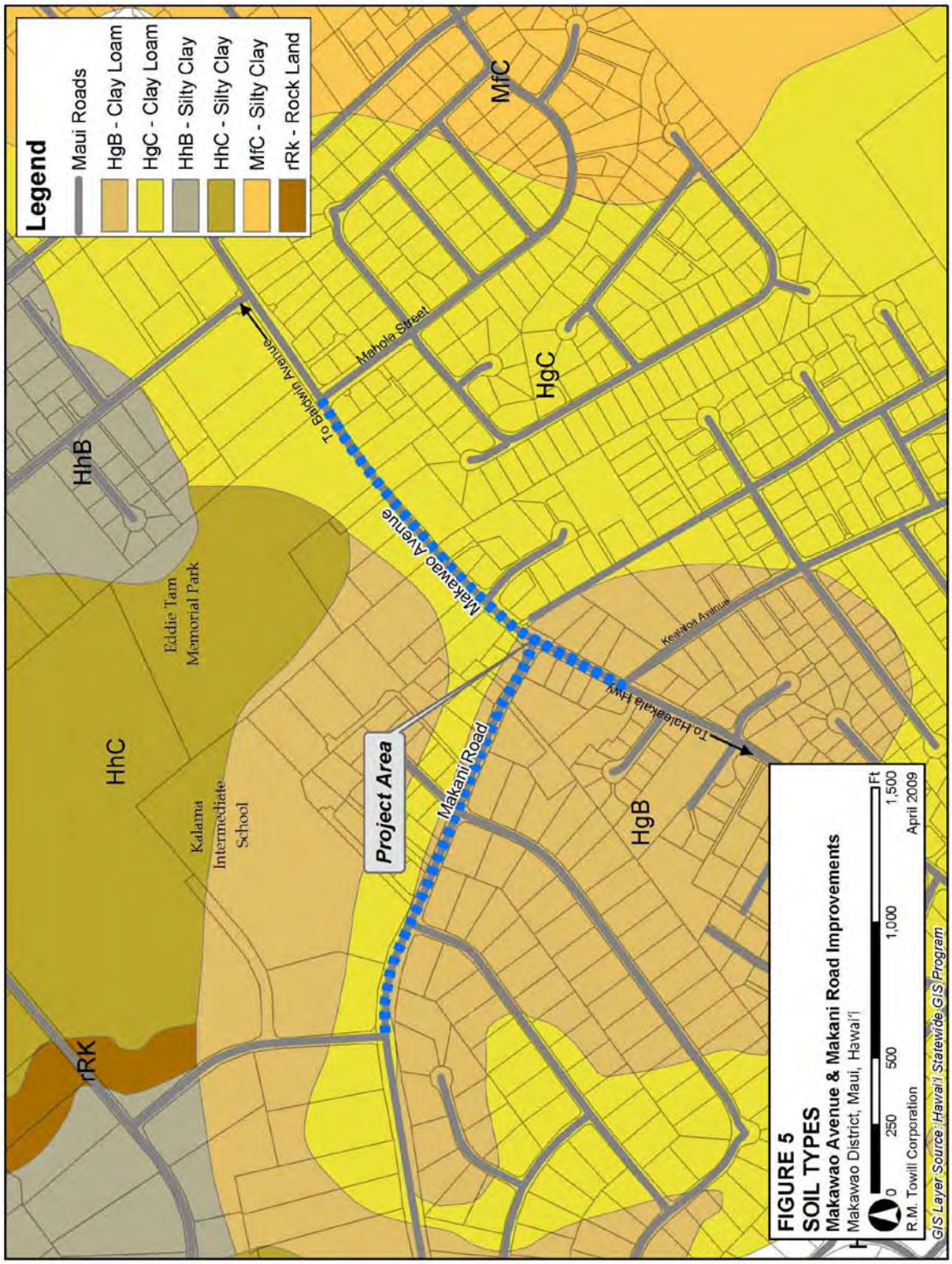
Both Hāli‘imaile and Makawao series soils have a surface layer of dark reddish-brown silty clay. Their substratum is dark reddish-brown and very dark grayish-brown clay. The specific soils found within the project area are Hāli‘imaile silty clay loam (Hg) of two different types (B and C), which are distinguished by their slopes, the latter being of higher slopes. Hāli‘imaile soils are characterized by medium runoff and a moderate erosion hazard (Soil Survey, 1972).

Impacts and Mitigation Measures

The proposed roadway improvements will not impact local climate. The project will not alter the local soil profile. Best Management Practices will be established to avoid or minimize potential soil erosion.

As with most construction work involving earthmoving activities, there is a likelihood that clearing and grading work will result in temporarily uncovered soils in the project site while other activities are carried out within these areas. Effective coordination and management of construction work, to minimize the time an area is left open, will ensure that soils are not transported outside the site. However, meteorological occurrences, such as rainstorms, are not always predicted. To reduce any impacts resulting from the erosion of existing soils that may occur during the project, the following Best Management Practices (BMPs) will be in place and monitored at all times during construction.

Figure 5 Soils Map



Fill materials will be comprised of excess excavated soils and/or clean imported fill. All materials used will be in accordance with specifications for construction of such facilities by the state and county. No materials containing contaminated soils or other hazardous wastes will be permitted for use. Any excess material will be disposed of at a county-approved facility. No pre-existing conditions are present which would result in potential for adverse impacts due to construction stormwater runoff. Construction materials that could contribute to release of pollutants will be covered with PVC sheet plastic or similar material to prevent inadvertent contact and mixing with stormwater. As required, berms and other similar controls will be placed to divert stormwater flows around material storage locations.

Adjacent road surfaces will be kept free of dirt and mud. As required, silt curtains, sand bags, gutter socks and other similar controls shall be placed to divert stormwater flows around material storage locations. All erosion control measures will be checked and repaired as necessary, e.g., weekly, in dry periods and within 24 hours after any rainfall event of 0.5 inches or greater within a 24-hour period. During prolonged rainfall, daily checking will be required. The owner shall maintain records of checks and repairs to structural controls.

Only under special circumstances will petroleum-based products be stored on-site. Any such petroleum-based products stored on-site will be enclosed in tightly-sealed containers with clearly readable labeling. Throughout construction, all equipment no longer necessary will be removed from the site. The contractor will be responsible for disposing of all construction debris and refuse at a county-approved facility. Areas of disturbance will be hydro-mulched and/or grassed to stabilize soils and prevent future erosion.

3.2. Flora/Fauna

Existing Conditions

Because of its previous use for residential, agricultural and ranching activities throughout the years, Makawao Town is a highly altered landscape with little remaining of the native floral and faunal species that previously occupied this area of Maui. The landscape surrounding the project area has been heavily modified by forest clearance to develop pasture lands, residential subdivision, and agriculture (Cultural Surveys Hawai‘i, 2008). A review of the biological literature concerning the area was conducted to determine the need for a biological assessment. There were no records of significant botanical and wildlife resources on or near the project area that suggested the presence of endangered or threatened plant or animal species.

Site assessments noted commonly-observed vegetation in the region that now consists of a number of introduced species of eucalyptus (*Eucalyptus robusta* being dominant), various introduced landscape plants and grasses, with the dominant plant species being Christmas berry (*Schinua teribinthifolious*), mango trees and various shower (jacaranda) trees (*Jacaranda minimsofolia*). Ti (*Cordyline fruticosa*), a non-native ornamental yard plant, can be observed at nearly every residence. Other observed species include guava, avocado, koa haole and yellow foxtail. The three small portions of the project area used as pasture are covered with moderately dense buffel grass (*Cenchrus ciliaris*) and other alien grass species. (Cultural Surveys Hawai‘i, 2008). Site photos indicate other floral species such as various pines, junipers, and low-lying shrubs and palms that are part of the landscape.

Mongoose, chicken, rat, dog and cat are common faunal species in the project area. Avifaunal species that can be observed around the project site include the golden plover (seasonal), gray fancolin, meijiro, rice bird, house finch, mynah, house sparrow, barred and spotted dove, and American cardinal (Cultural Surveys Hawai‘i, 2008). The Hawaiian owl, or pueo, periodically hunts in the Upcountry areas of Maui (Atlas of Hawai‘i, 1998).

3.2.1. Threatened or Endangered Species

The purpose of the Endangered Species Act of 1973 (ESA), is to protect and conserve ecosystems upon which endangered and threatened species are dependent, and to provide for the conservation of endangered and/or threatened species. The ESA is administered by the U.S. Department of Interior through the U.S. Fish and Wildlife Service and by the U.S. Department of Commerce through the National Marine Fisheries Service of the National Oceanic and Atmospheric Administration. However, a review of the literature pertaining to the area indicates that these species occur only sporadically throughout the Upcountry area and not directly within the project area.

According to funding requirements outlined by the State Department of Transportation, Highways Division, a project receiving funding from federal sources must address the possibility of impacting threatened or endangered species. If any areas within the project area are discovered to support the existence of a threatened or endangered species, consultations are required with the authorizing agency(s) to develop measures to mitigate impacts resulting from the project.

Impacts and Mitigation Measures

Project construction activities are not anticipated to affect the floral or faunal community structure for the area. Because the area has a long history of landscape alteration, most of the plants and animals that exist are components of the introduced landscape. Therefore, removal of existing vegetation within the project area will not have an adverse impact on the environment.

Because only common and non-native species are regularly observed in the area, the proposed development is not expected to have any adverse impacts on rare, endangered, or threatened fauna or avifauna. Should any endangered or threatened species be found to occur within the project area, or be affected by project activities, a mitigation plan will be developed to address construction activities.

3.3. Scenic and Visual Resources

Existing Conditions

In 1968, U.S. Congress created Public Law 90-542, also called the National Wild and Scenic Rivers Act, which provides for the protection of designated rivers. Under this Act, rivers with "*outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in free-flowing condition*," with existing national policy of dam construction within these resources containing policy to preserve other rivers or sections

"*in their free-flowing condition to protect the water quality of such rivers and to fulfill other vital national conservation purposes.*"

The State of Hawai'i does not have any river resources designated for protection by the National Wild and Scenic Rivers Act. Therefore, the project area is not located near any wild or scenic river resources. The closest moving water body, Māliko Stream, is a small perennial stream that occurs .43 miles northeast of the project site beyond a ridge that geographically divides the project site from the stream. Due to the geographic divide between the stream and the site, no direct or indirect impacts to Māliko Stream or any other free-flowing water resource is anticipated during the project. No mitigation measures are needed for these resources.

Impacts and Mitigation Measures

No adverse visual impacts are anticipated for the project. The proposed construction work will widen an existing road to achieve increased motorized and non-motorized (bicycle and pedestrian) traffic safety. Proposed road construction will neither impede existing view planes of the area nor create new encumbrances on the view planes from either upper or lower elevations. Furthermore, construction will not affect Makawao Town's identity as a former ranching and plantation community.

3.4. Surface and Ground Water Resources

Existing Conditions

According to a watershed map provided on the Division of Forestry and Wildlife web page, Makawao lies on top of the Central Aquifer Sector and receives a small amount of rainfall from the Haleakalā range (Maui Watershed Map, 2001). According to, in 2008, the County of Maui drew approximately 38.7 million Gallons per Day (MGD) of water resources to service the needs of the island. The Maui Department of Water Supply's second largest system, which serves the Upcountry towns of Kula, Pukalani, Makawao, and Haiku, drew approximately 5.6 MGD, or 20% of the Island's total water use (Maui County Department of Water Supply, 2009).

Surface water and groundwater resources in the general area are relatively minor due to current and historical farming withdrawals. The closest flowing water body is Māliko Stream, which is 0.43 miles northeast of the project site at its closest point. This perennial stream receives its waters partly from the Hāmākua Poko Watershed System and runs for approximately 13 miles from where its tributaries begin along the northern slopes of Mount Haleakalā down to its main discharge point at Pa'iā Bay. The stream is separated from the site by a ridge that divides the two areas and prevents any influence between the project site and the stream itself. Based on the definition of wetland provided by Title 33 of the Code of Federal Regulations (CFR) 328.3(b), no wetland resources occur in or around the proposed project area, and no indirect adverse impacts to downstream wetland resources are expected as a result of construction activities from the proposed project. No modifications to any water bodies and/or associated wildlife will occur as a result of the project.

Impacts and Mitigation Measures

No impacts to surface and/or groundwater resources in the area are expected during the proposed construction activities. Additionally, there are no direct or indirect impacts to any

surface or groundwater resources expected as a result of the proposed project. No impacts to Māliko Stream or its tributaries are anticipated as a result of the proposed project.

3.5. Historic and Archaeological Resources

Existing Conditions

Cultural Surveys Hawai‘i conducted an archaeological assessment in 2008 (see Appendix B) the study found that the lower coastal region of Maui was extensively developed for sugar and pineapple cultivation during the mid-to-late 1800's. The high level of disturbance to the soils of these regions has probably obliterated any original evidence that the initial occupants of the inland slopes may have tended small agricultural plots. The only observed remnants of pre-agricultural occupation within the project area are three (3) historic properties (walls) found during their inspections of the site (see **Figure 6**). These are designated below as "CSH-1," "CSH-2," and "CSH-3."

Impacts and Mitigation Measures

The identified rock walls are currently within the area proposed for improvement and therefore will require relocation. The cut-basalt construction material used at CSH-1, as well as the stacked and faced basalt cobbles at CSH-3, will be reassembled or reused by reconstructing the impacted sections in the vicinity of the present roadway project. In this way, the historic character of the sites may be preserved.

Pending consultations with the SHPD, the project will move forward with reconstructing the walls as this would provide mitigation while enabling the project to continue. To preserve the character of the sites, it will be necessary to reconstruct the walls outside of the proposed ROW. Consultations with the SHPD and community members will be carried out to ensure the proper handling of the sites. If any further significant archaeological or historical finds are discovered during construction activities, the SHPD will be informed immediately. Any significant historic properties that are found will be treated in accordance with a program approved by the SHPD.

Although the current archaeological finds are not believed to be related to any burial sites, if human remains are discovered, the SHPD Archaeology Branch will be notified immediately in the event that human remains are encountered. The finds will be treated as previously identified under Hawai‘i Administrative Rules (HAR) 13-300-31(b). If human remains are identified, no further work will take place until a decision has been rendered on the disposition of the skeletal remains. Project activities in the vicinity of the discovery of human remains may resume if an accepted Burial Treatment Plan has been approved or in the event that SHPD has agreed to permit the undertaking to proceed with culturally appropriate interim protective measures for human remains, which may include preservation in place or recordation.

Figure 6 Photographs of Archaeological Sites

Source: Cultural Surveys Hawai‘i

CSH-1: This is a historic cut-basalt wall which retains the grade of Makawao Avenue, allowing only the associated residential lot to drop in elevation some 60cm (2 feet) from the present elevation of Makawao Avenue. The individual cut-basalt “bricks” were stacked and set in order to allow for a change in the grade of Makawao Avenue.

Source: Cultural Surveys Hawai‘i

CSH-2: This is an early-historic partially intact stacked-basalt boulder and cobble wall which may have been constructed following the establishment of property boundaries in the region, possibly as early as the mid-1800’s.

Source: Cultural Surveys Hawai‘i

CSH-3: Like CSH-1, this appears to have been formed to accommodate a construction change to the roadway of Makawao Avenue. The historic stacked-and-faced basalt wall construction is of a massive size that retains the sidewall soil and rock of a sizable road-cut opposite (east) of the Mayor Eddie Tam Gymnasium complex. The wall has been cut through at a point approximately 30 feet northeast of an existing utility pole (seen above, top left) to provide access to a residential structure inside the property. The exact date of this action is not know, however it would coincide with the recent construction of a residential home that now occupies the property.

3.6. Noise

Background and Existing Conditions

The consideration of noise abatement as part of a roadway construction project is mandatory if federal-aid funds are to be used and if traffic noise impact is expected to increase. If traffic noise impacts are identified, noise abatement measures must be considered. In 2008, D.L. Adams and Associates, Ltd. conducted an environmental noise assessment of the project area to ascertain existing levels of noise, and how construction activities would impact the surrounding area (see **Appendix D)**. Existing noises emitted in the project area are attributed to human-related activities typical of residential communities and natural sounds, including bird calls and wind noises. The report by D.L. Adams and Associates outlines details regarding current and future noise forecasts relating to activity along the roadways.

Construction activities may include cutting of existing pavement, grading, filling, compacting, paving, etc. and may utilize equipment such as jackhammers, saw cutters, backhoes, front loaders, dump trucks, generators, and compressors. The various construction phases of the project will generate significant amounts of noise that could impact residences, the park, and the school. Pavement cutters, jackhammers, backhoes and earthmoving equipment, e.g., bulldozers and diesel-powered trucks will probably be the loudest equipment used during construction. The actual noise levels produced are dependent on the construction methods employed during each phase of the construction process. Earth moving equipment, such as diesel engine powered

bulldozers, trucks, backhoes, front-end loaders, graders, etc., will probably be the noisiest equipment used during construction.

Short-term Impacts and Mitigation Measures

Heavy construction equipment is anticipated to cause moderate temporary noise for the adjacent property owners. Construction equipment noise is expected to be in the range of 55 and 90 dBA in close proximity to the site. However, as the noise will be temporary, no lasting impact from the proposed project is expected. To mitigate short-term construction related impacts, the contractor will ensure that project activities are in compliance with the provisions of HAR, Chapter 11-46, "Community Noise Control." Impacts resulting from construction activities will be temporary and conditions will return to normal once all construction activities are completed.

The contractor will submit a temporary noise permit application to the State Department of Health (State DOH) as necessary, describing the construction activities for the project. The contractor will use reasonable and standard practices to mitigate noise, such as using mufflers on diesel and gasoline engines, 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. Other noise mitigation for construction activities will be incorporated into the project management to address day-to-day issues such as time restrictions, vehicular traffic, as well as other components of construction activities.

Long-Term Impacts and Mitigation Measures

Upon completion of construction, there is a likelihood of increased noise levels along the roadways. Since the planned improvements to Makawao Avenue and Makani Road will not immediately impact the volume of vehicles along the roadway, the change in traffic noise levels at the surrounding homes is due to the shift in alignment and widening of Makawao Avenue and Makani Road. For these residences, noise levels are expected to increase by less than 1 dB. Additionally, the County of Maui anticipates significant usage by the community of the newly constructed bicycle and pedestrian pathways which will provide safe and convenient access alongside the roadways. Although no information was available during the preparation of this EA on the existing or projected increase of pedestrian and bicycle use along both roadways, it is expected that the establishment of these user pathways will contribute to noise levels as well during peak hours of the day (i.e. before and after school).

It may or may not be practical to construct a noise barrier wall for the homes along Makawao Avenue that will be impacted by roadway improvements, as this will limit sight distances for drivers along the curves of the roadway. For structures along the same elevation gradient as the road, the insulation of homes (e.g. upgrading windows, air-conditioning or forced ventilation etc.) is an established practice for reducing noise within the confines of the home, while strands of vegetation along the property boundaries can reduce outside noise around the yard. Similarly, the construction of barrier walls for houses with higher elevations than the roadway will reduce the amount of noise that can be heard from the homes close to the roadway.

Based on the current and anticipated noise levels, the Federal Highway Administration guidelines suggest that the Makawao Avenue and Makani Road improvements do not qualify as a severe impact. Discussions with property owners and implementation of mitigation measures for the various residential configurations in the area will ensure that long-term impacts to the community are avoided.

3.7. Air Quality

Existing Conditions

The air quality of the Makawao area is considered good, as is consistent with Maui's overall conditions. Existing airborne pollutants are attributed primarily to automobile exhaust from the roadways in the area, as well as other airborne byproducts typical of residential communities. According to a report from the U.S. EPA Office of Air & Radiation, with monitoring data for seven different compounds considered to be air pollutants, no known major airborne emission point sources exist on or around the project site. The State DOH has noted that there are no monitoring sites in the Upcountry areas, with the nearest site in Kihei.

Impacts and Mitigation Measures

During the construction period, air quality in the immediate area will be temporarily reduced from dust and exhaust generated from activities and construction equipment. These impacts will be controlled through the use of Best Management Practices (BMPs) such as dust fences and water trucks to spray the ground to keep dust to a minimum. These methods, and any additional methods applied by the contractor, shall in be conformance with the Air Pollution Control Standards and Regulation of the State DOH and the Country of Maui Grading Ordinance.

3.8. Flood Hazard

Existing Conditions

The proposed project site is located in a flood area designated as Zone C on the Flood Insurance Rate Map number 1500030195C, and is outside any potential floodway area. Additionally, areas with this designation are defined by Federal Emergency Management Agency (FEMA) as having minimal to no flooding potential. The expansion of the roadway will add approximately .6 to .7 acres of impervious surface area, and will not contribute significantly to the existing impervious surface in the area. Drainage lines will be placed in the roadway to properly direct stormwater away from the roadways and into existing drainage channels. Additionally, drainage culverts will be installed at designated intervals along the roadways to direct stormwater to existing or newly constructed drainage swales. Because the proposed project site is in an elevated area of central Maui, and construction is to expand an existing roadway, no major impacts to the floodplain are anticipated.

Impacts and Mitigation Measures

There are no anticipated flood hazards for the project during construction or following construction.

3.9. Demographic and Economic Characteristics

Existing Conditions

The town of Makawao is grouped in with two neighboring towns for community planning purposes by the County of Maui, resulting in the Makawao-Pukalani-Kula Community or simply "Upcountry". In summary, Upcountry Maui saw a 22 percent increase in population from 1990 to 2005 (see Table 1). Recent lags in development of the area are assumed to be due to recent issues of water service to the Upcountry area. However, these issues have been addressed recently through conservation awareness programs and development of alternative water storage measures at the household level.

Table 1. Makawao-Pukalani Population

Makawao-Pukalani-Kula Socio-Economic Profile (Historical and Forecasted)						
	1990	**2000**	**2005**	**2010**	**2020**	**2030**
Total	18923	21571	23176	24644	27640	30880
Male	9539	10653	11455	12193	13701	15332
Female	9384	10918	11721	12451	13938	15548
Households	6179	7594	8331	8965	10266	11667
Median Household Income	$38,018	$49,994	$56,595	$60,180	$69,797	$80,093
Housing Demand			776	667	711	735
Civilian Jobs	2313	3936	4920	5411	6422	7338
Source: Maui Planning Department, 2030 Plan Update (2008)						

Between 1990 and 2005, job growth occurred at a rate of 113 percent. However, the County of Maui Planning Department forecast calls for economic growth to continue at a slower pace. With only one job Upcountry for every 2.5 households, the bulk of the area's residents commute outside the area for work. This will continue to be the case. Even by 2030, the forecast shows 2.1 households per local job (Maui Planning Department, 2008). Currently, the top three industries in the Upcountry towns are in the service industry, government, and the skilled trades.

Given that the current and projected income sources for many of Makawao community members requires travel outside of town, that the provision of reliable, safe, and convenient transportation routes for commuting is an important component in overall community planning. The proposed project helps to fulfill this requirement by widening the current thoroughfare from Makawao Town onto the major roadways. Additionally, the improvements will add to the safety of pedestrians in the area.

Joint Development

The proposed project is a capital improvement project initiated by the County of Maui, and is intended to benefit the community by providing more efficient travelways for motorists, as well as dedicated lanes for bicyclers and pedestrians. The project is a result of human and financial resources dedicated by the County of Maui and the State Department of Transportation,

Highways Division. Periodic maintenance and repair of the roadways will be the responsibility of the County of Maui, Department of Public Works.

3.9.1. Economic Impacts

Project impacts on the local economy will be short-term and limited mainly to supporting construction and construction-related industries which serve workers' requirements such as housing and food accommodations. Long-term, direct economic impacts to the community as a result the project are not expected. Indirect impacts from the project will be more efficient and safer roadways as well as anticipated economic growth from migration of urbanites seeking homes in a rural area of Maui.

3.9.2. Relocation or Property Loss Impacts

No relocation impacts are anticipated for the project, as road design will factor in the lots abutting the proposed project area, ensuring that affected lots will meet setback requirements for existing structures and minimum lot size standards in accordance with Maui County zoning designations. **Table 2** below shows the setback requirements and minimum lot sizes for their respective zones within the project area. The County will be obtaining title to partial sections of properties abutting the project area as required for the widening of the ROW. Acquisition of sections of lots will range from 1 to 9 feet wide, and will vary based on the minimum width needed from each property abutting the project area.

Chapter 61, Title 42 of the United States Code (Uniform Relocation Assistance and Real Property Acquisition Policies for Federal and Federally Assisted Programs) was enacted in 1970 to provide relief for individuals and businesses whose property is to be acquired for federally-funded projects. As implemented by the Code of Federal Regulations, 49 CFR Part 24, property owners whose real property is to be acquired are eligible for compensation under the terms and rules of the Act, now dubbed "the Uniform Act." The purpose of the Uniform Act and its components is to provide fair and equitable treatment of persons whose property will be acquired because of programs or projects financed with federal funds.

Table 2. Project-Relevant Zone Setback Requirements for the County of Maui

Project-Relevant Zone Setback Requirements for the County of Maui

Zone	Description	Setback
RU.5	Rural, minimum one-half acre lots allowing agriculture	25 Feet from ROW
R1	Residential, minimum lot size of 6,000 square feet	15 Feet from ROW
R2	Residential, minimum lot size of 7,500 square feet	15 Feet from ROW
R3	Residential, minimum lot size of 10,000 square feet	15 Feet from ROW
P1	Public or Quasi-Public	15 Feet from ROW
PK2	Community Park	20 Feet from ROW

Source: Maui County Planning Department, 2009

Prior to construction, the County will conduct negotiations with affected property owners to reach agreements on the acquisition of lands required for the expanded ROW. Property sections will be acquired with just compensation determined through a property appraisal process conducted by an independent, certified appraiser with the participation of the property owner. Based on the mitigation measures provided by the Uniform Act, the project is not expected to adversely affect property owners, as they will be provided with just compensation for the portion of their property needed to expand the roadway ROW.

3.10. Community Facilities

Existing Conditions

Within the project area, there are several public facilities that provide community services. The Eddie Tam Park and Memorial Center, a 40-acre community center, includes ball fields, sports facilities, rest rooms, a preschool, and a satellite police station. The Samuel Enoka Kalama Intermediate School, a public school for grades 6 through 8, is adjacent to the Eddie Tam Park and has an average enrollment of 850 students. Other public schools in the area include Makawao Elementary School, Pukalani Elementary School, Kula Elementary School, and King Kekaulike High School. Private schools in the project vicinity include St. Joseph School, Haleakalā Waldorf School, Montessori School of Maui, and Seabury Hall.

The closest medical center is the Kula Hospital, approximately 11 miles away, which is a fully-equipped medical facility. A number of private medical practitioners have offices within a few miles of the project area. The Makawao Fire Station is approximately two miles from the project site. Solid waste is transported by a private waste disposal contractor to the Central Maui Landfill in Puʻunene.

Impacts and Mitigation Measures

Other than improvements to the road, which is a public facility, the project is not expected to require the creation of new public facilities. The use of public facilities during construction will be for the construction-related management of waste and the use of water for various construction-related activities. The contractor will be required to coordinate efforts with the Solid Waste Division of the Maui County Department of Public Works for the drafting of a solid waste management plan for disposal of solid waste generated during construction activities.

3.11. Land Use

Existing Conditions

The project area is utilized today as a main thoroughfare for travel between the Haleakalā Highway and Makawao Town. A major portion, if not all, of the area has been impacted by a significant amount of modification and alteration of the landscape during historic times by the subdivision of lots for residential housing. Prior to residential subdivisions, the region was cleared of forest during the 1850s to provide pasture area for a dairy located on a 16-acre parcel which is now a part of the Samuel Kalama Intermediate School (Cultural Surveys Hawaiʻi, 2008). Beginning with the adoption of the Community Plan process in 1980, Makawao Town adopted ordinances to preserve the rural character of the town (County of Maui, 1996). The lots

between the Intermediate School and the Eddie Tam gymnasium complex are presently built-out in single-family homes.

The built environment consists of sections of rural and residential subdivisions, made up of single-family homes, each home on a separate lot averaging 7,500 square feet. Homes are located along both Makawao Avenue and Makani Road. The project area is located 0.75 miles west of Makawao Town's central core, and 0.75 miles east of the Haleakalā Highway (Route 37). Rural residential single-family homes line both sides of Makawao Avenue and both sides of Makani Road within the project area. The entire project area had been previously graded and cleared for rural residential subdivision use. Due to recent subdivisions in Makawao Town, the project area currently has mixed designations by the County of Maui, including rural, residential, and public designations (see **Figure 7**). Most single-family homes within the project area have been improved with boundary fences, retaining walls and landscaping. Municipal services include streets, utilities, and subsurface water.

Impacts and Mitigation Measures

3.11.1. Land Use Impacts

The Hawai‘i State Land Use Commission establishes the four (4) major land use districts in which all lands in the State are placed: Urban, Rural, Agricultural, and Conservation. The project area falls within the Urban district (see **Figure 8**), and is therefore compatible with the criteria for this Land Use District.

3.11.2. Farmland Impacts

No impacts to surrounding farmlands are anticipated as a result of the project. **Figure 9** shows a map of the project area and its relationship the Agricultural Lands of Importance to the State of Hawai‘i (ALISH). As depicted, the majority of the project site is outside of classified ALISH lands. The portion of the roadway that falls within the ALISH classification is already an existing roadway and the proposed project conforms to its existing use as a public transportation route. Much of the remaining farmland in the area is to the north and northwest of the project area (TMK 2-2-4-001-Various Plats), with the majority landowner being Maui Land & Pineapple Company. This company's thousand-acre farmland is well beyond the project area.

Figure 7 Zoning Map

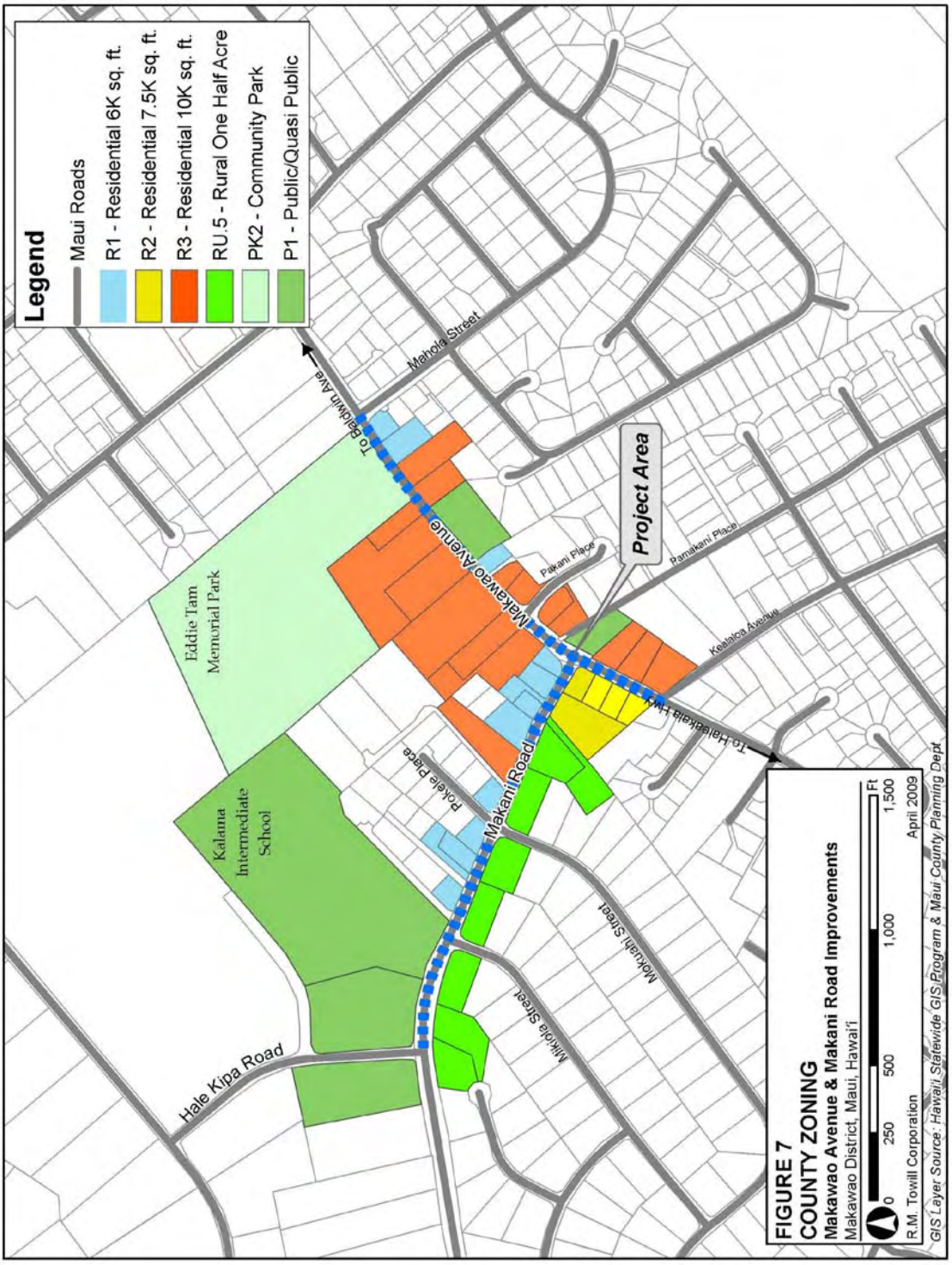


Figure 8 State Land Use Map

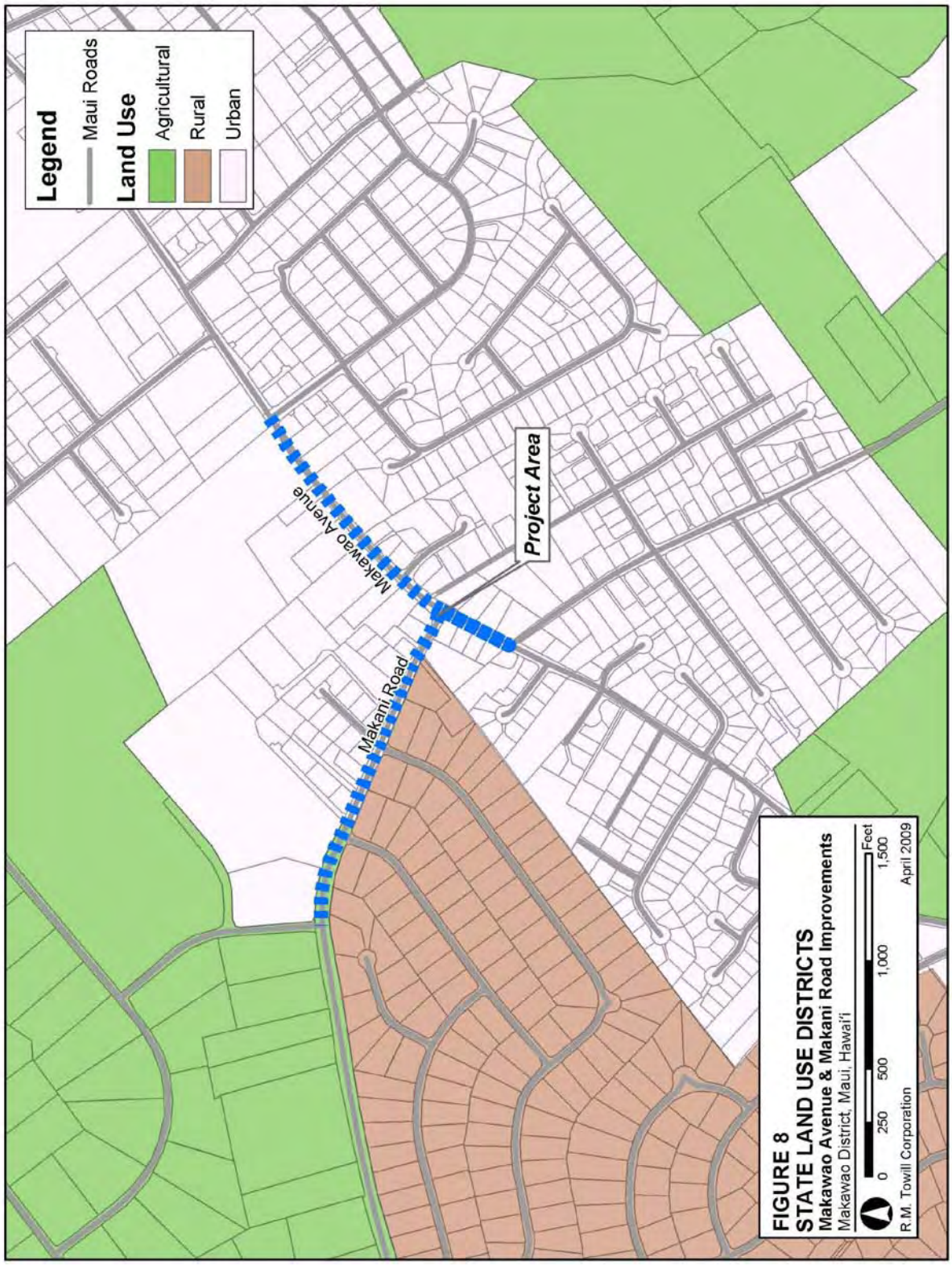
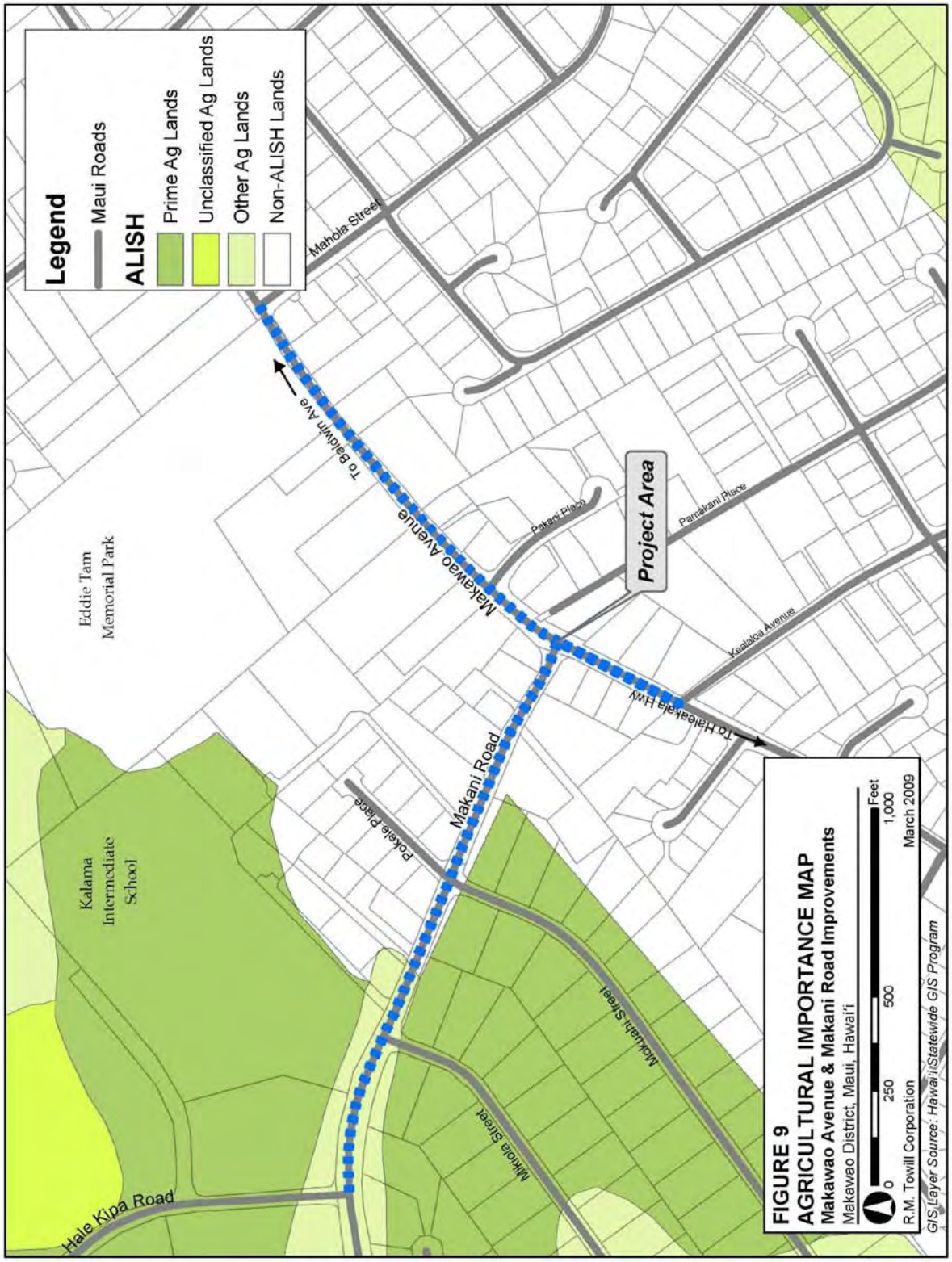


Figure 9 Agricultural Lands of Importance to the State of Hawai‘i



3.11.3. Hazardous Waste Site Impacts

A review of state and federal environmental regulatory databases indicated the following:

- No sites listed by the U.S. EPA on the National Priorities List (NPL) (Superfund) or delisted NPL databases were identified within the proposed project area.
- No Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) sites were identified within the project area.
- No Resource Conservation and Recovery Act (RCRA) corrective action sites or treatment, storage, and disposal facilities were identified within the project area.
- No RCRA hazardous waste generators were identified within the project area.
- No registered underground storage tank (UST) sites were identified within the proposed project area.
- No Brownfields sites, or sites with institutional or engineering controls, were identified within the proposed project area.

A review of relevant state and federal databases did not identify any institutional controls, engineering controls, or activity and use limitations associated with the subject properties or adjacent properties. In summary, there are no hazardous waste sites located within the proposed project area, nor will the proposed project result in the creation of a hazardous waste site. No hazardous wastes are anticipated to be generated by the construction activities, and all work will halt and the proper agencies will be contact if hazardous materials are found during construction activities.

3.12. Roadways and Traffic Conditions

Level of Service (LOS) is a term used to describe the conditions of a roadway based on factors that determine the rate of movement of vehicles along the roadway. LOS are ranked from A (free flow, the optimum condition) to F (forced or breakdown flow, the worst condition). The LOS method can be used as a tool to determine whether modification of a roadway is needed in order to prevent congestion. Although qualitative in nature, empirical analysis of statistical data collected throughout the years has enabled the refinement of the LOS system to produce a robust method of determining the present conditions and future needs of a roadway using the LOS Criteria.

Table 3 shows the method to rate an intersection or turn-in lane based on the amount of time required before turning into the lane. LOS C describes average delays and is considered acceptable for rural conditions; LOS D is considered acceptable for urban conditions.

Using the criteria in **Table 3** above for unsignalized intersections, two currently unsignalized intersections in the project corridor were evaluated: the Makawao Avenue–Makani Road intersection and the Makani Road–Kalama Intermediate School intersection.

Table 3. Level of Service Criteria

	Average delay per vehicle (seconds)					
Unsignalized	≤ 10	> 10 and ≤ 15	> 15 and ≤ 25	> 25 and ≤ 35	> 35 and ≤ 50	> 50
Signalized	≤ 10	> 10 and ≤ 20	> 20 and ≤ 35	> 35 and ≤ 50	> 50 and ≤ 80	> 80
Level of Service	A	B	C	D	E	F

Reference: *Highway Capacity Manual 2000*

At the intersection of Makani Road and Makawao Avenue, the existing road layout includes a single lane on each approach, each shared by two movements. While there is channelization for the westbound approach on Makawao Avenue, the right turn is so close to the intersection that it operates as if the lane is shared. Similarly, while right turning vehicles could possibly pass a vehicle waiting to turn left from Makani Road to Makawao Avenue, the intersection is constrained that it effectively has only one approach lane.

Table 4 shows the results of the traffic study for this project, which were based on the LOS grading scale of A to F.

Table 4. Traffic Count Results

	AM Peak Hour		**PM Peak Hour**	
	Left Turn from major street	**Minor Street Shared Lane**	**Left Turn from Major Street**	**Minor Street Shared Lane**
Kalama School Driveway to Makani Road				
Volume/capacity ratio	0.10	0.57	0.11	0.64
Average Delay (seconds)	9.3	24.9	8.2	26.4
Level of Service	A	C	A	D
Makani Road at Makawao Avenue				
Volume/capacity ratio	0.21	1.26	0.21	0.93
Average Delay (seconds)	11.2	214.8	9.2	95.7
Level of Service	B	F	A	F

Source: Julian Ng Incorporated (2008)

The results from the Julian Ng Inc. study (see Appendix E), shown above in **Table 4**, indicate that the Kalama School driveway to Makani Road traffic experiences unacceptable service levels during the afternoon peak hours, while the Makani Road – Makawao Avenue intersection experiences unacceptable conditions during both morning and afternoon peak traffic hours.

To estimate future conditions with an improved intersection, a preliminary evaluation was performed assuming that traffic volumes increase at a rate of 2% per year. Peak hour traffic volumes in year 2030 would require that each approach at the intersection of Makani Road and Makawao Avenue consist of two lanes, so that each movement has its own lane. The traffic counts and the preliminary analyses indicate that separate turning lanes should be provided on each approach at the intersection of Makani Road and Makawao Avenue. In addition, traffic signals at the intersection are needed and warranted, and would still be needed and warranted with the completion of the improvements to add lanes on each approach.

With respect to non-motorist users of the roadways, there are sections of the roadways that have existing sidewalks built into the road design. However, these sidewalks are not continuous and there are areas where grass is the only travelway for pedestrians, while bicycle riders must share the road with motorists.

Impacts and Mitigation Measures

During the one-year-long construction period for the proposed project, residences in the surrounding areas will experience traffic congestion due to the construction. Roadway construction will be coordinated with traffic conditions and routed to pass along one side of the street while construction proceeds on the other side, and vice versa once the first side is completed.

During construction, this projected traffic congestion will be temporary and limited to regular construction work hours. To maintain smooth traffic flow along both sides of the roadways for the duration of construction activity, the contractor will be required to utilize traffic control devices, flagmen, and/or police officers.

A positive impact resulting from the project is the increased roadway safety of both motorist and pedestrian traffic in the area. Dedicated turning lanes will be provided for Makawao Avenue intersections and will improve overall traffic flow along the thoroughfare. Additionally, for vehicles entering private residences along the roadway, turning lanes will provide a means of exiting the main thoroughfare. This also will reduce the overall traffic in through lanes. Pedestrian walkways as well as bike paths will be provided on both sides of the roadways, providing a safe and comfortable travelway for all users.

3.12.1. Pedestrian and Bicyclist Considerations

Once project construction activities are complete, the improved roadway will include bicycle lanes and pedestrian sidewalks along the improved project lengths for both Makawao Avenue and Makani Road.

3.13. Wastewater

Existing Conditions

Currently the Maui County Wastewater Division does not facilitate the collection, transportation, and treatment of wastewater from the Makawao area. The current limit of the Maui County wastewater collection is the Hāliʻimaile area, approximately 1.9 miles northwest of the project

site. Consultations with the Wastewater Division indicate that all residences and structures above the Hāli‘imaile area are served by individual wastewater systems or by group cesspools. Although plans exist for the expansion of the County wastewater services, development plans have not been implemented.

Impacts and Mitigation Measures

Due to the nature of the proposed construction work, which will only impact areas along public roadways, no impacts to individual wastewater systems or cesspools are anticipated during or after construction activities. Additionally, no impacts to public wastewater facilities and management of wastewater are anticipated, as the project will not generate significant amounts of wastewater during construction activities. Portable toilet facilities will be provided for construction workers, and no impacts to the existing wastewater infrastructure will occur.

3.14. Utilities

3.14.1. Overhead Utilities

Electrical, cable and telephone services are currently provided by Maui Electric Company, Oceanic Time Warner Cable and Hawaiian Telcom, respectively. Existing overhead utility lines are installed throughout the length of Makawao Avenue and Makani road, serving residences and facilities alongside both roadways.

3.14.2. Underground Utilities

Underground water utility lines of various sizes, ranging from 6-inch to 12-inch water main pipes provide services to residents and facilities along Makawao Avenue and Makani Road. Services are provided by the Maui Department of Water Supply.

Impacts and Mitigation Measures

The relocation of above-ground utility lines will be required, as the widening of the road will result in the relocation of poles currently lining the roadways. However, all underground waterlines will remain intact, as the removal and relocation of these utilities would incur significant construction costs. Only the necessary above-ground water utilities such as fire hydrants will be relocated. No mitigation measures are required or anticipated for the project. Relocation of utilities will be coordinated with the impacted utility company.

3.15. Commitment of Resources

The proposed Makawao Avenue and Makani Road improvements will require the irreversible and irretrievable commitment of resources. These resources include materials, capital, manpower and energy needed to plan, construct, and maintain the proposed roadway improvements.

Impacts and Mitigation Measures

Site development and construction will utilize fiscal, manpower, and material resources for planning, engineering and design, construction, and operations and maintenance (O&M) purposes. Expenditure of these resources will not be recoverable. Capital expenditures will

be required for management and the expansion of facilities and utilities over the proposed period of use.

The commitment of the additional areas of land required to widen both roadways will be irreversible and irretrievable, but will constitute a land use that is consistent with the development of the roadways. The use of the additional lands for bike shoulders and pedestrian walkways will eliminate it from private uses; however it will increase public safety for all roadway users and create a more comfortable means of traveling within the community.

Implementation of the project will not result in the significant loss of natural or cultural resources on the Island of Maui. The site is not a significant wildlife habitat. There are no federal or state listed endangered species known to inhabit the area. While there is a known archaeological and historic site present within the project boundary, proposed mitigation measures will ensure against potential for negative adverse impacts.

Section 4 Permits and Approvals that may be Required

4.1. Federal

Federal Highway Administration

Plan review and approval

4.2. State of Hawai‘i

Department of Transportation - plan review and approval

Department of Health

Community Noise Control Permit - required for construction

National Pollutant Discharge Elimination System Permit (Notice of Intent Form C, Construction Stormwater) - required for potential discharges of construction stormwater for project areas greater than one (1) acre.

4.3. County of Maui

Planning Department

Grading and Grubbing Permit

Perform Work on County Right of Way Permit

Plan review and approval

Department of Water Supply

Plan review and approval

4.4 Utility Companies

Maui Electric Company

Plan review and approval

Section 5 Relationship to Federal, State and County Plans and Policies

5.1. Federal Policies

5.1.1. Clean Water Act (CWA) Sections 401, 402, and 404

Section 401 (CWA) affirms that "States can review and approve, condition, or deny all federal permits or licenses that might result in a discharge to State waters, including wetlands. States and Tribes make their decisions to deny, certify, or condition permits or licenses primarily by ensuring the activity will comply with State water quality standards." Activities regulated by Section 401 (CWA) are currently administered by the Clean Water Branch (CWB) of the State Department of Health (DOH).

Section 402 (CWA) regulates discharges as part of the National Pollutant Discharge Elimination System (NPDES) permits. The CWB-DOH administers the provision of the Section 402. Section 11-55, Hawai'i Administrative Rules (HAR) will be used to guide the preparation of stormwater discharges from the project site. Section 404 (CWA) requires a permit before dredge or fill material may be discharged into waters of the United States including wetlands. The U.S. Army Corps of Engineers will be consulted to determine if the proposed project area is regulated according to Section 404, CWA.

Discussion:

The project area currently receives stormwater from upper elevations along Makawao Avenue and passes it through drainage lines onto the Eddie Tam Park where it continues on to drainage swales at the northwest corner of the park. Road improvements will include expansion and modification of the roadway drainage system to reflect the larger impervious surface area. The project are will exceed the use of an area of land greater than one acre requiring the filing of a NPDES construction Storm Water Permit application with the State DOH's CWB prior to the start of construction.

5.1.2. Department of Transportation Section 4(f)

Section 4(f) of the U.S. Department of Transportation Act of 1966, codified in federal law at 49 USC §303, declares that "it is the policy of the United States Government that special effort should be made to preserve the natural beauty of the countryside and public parks and recreation lands, wildlife and waterfowl refuges, and historic sites." Section 4(f) specifies that "[t]he Secretary [of Transportation] may approve a transportation program or project requiring the use of publicly owned land of a public park, recreation area, or wildlife and waterfowl refuge of national, State, or local significance, or land of an historic site of national, State, or local significance (as determined by the federal, state, or local officials having jurisdiction over the park, area, refuge, or site) only if:

"(1) There is no prudent and feasible alternative to using that land; and

(2) The program or project includes all possible planning to minimize harm to the park, recreation area, wildlife and waterfowl refuge, or historic site resulting from the use."

Section 4(f) further requires consultation with the U.S. Department of the Interior and, as appropriate, the involved offices of the U.S. Departments of Agriculture and Housing and Urban Development in developing transportation projects and programs, which use land protected by section 4(f).

In general, a section 4(f) "use" occurs with a DOT-approved project or program when:

"1) section 4(f) land is permanently incorporated into a transportation facility;

2) when there is a temporary occupancy of section 4(f) land that is adverse in term of the section 4(f) preservationist purposes as determined by specified criteria (23 CFR §771.135[p][7]); and 3) when section 4(f) land is not incorporated into the transportation project, but the project's proximity impacts are so severe that the protected activities, features, or attributes that qualify a resource for protection under section 4(f) are substantially impaired (constructive use) (23 CFR § 771.135(p)(1) and (2))."

Discussion:

A portion of the proposed project area requires the widening of the road ROW abutting the rear Eddie Tam Memorial Park, which calls for the transfer of ownership of a seven-foot-wide, approximately 2,600 square-foot strip of the park property alongside the existing roadway. This area of the property is to the rear of the park center, which is an incline that serves as part of a drainage swale to divert stormwater. No recreational activities are conducted on this area of the park, and therefore no impacts to park users will result from the widening of the roadway.

5.1.3. Endangered Species Act

The purpose of the Endangered Species Act of 1973 (ESA) is to protect and conserve ecosystems upon which endangered and threatened species are dependent, and to provide for the conservation of endangered and threatened species. The ESA is administered by the U.S. Department of Interior through the Fish and Wildlife Service and the U.S. Department of Commerce through the National Marine Fisheries Service, National Oceanic and Atmospheric Administration.

Discussion:

In order to ascertain if lands that fall within the objectives of Section 7 of the Endangered Species Act are impacted, the following agencies will be consulted: U.S. Fish and Wildlife Service, State Division of Forestry and Wildlife, and the National Marine Fisheries Service.

Each agency listed above will be provided with a project summary, a location map, a map of the proposed roadway alignment, and the typical roadway section, and a copy of the studies conducted for this document. Each agency will be asked to respond within 30

days. Based on the responses from the agencies, mitigation measures will be developed as necessary.

5.1.4. National Historic Preservation Act Section 106

The National Historic Preservation Act (NHPA) became law in 1966, and was last amended in 2000. The NHPA requires government agencies to evaluate the impact of government funded construction projects through a process known as the Section 106 Review. The goal of the process is to identify historic properties potentially affected by proposed development projects, assess its impacts and seek ways to minimize or mitigate adverse effects. The NHPA is administered by the U.S. Department of Interior, National Park Service and the Advisory Council on Historic Preservation (ACHP). At the State level, the NHPA is implemented by the State Historic Preservation Officer of SHPD.

The use of federal funds and the requirement of federal permits for the project triggers the need for National Historic Preservation Act (NHPA), Section 106 compliance. The purpose of the NHPA Section 106 review process is to evaluate the potential for effects on existing historic sites, if any, resulting from the project. The NHPA Section 106 review process encompasses a "good faith effort" in ascertaining the existence and location of historic properties near and within the project site, establishing an Area of Potential Effect (APE) of the project, identifying whether a potential for "adverse effects" on historic properties by the project exists, and developing a reasonable and acceptable resolution in the monitoring and treatment of any historic sites that is agreed upon by the Department of Transportation, County of Maui, and consulted government agencies, community associations, and native Hawaiian organizations.

As part of the planning process, the APE was defined as a project corridor approximately 100 feet wide by 3,140 feet long with a total area of approximately 7.2 acres. The 100-foot wide APE is comprised of two 50-foot offsets from the centerline of each existing road.

Discussion:

An initial archaeological assessment identified three (3) sites within the project area with features that suggested potential eligibility for nomination as historic sites. An ongoing survey phase of the project include the identification of individuals and groups who may have an interest in the project and the potential impact it may have on traditional cultural practices. Hawaiian organizations, agencies and community members will be contacted in order to identify potentially knowledgeable individuals with cultural expertise and/or knowledge of the study area and the vicinity.

Public involvement is a key ingredient in successful historic site consultation, and the views of the public should be solicited and considered throughout the process. The organizations to be consulted include but are not limited to the State Historical Preservation Division (SHPD), Office of Hawaiian Affairs (OHA), Maui Island Burial Council, and the Makawao-Pukalani-Kula Community Council. A summary of the findings of this investigation, as well as mitigation measures developed, will be attached with the Final Environmental Assessment.

5.1.5. Coastal Zone Management

The Coastal Zone Management Act (CZMA), enacted in 1972, provides states with financial incentives for the development and implementation of coastal zone management practices, and limited review power over federal actions affecting the State's coastal zone. The CZMA requires federally assisted actions, including federally-funded state and local government projects, be consistent with Hawai'i's CZM Program objectives and policies. The national CZM program is administered by the Office of Ocean and Coastal Resources Management (OCRM), an office within the National Oceanic and Atmospheric Administration, under the U.S. Department of Commerce. Provisions of the CZMA are administered in Hawai'i by the State Office of Planning. Administrative authority is defined by Chapter 205A, Hawai'i Revised Statutes.

Discussion:

The proposed roadway is under the jurisdiction of the CZMA. However, because of the approximately 6.2-mile distance from the project area to coastal waters, no coastal resources will be impacted. Therefore, no mitigation measures are required.

5.1.6. Section 6 Land and Water Conservation Fund (LWCF) Consultation

The LWCF Act (36 CRF 59.3) is the cornerstone of federal compliance efforts to ensure that the federal investments in LWCF assistance are being maintained in public outdoor recreation use. Section 6(f)(3) of this Act assures that once an area has been funded with LWCF assistance, it is continually maintained in public recreation use unless the National Park Service (NPS) approves substitution property of reasonably equivalent usefulness and location and of at least equal fair market value (NPS, 2008). The NPS established the following criteria for the conversion of public outdoor space funded by LWCF:

"Requests from the project sponsor for permission to convert LWCF assisted properties in whole or in part to other than public outdoor recreation uses must be submitted by the State Liaison Officer to the appropriate NPS Regional Director in writing. NPS will consider conversion requests if the following prerequisites have been met:

(1) All practical alternatives to the proposed conversion have been evaluated.

(2) The fair market value of the property to be converted has been established and the property proposed for substitution is of at least equal fair market value as established by an approved appraisal (prepared in accordance with uniform federal appraisal standards) excluding the value of structures or facilities that will not serve a recreation purpose.

(3) The property proposed for replacement is of reasonably equivalent usefulness and location as that being converted. Dependent upon the situation and at the discretion of the Regional Director, the replacement property need not provide identical recreation experiences or be located at the same site, provided it is in a reasonably equivalent location. Generally, the replacement property should be administered by the same political jurisdiction as the converted property. NPS will consider State requests to change the project sponsor when it is determined that a different political jurisdiction can better carry out the objectives of the original project agreement." (NPS, 2008)

"Equivalent usefulness and location will be determined based on the following criteria:

(i) Property to be converted must be evaluated in order to determine what recreation needs are being fulfilled by the facilities which exist and the types of outdoor recreation resources and opportunities available. The property being proposed for substitution must then be evaluated in a similar manner to determine if it will meet recreation needs which are at least like in magnitude and impact to the user community as the converted site." (NPS, 2008)

"This criterion is applicable in the consideration of all conversion requests with the exception of those where wetlands are proposed as replacement property." (NPS, 2008)

Discussion:

Since the Land and Water Conservation Fund's inception in 1964, the County of Maui has received a total of $3.96 million dollars in funding for various park-related developments and improvements to recreational infrastructure. According to a report available on the Fund's Web Site (see **Appendix C**), the Eddie Tam Memorial Park was not funded by the LWCF, nor has it received any funding since its construction. Therefore no mitigation is required to address Section 6(f)(3) requirements.

5.1.7. Environmental Justice

In 1994, President Clinton signed Executive Order 12898 to demonstrate "fair treatment" meaning that "no groups of people, including racial, ethnic or socioeconomic groups, should bear a disproportionate share of negative environmental consequences from industrial, municipal, and commercial operations, or the execution of federal, state, local, and tribal programs and policies."

The Executive Order further directed efforts to prevent environmental racism under Title VI of the 1964 Civil Rights Act. Title VI prohibits discrimination on the basis of race, color or national origin. It also prohibits recipients of federal funds, including federal and state agencies, from discriminatory actions.

The Federal Highway Administration (FHWA) defines Environmental Justice (EJ) persons as anyone belonging to any of the following groups:

- **Black** – a person having origins in any of the black racial groups of Africa.
- **Hispanic** – a person of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race.
- **Asian** – a person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent.
- **American Indian and Alaskan Native** – a person having origins in any of the original people of North America and who maintains cultural identification through tribal affiliation or community recognition.
- **Native Hawaiian or Other Pacific Islander** – a person having origins in any of the original peoples of Hawai'i, Guam, Samoa, or other Pacific Islands.
- **Low-Income** – a person whose household income (or in the case of a community or group, whose median household income) is at or below the U.S. Department of Health and Human Services poverty guidelines.

There are three fundamental environmental justice principles:

- To avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low -income populations.
- To ensure the full and fair participation by all potentially affected communities in the transportation decision-making process.
- To prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations.

To satisfy Title VI and EJ requirements, a project must illustrate that concern for environmental justice is integrated into every transportation decision, from the first thought about a transportation plan to the post-construction operations and maintenance. Every effort was made to ensure that a full and fair opportunity was made available to all members of all communities to participate in the development of the plan. In particular, the public outreach program was designed to ensure that this was accomplished.

Discussion:

Table 5 below shows that the population of Makawao during the 2000 census was diverse and only a small portion was below the poverty limit. Given that there have not been any major developments in the area recently, one can assume that the overall population of the area has not changed significantly since 2000. The proposed roadway plan does not impact any EJ or Title VI populations and will not require any relocation or dislocation of residences or businesses. Therefore no mitigation is required.

Table 5. Makawao Town Population Profile

Subject	Number	Percent
Total Population	**6,327**	**100**
Male	3,156	49.9
Female	3,171	50.1
Median Age (years)	34.6	-
18 Years and Over	4,456	70.4
Race		
One Race	4,350	68.8
White	2,565	40.5
Black or African American	20	0.3
American Indian and Alaska Native	35	0.6
Asian	1,078	17
Asian Indian	9	0.1
Chinese	38	0.6
Filipino	439	6.9
Japanese	435	6.9
Korean	18	0.3
Vietnamiese	-	-
Other Asian	139	2.2
Native Hawaiian and Other Pacific Islander	553	8.7
Native Hawaiian	518	8.2
Guamanian or Chamorro	1	-
Samoan	4	0.1
Other Pacific Islander	30	0.5
Some othe race	99	1.6
Two or more races	1,977	31.2
% of Population who Finished High School		90%
% of Population with College Degree		30%
% of Able Workers Employed		75%
Average Household Income	$46,681	
% of Households with Incomes below Poverty Line		7.4%
Source: U.S. Census Bureau, Census 2000		

5.2. Hawai‘i State Plan

The Hawai‘i State Planning Act (Hawai‘i Revised Statutes, Chapter 226) outlines policies used in the development of planning for the state’s facility systems. The following are excerpts from the Act in which areas relevant to the proposed project are underlined for emphasis.

Part I. Overall Theme, Goals, Objectives and Policies

226-17 Objectives and policies for facility systems-- transportation

§226-17 Objectives and policies for facility systems--transportation.

(a) Planning for the State's facility systems with regard to transportation shall be directed towards the achievement of the following objectives:

(1) An integrated multi-modal transportation system that services statewide needs and promotes the efficient, economical, safe, and convenient movement of people and goods.

(2) A statewide transportation system that is consistent with and will accommodate planned growth objectives throughout the State.

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

(1) Design, program, and develop a multi-modal system in conformance with desired growth and physical development as stated in this chapter;

(2) Coordinate state, county, federal, and private transportation activities and programs toward the achievement of statewide objectives;

(3) Encourage a reasonable distribution of financial responsibilities for transportation among participating governmental and private parties;

(4) Provide for improved accessibility to shipping, docking, and storage facilities;

(5) Promote a reasonable level and variety of mass transportation services that adequately meet statewide and community needs;

(6) Encourage transportation systems that serve to accommodate present and future development needs of communities;

(7) Encourage a variety of carriers to offer increased opportunities and advantages to interisland movement of people and goods;

(8) Increase the capacities of airport and harbor systems and support facilities to effectively accommodate transshipment and storage needs;

(9 Encourage the development of transportation systems and programs which would assist statewide economic growth and diversification;

(10 Encourage the design and development of transportation systems sensitive to the needs of affected communities and the quality of Hawai‘i's natural environment;

(11) Encourage safe and convenient use of low-cost, energy- efficient, non-polluting means of transportation;

(12) Coordinate intergovernmental land use and transportation planning activities to ensure the timely delivery of supporting transportation infrastructure in order to accommodate planned growth objectives; and

(13) Encourage diversification of transportation modes and infrastructure to promote alternate fuels and energy efficiency. [L 1978, c 100, pt of §2; am L 1986, c 276, §16; am L 1993, c 149, §1; am L 1994, c 96, §3]

Discussion:

The proposed project is compatible with the goals and objectives of Chapter 226 of the Hawai‘i State Plan (see underlined areas). Additionally, the project supports the overall goals of the Plan by integrating the design objectives of the Plan into its proposed layout.

5.3. State Functional Plans

5.3.1. Hawai‘i Statewide Transportation Plan (September 2002)

The Hawai‘i Statewide Transportation Plan (HSTP) provides transportation professionals and decision makers with a framework to be used in the planning of Hawai‘i’s transportation system. Integral to the plan’s development was an extensive public involvement and outreach effort that included a broad and diverse range of participants. The plan was a product of collaboration with the modal divisions of the State Department of Transportation and its county partners. A detailed research effort was also conducted to ensure that all technical issues associated with the plan were fully analyzed and considered, and that applicable federal and state regulations were satisfied. Areas relevant to the proposed project have been underlined for emphasis.

The primary purposes and utility of the HSTP are:

- *To establish a framework for the development, integrated management, and operation of Hawai‘i’s multi-modal transportation systems, programs, and facilities.*
- *To provide a foundation and identify the parameters within which the search for solutions can begin.*

The stated mission of the HSTP is “To provide for the safe, economic, efficient, and convenient movement of people and goods.”

The goals of the HSTP are:

GOAL I: Achieve an integrated multi-modal transportation system that provides mobility and accessibility for people and goods.

GOAL II: Ensure the safety and security of the air, land, and water transportation systems.

GOAL III Protect and enhance Hawai‘i’s unique environment and improve the quality of life.

GOAL IV: Support Hawai‘i’s economic vitality.

GOAL V: Implement a statewide planning process that is comprehensive, cooperative, and continuing.

***Discussion*:**

The proposed roadway plan does not require changing or amending the existing Statewide Transportation Plan as the proposed roadway project is compatible with and supported by the current goals and objectives of the Plan.

5.4. State Land Use Law (Chapter 205, Hawai‘i Revised Statutes (HRS))

Chapter 205 (HRS), relating to the Land Use Commission, establishes the four (4) major land use districts in which all lands in the State are placed: Urban, Rural, Agricultural, and Conservation. Criteria for these land use designations are cited below. The proposed roadway will traverse land that is designated Agriculture (see **Figure 8**).

§205-2, HRS, Districting and classification of lands.

(a) There shall be four major land use districts in which all lands in the State shall be placed: urban, rural, agricultural, and conservation. The land use commission shall group contiguous land areas suitable for inclusion in one of these four major districts. The commission shall set standards for determining the boundaries of each district, provided that:

(1) In the establishment of boundaries of urban districts those lands that are now in urban use and a sufficient reserve area for foreseeable urban growth shall be included;

(2) In the establishment of boundaries for rural districts, areas of land composed primarily of small farms mixed with very low density residential lots, which may be shown by a minimum density of not more than one house per one-half acre and a minimum lot size of not less than one-half acre shall be included, except as herein provided;

(3) In the establishment of the boundaries of agricultural districts the greatest possible protection shall be given to those lands with a high capacity for intensive cultivation; and

(4) In the establishment of the boundaries of conservation districts, the "forest and water reserve zones" provided in Act 234, section 2, Session Laws of Hawai‘i 1957, are renamed "conservation districts" and, effective as of July 11, 1961, the boundaries of the forest and water reserve zones theretofore established pursuant to Act 234, section 2, Session Laws of Hawai‘i 1957, shall constitute the boundaries of the conservation districts; provided that thereafter the power to determine the boundaries of the conservation districts shall be in the commission. In establishing the boundaries of the districts in each county, the commission shall give consideration to the master plan or general plan of the county.

(b) Urban districts shall include activities or uses as provided by ordinances or regulations of the county within which the urban district is situated.

(c) Rural districts shall include activities or uses as characterized by low density residential lots of not more than one dwelling house per one-half acre, except as provided by county ordinance pursuant to section 46-4(c), in areas where "city-like" concentration of people, structures, streets, and urban level of services are absent, and where small farms are intermixed with low density residential lots except that within a subdivision, as defined in section 484-1, the commission for good cause may allow one lot of less than one-half acre, but not less than 18,500 square feet, or an equivalent residential density, within a rural subdivision and permit the construction of one dwelling on such lot, provided that all other dwellings in the subdivision shall have a minimum lot size of one-half acre or 21,780 square feet. Such petition for variance

may be processed under the special permit procedure. These districts may include contiguous areas which are not suited to low density residential lots or small farms by reason of topography, soils, and other related characteristics.

(d) Agricultural districts shall include activities or uses as characterized by the cultivation of crops, orchards, forage, and forestry; farming activities or uses related to animal husbandry, aquaculture, and game and fish propagation; aquaculture, which means the production of aquatic plant and animal life for food and fiber within ponds and other bodies of water; wind generated energy production for public, private, and commercial use; bona fide agricultural services and uses which support the agricultural activities of the fee or leasehold owner of the property and accessory to any of the above activities, whether or not conducted on the same premises as the agricultural activities to which they are accessory, including but not limited to farm dwellings as defined in section 205-4.5(a)(4), employee housing, farm buildings, mills, storage facilities, processing facilities, vehicle and equipment storage areas, and roadside stands for the sale of products grown on the premises; wind machines and wind farms; small-scale meteorological, air quality, noise, and other scientific and environmental data collection and monitoring facilities occupying less than one-half acre of land, provided that such facilities shall not be used as or equipped for use as living quarters or dwellings; agricultural parks; and open area recreational facilities, including golf courses and golf driving ranges; provided that they are not located within agricultural district lands with soil classified by the land study bureau's detailed land classification as overall (master) productivity rating class A or B. These districts may include areas which are not used for, or which are not suited to, agricultural and ancillary activities by reason of topography, soils, and other related characteristics.

***Discussion*:**

The proposed roadway alignment does not require changing the existing State Land Use designations as the current urban designation of the project area is compatible with the proposed roadway improvement project.

5.5. Maui County 2030 General Plan Update

The proposed roadway conforms to the Maui County 2030 General Plan Update, Section IV, entitled *Goals, Objectives and Policies*. Applicability and conformance of the proposed project to Section IV are discussed in Sections 5.5.1 and 5.5.2 below.

5.5.1. Improve Parks and Public Facilities

Goal: A full range of island appropriate public facilities and recreational opportunities will be provided to improve the quality of life for residents and visitors.

Objective:

1. *Expand access to recreational opportunities and community facilities to meet the present and future needs of residents of all ages and physical abilities.*

   Policies:

   a. *Protect access to public shoreline and mountain resources.*
   b. *Expand and enhance the network of parks, multi-use paths, and bikeways.*
   c. *Assist communities in developing recreational facilities that promote physical fitness.*

d. Expand venue options for recreation and performances that enrich the lifestyles of Maui County's people.

e. Expand affordable recreational and after-school programs for youth.

f. Encourage and invest in recreational, social, and leisure activities that bring people together and build community pride.

g. Promote the development and enhancement of community centers, civic spaces, and gathering places throughout our communities.

h. Expand affordable access to recreational opportunities that support the local lifestyle.

Discussion:

The proposed roadway project will establish new pedestrian paths and bikeway shoulders for the lengths of the Makawao Avenue and Makani Road, which supports the goals and objectives of the Maui 2030 General Plan Update.

5.5.2. Diversify Transportation Options

Another important component of community transportation infrastructure is providing multiple means of getting around the community, whether travel be by motorize vehicle, bicycle, or by foot. The Maui County 2030 General Plan Update emphasizes the need for incorporating diversity in all future roadway designs within the County. Relevant items have been underlined for emphasis.

Goal: Maui County will have an efficient, economical, and environmentally sensitive means of moving people and goods.

Objectives:

1. *Provide an effective, affordable and convenient ground transportation system that is environmentally sustainable.*

   Policies:

   a. Execute planning strategies to reduce traffic congestion.

   b. Plan for the efficient relocation of roadways for the public benefit.

   c. Support the use of alternative roadway designs such as traffic calming devices and modern roundabouts.

   d. Increase route and mode options in the ground transportation network.

   e. Ensure that roadway systems are safe, efficient, and maintained in good condition.

   f. Preserve roads of distinction that have historic, scenic, or unique physical attributes that enhance the character and scenic resources of communities.

   g. Design new roads and roadway improvements to retain and enhance the existing character and scenic resources of the communities through which they pass.

   h. Promote a variety of affordable and convenient transportation services that meet countywide and community needs and expand ridership of transit systems.

   i. Collaborate with transit agencies, government agencies, employers, and operators to provide planning strategies that reduce peak-hour traffic.

j. Develop attractive, island appropriate, and efficient public transportation between the airport, harbors, visitor accommodations, activity centers, and visitor attractions.

k. Provide and encourage the development of specialized transportation options for the young, the elderly and the differently-abled.

l. Provide safer, better looking, and more efficient roadway designs.

m. Evaluate all alternatives to preserve quality of life before widening roads.

2. Reduce the reliance on the automobile and fossil fuels by encouraging walking, bicycling, and other energy efficient and safe alternative modes of transportation.

Policies:

a. Make walking and bicycling transport options safe and easy between and within communities.

b. Require development to be designed with the pedestrian in mind.

c. Design new and retrofit existing rights-of-way with adequate sidewalks, bicycle lanes or separated multi-use transit corridors.

d. Support the development of a county-wide network of bikeways, equestrian trails and pedestrian paths.

e. Support the reestablishment of traditional trails between communities, to the ocean, and through the mountains for public use.

***Discussion*:**

The proposed project will establish turn-in lanes for the intersection of Makawao Avenue and Makani Road to reduce traffic congestion and increase the safety of motorists using the roadways. Additionally, it will promote variety in transportation and create safer means of pedestrian and bicycle travel by creating a continuous pathway along both roads. These improvements support the Maui County 2030 General Plan Update objectives of incorporating roadway designs to accommodate non-motorist user of the roadways' ROW, as well as supports the development of a county-wide network of bikeways and pedestrian paths.

5.6. Makawao-Pukalani-Kula Community Plan

The proposed roadway supports and/or conforms to the following objectives and policies of the Makawao-Pukalani-Kula Community Plan, with relevant items underlined:

5.6.1 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.

Objectives and Policies:

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

A. Within Makawao Town:

- *Business use on Baldwin and Makawao Avenues around the established central core.*
- *Public use to support public and quasi-public needs.*
- *Open space areas which enhance the Makawao Town's country town ambiance.*
- *Pedestrian, equestrian, and bicycle pathways which provide alternative linkages among the various sections of Makawao.*
- *Residential use including elderly housing.*

***Discussion*:**

The proposed project supports the enhancement of access to the established central core by ensuring safe travel on wider roads by motorists, as well as by pedestrians and bicycle riders within their designated pathways along both Makawao Avenue and Makani Road.

5.6.2. 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 and Policies:

1. *Encourage urban design concepts which promote and produce pedestrian orientation, town centers, mixed land uses and energy conservation principles to enhance the identity and livability of new and existing communities.*
2. *Support the revision of subdivision and roadway design criteria and standards to be more compatible with the rural character of the Upcountry region.*
3. *Utilize design standards for multi-family residential uses which respect Upcountry's rural residential lifestyle.*
4. *Encourage commercial building scales which are compatible with the low-scale character of existing commercial structures.*
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.*
6. *Support the development of pedestrian, equestrian and bikeway connections which provide safe and convenient linkages within and between Upcountry communities.*
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 the each Upcountry community.*
8. *Enforce a two-story or 35-foot height limitation throughout the region, except for public/quasi-public uses such as auditoriums, gymnasiums, and fire stations.*

***Discussion*:**

The proposed project creates a continuous pedestrian and bicycle pathway along both roadways. This improvement supports the objectives of roadway designs accommodating non-motorist uses, and it supports the development of a county-wide network of bikeways and pedestrian paths within the Makawao-Pukalani-Kula Community.

Section 6 Agencies, Organizations, and Individuals Consulted

The following agencies, organizations and individuals were consulted to provide input into the Draft EA.

6.1. County of Maui

Office of the Mayor

Planning Department

Department of Water Supply, Resources & Planning

Environmental Management, Wastewater Reclamation Division

Department of Parks and Recreation

Eddie Tam Memorial Center

County Council, Infrastructure Management Committee

6.2. State of Hawai‘i

Department of Land and Natural Resources

Department of Transportation

Department of Health

Department of Business, Economic Development and Tourism, Office of Planning

Office of Hawaiian Affairs

Department of Education, Samuel Enoka Kalama Intermediate School

6.3. Federal Government

U.S. Army Corps of Engineers

Federal Highway Administration

Department of the Interior, U.S. Fish and Wildlife Service

National Oceanic and Atmospheric Administration, National Marine Fisheries Service

National Park Service

6.4. Organizations and Individuals

Maui Electric Company

Makawao Main Street Association

Abutting Property Owners (see **Appendix A**)

Section 7 Summary of Impacts and Significance Determination

7.1. Short-Term Impacts

Anticipated short-term impacts to the project include elevated noise levels, reduced air quality, increased traffic, and other short term construction-related impacts. These impacts have been discussed in relevant sections and include mitigation measures.

7.2. Long-Term Impacts

There are no anticipated adverse long-term impacts resulting from project activities or resulting from the improved roadways. Possible areas of impact have been addressed by this EA, and the overall long-term benefits of this project are discussed as well.

7.3. Significance Criteria

Hawai‘i Administrative Rules, Title 11, Chapter 200 of the State Department of Health, establishes criteria for determining whether an action may have a significant impact on the environment. This Rule establishes “significance criteria” for making the determination. The relationship of the proposed land use to the thirteen criteria is discussed below.

1. *Involves an irrevocable commitment to loss or destruction of any natural or cultural resource.*

   The project area was first modified when the lands were cultivated for sugarcane and pineapple production. Subsequently, some areas were modified and cleared for development and access roads, and later subdivided into large agricultural and ranching plots. The proposed roadway improvements will not result in the loss or destruction of natural or cultural resources. Mitigation measures proposed will ensure proper handling of cultural sites identified adjacent to the proposed improvements.

2. *Curtails the range of beneficial uses of the environment.*

   The proposed roadway will not curtail other uses of the area, as the proposed roadway improvements will be over an existing roadway. The proposed changes are consistent with the Maui County General Plan and the Makawao-Pukalani-Kula Community Plan.

3. *Conflicts with the State's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders.*

   The proposed roadway is consistent with the goals and guidelines expressed in Chapter 344, HRS, as it proposes to increase the modes of transportation within the community by providing wider roads and designated lanes for pedestrians and bicyclers along with motorists. This fulfills the goal of providing an environmentally-conscious transportation facility.

4. *Substantially affects the economic welfare, social welfare, and cultural practices of the community or State.*

   The proposed roadway project will generally benefit the community through the provision of safer and non-congested access to Makawao. During construction, the roadway project will provide employment for the construction contractor's employees. It is not anticipated that the proposed roadway will impact cultural practices in the area.

5. *Substantially affects public health.*

   There are no public health concerns related to the proposed roadway development. Construction impacts will be mitigated by the contractor.

6. *Involves substantial secondary impacts, such as population changes or effects on public facilities.*

   The proposed roadway project will not involve substantial secondary impacts in the form of population changes or effects on public facilities. The roadway project will entail improvements to already-existing roadways. The existing public facility (Eddie Tam Park) will be impacted by the project as land from the park will be required as part of the roadway widening. This land will be used to divert water during storms from the roadway.

7. *Involves a substantial degradation of environmental quality.*

   The proposed roadway project does not constitute substantial degradation of environmental quality.

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

   The proposed roadway project does not involve a commitment for a larger action at this time. It is anticipated that remaining portions of Makawao Avenue and Makani Road will be improved at some time in the future.

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

   The project area has been previously disturbed as a result of past agricultural activities and current development. Previous EAs for projects in the area did not identify incidences or habitats of rare, threatened or endangered species. Furthermore, the improvements are to an existing road in an urbanized residential area, which makes encroachment onto wildlife habitat areas unlikely.

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

    Mitigation measures have been outlined in relevant sections of this EA to address the possibility of detrimental noise impacts following roadway improvements. These measures will ensure that impacts to the area are minimal and comparable to existing conditions. The proposed roadway project will not increase the number of cars traveling on the roadway, and will not detrimentally affect air quality for the area. Water quality will not be affected by proposed construction activities, nor following these activities.

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

    The project area is not located near and adjacent to any environmentally sensitive area such as a flood plain, estuary, fresh-water, tsunami zone, or erosion-prone area, and therefore long-term "damage" is not anticipated. During construction, a Best Management Practices (BMPs) plan will ensure that stormwater runoff is minimized.

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

    The existing roadway is in a prominent location that can be seen from lower elevations. Because the part of roadway is on a slope its visual appearance cannot be fully obscured. Landscaping in the form of street trees will be utilized to soften the visual appearance of the roadway. The curves in the roadway will also soften the views. Ultimately, the roadway will maintain its existing panoramic views of the Maui landscape.

13. *Requires substantial energy consumption.*

    The proposed roadway improvements will require the consumption of energy in the form of petroleum products to fuel the equipment required for the construction of the roadway. Following its completion, additional energy will be required to light the roadway.

References

County of Maui, Planning Department, Long-Range Planning Division, (2008). "Draft Countywide Policy Plan - 2030 General Plan Update".

Cultural Surveys Hawai'i, Inc., (2008). "An Archaeological Literature Review and Field Inspection Report for the Proposed Makawao Avenue and Makani Road Improvements, Hāmākua Poko Ahupua'a Makawao District, Maui Island".

D. L. Adams Associates, Ltd., (2008) "Environmental Noise Assessment Report Makawao Avenue/Makani Road Improvements Makawao, Maui, Hawai'i".

Hawai'i State Department of Transportation, (1991). "Hawai'i Statewide Transportation Plan".

Julian Ng Inc., (2007). "Makani Road – Makawao Avenue Traffic Study".

Maui County Department of Water Supply, (2009). "County of Maui Historical Water Usage".

Maui County Council, (1996). "Makawao-Pukalani-Kula Community Plan".

State of Hawai'i, Department of Business, Economic Development and Tourism, (2007). "State of Hawai'i Data Book".

Stearns, H.T. and G.A. MacDonald, (1942). "Geology and Groundwater Resources of the Island of Maui, Hawai'i". Bull. Haw. Div. Hydrog. 7, 344 pp.

Transportation Research Board of the National Academies, (2000). "Highway Capacity Manual".

U.S. Department of Agriculture, Soil Conservation Service, (1972). "Soil Survey of Island of Kaua'i, O'ahu, Maui, Moloka'i, and Lana'i, State of Hawai'i, August 1972".

United States Department of the Interior, National Park Service Land and Water Conservation Fund, (2009). "Detailed Listing of Grants Grouped by County".

<http://waso-lwcf.ncrc.nps.gov/public/index.cfm>

U.S. Division of Forestry and Wildlife, Watershed Management Web Site, (2001). "Maui Watershed Information Map". <http://www.state.hi.us/dlnr/dofaw/wmp/default.htm>

U.S. Fish and Wildlife Service, (2009). "Coastal Barrier Resources Map".

<http://www.fws.gov/habitatconservation/coastal_barrier.html>

U.S. Department of Transportation, Federal Highway Administration, (1992). "Acquiring Real Property for Federal and Federal-Aid Programs and Projects", Publication No. FHWA-PD-95-005, 1992.

U.S. Environmental Protection Agency, (2002). "Hawai'i Facilities Emissions Report – Criteria Air Pollutants". <http://www.epa.gov/air/data/netemis.html?st~HI~Hawaii>

University of Hawai'i, Department of Geography, University of Hawai'i Press, Honolulu, HI, (1998). "Atlas of Hawai'i - Third Edition".

Appendices

A. List of Properties Abutting the Project Area

B. Cultural Surveys Hawai‘i, Inc., (2008). “An Archaeological Literature Review and Field Inspection Report for the Proposed Makawao Avenue and Makani Road Improvements, Hāmākua Poko Ahupua‘a Makawao District, Maui Island

C. Detailed Listing of Grants Grouped by County, April 2009
United States Department of the Interior, National Park Service Land and Water Conservation Fund, (2009). “Detailed Listing of Grants Grouped by County”. http://waso-lwcf.ncrc.nps.gov/public/index.cfm

D. Environmental Noise Assessment Report Makawao Avenue/Makani Road Improvements, May 2008

E. Makani Road – Makawao Avenue Traffic Study, September 2007.

Appendix A

List of Properties Abutting the Project Area

APPENDIX I - List of Properties Abutting the Project Area

	TMK NUMBER	LOT SIZE (ACRES)	LOT SIZE (SQ FT)	TAKE SIZE (SQ FT)	RESULTING LOT SIZE	ZONED AS
1	2-2-4-006-003	1.74	75,790.04	1,011.03	74,779.01	R3
2	2-2-4-006-004	2.07	90,343.44	717.17	89,626.27	R3
3	2-2-4-006-005	13.68	595,900.80	2,542.24	593,358.56	PK2
4	2-2-4-006-020	0.25	10,702.69	766.24	9,936.45	R1
5	2-2-4-006-021	0.59	25,635.06	658.55	24,976.51	R3
6	2-2-4-006-044	0.80	34,673.76	174.89	34,498.87	R3
7	2-2-4-006-046	0.42	18,295.20	138.23	18,156.97	R1
8	2-2-4-006-061	0.19	8,197.99	22.68	8,175.31	R1
9	2-2-4-006-062	0.25	10,890.00	364.15	10,525.85	R1
10	2-2-4-006-066	0.86	37,627.13	342.46	37,284.67	R3
11	2-2-4-006-068	0.22	9,422.03	473.90	8,948.13	R1
12	2-2-4-006-078	0.20	8,751.20	231.07	8,520.13	R1
13	2-2-4-006-089	0.34	15,002.06	526.00	14,476.06	R3
14	2-2-4-006-090	1.00	43,560.00	586.93	42,973.07	R3
15	2-2-4-006-098	0.24	10,236.60	71.34	10,165.26	R1
16	2-2-4-006-111	0.14	5,998.21	114.12	5,884.09	R1
17	2-2-4-006-112	0.14	5,998.21	193.27	5,804.94	R1
18	2-2-4-006-118	0.22	9,430.74	36.89	9,393.85	R1
19	2-2-4-006-126	0.17	7,588.15	1,082.05	6,506.10	R1
20	2-2-4-006-130	0.36	15,681.60	23.20	15,658.40	ROAD
21	2-2-4-018-008	0.44	19,371.13	560.66	18,810.47	P1
22	2-2-4-018-009	0.49	21,344.40	1,290.05	20,054.35	R3
23	2-2-4-018-010	0.37	15,925.54	1,405.15	14,520.39	R3
24	2-2-4-018-011	0.37	15,929.89	1,402.29	14,527.60	R3
25	2-2-4-018-012	0.23	10,058.00	699.08	9,358.92	R3
26	2-2-4-018-013	0.15	6,686.46	827.08	5,859.38	R3
27	2-2-4-018-014	0.04	1,550.74	122.14	1,428.60	ROAD
28	2-2-4-018-015	0.17	7,400.84	701.39	6,699.45	R1
29	2-2-4-018-031	0.20	8,502.91	672.95	7,829.96	R2
30	2-2-4-018-032	0.19	8,276.40	599.79	7,676.61	R2
31	2-2-4-018-033	0.19	8,276.40	665.31	7,611.09	R2
32	2-2-4-018-034	0.19	8,250.26	689.73	7,560.53	R2
33	2-2-4-018-035	0.79	34,591.00	3.26	34,587.74	R2
34	2-2-4-018-060	0.23	10,005.73	563.24	9,442.49	R3
35	2-2-4-018-061	0.25	10,881.29	378.99	10,502.30	R3
36	2-2-4-022-012	0.97	42,253.20	1,811.25	40,441.95	P1
37	2-2-4-022-013	0.39	16,944.84	506.82	16,438.02	R3
38	2-2-4-022-015	0.63	27,442.80	124.54	27,318.26	R3
39	2-2-4-032-109	10.43	454,452.77	457.38	453,995.39	P1
40	2-2-4-032-110	2.34	101,886.84	743.30	101,143.54	P1
41	2-2-4-034-038	0.51	22,215.60	1,111.40	21,104.20	RU.5
42	2-2-4-034-039	0.66	28,662.48	957.47	27,705.01	RU.5
43	2-2-4-034-051	0.52	22,433.40	1,182.01	21,251.39	RU.5
44	2-2-4-034-052	0.50	21,780.00	2,177.83	19,602.17	RU.5
45	2-2-4-034-078	0.54	23,653.08	2,252.88	21,400.20	RU.5
46	2-2-4-034-079	0.52	22,433.40	2,095.27	20,338.13	RU.5
47	2-2-4-034-080	0.56	24,524.28	1,247.33	23,276.95	RU.5
48	2-2-4-034-119	0.50	21,780.00	88.77	21,691.23	RU.5

	Zoning Minimums	Conversion
	square feet	acres
R1	6,000	0.1377
R2	7,500	0.1722
R3	10,000	0.2296
RU.5	21,780	0.5

NOTE: Gray Rows are Substandard Lots
Darker is Previously Substandard

Appendix B

An Archaeological Literature Review and Field Inspection Report
for the Proposed Makawao Avenue and Makani Road Improvements
Hāmākua Poko Ahupua‘a
Makawao District, Maui Island
March 2008

AN ARCHAEOLOGICAL LITERATURE REVIEW AND FIELD INSPECTION REPORT FOR THE PROPOSED MAKAWAO AVENUE AND MAKANI ROAD IMPROVEMENTS Hāmākua Poko Ahupua‘a Makawao District, Maui Island TMK: (2) 2-4-006:034 TMK: (2) 2-4-018:022

Prepared for

Mr. Kevin Polloi

R.M. Towill Corporation

Prepared by

Robert Hill, B.A.,

Tanya Lee-Greig, M.A.

and

Hallett H. Hammatt, Ph.D.

Cultural Surveys Hawai‘i, Inc.

Wailuku, Hawai‘i

(Job Code: MAKAWAO-1)

March 2008

O‘ahu Office
P.O. Box 1114
Kailua, Hawai‘i 96734
Ph.: (808) 262-9972
Fax: (808) 262-4950

www.culturalsurveys.com

Maui Office
16 S. Market Street, Suite 2N
Wailuku, Hawai‘i 96793
Ph: (808) 242-9882
Fax: (808) 244-1994

Management Summary

Reference	An Archaeological Literature Review and Field Inspection Report for the Proposed Makawao Avenue and Makani Road Improvements, Hāmākua Poko Ahupua‘a, Makawao District, Maui Island [TMK: (2) 2-4-006: 034, (2) 2-4-018: 022] (Hill et al. 2008).
Date	March 2008
Project Number	Cultural Surveys Hawai‘i Inc. (CSH) Job Code: MAKAWAO-1
Investigation Permit Number	CSH completed the literature review and field inspection under state archaeological permit No. 0719 (2007) issued by the Department of Land & Natural Resources/ State Historic Preservation Division (DLNR/ SHPD) per Hawai‘i Administrative Rules (HAR) Chapter 13-13-282.
Project Location	The project area is 0.75 miles (1.6 km) east of Haleakalā Highway (Route 37) along Makawao Avenue (Route 365), within the Hāmākua Poko Ahupua‘a, Makawao District, Maui Island, TMK: (2) 2-4-006:034, (2) 2-4-018:022. The project area includes the present road right-of-way and possible staging areas for construction equipment. This area is depicted on the 1992 Ha‘ikū 7.5-minute USGS topographic quadrangle.
Land Jurisdiction	Government: Federal and County of Maui
Agencies	• Federal Highway Administration • Department of Public Works (County of Maui) • DLNR/ SHPD
Project Description	CSH undertook this archaeological literature review and field inspection investigation for R.M. Towill Corporation, for the proposed roadway improvements to portions of Makawao Avenue and Makani Road .
Project Acreage	Approximately 8.41 Acres.
Area of Potential Effect (APE) and Survey Acreage	For this literature review and field inspection investigation, the project’s APE is defined as the entire 8.41-acre footprint of the proposed roadway improvement area. The project area is surrounded by a mixture of residential, State (Samuel E. Kalama Intermediate School), and municipal (Mayor Eddie Tam Memorial Gymnasium) uses. The proposed roadway improvements appear to pose no auditory, visual, or other environmental impacts to any surrounding potential historic properties. The area anticipated for staging of construction material will be within the improved area of the Mayor Eddie Tam Memorial Gymnasium complex.

Historic Preservation Regulatory Context	The proposed project is subject to Hawai‘i State environmental and historic preservation review legislation: • Hawai‘i Revised Statutes (HRS) Chapter 343 and .HRS 6E-8, and • Hawaii Administrative Rules (HAR) Chapter 13-13-275. The proposed project is also subject to federal legislation: • Section 106 of the National Historic Preservation Act, and • Section 4F of the Department of Transportation Act. This document is intended to assist in the project planning only, and does not fulfill the requirements for an archaeological inventory survey.
Fieldwork Effort	Fieldwork was accomplished on January 16, 2008 by Robert R. Hill, B.A., under the general supervision of Hallett H. Hammatt, Ph.D., as principal investigator. The field effort included a general overall pedestrian inspection and photographs. The total time required to complete the fieldwork consisted of 1 person-day.
Number of Historic Properties Identified	Four historic properties were identified: • CSH-1, a historic cut-basalt retaining wall, • CSH-2, a historic stacked basalt boulder and cobble boundary wall, • CSH-3, a historic stacked and faced basalt retaining wall, and • CSH-4, a historic cut-basalt curb stone alignment.
Summary and Interpretation	These four historic properties appear to be seldom-seen examples of roadway construction from an earlier era. Extensive modern land modifications for residential subdivisions, municipal roadway services, and utility right-of-ways have demolished portions of CSH-2. Although the construction of CSH-2 appears to pre-date the other three historic features described, there may not be enough information preserved in the structure to accurately assess the historic quality of CSH-2.
Recommendation	Cultural Surveys Hawai‘i recommends that an inventory survey-level investigation be undertaken to completely document and evaluate the significance and potential mitigation measures for each historic property. Cultural Surveys Hawai‘i further recommends that consultation regarding the appropriate mitigation for the stacked-basalt walls CSH-1, CSH-2 and CSH-3, as well as the basalt curb alignment CSH-4, take place with the SHPD. The cut-basalt construction material used at CSH-1 and CSH-4, including the stacked and faced basalt cobbles at CSH-3, appear to be of a quality that may be reassembled or reused in order that a small section of the original construction may be reconstructed in the vicinity of the present roadway project.

Table of Contents

List of Figures

List of Tables

Section 1 Introduction

1.1 Project Background

At the request of Mr. Kevin Polloi of R.M. Towill Corporation, Cultural Surveys Hawai‘i, Inc. (CSH) conducted an archaeological literature review and field inspection of portions of Makawao Avenue and Makani Road, located in Hāmākua Poko Ahupua‘a, Makawao District, Maui Island [TMK: (2) 2-4-006:034, 2-4-018:022]. (Figure 1) Access improvements, such as separate turn lanes for the Samuel E. Kalama Intermediate School on Makani Road, and the Mayor Eddie Tam Memorial Gymnasium on Makawao Avenue, are proposed for construction. The area of potential effect (APE) for the proposed project includes the road right-of-way affecting lands of three separate TMK Plats (Figure 2, Figure 3 and Figure 4). The entire 8.41-acre APE, hereafter referred to as the "present project area" was inspected as a part of this field inspection.

The present project area is bounded on all sides by residential subdivisions. The Mayor Eddie Tam Memorial Gymnasium is located at the northeastern end of the project area, on Makawao Avenue. The gymnasium complex includes a Maui County Police Department substation, and recreational areas for tennis, horseback riding and soccer. The Samuel E. Kalama Intermediate School is located on Makani Road, just northwest of the intersection of Makani Road and Makawao Avenue. A secondary access route to Kalama Intermediate School is provided by Makani Road via Haleakala Highway. A secondary access route to the gymnasium is provided by Makawao Avenue via Baldwin Avenue.

1.2 Scope of Work

The scope of work included:

1. Research on the historic background of the project area, including searches of historic maps, written records, and Land Commission Award documents. This research will focus on the specific project area, and will provide detailed background on previous archaeological reports, in order to construct a history of land use and to determine if archaeological sites have been recorded on or near this property;
2. A general ground survey of the project area for the purpose of identifying surface archaeological features. Archaeological features will be assessed for potential impact by the proposed development plans, and sensitive areas requiring further investigation or mitigation action will be identified;
3. Preparation of a literature review and field inspection report that includes the following:
    a. results of the historic research and the limited fieldwork;
    b. an assessment of archaeological potential based on the historic research, with recommendations for further archaeological work, if needed;
    c. and, provisions for mitigation recommendations if archaeologically sensitive areas are encountered.

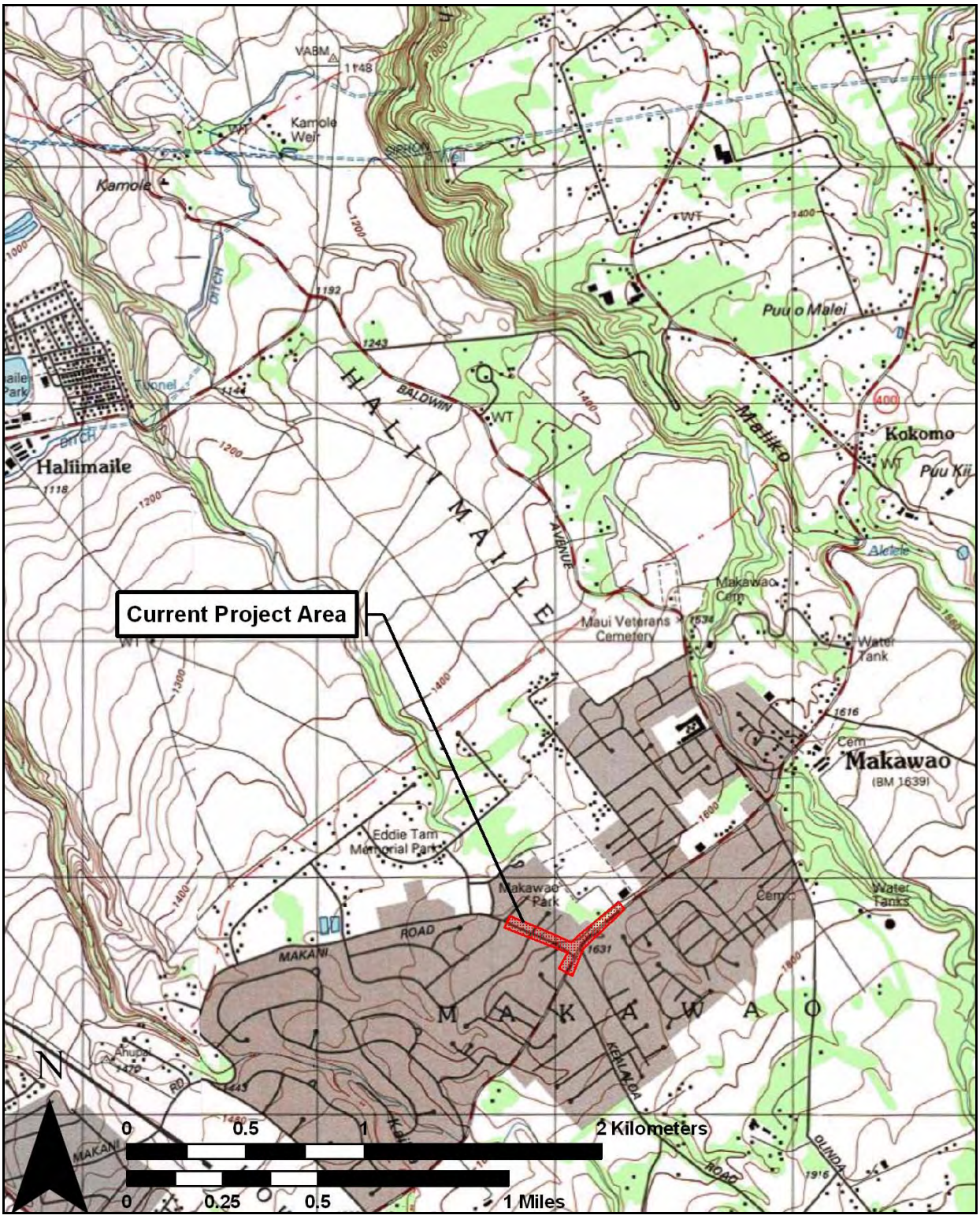


Figure 1. A portion of the 1992 Haiku 7.5-minute USGS topographic quadrangle. The project location is indicated within the red area as indicated by the label.

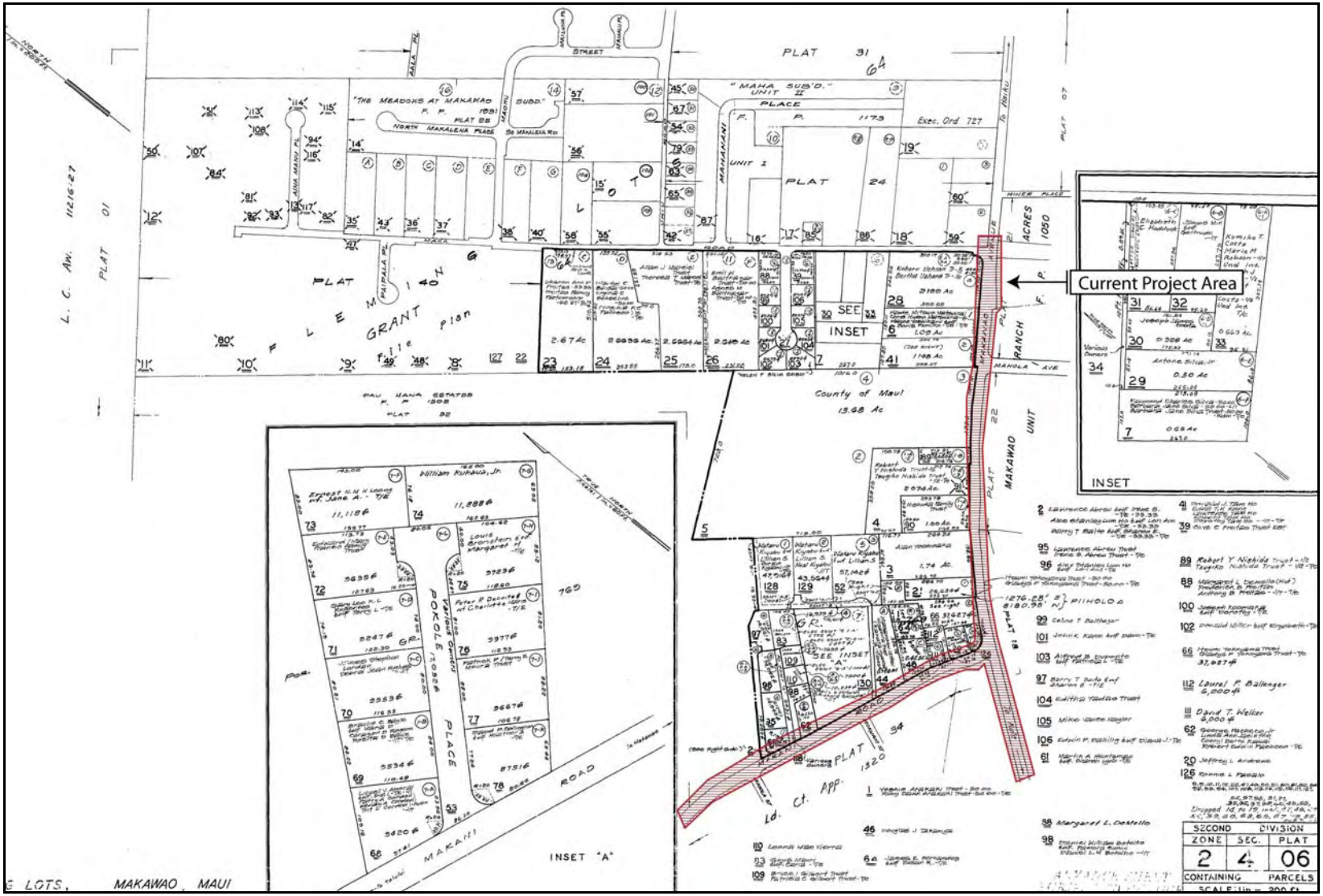


Figure 2. TMK map [TMK:(2) 2-4-006] showing red shaded project area. Parcel 5 is the Mayor Eddie Tam Memorial Gymnasium.

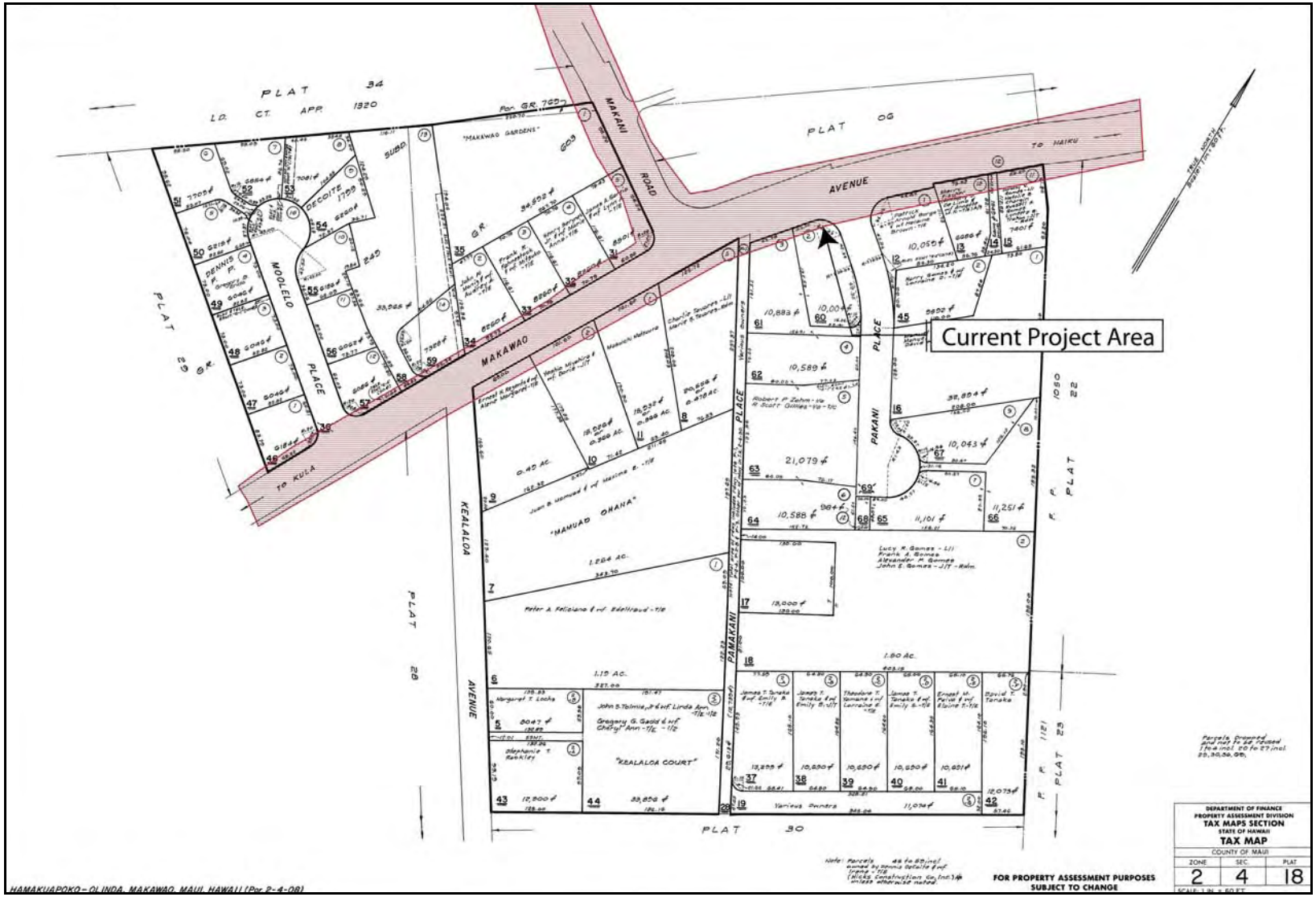


Figure 3. TMK map [TMK: (2)-2-4-18] showing red shaded project area: the intersection of Makani Road and Makawao Avenue.

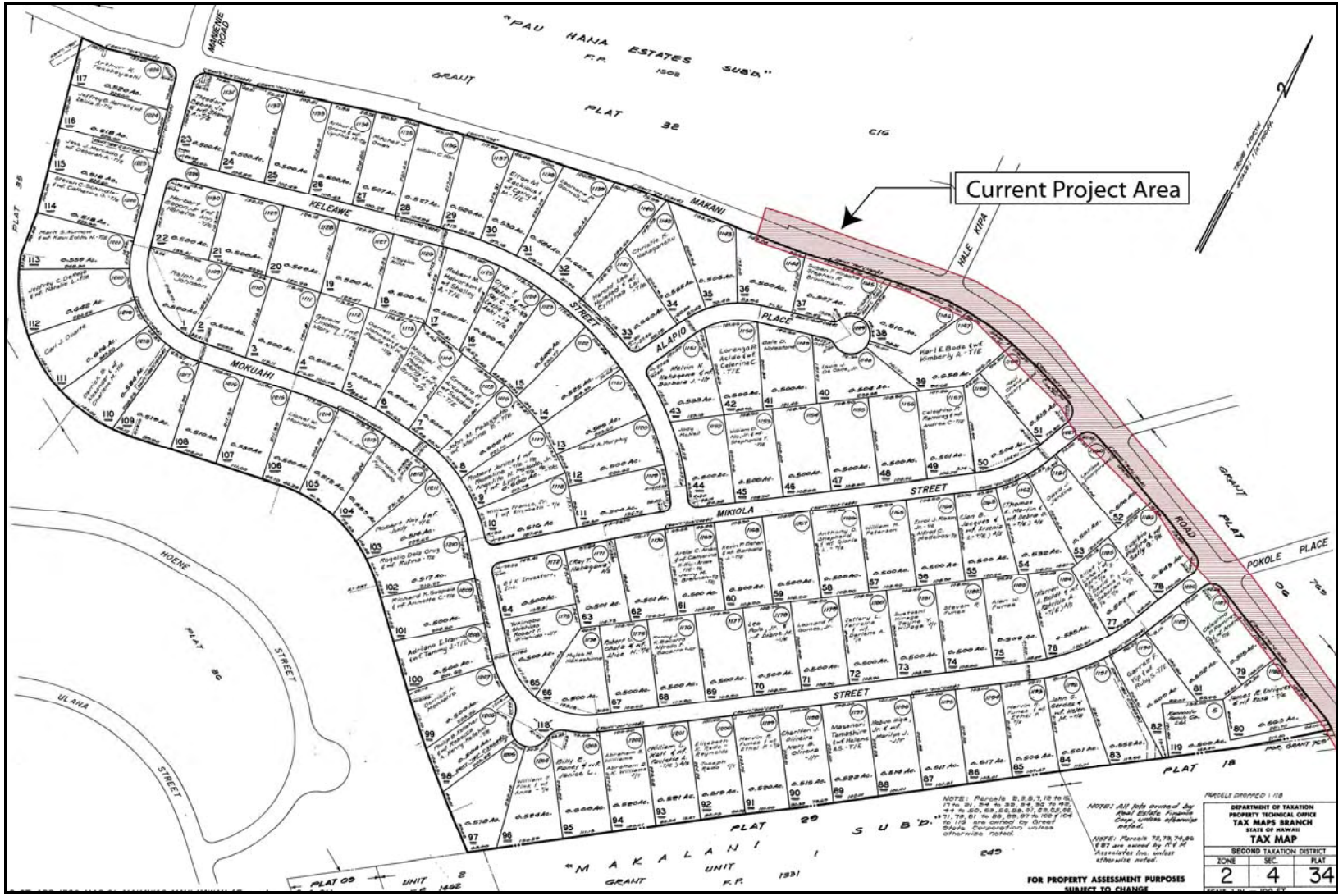


Figure 4. TMK map [TMK: (2) 2-4-34 showing red shaded project area. The Samuel Kalama Intermediate School is located north of the project area, in Plat 32.

1.3 Environmental Setting

1.3.1 Natural Environment

The project area is located along the westward-facing slope of Haleakalā mountain. The project area is at an average elevation of 1,600 feet above mean sea level (amsl), and consists mainly of soils of the Haliimaile Series. This soil series is found on the uplands on the island of Maui, mainly within elevations between 500 and 2,000 feet amsl (Foote et al. 1972:35). This soil series has developed from basic igneous rock of the Kula Volcanic Series (Stearns and MacDonald 1942), and is considered suitable for sugarcane, pineapple, pasture and woodland (Foote et al. 1972:248). The natural vegetation consists of guava, indigo, natal redtop, yellow foxtail, lantana, and *koa haole* (Foote et al. 1972:35).

Haliimaile Series soils have a surface layer of dark reddish-brown silty clay. Their substratum is dark reddish-brown and very dark grayish-brown clay. The specific soils found within the project area are Haliimaile silty clay loam, 7 to 15 percent slopes (HgC) (Figure 5). This soil type is characterized by medium runoff and a moderate erosion hazard. This soil type is considered good for sugar cane, both non-irrigated and irrigated, pineapple, pasture, and for woodland (Foote et al. 1972:36).

Soils which immediately bound the project area consist of Haliimaile silty clay (HgB), 3 to 7 percent slopes. This soil type is characterized by slow runoff and a slight erosion hazard. This soil type is considered excellent for sugar cane, both non-irrigated and irrigated, pineapple, pasture, and is also appropriate for home site development (Foote et al. 1972:35).

Rainfall accumulation within the project area averages between 40 and 60 inches per year with the heaviest rainfall occurring during the winter months (December through February) and with moderate rainfall during the summer months (June through August) (Giambelluca and Schroeder 1998:57). This pattern of rainfall once sustained a lowland dry and mesic forest, woodland and shrubland native ecosystem, prior to European contact (Pratt and Gon III 1998:122).

The landscape of the project area has been heavily modified by historic residential subdivision construction and forest clearance to develop pasture lands. Vegetation in the region now consists of a number of introduced species of eucalyptus (*Eucalyptus robusta* being dominant), various introduced landscape plants and grasses, Christmas berry (*Schinus teribinthiflious*), mango trees and various shower trees (jacaranda, or *Jacaranda mimisifolia*, being dominant). Ti (*Cordyline fruticosa*), a non-native ornamental yard plant, was observed at almost every residence.

The entire project area had been previously graded and cleared for rural residential subdivision use. Most single-family homes within the project area have been improved with boundary fences, retaining walls and landscaping. Municipal services including streets, sidewalks, utilities, and subsurface water and sewer service, are present. Three small portions of the project area are in pasture, all of which are covered in moderately dense buffel grass (*Cenchrus ciliaris*) and other alien grass species.

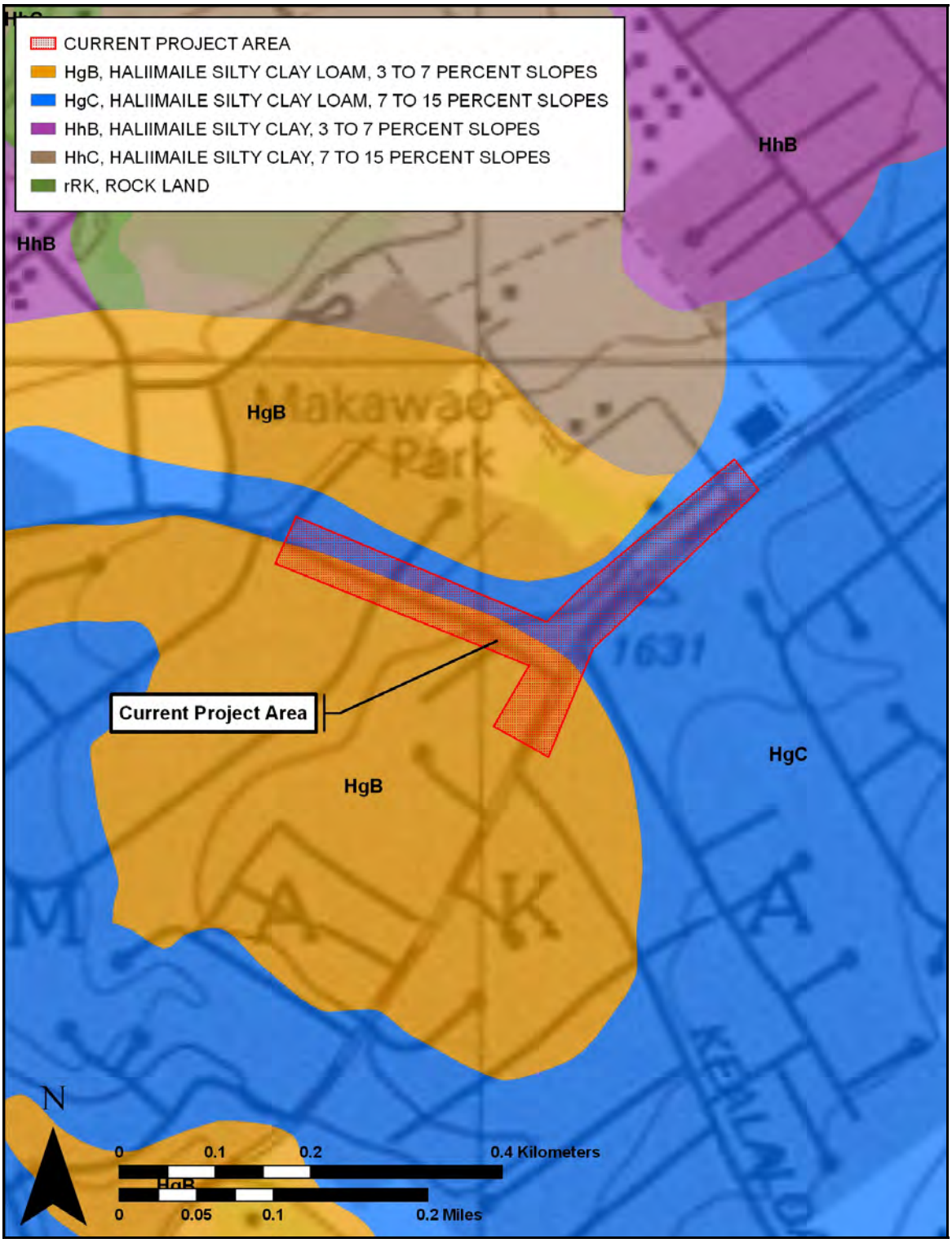


Figure 5. A portion of the 1992 Ha‘ikū 7.5-minute USGS topographic quadrangle, showing the project area relative to the local soil series (U.S. Department of Agriculture, Natural Resources Conservation Service 2001)

1.3.2 Built Environment

The built environment consists of sections of rural residential subdivisions, made up of single-family homes, each home on a separate lot averaging 7,500 square feet, or roughly one-quarter-acre in size. Homes are located along both Makawao Avenue and Makani Road. The project area is located 0.75 miles (1.6 km) west of the center of Makawao town, and 0.75 miles (1.6 km) east of the Haleakalā Highway (Route 37).

Rural residential single-family homes line both sides of Makawao Avenue (Figure 6) and both sides of Makani Road within the project area. The single family homes built along Makani Road (Figure 7) are more modern in construction, and are estimated to date to the 1960’s, with most of more recent construction, based on the widespread use of slab foundations for construction, and the frequency of two-story homes. In contrast, A number of homes located along Makawao Avenue appear to date to the 1920’s, and are characterized as one-story structures elevated off the ground on stilts. They are further characterized by single-wall construction, with exposed plumbing. A few of the older homes have corrugated iron roofs; it appears that most have replaced corrugated iron with modern wood/asphalt-shingle roofs.

In one instance, an older residence located at 1042 Makawao Avenue includes a detached Quonset hut-type building, which appears to have been modified as a residence. This probably occurred after the end of World War II (1945), when such buildings may have been abandoned by the U. S. military.

Figure 6. View of 1930’s-style single-family homes, left, located along the main thoroughfare of Makawao Avenue. This view, facing south, shows two single-wall construction homes. The second home has a corrugated iron roof, and both are elevated on stilts above ground level.

Figure 7. View of single-family homes along Makani Road. This view, to the southwest, shows homes constructed on slab foundations, with a second -story. In addition, homes on Makani Street often have air conditioning and/or fireplaces.

Section 2 Methods

Field inspection work was conducted by archaeologist Robert R. Hill, B.A., on January 16, 2008, under the direction of Principal Archaeologist Hallett Hammatt, Ph.D.

2.1 Field Methods

The project area consisted of two distinct landscape types:

1. Residential subdivision (Figure 8);
2. Sloping open lands (Figure 9).

The field inspection method consisted of a pedestrian check of each single-family residence from their frontage along Makawao Avenue and Makani Road. The vast majority of the project area consisted of rural residential single-family homes, each of which was photographed. Each residential house and lot was visually examined for native or indigenous plants, or evidence of traditional cultural architecture, practices, or beliefs. Photographs included other associated municipal services, such as overhead utilities, sidewalk right-of-ways, and drainage ways affected by the proposed project area.

Documentation methods included digital photographs and maps of three historic properties located within the project area. The location of CSH-1, a cut-basalt brick wall feature, was recorded with the Garmin GPSMAP 76S Unit using the UTM coordinate system, Zone 4 north.

2.2 Document Review

As part of the literature review and field inspection, a review of all previous archaeological work conducted in the surrounding area was performed. In addition, a variety of resources devoted to historical documentation of the region and traditional stories and accounts were reviewed. Research venues included the State Historic Preservation Division of the Department of Land and Natural Resources and the Survey Office of the Department of Accounting and General Services. Research regarding the history of Makawao was conducted utilizing an index of Maui News articles maintained by the Reference section of the Kahului Public Library. Additional research material was provided by Mary Cameron Sanford. All relevant Land Commission Awards (LCA) and Royal Patents were researched using resources associated with the Waihona Aina online database (Waihona Aina Corp. 2002).

Figure 8. Rural residential single-family home use dominates the project area. This photo shows a portion of Makani Road, looking west.

Figure 9. Three open lots are located along the western side of Makawao Avenue (view to northwest). This lot is just north of the Makawao/Makani intersection.

2.3 Consultation

An informal interview was conducted with Mrs. Mary Cameron Sanford, a fifth-generation descendant of Dr. Dwight Baldwin, who arrived as a protestant missionary in the Sandwich Islands in 1831. The next three generations of Dr. Dwight Baldwin's descendants - Henry Perrine Baldwin, Frank Fowler Baldwin and Asa Baldwin - were all managers of the Hawaiian Commercial & Sugar Company, a plantation acquired by H.P. Baldwin and S.T. Alexander in 1899. Frank Fowler's older brother, Harry Baldwin, married Ethel Smith. Their daughter, Frances Baldwin, married J. Walter Cameron. Frances and J. Walter Cameron are Mary Cameron Sanford's parents.

Henry Perrine Baldwin moved from Lahaina to Hāmākua Poko to start a large-scale commercial sugar plantation. As manager of the Hawaiian Commercial & Sugar Company, he first lived in Sunnyside, in the area of upper Pā‘ia, then moved further "upcountry," building a family estate at Maluhia, in the area of Olinda. Harry Baldwin, manager of the Maui Agricultural Company, first lived in Ha‘ikū, then moved his family to a newly-constructed home at Kaluanui in 1917.

Mary said that her grandmother, Ethel [Smith] Baldwin, had written that the name Kaluanui meant "the big pit." Ethel's writings included the story that heavy rains often caused waterfalls to form in the "sudden drop in Maliko Gulch just beyond Kaluanui," and that the name referred to the tumultuous flow of water in that portion of the gulch.

As Mary grew up, she heard Kaluanui as the name of the former sugar mill located on her grandparents' property. The mill had been in operation in the 1850's, but when Harry and Ethel Baldwin chose the site for their home in 1915, both the mill and the plantation that built it had been closed for decades. Mary said that her grandfather's first cousin, Charles William Dickey, was a prominent architect in California, and had begun to design fine homes for Honolulu businessmen. In 1915, Dickey designed the Italian-villa-inspired Kaluanui home for the Baldwins (which is now the Hui No'eau Visual Arts Center), and the stone and stained-glass Makawao Union Church. Both were completed in 1917 and still stand today.

Mary's mother, Frances [Baldwin] Cameron, recalled her visits to the Kaluanui estate before her parents bought it. They would stop to visit at Kaluanui on their way up to Makawao to visit "Mother Baldwin," (the wife of Henry Perrine Baldwin). Mary said her mother remembered the ride in a double-seat horse carriage with a yellow-fringed top and an extension in the back for baggage. Sitting in the back extension, Frances, her pet dog, her cat, or both, would ride from Haiku to Kaluanui to Maluhia in Olinda and back.

Mary's grandmother Ethel left behind many letters concerning the construction details at Kaluanui. According to Mary, her grandmother worried constantly about the cost of the construction, and pleaded with her husband to save money wherever he could. The servants' quarters were built of stucco, and the garage was built of solid concrete, despite her pleadings to build them less extravagantly.

In addition to these structures, a set of stables were built to house Harry Baldwin's horses. Mary explained, "Harry adored horses, from the time he was a young boy and his first job was to catch and saddle his father's horse early each morning. Harry's love for horses continued

through the generations to my mother and myself. We rode with him twice a week, rain or shine, through pineapple and cane fields, ranch pastures, and on dirt roads with immense enjoyment."

Mary also recalled that her mother told her of their early days at Kaluanui. Their house was built just across the road from Grove Ranch Camp. Mary has letters from her mother describing the camp: "There were a lot of people living at Grove Ranch, there was even a jail there. As our family was having our first dinner at dusk, we were surprised to see a crowd of people presumably from Grove Ranch watching the whole meal through the long dining room windows."

Mary spoke of her experiences during World War II, when the family home and grounds at Kalauanui were opened to servicemen who were stationed on Maui or were training on their way to combat in the Pacific: "My grandparents held huge luaus for the servicemen at the estate: they were on a first-name basis with the commanding officers of the Army Infantry Divisions. Sometimes my grandfather would take them out pheasant hunting on horseback. My grandmother Ethel was in charge of the Makawao U.S.O. center at the 'Crossroads' in Makawao (Figure 10) [what then became the famous Club Rodeo bar following World War II, and what is now Casanova's Italian Restaurant]."

Figure 10. Interior of the "Crossroads" U.S.O. center in Makawao during World War II.

"I have kept a sweater with the insignia of each of the military units that were based on Maui. I was sent away to college on the mainland when World War II broke out, as my parents felt it would be far safer for me not to remain in Hawaii. But as the war progressed in our favor, I was able to return home and see all of the patriotic work that my parents and grandparents did during the war," Mary said.

Section 3 Background Research

The division of Maui’s lands into political districts occurred during the rule of Kaka‘alaneo, under the direction of his *kahuna*, Kalaiha‘ōhi‘a (Beckwith 1970:383). This division resulted in twelve districts or *moku* during traditional times: Honua‘ula, Kahikinui, Kaupō, Kīpahulu, Hāna, Ko‘olau, Hāmākua Loa, Hāmākua Poko, Wailuku, Ka‘anapali, Lahaina, and Kula. The current project area is located within the windward region of Haleakalā in the *ahupua‘a* of Hāmākua Poko (Figure 11). According to Folk (1990), the *ahupua‘a* lands of Hāli‘imaile, Pā‘ia, Kū‘au and Hulā‘ia (spelled Hulē‘ia in Fornander 1916:284), were made a part of the larger Hāmākua Poko Ahupua‘a sometime prior to the land division known as the Great Māhele, in 1848.

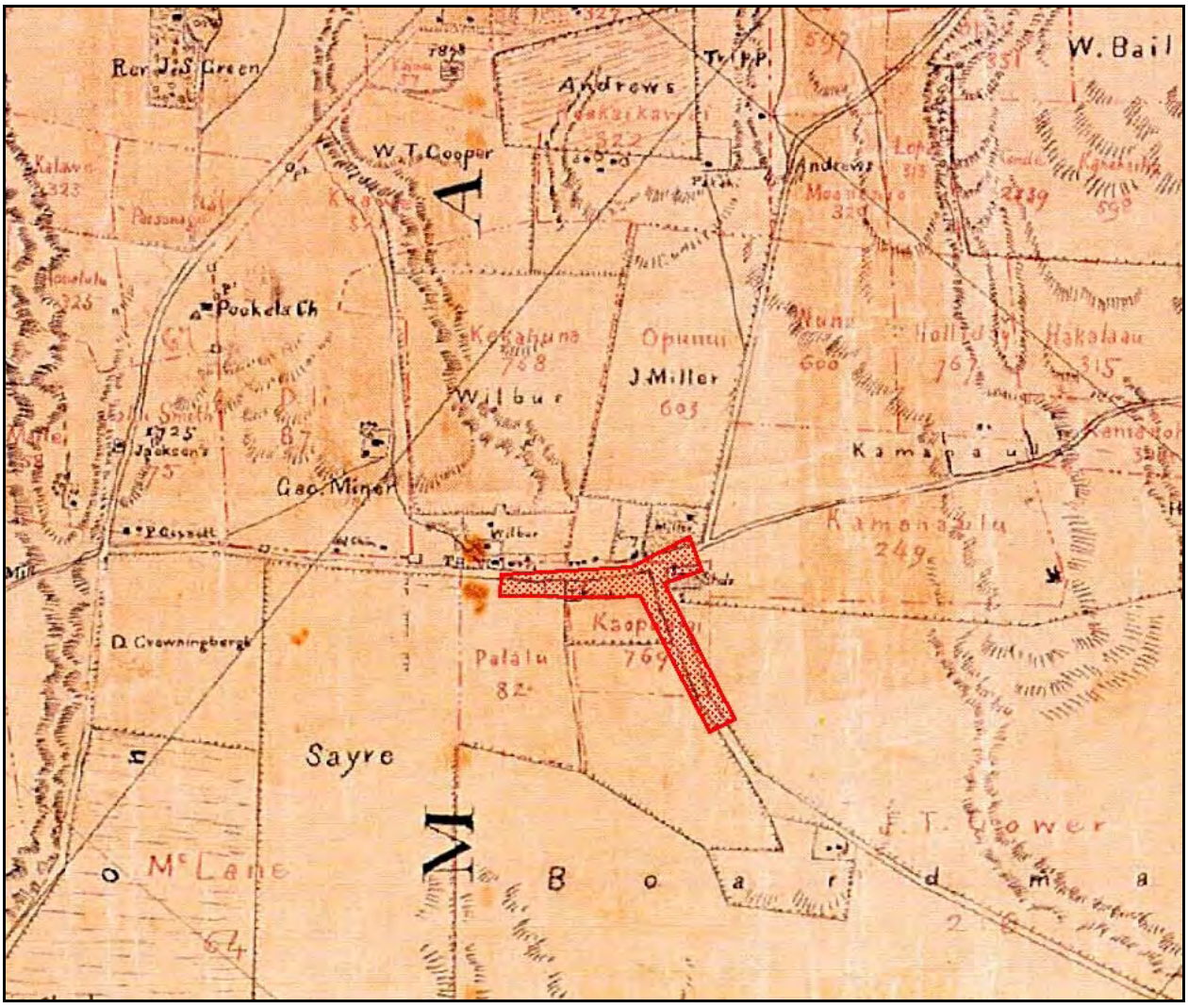


Figure 11. A portion of the C.J. Lyons map (1872) showing the region of Makawao within Hāmākua Poko Ahupua‘a (reprinted from Moffat and Fitzpatrick 1995). The Makawao Avenue/Makani Road intersection is located in Royal Patent 769 to Kaopualai. The geo-referenced project area is shown in red shading.

3.1 Traditional and Historical Background

3.1.1 Mythological Accounts

Tales of great wars fought in Hāmākua Loa somewhat overshadow mythological and traditional accounts of the Hāmākua Poko area. An analysis of the place name meanings (Table 1) for the region surrounding the project area may yield some insight into the patterns of life for this *ahupua‘a* that stretches from the ocean to the uppermost slopes of Haleakalā. Literal translations of several of the place names for land areas and divisions near to the project area are listed below. Unless otherwise noted, the translations are taken from Pukui et al. (1974):

Table 1. Place name meanings of the project area and vicinity.

‘Alelele	Name for a portion of a gulch which feeds into the Maliko Gulch just before Kōkomo (Sterling 1998).
Hāli‘imaile	*Lit.*, “*maile* vines strewn.” The location of a village, an *ahupua‘a* land division, and a congregational church.
Hāmākua Poko	*Lit.*, “short Hāmākua.” The project area *ahupua‘a,* and the *moku* land district encompassing both Hāmākua Poko and Hāli‘imaile *ahupua‘a*.
Ho‘olehua	*Lit.*, “acting the expert.” Region just north of the Haleakala Government Tract in Olinda.
Hulā‘ia	*Lit.*, “*pushed through,*” in reference to a union between the gods Kamapua‘a and Pele (Fornander 1918:342)
Kahaupali	*Lit.*, “the *hau* trees of the cliff.” The region *makai* of Mauna ‘olu school campus.
Kāheka	*Lit.*, “shallow pool.” Name of plantation village located just inland from Pā‘ia.
Ka‘ili‘ili	*Lit.*, “the pebble.” Site of a plantation village located further inland of Kōkomo
Kailua (Gulch)	*Lit.*, “two seas.” Name for the western boundary gulch of Hāmākua Poko Ahupua‘a.
Kalahau	Name given to a pre-contact burial area at Kū‘au Beach.
Kalena	*Lit.*, ‘the lazy one.” Name of a pool located at the foot of Pi‘iholo hill (Turner 1929).
Kaluanui	*Lit*., “the big pit.” Given in place name chants as “standing by the twin hills, the palm houses of Kane” (Fornander 1916:286). Also, the region of the present-day Hui Noeau Visual Arts Center.
Kamole	*Lit*., “the main root.”

Kapalaea	*Lit*.,“the daubing with ‘alaea (pala = to smear, daub; ‘alaea = red, ocherous earth).” Pukui (In Sterling 1998:98) felt the reference to preparations made for dedicating a *luakini heiau* applied here. The *ahupua‘a* boundary roadway was cleared of weeds, a stone altar was placed at each boundary of the *ahupua‘a*, and a priest smeared with a mixture of *‘alaea* and water offered a prayer and smeared the wooden image of a *pua‘a* (pig’s head) with the *‘alaea*. The land known as Kapalaea was the site of the Haleakala ranch in Makawao (Sterling 1998:97)
Kawa‘apae	According to Sterling (1998:97), the place name for the slight rise above Kaluanui, the place where J. Walter Cameron once lived.
Kōkomo	*Lit*.,“*koa* tree entrance.” Sterling (1998:97) gives the original name as “Koa komo,” subsequently shortened over time.
Ku‘aihulumoa	*Lit.*, “butchered chicken feathers,” a gulch which runs past Makawao and joins Maliko Gulch (Sterling 1998).
Kū‘au	*Lit.*, “handle.” Landing where sugar from the Haliimaile and Paia Sugar Plantations was shipped (Dean 1950).
Lilinoe	*Lit*., “mists,” Two legendary references for this name. The first, named for a goddess of the mists, and sister of Poliahu, goddess of snow. The second, the name given to the wife of Nu‘u, the Hawaiian counterpart of the biblical Noah (Fornander 1919:269). A name for the area of the J. Walter Cameron estate above Kaluanui (Sterling 1998:97).
Maka‘ehu	*Lit*., “red eye.” [irritated from dust] The region of Makawao-Kula boundary adjacent to Kapalaea (Sterling 1998:99).
Makawao	*Lit*., “forest beginning.” Name given to the town located *mauka*, in the mountainous region of the *ahupua‘a*.
Māliko (Gulch, Bay)	*Lit.*, “budding.” Once the site of an important coastal landing, where sugar was shipped out of the Pauwela region.
Maluhia	*Lit.*, “peaceful.” Name given to the Baldwin family home in Olinda.
Mauna ‘olu	*Lit.*, “cool mountain.” The site of Maunaolu Seminary, a school for women, established at the present site in 1900. The previous site of the school, between 1859 and 1899, was in Olinda.
Paholei	Fornander (1918:606) states Paholei was the word used for awa (Piper methysticum), the intoxicating plant of Polynesia. Also, the place name in Hāli‘imaile where early *paniolos* (cowboys) trained horses (Sterling 1998).
Pā‘ia	*Lit*., “noisy;” name given to the plantation town located *makai*, just inland of the northern coastline of the *ahupua‘a*.

Pālau‘ili	*Lit*., “to blow from various directions” [as a swirling wind]. The site of the present-day Makawao Union Church, completed in 1917 (Sterling 1998:97).
Paliuli	*Lit*., “green cliff,” Paliuli is one of two legendary hills under the powers of Kāne and Kanaloa (Fornander 1916:518). In another legend, Paliuli is the cliff under which the lizard-god, Kihanuilulumoku, sleeps (Fornander 1918:416). Site of present-day Rainbow Park (Sterling 1998) and former site of Robert Hind sugar mill circa 1870 (Dean 1950). Kalakaua (1888) refers to Paliuli as the mythological “Paradise” where the newly created man, Kumu-honua, and woman, Ke-ola-ku-honua, lived.
Pi‘iholo (Cinder Cone)	*Lit.*, “climb run.” The present-day site of Baldwin-owned ranch lands, located just north of Makawao town.
Po‘okela (Church)	*Lit.*, “foremost.” Located on a sharp rise east of Makawao town.
Pukalani	*Lit*., “heavenly gate.” Village located south of Makawao town.
Pu‘u ‘alaea	*Lit*., “hill of red rain,” named for the ocherous red earth used during religious ceremonies of pre-contact Hawai‘i.
Pu‘u o Kāka‘e	*Lit.*, “hill of Kāka‘e,” named for a high-ranking order of Maui chiefs (Kamakau 1992:85).
Pu‘u Makani	*Lit., ‘hill of wind.*” The hill which the present-day Mauna ‘olu campus occupies.
Wa‘aluawai	*Lit.*, “canoe water hole,” regional place name *makai* of the original Makawao Union Church, in lower Makawao town.
Wai‘alalā	*Lit*., “screaming water.”
Waihou	*Lit.*, “new water.” The location of fresh-water springs in upper Olinda.

The above place names, together with the environmental data, suggest that the lands within the upland region of Hāmākua Poko were fertile agriculturally, with ample rains. According to community consultation conducted by Mann and others (2003), informant Sam Ka‘ai reported that the rains of the Makawao region were given many different names by the Native Hawaiians, some because of the specific area (such as Pi‘iholo) where the rains fell. According to Rechtman and Clark (2001), pre-contact permanent habitation of the *ahupua‘a* took place in the coastal region of Kū‘au and Pā‘ia, owing to pronounced evidence of midden deposits, ceremonial structures, and pre-contact burials. Evidence of continuing habitation along the coast and into the early historic-era is evidenced by structural remnants of sugar plantations that predate the large-scale commercial ventures of the 1880’s (Sande 1976). Evidence of pre-contact agriculture and habitation in the upland portion of Hāmākuapoko begins within the sidewalls and valleys of the Maliko and Hāmākuapoko Streams: areas less affected by widespread commercial cultivation of sugar and pineapple in historic times. According to Inez Ashdown (1970), a *heiau* named Kau-

ma-ka-‘ula was once found in Maliko Gulch. The *heiau* was originally associated with high chief Ka-me-ha-i-kau‘a but it was later rededicated to the chief Ke-kua-o-ka-lani (Ashdown 1970:30).

The movement of people in pre-contact times between the coastal settlements and habitation areas further upland resulted in the establishment of ceremonial *heiau* structures (Kennedy 1990) along the upper reaches of the Kailua Gulch. It is notable that the *ahupua‘a* is bounded by two large gulches, the Kailua to the west and the perennial flow of Māliko to the east. It is between these two gulches, and entirely within this single *ahupua‘a*, that an ascent can be made to the rim of Haleakalā crater without great difficulty (Richards 1829). When the first Protestant missionaries made the ascent in 1828, they were undoubtedly guided by those who had traditionally made the climb from the isthmus many times before.

3.1.2 Traditional Accounts

A landform which appears at the uppermost elevation of the Hāmākua Poko Ahupua‘a is a cinder cone named Pu‘u Alaea. The promontory name is noteworthy because *alaea* is a word of great import in the Hawaiian language. According to Fornander (1919), two separate priests, the *kualaea* priest (he who oversees the colored earth basin) and the *kahalaalaea* priest (he who is marked with colored earth) were both essential to the process of dedicating temples. In the following account, the importance of these priests becomes clear:

> After the king and the priest had come to a decision, and the day for the dedication of the temple was near, the king spoke to the kahalaalaea priest, saying: “Be prepared to go into sanctity, with your ordinances and your methods, and if it is favorable let me know.” The kahalaalaea priest went into sanctity on the night of Kane, preparing and praying throughout the night; and in the morning, the day of Lono, there stood the basin of colored earth, necessary for the priest’s duties; these were the essentials of the temple. And on the next day, that of Mauli, the king and a multitude of men came to hear the words of the kahalaalaea priest. The priest then performed the duties of his office. A certain man placed on his (the man’s) head a covering of ancient human hair, a custom of his ancestors which was transmitted to him, and a duty also belonging to the temple. The priest praying meanwhile, the king reached the alaea image where the basin of colored earth stood before the priest; this being the diety with a white covering to make its impressiveness as a god more effective (Fornander 1919:8).

Fornander notes that the “Night of Kāne” referred to above, was the twenty-seventh of the lunar month; Lono the twenty-eighth, and Mauli the twenty ninth.

Further in the temple dedication ceremony, Fornander (1919) described a procession whereby the *alaea* image was used to consecrate blocks of *kukui* wood that had been carved with markings to resemble swine features for sacrifice. When the *alaea* god arrived at the place for the pig services, the *pua‘a-kukui* (kukui-wood pig effigies) were prepared, and marked with red earth by the priest, who offered a prayer, and received tribute from the people in the form of pigs, foodstuffs, feathers, and cloth.

Following additional preparations for the sanctification of the temple, Fornander (1919) describes one of the most important steps:

> Then the priest who had the alaea arose and placed a hala wreath on the king, and one around the neck of the idol, and one around his own neck; this was an ordinance of the alaea priest. And then he said to the people, “Keep quiet, all of you people and all of you chiefs.” He then turned to the king and said: “Listen to my prayer for you. During my supplication, if a chief interferes, he is a traitor to the land: but if a common man he shall die for your god” (Fornander 1919:16).

From these accounts, the importance of the landmark Pu‘u Alaea, the highest promontory of the ahupua‘a, is made known. In a similar manner, Fornander (1919) records an account of Kaluanui which attribues great significance to this region of Makawao:

> Kaluanui! Kaluanui!
>
> They stand as twin hills, the hat-palm houses
>
> Which Kane thatched;
>
> The birds are calling me from the kakio
>
> Which Kane cultivated;
>
> Tilled by Kikau of Hana
>
> During the oopu season of Waikolu
>
> I am going home to eat;
>
> Kala is the fish I will eat until satisfied,
>
> It is the fish sacred to my god; alas! (Fornander 1919:48)

In the earliest traditions of the people of Maui, the place name of Makawao is synonymous with legends associated with rainfall. In one story, the ‘ūkiukiu rain of Makawao is measured as a soft drizzle, a phenomenon of the region that occurs when “the Kiu rain cloud of Makawao meets the Naulu rain cloud from Kula then the rain comes, the typical Makawao rain” (Sterling 1998:99).

Sterling (1998) recorded six additional words meant to differentiate the many wind and rain combinations found in the Makawao area. These traditional terms for the various rains of Makawao were defined by Sam Ka‘ai in an interview conducted by Mann and others (2003): “‘Ūkiukiu is the rain proudly moving across the top of Pi‘iholo.” Sam Ka‘ai went further in his analysis of mists and rains of the region, where special meanings have been given to the falling of rain and the generation of streams at Hāmākua Poko. “The mist rains of ‘ulalena are the reddish-yellow rains, which is, the rain is falling and the light comes through from the dawn, and that is the water spirit, and it would be one of the lower manifestations of the kūohu, the cloud of Kāne’s involvement – when the rain falls. You see, it’s Kāne, it’s the rains of Kāne falling on the forest of Haumea [a female spirit of the forest (Fornander 1920:249)] (Sam Ka‘ai in Mann et al. 2003:44).

In ancient times, the interior of Māliko Gulch was known for its extensive terracing for dryland taro. (Handy and Handy 1995:498). In an excerpt from E.S.C. Handy in *Sites of Maui* (Sterling 1998:93), cultivation along the Māliko Stream is described: “The deep gulch of Maliko Stream widens at its seaward end into a flat-bottomed valley which, in pre-sugar days, when the

stream had a constant flow, harbored a number of terraces. The gradually rising land of Hamakuapoko in earlier times would have been suitable for dry taro but not for wet. It was probably well populated and cultivated, for the *kula* land east of Maliko was a small patchwork of *ahupua‘a.*"

3.1.3 Early Historic Period

The earliest account concerning Hāmākua Poko is given by Fornander (1880:236) during the time of Kamehameha I's conquest of Maui in 1790. A large force of canoes, sent by Kamehameha I and led by his commander Keawemauhili, embarked from the island of Hawai‘i and landed at Hāmoa, in Hāna. The Maui chief Kalanikupule sent his forces through the district of Hāmākua Loa to meet the invaders, which now included Kamehameha himself. Both armies met in battles at Pu‘ukoa‘e and Halehaku, with the Maui forces eventually being routed and pursued to Hāmākua Poko. There, at Kokomo, a final stand was made. The champion of the Maui forces, Kapakahili, was killed by Kamehameha, causing the remaining Maui defenders to flee. The road to Wailuku lay open to Kamehameha, and his fleet of war canoes was said to have stretched from Kahului to Hopukoa. The resulting battle is perhaps the most famous for which the Maui landmark, ‘Īao Valley, is known. Kamehameha's forces drove the Maui army into ‘Īao Valley and annihilated them, blocking the waters of ‘Īao Stream with corpses of the defenders. One of the names of the battle is "Kepaniwai," or the damming of the waters (Fornander 1880:237).

By 1810, Kamehameha I had united all of the Hawaiian Islands and had brought a period of peace across the Kingdom. Foreign merchants established a major trading port at Lahaina, on the island of Maui. In 1828, Protestant missionaries from Lahaina embarked on a tour around the entire island (Richards 1829). The missionaries had been given canoes and native helpers in order to inspect schools which had been established by native teachers. During this tour, resources of the lands of Hāmākua Poko were noted, and the first ascent of Haleakalā by white foreigners was made by way of Hāli‘imaile:

> [August] 20 [1828]. Proceeded on our way, by land, crossed the neck, which unites East and West Maui. This neck is about 10 miles wide. It is probable, that Maui was once two islands. After walking eight or ten miles on the beach, we reached Kamakuapoko. This is a large district…. Soon after leaving the place, we began to ascend, towards the mountain, and traveled through tracts of land, of an excellent quality. As there is sufficient rain, at all seasons of the year, on this part of the island, these fields would, doubtless, produce fine wheat, and other English grain. About 3 o'clock P.M., we reached Kaalimaile, and examined another school. There were about 40 scholars. This is a school of no ordinary character; and one, in whose history we were highly gratified.
>
> Here we tarried over night, intending in the morning, to ascend the mountain, near which we were, and sleep on the highest land on Maui. We were told by the natives, that the way was long, but the ascent very easy. We suppose no English travellers [sic] had ever ascended this mountain. (Richards 1829:247)
>
> [August] 21 [1828]. We rose early, and prepared for our ascent. Having procured a guide, we set out; taking only a scanty supply of provisions. Half way up the

> mountain, we found plenty of good water, and at a convenient fountain, we filled our calabash for tea. By the sides of our path, we found plenty of ohelos, (a juicy berry, very palatable), and, occasionally, a cluster of strawberries. On the lower part of the mountain, there is considerable timber; but as we proceeded, it became scarce, and, as we approached the summit, almost the only thing, of the vegetable kind, which we saw, was a plant that grew to the height of six or eight feet, and produced a most beautiful flower. It seems to be peculiar to this mountain, as our guide and servants made ornaments of it for their hats, to demonstrate to those below, that they had been to the top of the mountain.

Travel through Hāmākua Poko continued with their arrival at the crater itself. The geologic features of Haleakalā mesmerized the missionaries much the same way that modern tourists view a sunrise or sunset from the summit:

> It was nearly 5 o'clock, when we reached the summit; but we felt ourselves richly repaid for the toil of the day, by the grandeur and beauty of the scene, which at once opened to our view. The day was very fine. The clouds, which hung over the mountains on West Maui, and which were scattered promiscuously, between us and the sea, were far below us; so that we saw the *upper side* [italics theirs] of them, while the reflection of the sun painting their verge with varied tints, made them appear like enchantment. On the other side, we beheld the seat of Pele's dreadful reign. We stood on the edge of a tremendous crater, down which, a single misstep would have precipitated us 1,000 or 1,500 feet. This was once filled with liquid fire, and in it, we counted sixteen extinguished craters. To complete the grandeur of the scene, Mouna Kea and Mouna Roa lifted their lofty summits, and convinced us, that, though far above the clouds, we were far below the feet of the traveller [sic] who ascends the mountains of Hawaii. By this time, the sun had nearly sunk in the Pacific; and we looked around for a shelter during the night. Our guide and other attendants we had left far behind; and we reluctantly began our descent, keeping along on the edge of the crater (Richards 1829:248).

As the explorers searched along the southwest rim of the crater, they were able to find ancient rock shelters built, as they assumed, by pre-contact Hawaiians:

> After descending about a mile, we met the poor fellows, who were hobbling along on the sharp lava, as fast as their feet would suffer them. They were glad to stop for the night, though they complained of the cold. We kindled a fire, and preparations were made for tea and lodgings. The former we obtained with little trouble. We boiled part of a chicken, roasted a few potatoes, and, gathering round the fire, we made a comfortable meal; but the place of lodging, we obtained with some difficulty. At length, we spread our mats and blankets in a small yard, enclosed, probably, by natives, when passing from one side of the island to the other. We were within twenty feet of the precipice, and the wind whistled across the valley, forcibly reminding us of a November evening in New England.

The 22nd of August, 1828, the explorers described the Ko‘olau and Kaupō Gaps, and moved down through Hāmākua Poko:

> Early in the morning, we arose, and reascended [sic] the mountain, to its summit and contemplated the beauties of the rising sun, and gazed a while longer, on the scenery before us. There seemed to be but one or two places, where the lava had found a passage to the sea, and through these channels, it must have rushed with tremendous velocity. Not having an instrument, we were unable to acertain the height of the mountain. We presume it would not fall short of 10,000 feet. The circumference of the great crater, we judged to be no less than fifteen miles. We were anxious to remain longer, that we might descend into the crater, to examine the appearance of things below, and ascend other eminences; but as we were nearly out of provisions and our work but just commenced, we finished our chicken and tea, and began our descent. When we reached the cluster of houses nearest the mountain, the occupants, who had heard of our approach, kindly presented us with roasted corn and bananas (Richards1829:248).

The missionaries walked out of Hāmākua Poko, and into Hāmākua Loa:

> About one o’clock, P.M., we reached the place, where we had left our furniture for traveling. From this place to the sea, we walked, in a new direction, over some of the most beautiful land we ever saw. The greater part of it is uncultivated, but a New England farmer would make it like the garden of Eden. The timber, which is plenty, is mostly of the Kui, [Kukui] or lamp tree. It yields a nut, nearly as large as a butternut, from which oil, of an excellent quality, is easily extracted. The natives open the nut, string the meats on a small stick, and set the upper one on fire. They burn with great freedom, and give a good light. As we proceeded, our attendants pointed out several places, where hostile armies had met in battle.

Ships engaged in whaling and sandalwood and fur trading sought repairs and provisions, while the establishment of sugar plantations and missionary stations spurred the proliferation of small landings. From two such landings, one at Kū‘au and one at Māliko, the Haliimaile Plantation shipped its first cargo of raw sugar and molasses. The Haliimaile Plantation was organized in 1848, and eventually included lands extending from the present-day location of the HC&S Paia Mill to the present-day location of the Hui No‘eau Visual Arts Center, with its western boundary along the Kailua Gulch. This plantation was renamed the Brewer Plantation in the 1850’s, the Union Plantation in the 1860’s (during the American Civil War), the Hobron Plantation in the 1870’s, and finally the Grove Ranch Plantation, prior to merging with the Paia Plantation in 1889 (Burns 1991).

As the agricultural and ranching population of Hāmākua Poko grew, Makawao became an established plantation town and a focus for Christian life in the 1840’s and 1850’s. Government-sponsored schools, independent churches and church-organized schools were set up in small villages from Pā‘ia to Olinda. In addition to the Haliimaile Plantation, two other small independent plantations became established in the region: the East Maui Plantation and the Haiku Sugar Company.

The East Maui Plantation was set up in 1850 by Dr. Robert W. Wood in partnership with Ambrose H. Spencer. Together, they cultivated 500 acres of land in Kaluanui. In 1852, their mill at Kaluanui became the first to use centrifugals to separate sugar from molasses in the sugar manufacturing process (Dorrance 2000). This plantation was acquired by the Haiku Sugar

Company in 1886, whereupon the small Kaluanui mill (the ruins of which can still be seen on the grounds of the Hui No‘eau Visual Arts Center) was closed (Sanford 2008).

Although two missionaries (Richard Armstrong and Amos Cooke) established the Haiku Sugar Company in 1858, its commercial success was due to a second-generation missionary descendant, Henry Perrine Baldwin. In 1877, Baldwin constructed a sugar mill on the west side of Maliko Gulch, named the Hamakuapoko Mill, a structure which was placed on the U.S. Historic American Building Register in 1966 (HABS no. HI-44) (Figure 12). By 1880, the Haiku Sugar Company was milling and bagging raw sugar at Hāmākua Poko for shipment out of Kuau Landing. The Kuau Landing was abandoned in favor of the newly-completed Kahului Railroad line in 1881, with all regional sugar sent then by rail to the port of Kahului. By 1884, the partnership of Samuel T. Alexander and Henry P. Baldwin had bought the controlling interest in the Haiku Sugar Company (Dorrance 2000).

Figure 12. Historic American Buildings Survey (HABS) photo of the Hamakuapoko Mill Ruins (Library of Congress 2008).

3.1.4 Mid- to late-1800s

The most significant change in land-use patterns and land allocation came with the Great Māhele of 1848 and the privatization of land in Hawai‘i. This action hastened the shift of the Hawaiian economy from subsistence-based to market-based. During the Māhele, all of the lands

in the Kingdom of Hawai‘i were divided between *mō‘ī* (king), *ali‘i* (chiefs), *konohiki* (resident overseers of an *ahupua‘a*), and *maka‘āinana* (tenants of the land), which allowed the land to pass into the Western land tenure model of private ownership. On March 8, 1848, Kauikeaouli (Kamehameha III) further divided his personal holdings into lands he would retain as private holdings and parcels he would give to the government. This act paved the way for government land sales to foreigners. With the exception of land sales offered by the Kingdom in 1845 at Makawao and at Mānoa, on O‘ahu, the legislature granted resident aliens the right to acquire fee simple land rights in 1850 (Moffat and Fitzpatrick 1995: 41-51).

Native Hawaiians who desired to claim the lands on which they resided were required to present testimony before the Board of Commissioners to Quiet Land Titles. Upon acceptance of a claim the Board granted a Land Commission Award (LCA) to the individual. The awardee was then required to pay in cash an amount equal to one-third of the total land value or to pay in unused land. Following this payment, a Royal Patent was issued that gave full title of ownership to the tenant. In this way, the government of Hawaii offered land for sale to both Native Hawaiians and foreigners. Such lands were referred to as Royal Patent Grants or as Grants (Alexander 1891).

Prior to the 1848 Māhele, approximately 80 tracts of land were offered for sale in fee simple by way of Land Grant Patents in the Makawao region of Hāmākua Poko. Most parcels were purchased in 1845 and 1846 from the Kingdom for $1.00 per acre (Donham 1990). A map prepared in 1847 by Theophilus Metcalf (Figure 13) shows that the land in which the current project area lies was originally sold as parcels of almost 20 acres each, and were purchased as Land Grant Patents (see Table 2: all boldface numbers are Land Grants Patents in the immediate vicinity of the current project area) (Waihona ‘Aina 2000). The lands portrayed in the Metcalf (1847) map were among the first parcels in the islands to be sold to individuals (Moffat and Fitzgerald 1995). Missionaries Richard Armstrong (surveyor) and Jonathan Smith Green (agent for Kamehameha III) assisted in recording the land sales and establishing boundaries. The concentration of the Land Grant Patents, the acreage involved, and the predominance of Native Hawaiian purchasers indicate that Native Hawaiians living within the *ahupua‘a* of Hāmākua Poko were desirous of purchasing land in fee simple (Waihona ‘Aina 2002). Excempt from this sale were two parcels totaling 688.94 acres, which belonged to one McLane as plantation lands.

Land owners within the *ahupua‘a* of Hāmākua Poko utilized most of the lands in the lower elevations for sugar, cleared land for ranching throughout Makawao, and developed the upper elevations for watershed. True commercial cultivation of sugar throughout Pā‘ia was initiated by Samuel T. Alexander and Henry P. Baldwin in the 1880’s, when the first large-scale ditch system to bring water from East Maui to the relatively arid area of Hāmākua Poko was developed (Dean 1950). The hillsides above Makawao became home to the *paniolo*, or Hawaiian cowboy, as cattle ranged across the lands of the Haleakalā Ranch (von Tempski 1968). Ambitious projects to develop the water resources for a growing upcountry population led to the construction of reservoirs at the very highest reaches of the *ahupua‘a* (Stearns 1942).

Reverend Johnathan Smith Green became an independent pastor for the American Missionary Association, having resigned from service with the American Board of Commissioners for Foreign Missions in Hawai‘i. He moved to Makawao with his wife in 1842,

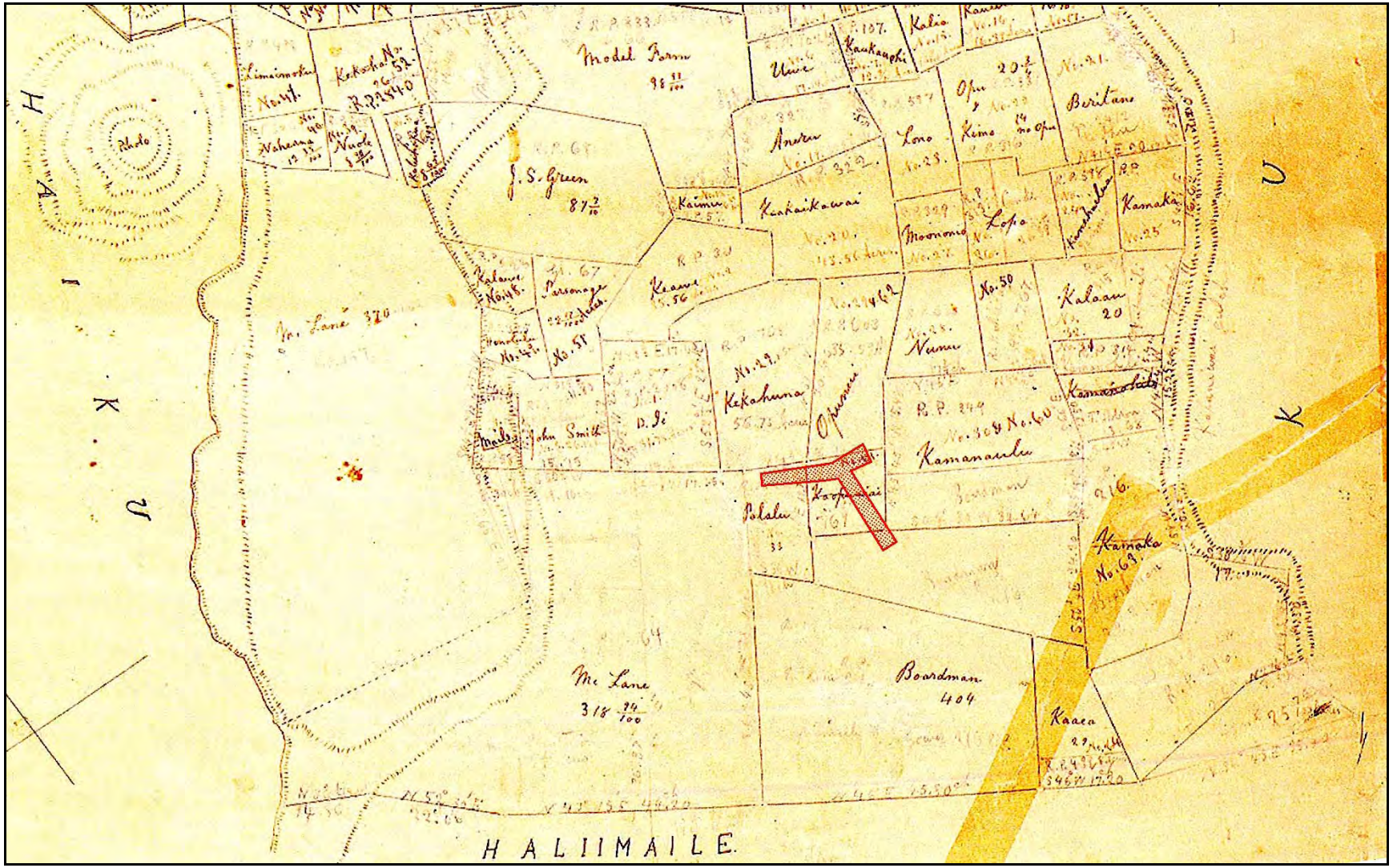


Figure 13. Map of Land Grant Patents awarded in Makawao 1845-1846. Map drawn in 1847 by Theophilus Metcalf and reprinted from Moffat and Fitzpatrick (1995). The red shaded area (center) is the present project area geo-referenced to show its location

.Table 2. Land Grants and Land Commission Awards within Hāmākua Poko Ahupua‘a. All boldface numbers are Land Grants Patents in the immediate vicinity of the current project area

LCA	Land Grant Number	Claimant	Comments	Acreage
	4937	H.P. Baldwin	Portion of Olinda	70.50 Ac.
	3084	Jas. Makee	Portion of Laniwai	
	2285	Kauwe		
	770	Kapai		
	2130		Haleakala School	
	599	Kiaipu		68.95 Ac.
		C.B. Andrews	Church	
	504	Kekina		
	326	Kuli		25.12 Ac.
	2840	Kekua		37.65 Ac.
		S. Moo		
	317	Kahanapule		21.10 Ac.
	319	Ohule		12.61 Ac.
	318	Kekalo		
	602	Kalawaiahou		
	2009	M.E. Green		
	330	Makua		19.20 Ac.
	84	Kekoa		18.82 Ac.
	56	Paele		2.93 Ac.
	79	Kalawe		11.10 Ac.
	320	Honuaakaha		19.22 Ac.
	833	Model Farm		98.93 Ac.
	85	Kalaiohua		19.79 Ac.
	86	Kahainapule		35.06 Ac.
	498	Limaimoku		
	324	Naheana		
	328	Nuhole		
	65	Kaleihonu		
	68	J.S. Green		87.70 Ac.
	57	Kaima		
	327	Aneru	Female Seminary	
	322	Keakaikawai		43.56 Ac.
	102	Uwe		
	107	Kaukauohi		12.90 Ac.
	90	Kalia		13.11 Ac.
	332	Kawila		16.39 Ac.
	601	Uwekalohe	Dairy	16.60 Ac.
	2472	Ihu		

LCA	Land Grant Number	Claimant	Comments	Acreage
	316	Kimo		20.80 Ac.
	597	Lono		
	331	Opu		20.75 Ac.
	313	Lopa		
	2639	Conde		
	598	Kanekailua		
		Kamaka		
	157	McLane		370 Ac.
	325	Honolulu		
	323	Kalawe		
	67	J.S. Green	Parsonage	22.17 Ac.
	321	Keawe		35.56 Ac.
	322	Keakaikawai		
	329	Moanonio		
	1817	Kupaiuli		
	315	Hakalaau		
	767	Holliday		
	600	Nunu		17.20 Ac.
	603	Opunui		35.59 Ac.
	768	Kekahuna		56.75 Ac.
	2008	D. Ii	Site of Po‘okela Church	
	75	Jackson		
	1725	John Smith		15.75 Ac.
	58	Maile		
	64	McLane		318 Ac.
	82	Palalu		
	769	Kaupuaiai		
	249	Kamanaulu		
	314	Kamanohili		
	216	Boardman		
	499	Kaaea		
11216		Miriam Kekauonohi	Hobron Plantation, Hāli‘imaile, (Royal Patent 7512)	4,260 Ac.

first establishing a church for Hawaiians at Makawao (The Po‘okela Independent Church), at the invitation of a district chief named Kiha (Green 1948), whereby land and material for the church were donated by Kamehameha III. In 1845, when the Kingdom of Hawai‘i announced that 900 acres of land in Makawao would be made available for fee simple purchase. Johnathan Green became an agent for the Kingdom and collected monies due the government. Each parcel was

registered as a Land Grant, and was not listed in the Indices of Land Commission Awards, a process which began in 1848 (Donham 1990).

In 1853, the government of the Kingdom of Hawai‘i had set aside much of the *ahupua‘a* of Hāmākua Poko to the Board of Education (Burns 1991). Within the 5,000 acres transferred by the Kingdom were a number of large *kuleana* belonging to native Hawaiian owners. The Board of Education deeded the Hāmākua Poko acreage which was unencumbered by native claims to the Trustees of Oahu College in 1860, who then sold the land to the Haiku Sugar Company (Dean 1950).

A “foreign” church, which conducted services in English, was established in 1861 at the site of the present Makawao Veteran’s Cemetery. This church was known as the Makawao Union Church, and the cemetery holding the departed members of Maui’s most prominent families remains as it was when the church was moved to its present site, below Paliuli, in 1889. The present stone Makawao Union Church, designed by the prominent architect Charles William Dickey, was actually the second “new” Makawao Union Church, which was completed in 1917. The first “new” Makawao Union Church was a wooden structure, completed at the site of the present church in 1889 (Figure 14).

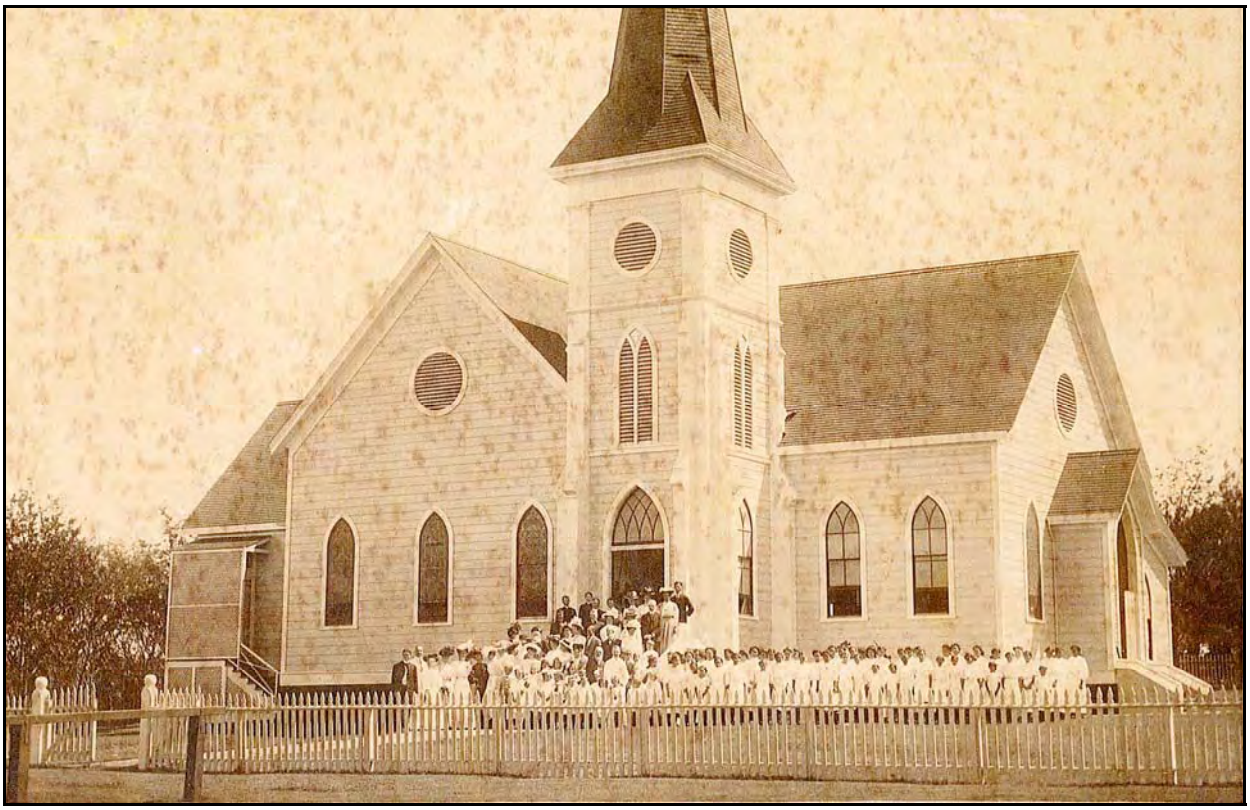


Figure 14. The “new” Makawao Union Church, circa 1909 This church was replaced in 1917 with the present-day stone Makawao Union Church (Photo courtesy of Mary Cameron Sanford).

The Reverend Claudius Buchanan Andrews moved to Makawao in search of a better climate for his wife’s health in 1860. In 1861 he purchased a piece of land above Makawao village where he founded the East Maui Female seminary, just uphill from the Po‘okela Independent Church.

The school gave preference to the education of Hawaiian women, with a course of studies which included home economics and music. In 1864, the name of the institution was changed to the Mauna‘olu Seminary, and in 1869, the school building burnt down. Donations and materials for a new two-story building were collected across Maui, and the school reopened in 1871(Turner 1929).

The value of agricultural land in the lower elevations of Hāmākua Poko was dramatically increased with the construction of the Hamakua Ditch in 1879. The partnership of Samuel T. Alexander and Henry P. Baldwin engineered the delivery of vast amounts of water from East Maui to the 1,000 foot elevation above Pā‘ia, Spreckelsville and Pu‘unēnē, and began to irrigate portions of the central isthmus of Maui (Wilcox 1996).

3.1.4.1 Additional Water Source Development

The Lowrie Ditch project, named for former HC&S manager William J. Lowrie, brought a second source of water to the dry Pā‘ia lowlands, following the original construction of the Hamakua Ditch in 1879. Lowrie’s plan was to begin the ditch in East Maui at the Pāpa‘a‘ea Reservoir, at the 1,000 ft. elevation, and maintain a four-foot drop per mile following the ditch’s initial plunge from the Kailua reservoir. During the construction in 1898, steep mountain gulches were traversed using the force of the constant weight of water flowing in a series of siphons. The Halehaku Gulch, at 250 feet deep, and the Māliko Gulch, at over 350 feet deep, were both crossed by giant siphons fabricated of three-eighths-inch iron, and set in place by Japanese laborers. At a weir located above Pā‘ia, the allocation of water began. The first tenth of the water flow in the Lowrie Ditch was divided out to the Paia Plantation (an 11/20ths share) and the Haikū Plantation (a 9/20ths share). The distance traveled, from Kailua to the plantation’s central isthmus boundary, was 21.9 miles (Thrum 1900).

In 1901, Samuel T. Alexander ordered the construction of a new ditch, tapping the water sources from Nāhiku to Honomanū. It was determined that the Paia Plantation would receive a substantial percentage of the capacity from the enterprise (Dean 1950).

At the highest elevation within the Hāmākua Poko Ahupua‘a, a third water system was developed to supply water to Olinda and Makawao. Fed by two river intakes at an elevation of 4,200 feet amsl, the Haipua‘ena and Waikamoi Streams were diverted into a ditch in Ha‘ikū Uka Ahupua‘a, which then carried the water 3.5 miles to a reservoir in Olinda. Below Olinda, water was stored at a reservoir in Maluhia, which then supplied water to Makawao Village (Stearns 1942).

A fourth water system supplied hydroelectric power to Pā‘ia. Mountain water diverted to the Wailoa Ditch from streams in Alo and Halehaku was delivered to Mauna‘olu, where the flow supplied water to two inclined penstocks. The resulting steep gradient applied such force to the water that hydroelectric power was generated at a plant located at Kāheka, supplying electricity to all of lower Pā‘ia (Stearns 1942).

The majority of Hāli‘imaile Ahupua‘a in the region just west of the present project area was included in Royal Patent 7512 to Miriam Kekauonohi. This land transfer occurred in the 1840’s, but was perfected as a Royal Patent recorded in 1880. Royal Patent 7512 from King David Kalākaua included the entire *ahupua‘a* of Hāli‘imaile (Waihona ‘Aina 2002). The lands of

Hāli‘imaile are presently owned and cultivated in pineapple by the Maui Land & Pineapple Company, which includes portions of the original Hamakua Ditch.

3.1.5 The Early 1900s

The largest landowner of the upper Pā‘ia region was the Haiku Sugar Company. By 1897, the Haiku Sugar Company and the Paia Plantation had become business partners of Alexander & Baldwin, Ltd. Their company stores offered goods to the population of the plantation towns from Hāmākua Poko to Huelo. Between a huge influx of immigrant workers in 1909, and the burning of village areas of Pā‘ia and Kahului to control an outbreak of smallpox in 1910, changes to the camp system were in full swing. The tiny township of Makawao was expanding, and Chinese-owned businesses began to mingle with those run by the plantations. Lumber was harvested in the lands of Ka‘ili‘ili (Figure 15), a dairy was started in Pukalani, and polo, “the sport of kings,” became an important fixture of “upcountry” life (Bartholomew and Bailey 1994). The plantation workforce continued to expand until 1917, when the United States declared war on Germany, and the accompanying draft seriously depleted the labor pool. By 1919, postwar requirements for sugar had driven the price to $471.40 per ton, an all-time high (Burns 1991).

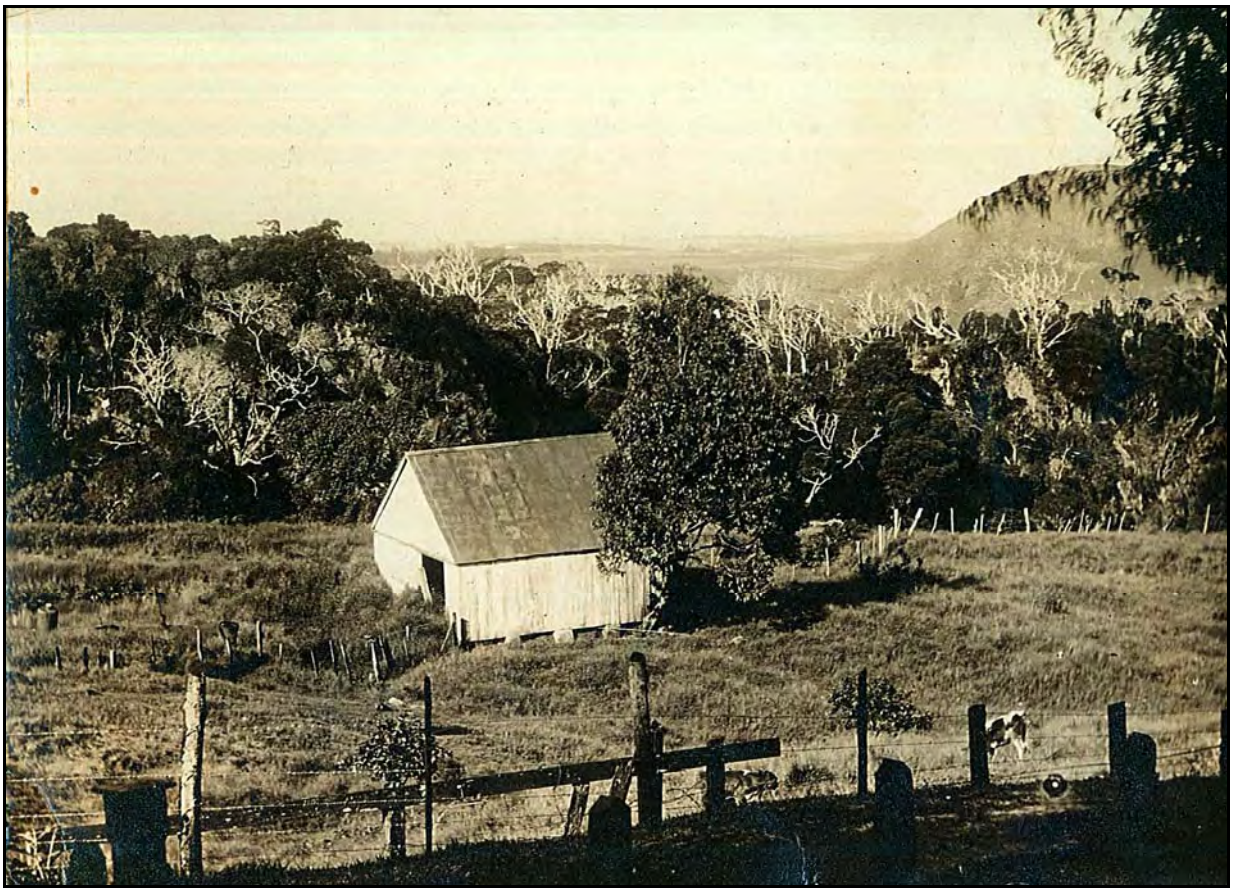


Figure 15. Photograph of Ka‘ili‘ili, a plantation village located east of Pu‘u Pi‘iholo (right of frame). The cutting of the forest as fuel for plantation villages allowed for lands in the region to be used for pasture (Robert Hill private collection).

In the mid-1910’s, the Libby, McNeill, and Libby Company had constructed a pineapple cannery complex just outside of Ha‘ikū, in Pa‘uwela. Construction of the Pa‘uwela facility included a garage in Kuiaha, and laborer camps in Ha‘ikū, Pa‘uwela, and Pukalani. Water was supplied to the cannery by way of the Wailoa Ditch (Stearns 1942). The cannery was bolstered by the construction of a 250-foot tall bridge spanning the 780-foot wide Maliko Gulch in 1913. This bridge allowed the Kahului Railroad Company to construct its’ easternmost terminus at Ha‘ikū, and transport fresh pineapple directly to the wharves at Kahului. The Haiku Fruit and Packing Company operated a cannery in Ha‘ikū, an enterprise started by brothers Henry Perrine and Dwight David Baldwin in 1903, which prospered greatly with the construction of the railroad through Hāmākua Poko (Dean 1950).

The cultivation of new fields demanded new sources of irrigation water. The commercial agricultural lands of Hāmākua Poko were irrigated by ditches maintained by East Maui Irrigation Company, and augmented with water supplied by pumping stations constructed by each individual plantation. Ownership of the upper Hamakua Ditch, the Kauhikoa and Keahua Ditches, as well as the Keahua Ditch extension all vested with the Maui Agricultural Company. The expansion of Pā‘ia as a major commercial center occurred as pineapple cultivation in Pa‘uwela accelerated, and Pā‘ia village expanded with new housing construction (Figure 16).

Figure 16. The Maui Agricultural Company Paia Store (Mid-Pacific Magazine 1919).

In 1913, the monthly magazine “Paradise of the Pacific” published a five-page article extolling the virtues of a motor-car journey through Hāmākua Poko and the horse ride to the summit of Haleakalā. The author, V.L. Stevenson, pointed out that, “Mauka – or, ‘toward the mountain’ – [from Malikō] is an old village of Pauwela. The old-time Hawaiian may be seen

there, and many the story of the days of long ago are to be heard. The cottages cluster among mango and alligator pear trees, and the flowers seem to bloom all the time" (Stevenson 1913).

By 1925, large areas of Maui Agricultural Company lands not adapted for the growing of cane were put into pineapple production. Pineapple grown in Hāli‘imaile was canned in Kahului, and sent to the mainland. Operations were successful, and acreage was added to the venture until the effects of the Great Depression caused a cut-back in production. At this time, the combined assets of both the Pineapple Department of the Maui Agricultural Company, and the Alexander & Baldwin-owned Haleakala Pineapple Company, were merged to become the Maui Pineapple Company. Sales slowly gained momentum based on the reputation of Hawaiian pineapple, and by the outbreak of World War II, product diversification included different grades of canned pineapple, and the successful introduction of canned pineapple juice (Dean 1950).

3.1.6 World War II (1941-1945)

U.S. Army National Guard Divisions were assigned to occupation, guard, and training stations in the Territory of Hawai‘i following the outbreak of World War II in December 1941. Although the bulk of these defenses were placed along the shorelines, ammunition depots were established across the upcountry regions of Ha‘ikū, Makawao and Kula. These depots were defended by elements of the 27th Infantry Division. They were soon reinforced by men of the 40th Infantry Division (Your Victory 1947). As elements of both the 27th and 40th Divisions were combined and sent to the South Pacific for combat duty, they were replaced on Maui by regiments from the 33rd Infantry Division (Infantry Journal 1948). Finally, in April 1944, the 98th Infantry Division arrived for training on Maui, leaving for occupation duty in mainland Japan in 1945.

The "Seabees," construction specialists of the 39th, 48th, and 127th Construction Battalions were also on duty in upcountry Maui. Camps, training areas, depots and roads were constructed across the windward slopes of Haleakalā, in order to house the vast numbers of soldiers, sailors, and pilots who would temporarily call Maui "home" (Turner 1946).

3.1.6.1 The Olinda Honor Farm

Established by the Territorial government in 1953, the 30-bed Olinda Honor Farm (known as the "Olinda Prison Camp": per the 1957 U.S.G.S. Maui map) was located at Waihou Springs, in order to ease overcrowding in O‘ahu prisons (Mann et al. 2003). Low-security prisoners housed here were put to work to dig up gorse that had overrun portions of upcountry Maui. Other work projects performed by the prisoners included the construction of the road which now circles West Maui (Honolulu Advertiser 1955), as well as the road that connected ‘Ulupalakua with Kaupō (Norman Saito personal communication 2008). Budget problems within the Hawaii State Prison System forced the closure of the facility in 1973.

Renewed interest in the Olinda prison buildings by the Hawaii State Department of Land and Natural Resources led to the establishment of the Olinda Endangered Species Propagation Facility by the DLNR's Division of Forestry and Wildlife in the mid-1980's. The site is presently run by the DLNR as the Maui Forest Bird Conservation Center.

3.1.7 Modern Land Use

The present-day project area is utilized as a main thoroughfare for travel between the Haleakalā Highway and the town of Makawao. The field inspection area has been impacted by a significant amount of modification and alteration of the landscape during historic times by the subdivision of residential housing. The survey region was cleared of forest during the 1850's to provide pasture area for a dairy, located on a 16-acre parcel which is now a part of the Samuel Kalama Intermediate School. The area between the Intermediate School and the Mayor Eddie Tam gymnasium complex is presently built-out in single-family homes.

This region in the 1950's was characterized by modernization and consolidation. Following the end of World War II, trucks replaced railroads, and the largest landowners of the region, the Maui Agricultural Company and the Hawaiian Commercial & Sugar Company, merged their operations. As the large agricultural interests began to shift their emphasis toward the central isthmus, the outlying plantation camps at Grove Ranch, Hāli‘imaile, Kailua, Ha‘ikū, Kāheka, Ka‘ili‘ili, Pukalani and Pa‘uwela began to empty. New homes were developed in Kahului to accommodate plantation families and the return of Maui veterans from military service during WWII.

Pineapple cultivation expanded within the region of Hāli‘imaile. The Hawaiian Commercial & Sugar Company constructed its manager's residence just below the Maui Land and Pineapple baseyard.

By 1966, the Kahului Railroad Company had suspended its operations in Hāmākua Poko entirely, and sold off the various rights-of-way that had been owned by the railroad (Burnett 1966). Sugar operations east of the Māliko Gulch had been curtailed since the 1940's. Shortly after, pineapple canning operations in Ha‘ikū and Pa‘uwela were shifted to the larger cannery in Kahului, signaling the demise of the railroad. The Māliko Gulch trestle was dismantled, and agricultural businesses related to the Hāmākua Poko region began to be centered around the HC&S Pā‘ia Mill, or the HC&S Pu‘unene Mill. Between 1985 and 1990, both the Pā‘ia Mill and the Pu‘unene Mill were computerized. In 2000, the Pā‘ia Mill was closed, leaving only the Pu‘unene Mill on Maui, and the Gay & Robinson Sugar Company on Kaua‘i as the last two operating sugar enterprises in the State of Hawai‘i (Dorrance 2000).

Beginning with the adoption of the Community Plan process in 1980, Makawao town adopted ordinances to preserve the rural ranching character of the town (County of Maui 1996). The Makawo Rodeo, held each July 4th weekend at the Oskie Rice Arena in Olinda, is known as the famous event in "upcountry" Maui. The rodeo is preceded by a parade that begins at the Makawao Veteran's Cemetery and travels through Makawo town.

Section 4 Previous Archaeological Research

The earliest documented archaeological study in the Hāmākua Poko Ahupua‘a was conducted by Winslow M. Walker (1930), who expanded work done earlier on Maui by John F.G. Stokes for the B.P. Bishop Museum around 1916. Walker completed surveys within the coastal region of Maui, but ventured inland at Hāmākua Poko to investigate reports of a *heiau* structure at Kailua, some ½ mile west of the Paia Road. According to Walker's notes, the *heiau* platform had, at one time, measured 50 by 80 feet, but had been previously destroyed during cane cultivation.

Most inventory surveys and subsurface testing performed in Hāmākua Poko Ahupua‘a have taken place along the shoreline of Pā‘ia, owing to the rapid pace of development in the region. An upsurge in residential development in the Pukalani region, and new water resource development projects occurring in the uppermost region of Waihou Springs have also generated recent archaeological reports.

But there have been few archaeological reconnaissance and inventory surveys in the Makawao area (Figure 17 and Table 3), and those that have been performed have produced relatively little significant information in the way of archaeological data. This is due in large measure to few changes in regional land use. Little has changed in Makawao. Lands set aside for forestry, sugar cane and pineapple cultivation, and ranching have remained in those uses for generations. It is perhaps safe to say that few areas in the Hawaiian Islands have less in the way of documented Hawaiian cultural deposits than Makawao.

That is not to say that pre-contact settlement evidence does not exist in the Makawao region. Researcher Inez Ashdown (1970) noted that two *heiau* structures were located in the vicinity of Makawao town and Pukalani, albeit both far from the present project area. References to other *heiau* structures in the region were noted by Kennedy (1991): none of them closer than Pu‘u Pane, a cinder cone miles from the present project area containing SIHP 50-50-11-1275. The discussion of radiocarbon dates and settlement patterns will resume in Section 4.1, "Background Summary and Predictive Model."

Studies undertaken in each of the three distinctly different settlement regions within the *ahupua‘a* have yielded radiocarbon dates that suggest a pattern of settlement consistent with the Hawaiian Cultural Sequence established by Kirch (1997). Within this sequence, Kirch (1997) set date ranges for five periods of Polynesian colonization within the Hawaiian Islands. Following Kirch's model, evidence of the settlement of the coastal, stream valley and upland regions of the *ahupua‘a* of Hāmākua Poko can be organized and understood.

Additionally, because Makawao is a historic district, structures related to the early use of the area for ranching and agriculture are significant. The Frank and Theresa Gomes house, at 32 Pakani Place in Makawao, and the Hardy House, at 808 Makawao Avenue, have both been placed on the National Register of Historic Places in 2001 and 1984, respectively. The Pakani Place home is located off of Makawao Avenue along the section of roadway planned for development of the proposed project, as is the Makawao Avenue house, located only a few hundred feet south of the Makwao/Makani intersection.

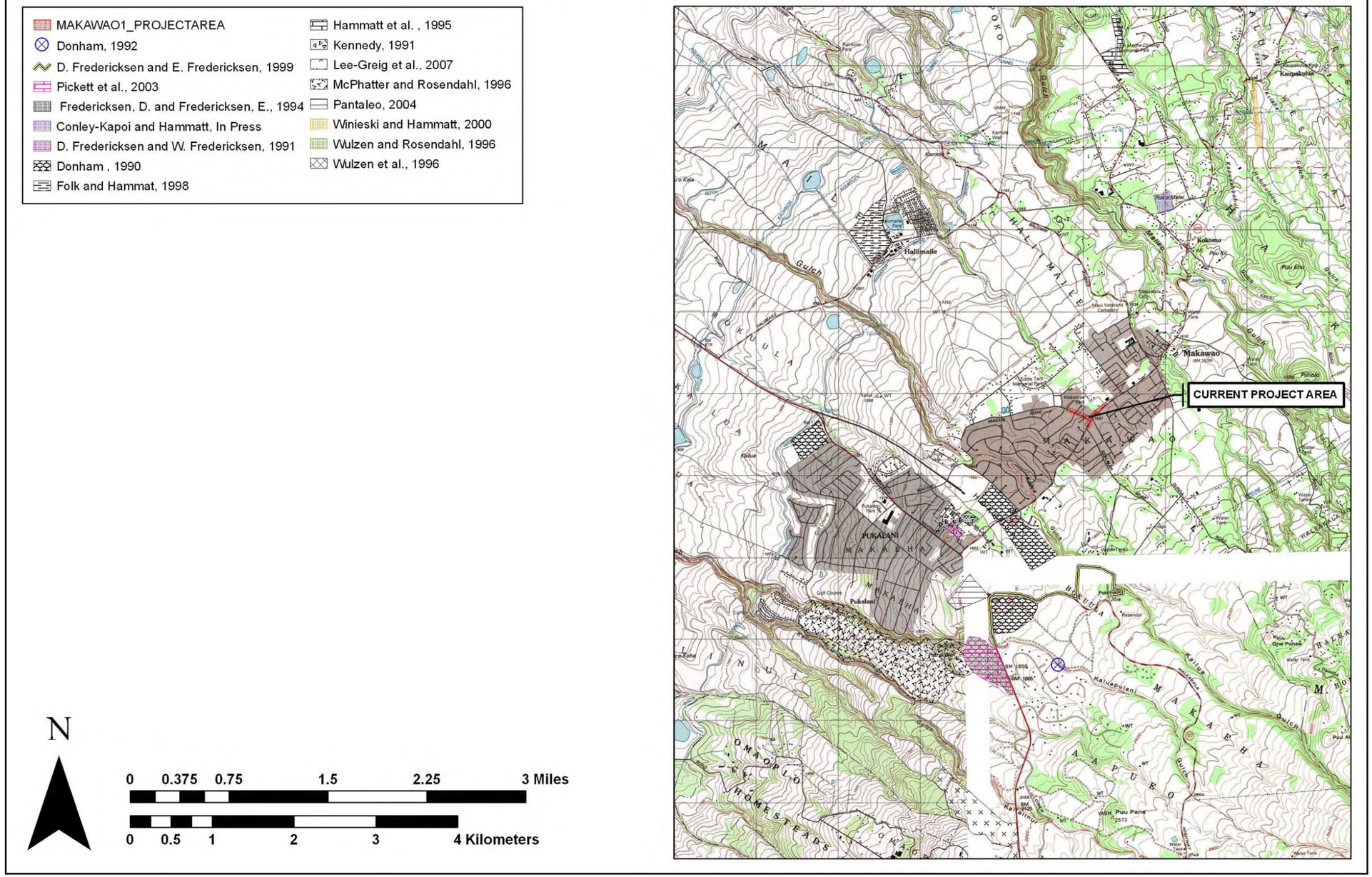


Figure 17. A portion of the 1992 Haiku 7.5-minute USGS topographic quadrangle, showing the project area relative to areas of previous archaeology.

Table 3 .Summary of Previous Archaeology of the Hāmākua Poko Ahupua‘a.

Date	Author	Region	Nature of Study	Findings
1930	W. Walker	Entire Island	Reconnaissance Survey	one *heiau* in the lowlands of Hāmākua Poko
1988	Estioko-Griffin	Waikamoi Reservoir to Olinda Water Treatment Plant	Archaeological Inventory Survey	No evidence of historic properties.
1988	W., D., & E. Fredericksen	Pā‘ia Town	Archaeological Inventory Survey	No evidence of historic properties.
1990a	D. Borthwick	Kahakapao Reservoirs	Reconnaissance Survey	No evidence of historic properties.
1990b	D. Borthwick	Kū‘au Beach	Reconnaissance Survey	No evidence of historic properties in existing sugar cane field. Existence of “Kalahau Burials” in coastal strip of project area mandates preservation.
1990	W. Folk II	69-acre parcel at Kū‘au	Reconnaissance Survey	No historic properties identified at surface, but two previously identified subsurface sites may extend into the project area.
1990	T. Donham	Hāli‘imaile, Hōkū‘ula, Kailua and Maka‘eha Ahupua‘a	Archaeological Inventory Survey	Five potential Maui High School sites were investigated in Hāli‘imaile, Hōkū‘ula, Kailua and Maka‘eha, with no historic properties identified.
1991	Kennedy	Pukalani Highlands	Archaeological Inventory Survey	Three historic properties, two possible agricultural *heiau* and one probable burial, SIHP -2497, -2498, and -2499 respectively, were identified within the project area.
1994	D. and E. Fredericksen	Pukalani Highlands	Archaeological Inventory Survey	Two historic properties, a historic agricultural clear pile and a historic road right-of-way, SIHP -3526 and 3527 respectively, were identified within the project area.

Date	Author	Region	Nature of Study	Findings
1996	Wulzen et al.	A‘apueo	Archaeological Inventory Survey	Formal documentation of the historic era site (50-50-10-4181) complex previously identified by Wulzen and Rosendahl 1996.
1997	H. Hammatt	Kū‘au Beach	Archaeological Subsurface Testing	
1998	W. Folk and H. Hammatt	Hāli‘imaile	Archaeological Inventory Survey	No evidence of historic properties.
1999	P. Conte	Kū‘au Beach	Archaeological Data Recovery	Five partial sets of human remains were recovered from an eroding sand dune within the area of the “Kalahau Burials”.
1999	D. and E. Fredericksen	Hōkū‘ula	Archaeological Inventory Survey	Five previously unrecorded historic properties, four which were associated either with ranch-era activities or post-contact settlement of the area, and the fifth, an inaccessible cave, of an indeterminate time period.
2000	P. Titchenal	Pā‘ia	Archaeological Inventory Survey	Backhoe testing within a 9.36-acre parcel ½ mile west of Pā‘ia town revealed no cultural deposits.
2001	L. Morawski and R. Spear	Pā‘ia	Archaeological Inventory Survey	Backhoe testing within a quarter-acre parcel revealed no significant cultural deposits.
2001	R. Rechtman and M. Clark	Pā‘ia	Archaeological Inventory Survey	Backhoe testing within a three-acre parcel of vacant land in Pā‘ia Town revealed no cultural deposits.
2003	L. O’Rourke	Kū‘au	Archaeological Inventory Survey	Backhoe testing within a 0.16-acre residential parcel in Kū‘au revealed no cultural deposits.

Date	Author	Region	Nature of Study	Findings
2003	J. Pickett, D. Guerriero, L. Rotunno-Hazuka and J. Pantaleo	Pukalani	Archaeological Monitoring Report	Ten burials within a historic Chinese cemetery (SIHP-5173), a pre-contact fire pit (SIHP-5469) and a historic irrigation ditch (SIHP -5470) were documented during grading of the Kulamalu Commercial Subdivision.

Estioko-Griffen (1988) conducted an archaeological investigation along the path of a proposed waterline improvement in upper Makawao. During the course of the inventory survey, Estioko-Griffen identified native trees within the study area, but did not observe any significant historic properties within the project area corridor between Olinda and Waikamoi.

Walter, Demaris and Erik Fredericksen (1988) conducted an archaeological inventory survey of 14 acres of property located in the western portion of Pā‘ia Town. The study area included cane fields, a former railroad right-of-way, existing residences, and a building formerly leased to the Boy Scouts of America. Following a program of shovel probes and auger tests, no evidence of cultural deposits were observed.

Douglas Borthwick (1990a) conducted an archaeological inventory survey of a portion of the Makawao Forest Reserve. The project area contained two sets of concrete and basalt pylons which, during the late 1800’s, supported an elevated water pipeline. Borthwick recommended no further archaeological work be performed in the project area.

In addition, Borthwick (1990b) performed an archaeological reconnaissance within a 12.4-acre parcel located at TMK: 2-6-009:002, along the coast near the Kū‘au Gardens area. The survey area consisted mostly of existing sugar cane fields, but included a strip of property including a portion of Kū‘au Beach. The sand dune portion in this region of Kū‘au Beach included a portion of SIHP 50-50-05-1064: the “Kalahau Burials” area. Monitoring of construction within the area cultivated in sugar cane was recommended, and continued preservation of the burial area dune was mandated.

William Folk II (1990) conducted an archaeological reconnaissance of a 69-acre parcel located along the coast of Kū‘au, which included two previously identified subsurface sites, SIHP 50-50-05-1780 and -1782. Both sites were first described by Clark and Toenjes (1987), following their work monitoring a sewer line excavation, and both were recorded as buried cultural layers with associated features which included midden and charcoal. Although both sites appeared along the edge of the 1990 study area, their subsurface extent was unknown.

Theresa Donham (1990) conducted an archaeological inventory survey of five potential upcountry sites for a new Maui High School campus. This inventory survey resulted in the discovery of three pre-contact lithic tools or tool fragments, and a lithic game stone fragment, all of which were associated with the subject property located along the north side of Makawao Avenue, in an area ½ mile from the present project area. Historic properties reflecting twentieth-century use (ceramics and glass) at Parcel 1 (Pukalani), pre-contact and historic occupation of

Parcel 4 (Hōkū‘ula), and an isolated pre-contact lithic adze at Parcel 5 (Hāli‘imaile), were recorded during the course of this inventory survey.

An archaeological inventory survey of approximately 26 acres was conducted within Kailua Ahupua‘a at a place commonly referred to as Pukalani (Kennedy 1991). A total of three historic properties (SIHP No. -2497, -2498, -2499) were identified during the course of this study and recommended for preservation. Both SIHP -2497 and -2498 were classified as rock-filled platforms with similar construction features. SIHP -2499 was noted as significantly different from that of the other two sites and classified as a mound feature. Based on oral testimony, excavated materials, and apparent elaborate construction of Sites -2497 and -2498, Kennedy (1991) postulated that these features were either agricultural *heiau* or burial mounds, or both. Due to the construction style, the mound feature (SIHP -2499) was interpreted as a probable burial feature.

Demaris and Erik Fredericksen (1994) conducted an archaeological inventory survey within a six-acre parcel of the Pukalani Highlands. Two historic properties were identified and tested. SIHP 50-50-05-3526, a historic agricultural clear pile, was deemed recent due to the presence of plastic mulch in the test unit. SIHP-3527 was found to be a recent plantation road extension. No further work was recommended.

A follow-up archaeological inventory survey (Wulzen et al. 1996) was conducted on 44-acres of property that had undergone a previous archaeological reconnaissance (Wulzen et al. 1996). Formal documentation of the historic era complex (SIHP 50-50-10-4181) identified by Wulzen and Rosendahl (1996) and evaluation of significance was accomplished as a result of the inventory survey.

Hallett H. Hammatt (1997) conducted backhoe testing at a property proposed for the development of beach lots at Kū‘au Beach. Nine backhoe trenches located along the proposed access roadway did not reveal any archaeological deposits. However, monitoring was recommended for a proposed sewer line extension in the western portion of the subdivision.

William Folk II and Hallett H. Hammatt (1998) conducted an archaeological inventory survey in a 55-acre parcel at Hāli‘imaile. No archaeological features were observed during the survey. The project area included features consistent with the on-going cultivation of sugar. Irrigation ditches within the project area were deemed to be of no consequence if they were removed during the development of the project area parcel.

Patty J. Conte (1999) removed five partial sets of human skeletal remains eroding from a sand dune known to be a pre-contact burial area. SIHP 50-50-05-1064, the “Kalahau Burial Complex,” is located along the beach fronting north Pā‘ia.

An archaeological inventory survey of a waterline corridor of approximately 3,675 feet (1.12 kilometers) and water tank area of approximately 1.041 acres was conducted by Xamanek Resarches within Hōkū‘ula Ahupua‘a (D. Fredericksen and E. Fredericksen 1999). A total of five previously unrecorded historic properties were documented on the outskirts of the waterline and tank project area. Four of the historic properties were interpreted as post-contact or historic era sites likely associated with ranching or post-contact settlement of the area. A fifth site was tentatively identified as a shelter, however, the inaccessible location of this site made verification difficult. Site 50-50-10-4677 consists of a dry-stacked ranch-era retaining wall at the base of

northern bank of Kailua Gulch. SIHP -4678 is a culturally modified shelter or storage cave that was interpreted as a post-contact shelter based on the presence of a metal fork and modification to the *pahoehoe* flow that appear to have been accomplished by metal pick. SIHP -4679 is a cave located along an inaccessible portion of cliff on the northern side of Kailua Gulch and was tentatively interpreted as a shelter. SIHP -4680 is located near the floor of Kailua Gulch and consists of a retaining wall that appeared to be associated with an unimproved road to the west of the wall. SIHP -4681 is a multi-component site located atop a *pu‘u* and based on location and structure was tentatively identified as comprising burials.

Paul Titchenal (2000) conducted an archaeological inventory survey of a 9.36-acre beachfront parcel located immediately east of Baldwin Beach Park. Twelve backhoe trenches did not reveal any cultural deposits. An overall lack of stratification in the trenches was interpreted as the result of nearby historic sand mining operations and the subsequent re-importation of sand back to the region.

Lauren Morawski and Robert L. Spear (2001) conducted an inventory survey and subsurface backhoe tests within a quarter-acre parcel slated for development as a skateboard park in Pā‘ia Town. No significant cultural deposits were observed.

Robert Rechtman and Matthew Clark (2001) conducted an inventory survey and subsurface backhoe tests within a three-acre vacant parcel in Pā‘ia Town. No cultural deposits were observed. According to consultation with local area residents, the project parcel once had a residence which had burned down. Historic well sites associated with sugar cultivation were also noted.

Laura C. O’Rourke (2003) conducted subsurface backhoe testing within a 0.16-acre residential parcel in Kū‘au. No cultural deposits were observed.

Jeffrey Pantaleo (2003) conducted a surface survey and dug 26 backhoe test units within a 28.7-acre parcel proposed for the Kualono Residential Subdivision in Pukalani. SIHP 50-50-05-2701, a *heiau* structure, was previously identified by Joseph Kennedy in 1990. Kennedy (1990) carbon-dated the structure to AD 1620-1770. In the survey report by Panteleo (2003), the *heiau* was recommended for protection within a 2-acre reserve. All subsurface backhoe tests performed during the survey revealed no cultural deposits within the project parcel.

Jenny Pickett, Diane Guerriero, Lisa Rotunno-Hazuka and Jeffrey Pantaleo (2003) completed a monitoring report for the 40-acre Kulamalu Commercial Village Project Site. An inadvertent find of a historic-era burial during the excavation phase of construction led to the discovery of an additional nine Chinese burials, as well as associated traditional Chinese grave goods. The retention basin of the project was redesigned to accommodate the burial area. The Chinese cemetery was assigned SIHP 50-50-10-5173, a pre-contact fire pit was assigned SIHP -5469, and a historic drainage ditch was assigned SIHP -5470.

4.1 Background Summary and Predictive Model

The chronological timeline for settlement of the Hāmākua Poko coast can be postulated based on research performed by archaeologists in the region. Based on the discovery of *in situ* midden deposits and burials functionally attributed to a pre-contact population of a fishing village by Clark and Toenjes (1987), habitation in the Hāmākua Poko coastal region may date to as early as A.D. 1420-1810. The same study recorded a basalt boulder displaying petroglyphs (SIHP -1063) at Kū‘au as well as an associated boulder believed to have been used as a polishing stone for adzes. Midden evidence of habitation, the widespread use of this coastal area for burials, and the location of ceremonial sites, including a *heiau* site at coastal Kailua described by Walker (1931), leads us to believe that habitation in the windward coastal region of Hāmākua Poko was permanent and perhaps even sizable.

Evidence of pre-contact pondfield irrigation within the gulch areas of Kailua and Māliko was established by ethnographic research performed by E. F. Craighill Handy and Elizabeth Handy in the 1930’s. Permanent habitation in the gulches was consistent with the care of crops irrigated by the flowing streams. “Maliko Stream, flowing in a gulch that widens and has a flat bottom to seaward, in pre-sugar-plantation days had a considerable number of lo‘i” (Handy and Handy 1995:498). Plentiful marine resources found at the landings at Pā‘ia and Kū‘au would have allowed for a portion of the inland population to travel to and along the shoreline and exchange wetland and dryland crops for fish. The establishment of inland pond agriculture in this region is consistent with Kirch’s (1997) definition of the Expansion Period (A.D. 1100-1650).

According to Folk (1998), the accepted land use for the Makawo region of Hāmākua Poko Ahupua‘a is one of dryland agriculture, as indicated by his research of claims presented for Land Commission Awards in the region. The LCA’s documented “kula land” uses, consistent with late pre-contact use for sweet potato, banana, paper mulberry trees (*Broussonetia papyrifera)*) and pasture (Folk 1998). This fits with the model that the more intensive use of the Makawao area was of a later pre-contact development that corresponded with the continued expansion of upland permanent habitation, ceremonial construction, and agricultural clearing in the Makawao-Pukalani region.

Further support for permanent habitation in the Makawo-Pukalani region comes from local historian and author Inez Ashdown (1970), who recorded evidence of pre-contact activity in the Makawao area in the form of two *heiau* structures. Ashdown (1970) described the site of one *heiau* as adjacent to the “old Makawao Post Office:” on lands “once owned by Louis von Tempski.” The other *heiau* “was just above where Bullock’s [restaurant] is now on the Puka-lani road. That entire area was upland farming for natives.”

A *heiau* [SIHP 50-50-05-2701] described by Kennedy (1991) and Pantaleo (2003), in Pukalani provided evidence in the form of volcanic glass, basalt flakes, and kukui that tool-making occurred there. Charcoal sampled from the test excavation of this site indicated settlement in the vicinity of Pukalani by circa A. D. 1620-1770, dates which place the occupation of the region in Kirch’s (1997) Proto-Historic Period (A.D. 1650-1795).

From these studies a strong outline for an overall settlement pattern in Hāmākua Poko Ahupua‘a can be postulated. Permanent populations were concentrated in gulch areas in the vicinity of fresh water sources, as well as in areas providing access to dryland agriculture in the

uplands (Donham 1990). The population required to construct and maintain the taro *lo‘i* (terraces), and the evidence of wetland cultivation within the valley areas of Maliko Stream by Handy and Handy (1995), coupled with the concentration of pre-contact human burials in the region of the Baldwin Beach Park and both the Pā‘ia and Kū‘au coasts, all indicate a somewhat sizable, politically centralized, permanent settlement along the coastal region, bounded by both the Kailua Stream and the Maliko Stream. The coastal sites may have been settled as early as A.D. 1420, according to Clark and Toenjes (1987), with settlement of the region of Makawao occurring as early as A.D. 1620 (Kennedy 1990). Tool-making, the construction of *heiau* structures, and access to forest resources, such as sandalwood (*Santalum sp*.) and *koa* (*Acacia koa*) trees in the region of Pukalani, is estimated to have occurred in the century just prior to European contact (Kennedy 1991).

Section 5 Results of Fieldwork

5.1 Field Inspection Findings

A general field inspection was conducted by archaeologist Robert R. Hill, B.A. under the supervision of Principal Archaeologist Hallett H. Hammatt, Ph.D., on January 16, 2008.

The entire project area has been heavily modified by previous road construction beginning in the early historic period (about 1850), when carriage roads were developed to support a small but growing population at Makawao. These carriage roads were widened, and subsequently paved by the 1930's, when the regional roads were improved to connect to the newly constructed Haleakala Highway (Maui News 1935). The present project area is located equidistant between the Makawao Avenue intersection with Haleakala Highway, and the Makawao Avenue intersection with Baldwin Avenue. Early maps of the region geo-referenced with present-day maps illustrate the roadway within the same corridor beginning about 1872, according to a Government Survey map by C.J. Lyons. A 1917 plantation map of the Maui Agricultural Company matches the present-day roadway in width, and follows precisely the present-day roadway alignment (Figure 18).

The Makawao Avenue portion of the project area has slightly older homes located along it than the homes located along Makani Road. The pedestrian survey along the Makawao Avenue portion of the project area revealed some homes that date to the 1920's. These homes exhibited single-wall construction (with exposed plumbing) and were erected on stilts. In contrast, most all of the homes located on Makani Road appear to have been built around or after 1960, and are of slab foundation construction.

Three sections of stacked basalt wall and one section of basalt brick road curbing located along Makawao Avenue were identified as historic properties during the pedestrian survey of the project area, using (See 5.2 Site Descriptions). Each of the four sections of roadside stone construction containing these historic properties was located in the project area using GPS coordinates and photographed.

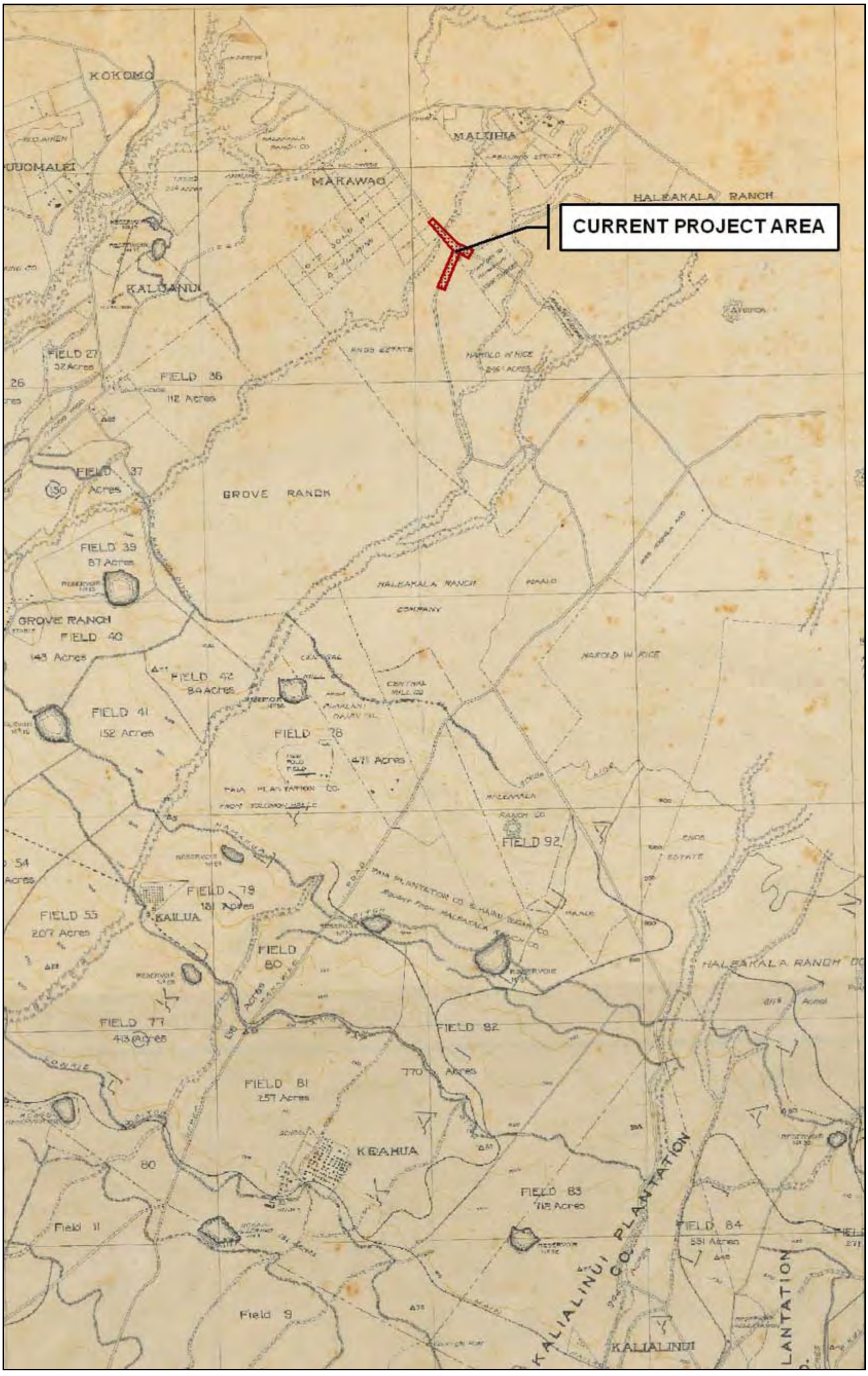


Figure 18. In a 1917 Maui Agricultural Company map, the location of the Makawao Avenue/ Makani Road intersection remains unchanged from the earlier Curtis J. Lyons' 1872 Government Survey map. The project area is shown within the red shaded area. (Collins 1917) (Map courtesy Alexander & Baldwin Inc., Pu‘unēnē, Maui.).

5.2 Site Descriptions

5.2.1 CSH-1

FEATURE:	Cut Basalt Wall
FEATURE TYPE:	Retaining
FEATURE FUNCTION:	Roadway
AGE:	Historic
DIMENSIONS:	Approximately 50 ft (15m) long by 9 in (22cm) wide by 24 in (60cm) below grade.

Description: CSH-1, a historic cut-basalt brick retaining wall, is a structure fronting a property on Makawao Avenue. The construction consists of at least four courses of cut-basalt brick (Figure 19), retaining the present grade of Makawao Avenue, and allowing the frontage of a residential lot to drop 24 inches, level with the residence structure. Further investigation of CSH-1 would allow for a better understanding of the construction method and materials, and a more accurate date of construction.

Figure 19. CSH-1: a cut-basalt brick wall retaining the grade of Makawao Avenue. View to north, along the downslope (west) side of Makawao Avenue.

5.2.2 CSH-2

FEATURE:	Stacked Basalt Wall
FEATURE TYPE:	Boundary
FEATURE FUNCTION:	Roadway
AGE:	Historic
DIMENSIONS:	Approximately 50 ft (15m) long by 4 ft (1.2m) wide by 24 in (60cm) high.

Description: CSH-2, a historic stacked basalt wall, is a structure fronting a property on Makawao Avenue. The construction consists of at least two courses of subangular and rounded basalt stones (Figure 20). The feature is mostly in a state of collapse, damaged most recently by the installation of a boundary fence. Further investigation and mapping of CSH-2 may allow for a better understanding of the construction method and materials, and a more accurate date of construction.

Figure 20. CSH-2: Stacked basalt wall, showing a break in the street frontage to allow for a driveway. View to north, along the downslope (west) side of Makawao Avenue.

5.2.3 CSH-3

FEATURE:	Stacked Basalt Wall
FEATURE TYPE:	Retaining
FEATURE FUNCTION:	Roadway
AGE:	Historic
DIMENSIONS:	Approximately 150 ft (45m) long by 1.5 ft (45cm) wide by 4.5 ft (1.4m) high.

Description: CSH-3, a historic stacked basalt wall, is a structure fronting a property on Makawao Avenue. The construction consists of at least six courses of subangular, faced, basalt stones (Figure 21). The feature is in an excellent state of preservation, but has been modified over the years by the addition of concrete patches, sections showing modern repairs, and the further addition of a driveway. Inventory survey-level documentation of CSH-3 would allow for a better understanding of the construction method and materials, and a more accurate date of construction.

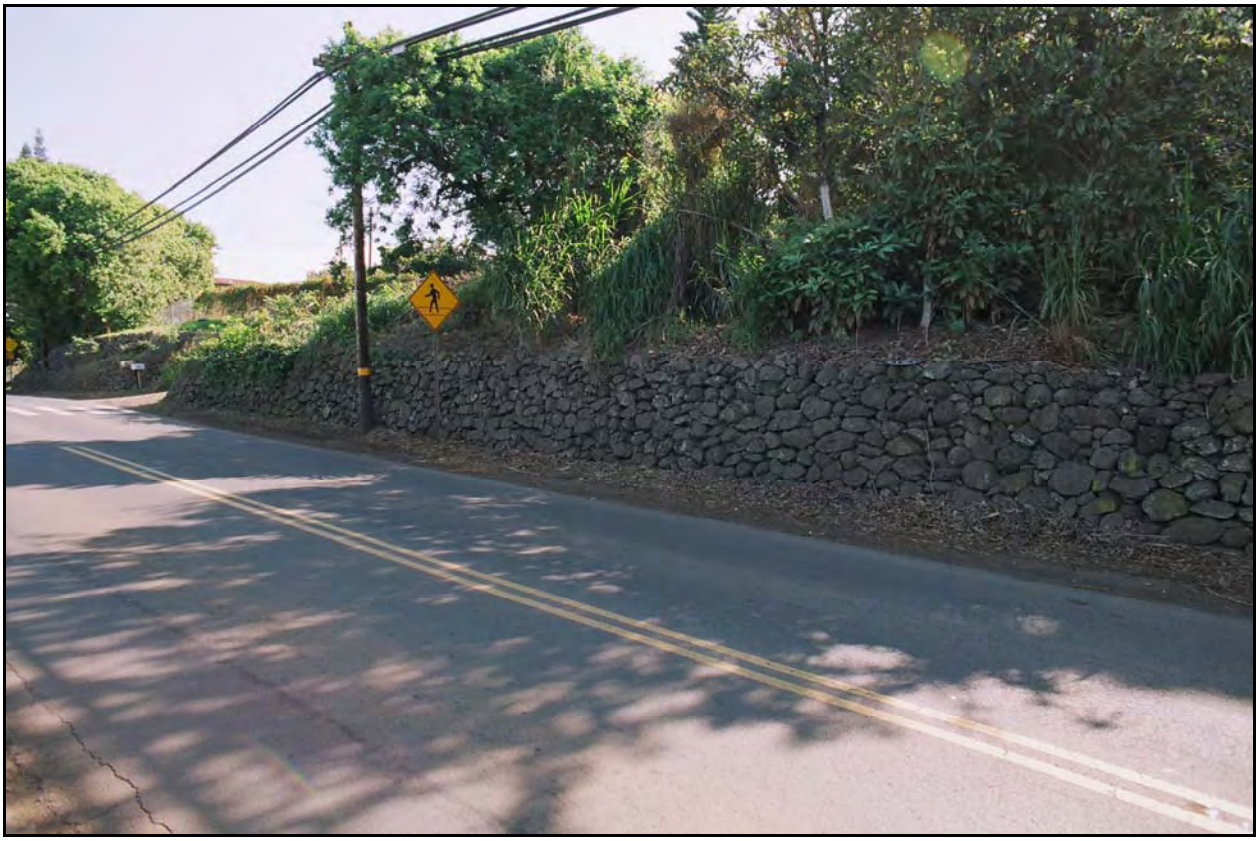


Figure 21. CSH-3: Stacked basalt retaining wall, showing setting and facing of the constituent building material. View to northeast, along the upslope (east) side of Makawao Avenue.

5.2.4 CSH-4

FEATURE:	Cut Basalt Curb
FEATURE TYPE:	Retaining
FEATURE FUNCTION:	Roadway
AGE:	Historic
DIMENSIONS:	Approximately 50 ft (15m) long by 9 in (22cm) wide by 24 in (60cm) below grade.

Description: CSH-4, a historic cut-basalt brick road curb, is a structural feature found fronting properties on the east side of Makawao Avenue in the immediate vicinity of Miner Place, across Makawao Avenue from the Makawao Business Center. The construction consists of individual cut-basalt bricks (Figure 22), set in place to retain the present grade of a macadam sidewalk. In a few sections, an earlier surface of the macadam sidewalk can be seen beneath modern asphalt surface repairs. Further investigation of CSH-4 would allow for a better understanding of the use of cut-basalt brick in the Makawao area, and a more accurate date of construction.

Figure 22. CSH-4: a cut-basalt brick curb retaining the grade of the sidewalk along the east side of Makawao Avenue. View to north.

Section 6 Summary and Interpretation

6.1 Summary

A review of the historic documentation indicates that the lower coastal region of Pā‘ia and the Hāli‘imaile region within the Hāmākua Poko Ahupua‘a were extensively developed for sugar and pineapple cultivation during the mid-to-late 1800’s. The high level of disturbance to the soils of these regions has probably obliterated any original evidence that the initial occupants of the inland slopes may have tended small agricultural plots.

With the project area located within the region of Makawao, the pre-contact settlement pattern proposed for this region of Maui states that pre-contact site density was expected to be low. The lands in and surrounding the current project area were noted to have contained *heiaus*, ceremonial sites set in the Makawao/Pukalani region of the *ahupua‘a*. However, in the years since European contact, the project area lands have undergone heavy landscape modifications by historic sugar and pineapple cultivation and forest clearance, effectively eliminating most surficial pre-contact archaeological sites. The current literature review and field inspection has documented a partially intact early post-contact stone wall, two intact late-historic stone retaining walls and a roadway curb feature, and confirmed the history of forestry and ranching modifications made within the project area.

Four historic properties were identified and (subject to further investigation) interpreted during the course of the present field inspection and literature rerview. CSH-1 is interpreted as a cut-basalt retaining wall constructed sometime in the years 1910-1940, during a time when the surface grade of Makawao Avenue changed. CSH-2 is interpreted as an early post-contact stacked basalt wall, possibly constructed following the establishment of boundaries for various Makawao parcels in the mid-1800’s. CSH-3 is interpreted as a massive stacked-basalt faced retaining wall constructed as a public-work project in the 1930’s, or earlier. CSH-4 is interpreted as cut-basalt brick curb stones set in place as a durable buffer for the sidewalk along Makawao Avenue.

The historic properties evident at CSH-1, CSH-2, CSH-3 and CSH-4 are potentially eligible for both the Hawai‘i and National Registers for Historic Places, as they are over 50 years old. Further archaeological documentation of CSH-1, CSH-2, CSH-3 and CSH-4 would be necessary in order to establish the significance of each historic property.

In addition to the main project area, field inspection of two empty residential lots, as well as the parking area for the Mayor Eddie Tam Memorial gymnasium was performed. These areas may be used as lay-down, or storage areas for construction material. No cultural deposits were observed at either location.

The results of the current field inspection and accompanying literature review generally confirms most of the expectations derived from the historical and archaeological background research. Any evidence that traditional Hawaiian habitation and/or agriculture had been employed in the region of the present project area was destroyed by the razing of forested areas for pasture, the partitioning of land purchases for the commercial cultivation of sugar cane and pineapple, and the development of residential subdivisions with appurtenant roads and utilities.

Section 7 Recommendations

Four historic properties were investigated during the present field inspection and literature review. CSH-1 is a historic cut-basalt wall which retains the grade of Makawao Avenue, allowing only the associated residential lot to drop in elevation some 60cm (2 feet) from the present elevation of Makawao Avenue. The individual cut-basalt “bricks” were stacked and set in order to allow for a change in the grade of Makawao Avenue.

CSH-2 is an early-historic partially intact stacked-basalt boulder and cobble wall which may have been constructed following the establishment of property boundaries in the region, possibly as early as the mid-1800’s.

CSH-3, like CSH-1, appears to have been constructed to accommodate a construction change to the roadway of Makawao Avenue. The historic stacked-and-faced basalt wall construction is of a massive size that retains the sidewall soil and rock of a sizable road-cut opposite (east) of the Mayor Eddie Tam Gymnasium complex.

CSH-4 is a line of historic cut-basalt curb stones, set along the east side of Makawao Avenue, an alignment that appears to have been required during an earlier widening project.

Cultural Surveys Hawai‘i recommends inventory survey-level documentation in accordance with Hawaii Administrative Rules (HAR) Chapter 13-13-275, as well as consultation with SHPD regarding appropriate mitigation or preservation measures for each of the four historic properties. The cut-basalt construction material used at CSH-1 and CSH-4, and the stacked and faced basalt cobbles at CSH-3 appear to be of a quality that may be reassembled or reused in order that a small section of the original construction may be reconstructed in the vicinity of the present roadway project. In this way, the historic character of the walls may be preserved.

Section 8 References Cited

Allen, Gwenfread E.
1950 *Hawaii’s War Years, 1941-1945*, Greenwood Press, Westport, CT.

Alexander, William DeWitt
1891 A Brief History of Land Titles in the Hawaiian Kingdom, article, *Hawaiian Almanac and Annual for 1891*, Thomas G. Thrum, compiler and publisher, Press Publishing Company, Honolulu.

Ashdown, Inez
1970 *Ke Alaloa O Maui* (The Broad Highway of Maui), Kama‘aina Historians Inc., printed by Ace Printing Company, Wailuku Maui.

Bartholomew, Gail and Bren Bailey
1994 *Maui Remembers, A Local History*, Mutual Publishing, Honolulu.

Beckwith, Martha
1970 Hawaiian Mythology, University of Hawai‘I Press, Honolulu.

Borthwick, Douglas
1990a Archaeological Reconnaissance Survey for the Proposed Kahakapao Reservoirs Kula, Maui, Hawaii, TMK: 2-4-16:01 and 2-3-05:4, Cultural Surveys Hawai‘i, Inc., Kailua, HI.

1990b *Archaeological Reconnaissance of a 12.4-Acre Parcel, Paia, Makawao, Maui*, Cultural Surveys Hawai‘i, Inc., Kailua, HI.

Burnett, Charles H. “Buster”
2006 Archive of dissolution records for the Kahului Railroad Company, Ltd, maintained by the Samuel and Mary Castle Foundation, Honolulu.

Burns, Irma Gerner
1991 *Maui’s Mittee and the General, A glimpse into the lives of Mr. and Mrs. Frank Fowler Baldwin*, Ku Pa‘a Inc., Honolulu.

Clark, S.D., and James Toenjes
1987 *Archaeological Monitoring of Sewer Line Construction from Spreckelsville to Ku‘au, Maui, State of Hawaii*, B.P. Bishop Museum, Honolulu.

Collins, A.W.
1917 *Map of Sugar Plantation at Paia- Maui, T.H., Owned by Maui Agricultural Co.*, field map archived by Alexander & Baldwin Inc., Pu‘unēnē, Maui.

Conde, Jesse C. and Gerald M. Best
1973 *Sugar Trains, Narrow Gauge Rails of Hawaii*, Glenwood Publishers, Felton, California.

Conde, Jesse C.
1993 Fowler Locomotives in the Kingdom of Hawaii, article, *The Narrow Gauge*, edited by Alan Burgess, 22 Peveril Road, Peterborough, England.

Conte, Patty J.
1999 Partial Removal of Eroding Burials – Kalahau Burial Complex, Site 50-50-05-1064, Hamakuapoko Ahupua‘a, Makawao District, Maui, TMK: 2-6-9:02, Hawai‘i State Historic Preservation Division, Maui Island.

County of Maui
1996 Makawao-Pukalani-Kula Community Plan, Community Plan Update 1996, accessed at www.co.maui.hi.us/departments/Planning/pdf/**makawao**.pdf.

Dean, Arthur L.
1950 *Alexander & Baldwin Ltd., and the Predecessor Partnerships,* Advertiser Publishing Company, Honolulu.

Donham, Theresa K.
1990 *Archaeological Inventory Survey Potential Upcountry Maui High School Sites, Lands of Haliimaile, Hokuula, Kailua and Makaeha, Makawao District, Island of Maui*, PHRI, Hilo, HI.

1992 *An Unmarked Burial Site, Honopou Ahupua‘a, Hamakualoa, Maui (Site 50-50-06-2922)*, State HPO, DLNR, Honolulu, HI.

Dorrance, William H.
2000 Sugar Islands, The 165-year Story of Sugar in Hawai‘i, Mutual Publishing, Honolulu.

Estioko-Griffin, Agnes
1988 *An Archaeological Surface Survey of the Proposed Kula Water System Improvements, Kula, Makawao, Maui*, TMK: 2-3-5:4, 2-3-6:6, 2-4-15:29, 2-4-16:1-4, Hawai‘i State DLNR, Division of Parks, Honolulu.

Foote, Donald 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*, U.S. Dept. of Agriculture, U.S. Government Printing Office, Washington.

Folk, William H., II
1990 *Archaeological Reconnaissance of a 69-Acre Parcel, Kū‘au, Maui* (TMK: (2) 2-5-05: 021), Cultural Surveys Hawai‘i Inc., Kailua, HI.

Folk, William H., II, and Hallett H. Hammatt
1998 Archaeological Inventory Survey of a 55-Acre Parcel in Hāli‘imaile, Makawao, Maui (TMK: 2-5-03:10 por.), Cultural Surveys Hawai‘i Inc., Kailua, HI.

Fornander, Abraham
1878 Volume I, *An Account of the Polynesian Race, Its Origins and Migrations*, Trübner and Co., Ludgate Hill, London.

1880 Volume II, *An Account of the Polynesian Race.*

1885 Volume III, *An Account of the Polynesian Race.*

Fornander, Abraham
1916 Volume IV, *Fornander Collection of Hawaiian Antiquities and Folk-Lore, Memoirs of the Bernice Pauahi Bishop Museum*, Bishop Museum Press, Honolulu.

1918 Volume V, *Fornander Collection of Hawaiian Antiquities and Folk-Lore.*

1919 Volume VI, *Fornander Collection of Hawaiian Antiquities and Folk-Lore.*

Fredericksen, Demaris L., and Erik M. Fredericksen
1994 *An Archaeological Inventory Survey of Two Parcels of Land in Proposed Pukalani Highlands Subdivision, Phase II, Hokuula Ahupua‘a, Makawao District, Island of Maui* (TMK: 2-3-44: 41 and 42), Xamanek Researches, Pukalani, Maui.

1999 Archaeological Inventory Survey for the Kulamalu Watertank and Waterline Improvements, Hōkū‘ula Ahupua‘a, Makawao District, Maui Island (TMK: 2-3-07: por. 10 and 11). Prepared for Munekiyo, Arakawa and Hiraga, Inc. Xamanek Researches Pukalani, HI.

Fredericksen, Walter M., Demaris L. Fredericksen and Erik M. Fredericksen
1988 *Archaeological Inventory Survey Preliminary Report on a Parcel of Land (14 acres) in Pā‘ia , Makawao District, Maui Island, Hawai‘i* (TMK: 2-5-05: 18 por.), Xamanek Researches, Pukalani, Maui, HI.

Giambelluca, Thomas W. Michael A. Nuller, Thomas A. Schroeder
1986 *Rainfall Atlas of Hawai‘i*, State Department of Land and Natural Resources, Honolulu, Hawai‘i.

Gilmore, A.B.
1939 *The Hawaii Sugar Manual*, New Orleans, Louisiana.

Green, Laura C.
1948 Letter, from the Hawaiian Mission Children’s Society to Mrs. Theodore Shultz, Makawao, archive, *Mission Houses Museum*, Honolulu.

HABS No. HI-44
1966 Historic American Buildings Survey, Hamakuapoko Mill Ruins, photographed by Jack E. Boucher, July 1966 (6 photographs).

Hammatt, Hallett H.
1997 Archaeological Subsurface Testing of the Kū‘au Beach Lots Subdivision, Kū‘au, Hāmākua Poko Ahupua‘a, Makawao District, Maui (TMK: 2-6-09:02), Cultural Surveys Hawai‘i, Kailua HI.

Handy, E.S. Craighill and Elizabeth Green Handy
1995 Native Planters in Old Hawaii: Their Life, Lore, and Environment, Bishop Museum Bulletin 233, Honolulu.

Hawaiian Commercial & Sugar Company, Ltd.
2008 Archives, Mr. Garlord Kubota, Sugar Museum, Mr. Randall Moore, engineering division, and Tim Walker, mapping division.

Honolulu Advertiser
1955 *Improving and Expanding Olinda Suggested to Ease Hawaii's Prison Problems*, article, January 24, 1955, page 1.

Infantry Journal Inc.
1948 *A History of the 33rd Infantry Division*, 1115 17th Street, Washington, D.C.

Judd, Albert F., and Bernice Judd
1969 *Missionary Album, Portraits and Biographical Sketches of the American Protestant Missionaries to the Hawaiian Islands*, Hawaiian Mission Children's Society, Honolulu.

Kalakaua, David, and R. M. Daggett
1888 *The Legends and Myths of Hawaii, Fables and Folklore of a Strange People*, Charles L. Webster & Co., New York

Kamakau, Samuel Manaiakalani
1992 *Ruling Chiefs of Hawaii*, Revised Edition, The Kamehameha Schools Press, Honolulu.

Kennedy, Joseph
1990 *Archaeological Investigations at a Suspected Heiau Site, Located near Pukalani, , District of Kula, Island of Maui,* Archaeological Consultants of Hawaii, Inc. Haleiwa, HI.

1991 *Archaeological Inventory Survey and Test Results for the Proposed Pukalani Highlands Property, Located at Pukalani, Ahupua‘a of Kailua, District of Makawao, Island of Maui TMK 2-3-44:20.* Prepared for Pukalani Highland Partners, Kahului, HI. Archaeological Consultants of Hawaii, Inc. Haleiwa, HI.

Kirch, Patrick Vinton
1997 Feathered Gods and Fishhooks, An Introduction to Hawaiian Archaeology and Prehistory, University of Hawai‘i Press, Honolulu.

Kuykendall, Ralph S.
1967 The Hawaiian Kingdom, University of Hawai‘i Press, Honolulu.

Library of Congress
2008 HABS/HAER online register, accessed at http://memory.loc.gov/pnp/habshaer/hi/hi0000/hi0007/photos/058699pv.jpg, Washington, D.C.

Lyons, Curtis Jere
1872 Map, Makawao, Maui, Hawaii State Survey Registered Map No. 603, scale !:12,000, original size 180 x 97 cm.

Macdonald, G.A., A.T. Abbott and Frank L. Peterson
1983 *Volcanoes in the Sea*, Second Edition, University of Hawaii Press, Honolulu, HI.

Mann, Melanie M., Douglas Borthwick and Hallett H. Hammatt
2003 Cultural Impact Assessment for the Proposed Kahakapao Loop and Waihou Springs Trails, Hāmākua Poko Ahupua‘a, Makawao District, Maui Island, TMK: 2-4-16:2, 2-4-15:2,3,4,6,12, Cultural Surveys Hawai‘i, Inc., Kailua, HI.

Maui News
1935 Feb. 23rd 100-page commemorative supplement to the Maui News, Haleakala Highway grand opening ceremony, Maui Publishing Co., Wailuku.

McCandless, James Sutton
1936 *Development of Artesian Well Water in the Hawaiian Islands, 1880-1936*, Advertiser Publishing Company, Honolulu.

Metcalf, Theophilus
1847 Map, Makawao, Hawaii State Survey Division, Registered Map No. 186, Scale 1:9,504, original size 56 x 56 cm.

Mid-Pacific Magazine
1919 Vol. XVIII, No. 6, December 1919, pp 49, published by Alexander Hume Ford, Honolulu.

Moffat, Riley M., and Gary L. Fitzpatrick
1995 *Surveying the Mahele*, Editions Unlimited, Honolulu.

Morawski, Lauren, and Robert L. Spear
2001 *Archaeological Inventory Survey of 0.25 Acres in Hāmākuapoko Ahupua‘a, Makawao District, Island of Maui, Hawai‘i,* TMK: 2-6-01:1 and 2-5-05:50, Scientific Consultant Services, Inc., 711 Kapiolani Blvd., Suite 1475, Honolulu.

O’Rourke, Laura C.
2003 Archaeological Inventory Survey of 0.16 Acres in Hāmākuapoko Ahupua‘a, Makawao District, Island of Maui, Hawai‘i, TMK: 2-6-12:46, Scientific Consultant Services, Inc., 711 Kapiolani Blvd., Suite 1475, Honolulu.

Pantaleo, Jeffrey
2003 Archaeological Inventory Survey Report for the proposed Kualono Residential Subdivision, Pukalani, Makawao District, Island of Maui, TMK: 2-3-11:1 and 2, Archaeological Services Hawaii, LLC, 16 S. Market Street, Suite G, Wailuku, Maui, HI 96793.

Pickett, Jenny, Diane Guerriero, Lisa J. Rotunno_Hazuka and Jeffrey Pantaleo
2003 Archaeological monitoring Report for the Kulamalu Commercial Subdivision, TMK: 2-3-08:38 and portions of 39, A‘apueo Ahupua‘a, Kula District, Island of Maui, ASH LLC, Wailuku, Maui.

Pratt, Linda W., and Samuel M. Gon III
1998 Terrestrial Ecosystems, in Atlas of Hawai‘I, Third Edition, Edited by Sonia P. Juvik and James O. Juvik, University of Hawai‘I Press, Honolulu.

Proehl, Carl W.
1946 The Fourth Marine Division in World War II, Infantry Press, Washington, D.C.

Pukui, Mary K., Samuel H. Elbert and Esther Mookini
1974 *Place Names of Hawaii*, University of Hawaii Press, Honolulu, HI.

Rawls, James J., Richard J. Orsi and Marlene Smith-Baranzini
1999 A Golden State: Mining and Economic Development in Gold Rush California, University of California Press, Berkley, California.

Rechtman, Robert B. and Matthew R. Clark
2001 An Archaeological Inventory Survey of TMK: (2) 2-6-005:007, 008, 009, Hāmākuapoko Ahupua‘a, Makawao District, Island of Maui, Rechtman Consulting, HC1, Box 4149, Kea‘au, HI.

Richards, William
1829 Tour Around Maui, narrative, in *The Missionary Herald*, for the Year 1829, Vol. XXV, Crocker & Brewster, Boston.

Sande, Theodore Anton
1976 Industrial Archaeology, A New Look at the American Heritage, Penguin Books, New York.

Sanford, Mary Cameron
2008 Personal Communication.

Stearns, Harold T. and Gordon A. MacDonald
1942 *Geology and Ground-Water Resources of the Island of Maui, Hawaii*, U.S. Geological Survey, in conjunction with the Territory of Hawaii’s Division of Hydrography, Government Printing Office, Washington, D.C.

Sterling, Elspeth P.
1998 *Sites of Maui*, Bishop Museum Press, Honolulu.

Stevenson, V.L.
1913 Maui No Ka Oi, article, *Paradise of the Pacific*, January 1913, Vol. XXVI, No. 1, William M. Langton, editor, Honolulu.

Thrum, Thomas G.
1900 *Hawaiian Almanac and Annual for 1901*, Hawaiian Gazette Company, Honolulu.

Titchenal, Paul
2000 An Archaeological Inventory Survey of a 9.36-Acre Parcel Near Pā‘ia, Hamakuapoko, Makawao, Maui (TMK: 2-5-05:16), Aki Sinoto Consulting, 2333 Kapiolani Blvd., #2704, Honolulu, HI.

Shoemaker, H.I.
1910 *Map of Sugar Plantation at Puunene-Maui T.H. Owned by Hawaiian Commercial and Sugar Co.* On file at the Department of General Accounting and Services, Archives Division.

Thrum, Thomas G.
1907-1921"Heiau of Maui," *Hawaiian Annual* (compilation, as catalogued at SHPD), Honolulu, HI.

Turner, Charlotte L.
1929 The Story of Maunaolu Seminary, Published by The Friend, Honolulu.

Turner, Jack W., and Cmdr Joshua T. Davis
1946 *Tradewinds*, Souvenir Edition, no publisher, softcover version of Tradewinds, Unit History of the 48th United States Naval Construction Battalion.

United States Government Printing Office
1947 *Building the Navy's Bases in World War II, History of the Bureau of Yards and Docks and the Civil Engineer Corps 1940-1946*. Volume II, U.S. Government Printing Office, Washington.

United States Department of the Interior
2004 Title 36--Parks, Forests, and Public Property, Chapter I--National Park Service, Department of the Interior**,** Part 60--National Register of Historic Places , Revised as of July 1, 2004, [CITE: 36CFR60].

Von Tempski, Armine
1968 Born in Paradise, Hawthorn Books, New York

Waihona ‘Aina Corp.
2002 The Māhele Database and The Boundary Commission Database, as maintained by Project Director Victoria S. Creed (Accessed 2006: www.waihona.com).

Walker, Winslow
1931 *Archaeology of Maui*, Manuscript at B.P. Bishop Museum, Honolulu, HI.

Wilcox, Carol
1996 *Sugar Water: Hawaii's Plantation Ditches*, A Kolowalu Book, University of Hawai‘i Press, Honolulu.

Woodbury, David O.
1947 *Builders for Battle, How the Pacific Naval Air Bases Were Constructed*, New York, E.P. Dutton and Company, Inc.

Wulzen, Warren, Paul H. Rosendahl, and Helen Wong Smith
1996 Archaeological Inventory Survey 44-Acre Pukalani Terrace Subdivision III Land of ‘A‘apueo, Makawao District Island for Maui (TMK:2-3-08:Por.5). Prepared for Dowling Company, Inc. PHRI Paul H. Rosendahl, Ph.D., Inc. Hilo, HI.

Your Victory
1947 A History of the Middle Pacific Command and the Pacific Ocean Areas, Americans Based in New Caledonia, Army and Navy Publishing Company, Baton Rouge, LA.

Appendix C

. Detailed Listing of Grants Grouped by County
April 2009

United States Department of the Interior
National Park Service
Land & Water Conservation Fund

Detailed Listing of Grants Grouped by County

Today's Date: 4/1/2009

Hawaii - 15

Grant ID & Element	Type	Grant Element Title	Grant Sponsor	Amount	Status	Date Approved	Exp. Date	Cong. District
HAWAII								
5 - XXX	D	ONEKAHAKAHA BEACH PARK DEVELOPMENT	HAWAI'I COUNTY	$75,658.25	C	4/15/1966	6/30/1969	2
6 - XXX	D	SPENCER BEACH PARK	HAWAI'I COUNTY	$72,250.00	C	4/15/1966	6/30/1969	2
15 - XXX	D	MAUNA KEA STATE PARK	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$149,940.00	C	10/22/1966	12/31/1970	2
19 - XXX	D	COCONUT ISLAND BEACH PARK DEVELOPMENT	HAWAI'I COUNTY	$75,465.46	C	8/29/1967	9/30/1970	2
23 - XXX	D	HAPUNA BEACH STATE PARK DEVELOPMENT	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$53,812.53	C	9/13/1967	12/31/1970	2
24 - XXX	A	HAPUNA BEACH STATE PARK ACQUISITION	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$19,219.70	C	9/12/1967	12/31/1970	2
26 - XXX	D	KAHALUU BEACH PARK DEVELOPMENT	HAWAI'I COUNTY	$16,203.21	C	9/14/1967	7/31/1969	2
30 - XXX	D	KAMEHAMEHA PARK TENNIS COURT DEVELOPMENT	HAWAI'I COUNTY	$24,643.00	C	9/14/1967	12/31/1969	2
33 - XXX	D	HOOLULU PARK TENNIS COURT DEVELOPMENT	HAWAI'I COUNTY	$13,395.00	C	9/14/1967	9/30/1969	2
35 - XXX	D	WAIOHINU PARK DEVELOPMENT	HAWAI'I COUNTY	$9,099.42	C	9/15/1967	12/31/1968	2
40 - XXX	A	HOOKENA BEACH PARK ACQUISITION	HAWAI'I COUNTY	$130,350.33	C	4/3/1970	12/31/1976	2
42 - XXX	D	KOLEKOLE BEACH PARK DEVELOPMENT	HAWAI'I COUNTY	$22,251.67	C	6/15/1970	3/31/1971	2
44 - XXX	D	LAUPAHOEHOE BEACH PARK DEVELOPMENT	HAWAI'I COUNTY	$17,804.38	C	11/20/1970	12/31/1971	2
54 - XXX	D	HAPUNA BEACH STATE PARK - PHASE II	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$514,418.62	C	9/3/1971	9/3/1976	2
56 - XXX	D	SPENCER BEACH PARK - PHASE II	HAWAI'I COUNTY	$80,600.00	C	2/4/1972	12/31/1976	2
57 - XXX	A	JAMES KEALOHA BEACH PARK ACQUISITION	HAWAII COUNTY	$650,000.00	C	3/3/1972	6/30/1974	2
63 - XXX	A	LELEIWI BEACH PARK ACQUISITION	HAWAI'I COUNTY	$608,340.00	C	12/13/1972	12/31/1975	2
69 - XXX	A	JAMES KEALOHA BEACH PK-PHASE II	HAWAII COUNTY	$292,240.00	C	6/6/1973	12/31/1975	2

United States Department of the Interior
National Park Service
Land & Water Conservation Fund

Detailed Listing of Grants Grouped by County

Today's Date: 4/1/2009

Hawaii - 15

Grant ID & Element	Type	Grant Element Title	Grant Sponsor	Amount	Status	Date Approved	Exp. Date	Cong. District
HAWAII								
87 - XXX	D	HONOKOHAU BOAT LAUNCHING RAMPS	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$239,429.00	C	7/17/1978	12/31/1980	2
142 - XXX	D	WAILEA RESTROOM, HAPUNA BEACH SRA	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$214,624.75	C	5/16/2002	5/16/2007	2
148 - XXX	R	ISAAC HALE BEACH PARK DEVELOPMENT	HAWAI'I COUNTY	$520,824.00	C	2/19/2004	2/19/2009	2
150 - XXX	A	KEOLONAHIHI STATE HISTORICAL PARK	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$600,000.00	A	1/20/2005	1/20/2010	2
157 - XXX	R	IMPROVEMENTS AT LAVA TREE STATE MONUMENT	DEPT. OF LAND & NATURAL RESOURCES	$200,000.00	A	1/21/2009	12/31/2010	2
159 - XXX	R	ISAAC HALE MEMORIAL PARK - PHASE II IMPROVEMENTS	COUNTY OF HAWAII	$350,000.00	C	9/16/2008	12/31/2008	2

HAWAII County Total: **$4,950,569.32** **County Count:** **24**

Grant ID & Element	Type	Grant Element Title	Grant Sponsor	Amount	Status	Date Approved	Exp. Date	Cong. District
HONOLULU								
8 - XXX	D	WAIMANALO BEACH PARK CAMPING FACILITIES	CITY AND COUNTY OF HONOLULU	$62,231.00	C	4/30/1966	4/30/1968	2
9 - XXX	A	HALEIWA SMALL BOAT HARBOR - ACQUISITION	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$142,800.00	C	7/23/1966	2/28/1967	2
11 - XXX	D	PEARL HARBOR PARK DEVELOPMENT	CITY AND COUNTY OF HONOLULU	$134,951.24	C	11/7/1966	6/30/1967	1
17 - XXX	D	KOKO HEAD SANDY BEACH PARK DEVELOPMENT	CITY AND COUNTY OF HONOLULU	$98,666.00	C	2/22/1967	5/31/1968	1
20 - XXX	D	PEARL HARBOR PARK - SECOND INCREMENT	CITY AND COUNTY OF HONOLULU	$95,563.72	C	9/5/1967	12/31/1969	1
22 - XXX	D	POKAI BAY BEACH PARK	CITY AND COUNTY OF HONOLULU	$43,824.30	C	9/5/1967	3/31/1969	2
25 - XXX	D	HALEIWA SMALL BOAT HARBOR	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$79,738.00	C	3/18/1968	12/31/1970	2
31 - XXX	A	SUNSET BEACH PLAYGROUND LAND ACQUISITION	CITY AND COUNTY OF HONOLULU	$48,296.00	C	12/30/1967	12/31/1971	2
37 - XXX	D	WAILUPE BEACH PARK DEVELOPMENT	CITY AND COUNTY OF HONOLULU	$19,880.58	C	9/15/1967	6/30/1969	1
38 - XXX	D	HALEIWA (WAIALUA) BEACH PARK	CITY AND COUNTY OF HONOLULU	$150,545.49	C	2/27/1970	6/30/1971	2
39 - XXX	D	WAIMEA BAY BEACH PARK DEVELOPMENT	CITY AND COUNTY OF HONOLULU	$64,576.71	C	2/20/1969	6/30/1971	2
46 - XXX	D	MAUNALUA BAY BEACH PARK	CITY & COUNTY OF HONOLULU	$87,511.22	C	11/25/1970	12/31/1971	1
47 - XXX	D	NUUANU PALI STATE PARK DEVELOPMENT	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$188,808.92	C	3/17/1971	6/30/1976	2
53 - XXX	D	WAIMANALO BAY PARK STATE PARK DEVELOPMENT	CITY AND COUNTY OF HONOLULU	$231,567.50	C	6/30/1971	12/31/1975	2
55 - XXX	D	SAND ISLAND STATE PARK DEVELOPMENT	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$588,532.51	C	8/23/1971	8/23/1976	1
58 - XXX	D	KOKO HEAD DISTRICT PARK DEVELOPMENT	CITY AND COUNTY OF HONOLULU	$262,777.85	C	6/1/1972	12/31/1974	1
59 - XXX	D	KANEOHE DISTRICT PARK DEVELOPMENT	CITY AND COUNTY OF HONOLULU	$439,071.88	C	6/30/1972	12/31/1974	2

Grant ID & Element	Type	Grant Element Title	Grant Sponsor	Amount	Status	Date Approved	Exp. Date	Cong. District
HONOLULU								
60 - XXX	D	KAMILOIKI COMMUNITY PARK DEVELOPMENT	CITY AND COUNTY OF HONOLULU	$90,438.65	C	8/7/1972	12/31/1974	1
65 - XXX	A	AINA HAINA BEACH PARK	CITY AND COUNTY OF HONOLULU	$494,000.00	C	3/6/1973	12/31/1975	1
66 - XXX	D	SUNSET BEACH PARK DEVELOPMENT	CITY AND COUNTY OF HONOLULU	$96,525.32	C	3/20/1973	12/31/1975	2
67 - XXX	D	EWA BEACH COMMUNITY PARK	CITY AND COUNTY OF HONOLULU	$80,199.86	C	3/1/1973	12/31/1975	1
77 - XXX	D	AINA HAINA BEACH PARK DEVELOPMENT	CITY AND COUNTY OF HONOLULU	$129,729.94	C	10/29/1974	12/31/1976	1
80 - XXX	A	HEEIA STATE PARK ACQUISITION	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$1,943,715.93	C	6/30/1975	12/31/1979	2
81 - XXX	D	PEARL RIDGE COMMUNITY PARK	CITY AND COUNTY OF HONOLULU	$217,077.80	C	11/13/1975	12/31/1978	1
82 - XXX	A	MALAEKAHANA S.P. ACQ.	DEPT. OF LAND & NATURAL RESOURCES	$2,368,380.73	C	6/23/1976	3/31/1981	2
83 - XXX	A	MALAEKAHANA S. P., PHASE II	DEPT. OF LAND & NATURAL RESOURCES	$2,893,789.13	C	9/28/1977	12/31/1983	2
89 - XXX	D	SAND ISLAND STATE PARK DEVELOPMENT II	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$829,410.18	C	9/29/1978	6/30/1981	1
90 - XXX	D	WAIANAE BOAT HARBOR IMPROVEMENTS	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$919,778.96	C	9/29/1978	12/31/1981	2
91 - XXX	D	WAIMANALO DISTRICT PARK	CITY AND COUNTY OF HONOLULU	$462,800.00	C	9/29/1978	12/30/1981	2
94 - XXX	D	MAILI BEACH PARK DEVELOPMENT	CITY AND COUNTY OF HONOLULU	$275,600.00	C	9/21/1979	12/31/1982	2
99 - XXX	A	RAINBOW BAY STATE PARK ACQUISITION	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$1,001,000.00	C	7/1/1980	12/31/1983	1
100 - XXX	A	KALAMA BEACH PARK ACQUISTION	CITY AND COUNTY OF HONOLULU	$780,000.00	C	7/8/1980	12/31/1981	2
102 - XXX	D	SAND ISLAND STATE PARK DEVELOPMENT III	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$469,939.73	C	5/14/1981	12/31/1983	1
106 - XXX	A	ULU PO (HEIAU) STATE PARK ACQUISITION	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$237,909.88	C	7/22/1982	12/31/1984	2
107 - XXX	D	KULIOUOU NEIGHBORHOOD PARK	CITY AND COUNTY OF HONOLULU	$264,443.40	C	1/18/1983	12/31/1984	1

Grant ID & Element	Type	Grant Element Title	Grant Sponsor	Amount	Status	Date Approved	Exp. Date	Cong. District
HONOLULU								
108 - XXX	D	WAIAU DISTRICT PARK	CITY AND COUNTY OF HONOLULU	$293,505.66	C	1/17/1983	12/31/1987	1
110 - XXX	D	HALEIWA BOAT HARBOR IMPROVEMENTS	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$99,619.13	C	8/30/1983	9/15/1984	2
111 - XXX	D	SAND ISLAND STATE PARK DEVELOPMENT IV	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$158,508.28	C	8/30/1983	9/30/1984	1
112 - XXX	D	QUEEN KAPIOLANI PARK IMPROVEMENT	CITY AND COUNTY OF HONOLULU	$38,480.00	C	8/30/1983	9/15/1984	1
113 - XXX	D	SAND ISLAND STATE PARK DEVELOPMENT V	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$193,440.00	C	7/17/1984	12/31/1987	1
114 - XXX	D	ALA MOANA BEACH PARK LIGHTING	CITY AND COUNTY OF HONOLULU	$173,160.00	C	9/27/1984	12/31/1987	1
115 - XXX	A	KAWAINUI MARSH PARK ACQUISITION	DEPT. OF LAND & NATURAL RESOURCES	$1,482,805.48	C	3/20/1985	12/31/1990	2
116 - XXX	D	MOANALUA VALLEY NEIGHBORHOOD PARK	CITY AND COUNTY OF HONOLULU	$92,040.00	C	4/22/1985	12/31/1988	1
117 - XXX	D	HAUULA PLAYGROUND EXPANSION	CITY AND COUNTY OF HONOLULU	$139,888.84	C	5/1/1985	12/31/1988	2
122 - XXX	D	MALAEKAHANA STATE PARK DEVELOPMENT	DEPT. OF LAND & NATURAL RESOURCES	$51,732.20	C	9/29/1986	12/31/1988	2
123 - XXX	D	WAIMANALO BAY STATE PARK II	CITY AND COUNTY OF HONOLULU	$78,184.60	C	9/30/1986	12/31/1988	2
124 - XXX	A	KAILUA BEACH PARK ACQUISITION	CITY AND COUNTY OF HONOLULU	$177,268.00	C	11/26/1986	9/30/1989	2
126 - XXX	A	KAILUA BEACH PARK ACQUISITION II	CITY AND COUNTY OF HONOLULU	$259,350.00	C	9/30/1988	12/31/1991	2
129 - XXX	D	HEEIA STATE PARK IMPROVEMENT	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$104,000.00	C	3/26/1991	12/31/1993	2
132 - XXX	A	KAWAILOA BEACH PARK ACQUISITION	CITY AND COUNTY OF HONOLULU	$538,720.00	C	11/12/1992	12/31/1994	2
136 - XXX	D	AIEA BAY STATE RECREATION AREA IMPRO	DEPT OF LAND & NATURAL RESOURCES	$240,860.00	C	3/5/1996	9/30/1999	2
137 - XXX	D	KAHANA STATE BEACH PARK IMPROV	DEPT OF LAND & NATURAL RESOURCES	$100,000.00	C	6/27/1997	12/31/1999	2
138 - XXX	A	WAIHEE MARSH ACQUISITION PROJECT	CITY AND COUNTY OF HONOLULU	$100,000.00	C	10/26/2001	9/1/2002	2

Grant ID & Element	Type	Grant Element Title	Grant Sponsor	Amount	Status	Date Approved	Exp. Date	Cong. District
HONOLULU								
146 - XXX	D	CENTRAL OAHU REGIONAL AQUATIC CENTER	CITY AND COUNTY OF HONOLULU	$725,000.00	C	12/11/2003	12/11/2008	1
149 - XXX	R	DIAMOND HEAD STATE MONUMENT DEVELOPMENT	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$200,000.00	A	9/22/2005	9/22/2010	1
155 - XXX	D	GEIGER COMMUNITY PARK, OAHU	City and County of Honolulu	$660,000.00	A	8/22/2007	12/31/2009	1

HONOLULU County Total: **$22,200,644.62** **County Count:** **56**

Grant ID & Element	Type	Grant Element Title	Grant Sponsor	Amount	Status	Date Approved	Exp. Date	Cong. District
KAUAI								
1 - XXX	D	KAPAA BEACH DEVELOPMENT	KAUA'I COUNTY	$20,518.48	C	4/15/1966	12/31/1967	2
3 - XXX	D	HANAPEPE SALT POND BEACH PARK DEVELOPMENT	KAUA'I COUNTY	$7,601.47	C	4/15/1966	12/31/1967	2
4 - XXX	D	KEKAHA BEACH PARK DEVELOPMENT	KAUA'I COUNTY	$13,255.72	C	4/15/1966	12/31/1967	2
12 - XXX	D	WAILUA RIVER STATE PARK	KAUAI COUNTY	$168,688.42	C	5/25/1967	12/31/1970	2
13 - XXX	A	WAILUA RIVER STATE PARK INHOLDINGS ACQUISITION	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$15,402.00	C	5/24/1967	12/31/1969	2
21 - XXX	D	POIPU BEACH PARK DEVELOPMENT	KAUA'I COUNTY	$13,431.60	C	8/31/1967	9/30/1988	2
27 - XXX	A	KALIHIKAI BEACH PARK	KAUAI COUNTY	$44,431.71	C	9/14/1967	12/31/1971	2
28 - XXX	D	WAIMEA PARK TENNIS COURT	KAUAI COUNTY	$22,174.80	C	9/14/1967	12/31/1969	2
32 - XXX	D	HANAMAULU BEACH PARK DEVELOPMENT	KAUA'I COUNTY	$61,892.00	C	9/14/1967	7/31/1970	2
51 - XXX	D	LUCY WRIGHT PARK DEVELOPMENT	KAUAI COUNTY	$28,190.76	C	6/30/1971	12/31/1971	2
61 - XXX	A	HAENA STATE PARK ACQUISITION	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$1,301,898.00	C	7/27/1972	7/27/1977	2
62 - XXX	A	HANALEI BEACH PARK ACQUISITION	KAUA'I COUNTY	$210,600.00	C	1/2/1973	12/31/1973	2
70 - XXX	D	ANINI BEACH PARK DEVELOPMENT	KAUA'I COUNTY	$75,645.04	C	6/29/1973	12/31/1976	2
72 - XXX	D	PUHI PARK DEVELOPMENT	KAUA'I COUNTY	$99,768.00	C	6/29/1973	12/31/1976	2
73 - XXX	A	KALAWAI PARK ACQUISITION	KAUA'I COUNTY	$118,614.54	C	9/25/1973	12/31/1976	2
75 - XXX	D	KAPAA BALL PARK DEVELOPMENT	KAUA'I COUNTY	$271,604.19	C	6/28/1974	6/30/1977	2
76 - XXX	A	POIPU BEACH PARK ACQUSITION	KAUA'I COUNTY	$34,996.00	C	6/27/1974	6/30/1977	2
85 - XXX	D	NAWILIWILI RAMP IMPROVEMENT	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$16,053.47	C	5/12/1978	12/31/1980	2
92 - XXX	D	KILAUEA PARK IMPROVEMENTS	KAUA'I COUNTY	$51,129.78	C	1/23/1979	12/31/1981	2

Grant ID & Element	Type	Grant Element Title	Grant Sponsor	Amount	Status	Date Approved	Exp. Date	Cong. District
KAUAI								
93 - XXX	D	HANAMAULU PARK IMPROVEMENTS	KAUA'I COUNTY	$65,985.81	C	6/7/1979	12/31/1983	2
98 - XXX	D	NAWILIWILI BOAT HARBOR PHASE II	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$91,399.97	C	9/28/1979	12/31/1982	2
101 - XXX	D	KALAWAI PARK IMPROVEMENTS - PHASE II	KAUA'I COUNTY	$223,503.47	C	2/18/1981	12/31/1983	2
103 - XXX	D	WAILUA HOMESTEADS PARK	KAUA'I COUNTY	$325,834.12	C	8/25/1981	12/31/1984	2
119 - XXX	D	HANAPEPE TENNIS COURT	KAUAI COUNTY	$41,600.00	C	4/22/1985	12/31/1988	2
120 - XXX	R	KAPAA SWIMMING POOL	KAUA'I COUNTY	$145,600.00	C	3/13/1986	12/31/1989	2
121 - XXX	D	KEKAHA GARDENS PARK, INCREMENT 1	KAUA'I COUNTY	$48,620.00	C	5/2/1986	6/30/1989	2
131 - XXX	R	POLIHALE STATE PARK DEVELOPMENT	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$169,162.79	C	5/28/1992	12/31/1995	2
147 - XXX	D	VIDINHA STADIUM RUBBERIZED TRACK DEVELOPMENT	KAUAI COUNTY	$430,000.00	C	8/30/2004	8/30/2009	2
151 - XXX	D	PLAYGROUNDS AT HANAPEPE HEIGHTS	KAUA'I COUNTY	$42,000.00	A	1/19/2005	1/19/2010	2
154 - XXX	D	KEKAHA GARDENS PARK, KAUAI	KAUAI COUNTY	$200,000.00	A	12/5/2006	6/30/2010	2
			KAUAI County Total:	**$4,359,602.14**		**County Count:**		**30**

Grant ID & Element	Type	Grant Element Title	Grant Sponsor	Amount	Status	Date Approved	Exp. Date	Cong. District
MAUI								
7 - XXX	D	KEPANINAI BOTANICAL GARDEN COMPLEX EXPANSION	MAUI COUNTY	$82,765.00	C	4/15/1966	12/31/1969	2
14 - XXX	D	WAIANAPANAPA STATE PARK DEVELOPMENT	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$83,640.00	C	10/25/1966	12/31/1970	2
18 - XXX	C	MOLOKAI SWIMMING POOL ACQ & DEV	MAUI COUNTY	$127,695.18	C	2/23/1967	12/31/1969	2
48 - XXX	D	KALAMA BEACH PARK DEVELOPMENT	MAUI COUNTY	$19,409.00	C	2/22/1971	12/31/1973	2
49 - XXX	D	KAMAOLE BEACH PARK II & III DEVELOPMENT	MAUI COUNTY	$44,845.49	C	2/22/1971	12/31/1973	2
64 - XXX	C	KAHULUI COMMUNITY PARK - PHASE I-A	MAUI COUNTY	$504,774.83	C	1/2/1973	12/31/1976	2
74 - XXX	D	WAIHEE BEACH PARK DEVELOPMENT	MAUI COUNTY	$44,579.60	C	4/8/1974	6/30/1976	1
78 - XXX	D	KANAHA BEACH PARK DEVELOPMENT	MAUI COUNTY	$107,280.05	C	2/26/1975	12/31/1977	2
79 - XXX	D	HANA BOAT LAUNCHING RAMP	DEPT. OF LAND & NATURAL RESOURCES	$53,040.00	C	6/30/1975	12/31/1977	2
86 - XXX	D	MALA BOAT LAUNCHING FACILITY	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$240,770.89	C	7/14/1978	5/2/1979	2
96 - XXX	A	MAKENA-LA PEROUSE STATE PARK	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$211,388.46	C	9/28/1979	12/31/1983	2
97 - XXX	D	KIHEI BOAT LAUNCHING FACILITY	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$503,360.00	C	9/28/1979	12/31/1983	2
105 - XXX	C	HANAKAO'O BEACH PARK	MAUI COUNTY	$588,140.22	C	12/15/1981	12/31/1984	2
109 - XXX	R	LAHAINA BOAT HARBOR IMPROVEMENTS	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$46,914.50	C	8/30/1983	9/15/1984	2
118 - XXX	D	LAHAINA RECREATIONAL CENTER	MAUI COUNTY	$453,847.08	C	5/1/1985	12/31/1988	2
133 - XXX	D	WAR MEMORIAL SWIMMING POOL IMPROVEMENTS	MAUI COUNTY	$260,000.00	C	2/28/1995	12/31/1997	2
139 - XXX	D	LAHAINA RECREATION CENTER EXPANSION PROJECT	MAUI COUNTY	$300,000.00	C	10/31/2000	9/30/2003	2

Grant ID & Element	Type	Grant Element Title	Grant Sponsor	Amount	Status	Date Approved	Exp. Date	Cong. District
MAUI								
140 - XXX	D	MAKANA PARK IMPROVEMENTS	MAUI COUNTY	$190,000.00	C	5/23/2002	5/23/2007	2
141 - XXX	R	LANAI TENNIS/BASKETBALL COURT IMPROVEMENTS	MAUI COUNTY	$100,000.00	C	5/14/2002	5/14/2007	2
			MAUI County Total:	**$3,962,450.30**		**County Count:**	**19**	
MULTI-COUNTY								
29 - XXX	D	PUNALUU BEACH PARK	CITY AND COUNTY OF HONOLULU	$34,975.42	C	9/14/1967	6/30/1969	2
34 - XXX	D	PUNALUU BEACH PARK DEVELOPMENT (HAWAII)	HAWAI'I COUNTY	$11,526.00	C	2/2/1968	12/31/1968	2
128 - XXX	D	MALAEKAHANA STATE PARK DEV. IIMENT	DEPT. OF LAND & NATURAL RESOURCESES	$51,480.00	C	7/26/1989	12/31/1991	2
130 - XXX	D	MAKENA-LA PEROUSE STATE PARK II	HI DEPARTMENT OF LAND AND NATURAL RESOURCES	$269,889.20	C	5/18/1992	12/31/1996	2
143 - XXX	D	LAHAINA RECREATION CENTER EXPANSION PROJECT	MAUI COUNTY	$220,000.00	C	5/16/2002	5/16/2007	2
			MULTI-COUNTY County Total:	**$587,870.62**		**County Count:**	**5**	

United States Department of the Interior
National Park Service
Land & Water Conservation Fund

Detailed Listing of Grants Grouped by County

Today's Date: 4/1/2009

Hawaii - 15

Grant ID & Element	Type	Grant Element Title	Grant Sponsor	Amount	Status	Date Approved	Exp. Date	Cong. District
PLANNING								
16 - XXX	P	STATE OUTDOOR RECREATION PLAN	DEPT. OF PLANNING & ECONOMIC DEV.	$82,524.00	C	12/21/1966	12/31/1968	99999
43 - XXX	P	SCORP	DEPT. OF PLANNING & ECONOMIC DEV.	$43,258.88	C	6/30/1970	8/31/1971	99999
68 - XXX	P	HAWAII OUTDOOR RECREATION PLAN	DEPT. OF PLANNING & ECONOMIC DEV.	$80,000.00	C	6/30/1973	12/31/1976	99999
84 - XXX	P	HAWAII SCORP	DEPT. OF LAND & NATURAL RESOURCES	$108,434.31	C	4/17/1978	12/31/1980	99999
104 - XXX	P	1981-83 PLANNING GRANT PROGRAM	DEPT. OF LAND & NATURAL RESOURCES	$113,605.56	C	9/25/1981	3/21/1986	99999
125 - XXX	P	SCORP WETLANDS RESOURCES PLAN	DEPT. OF LAND & NATURAL RESOURCES	$102,000.00	C	7/23/1987	9/30/1991	99999
134 - XXX	P	STATE COMPREHENSIVE OUTDOOR REC PLAN	DEPT. OF LAND & NATURAL RESOURCES	$50,000.00	C	7/13/1995	6/30/1996	99999
144 - XXX	P	SCORP UPDATE	DEPT. OF LAND & NATURAL RESOURCES	$55,000.00	C	9/10/2002	9/10/2007	99999
156 - XXX	P	2008 SCORP UPDATE	DEPT. OF LAND & NATURAL RESOURCES	$70,000.00	A	9/7/2007	6/30/2009	99999
			PLANNING County Total:	**$704,822.75**		**County Count:**		**9**
			State Total:	**$36,765,959.75**		**Total # of Grants:**		**143**

Appendix D

Environmental Noise Assessment Report
Makawao/Makani Road Improvements
May 2008

D. L. ADAMS ASSOCIATES, LTD.
Consultants in Acoustics and Performing Arts Technologies

Environmental Noise Assessment Report
Makawao Avenue/Makani Road Improvements
Makawao, Maui, Hawaii

May 2008

DLAA Project No. 08-05

Prepared for:
RM Towill Corporation
Honolulu, 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

1.0 EXECUTIVE SUMMARY

1.1 The proposed project involves roadway improvements on the existing sections of roadway along Makawao Avenue and Makani Road between the Eddie Tam Memorial Center and the Samuel Enoka Kalama Intermediate School. The purpose of the project is to widen the existing roadway to improve traffic conditions and meet projected traffic demands.

1.2 The noise environment near the project site is relatively dynamic and depends significantly on vehicular traffic patterns on Makani Road and Makawao Avenue. The measurements show that noise levels 20 feet from Makani Road typically range from 57 dBA to 70 dBA during the daytime hours (7:00 a.m. to 10:00 p.m.) and 46 dBA to 63 dBA during the nighttime hours (10:00 p.m. to 7:00 a.m.). Noise levels 15 feet from Makawao Avenue range from 64 dBA to 70 dBA during the daytime hours and 52 dBA to 68 dBA during the nighttime hours.

1.3 Additional noise measurement data indicates that noise levels at 20 feet from Makani Road have a day-night level, L_{dn}, of 68 dBA. Noise levels at 15 feet from Makawao Avenue have an L_{dn} of 70 dBA. Although these calculated day-night noise levels are above the current EPA noise design goal of $L_{dn} \leq 65$ dBA based on the close distance to the road, homes that are located more than 40 feet from Makawao Avenue experience noise levels that are within the EPA design goal.

1.4 Most of the project site should be considered noise sensitive and will be impacted by construction noise. During the project construction, the dominant noise sources will probably be backhoes, front loaders, pavement cutters, generators, and earthmoving equipment, e.g., bulldozers and diesel-powered trucks. Noise from construction equipment must comply with State of Hawaii Community Noise Control Rules and the construction noise permit.

1.5 The projected increase in traffic volume in the year 2030 will increase traffic noise levels such that homes located within 35 feet from the existing edge-of-pavement of Makawao Avenue will exceed the maximum noise limit. Although the realignment and widening of Makawao Avenue is not expected to substantially increase future traffic noise levels, noise abatement measures should be considered since the traffic noise levels exceed the FHWA criteria.

1.6 For the residences adjacent Makani Road, existing and future noise levels were calculated to be well below the FHWA/DOT maximum noise limit of 67 dBA.

2.0 PROJECT DESCRIPTION

The proposed project is located in the Makawao District on the Island of Maui. The project involves roadway improvements on the existing sections of roadway along Makawao Avenue and Makani Road between the Eddie Tam Memorial Center and the Samuel Enoka Kalama Intermediate School, as shown in Figure 1. The purpose of the project is to realign and widen the existing roadway to improve traffic conditions and meet projected traffic demands. The project will include increasing the width of the existing right-of-way to accommodate roadway widening, installation of curbs, gutters and sidewalks on both sides of the roadway, installation of street lights, relocation of utilities, and associated drainage improvements.

Vehicular traffic on affected streets will be modified during the roadway improvements. During construction only one lane of traffic may be open, so the speed of traffic through the project site will be slower than the existing traffic speeds. An alternate detour route is not planned. Typical construction equipment may remain on-site throughout the construction period.

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 address most *moving* sources, such as vehicular traffic noise, air traffic noise, or rail traffic noise. However, the Community Noise Control Rule does regulate noise related to agricultural, construction, and industrial activities, which may not be stationary.

The 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 2. 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 3. 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 a Federal Highway Administration traffic noise model [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 15 dB.

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 Board of Education (BOE)

BOE policy 6700 [Reference 6] sets four classroom noise level requirements:

1. Soundproofing design shall be used to reduce the noise level whenever the internal noise level exceeds 50 dBA.

2. Noise control shall be provided for all school facilities which generate exterior noise levels at the property line exceeding DOH standards.

3. Noise control measures shall be installed in classrooms and administration/staff facilities (excluding shop classrooms) whenever 50 percent of the intruding noise level measurements exceed 55 dBA when inside the classroom with windows and doors open and the room empty.

4. Air conditioning shall be provided to facilities exposed to exterior noise levels greater than L_{10} =65dBA.

4.0 EXISTING ACOUSTICAL ENVIRONMENT

Two types of noise measurements were conducted to assess the existing acoustical environment in the vicinity of the project location. The first noise measurement type consisted of continuous long-term ambient noise level measurements (Location L1 and L2), as shown in Figure 1. Long term measurements were conducted between February 11, 2008 and February 12, 2008. The second type of noise measurement was short-term in duration and included traffic counts (Location S1 and S2). The purpose of the short-term noise measurements and corresponding traffic counts were to validate a traffic noise prediction model. Short term measurements were conducted on February 11, 2008 and February 12, 2008.

4.1 Noise Measurement Procedure

Long-Term Noise Measurement Procedure

Continuous, hourly, statistical sound levels were recorded for approximately 1 day at each location. 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. 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.

Short-Term Noise Measurement Procedure

An approximate 30-minute equivalent sound level, L_{eq}, was measured. Vehicular traffic counts and traffic mix were documented during the measurement period. The noise 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. 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.

4.2 Noise Measurement Locations

Long-Term Noise Measurement Locations

Location L1: Positioned approximately 20 feet north of the edge-of-pavement (EOP) of Makani Road. The meter was located on the Kalama Intermediate School property, slightly below the roadway elevation

due the natural topography of the site. The meter was located just outside the boundaries of the project site.

Location L2: Positioned approximately 15 feet west of the edge-of-pavement (EOP) of Makawao Avenue. The meter was located on the Eddie Tam Memorial Center property, slightly below the roadway elevation due the natural topography of the site. The meter was located just outside the boundaries of the project site.

Short-Term Noise Measurement Locations

Location S1: Positioned adjacent to Makani Road between Pokole Place and Mikiola Street, approximately 35 feet north of the edge-of-pavement.

Location S2: Positioned adjacent to Makawao Avenue at the Eddie Tam Memorial Center, approximately 35 feet west of the edge-of-pavement. The meter was located just outside the boundaries of the project site.

4.3 Noise Measurement Results

The measured equivalent sound levels, L_{eq}, in A-weighted decibels (dBA) are graphically presented in Figure 4 for each location. As shown in the graph, the noise environments at locations L1 and L2 are relatively dynamic and depend significantly on the vehicular traffic patterns of Makani Road and Makawao Avenue.

The measurements show that noise levels 20 feet from Makani Road (L1) typically range from 57 dBA to 70 dBA during the daytime hours (7:00 a.m. to 10:00 p.m.) and 46 dBA to 63 dBA during the nighttime hours (10:00 p.m. to 7:00 a.m.). There is an unexpected peak of 75 dBA at 2:00 p.m. that may have been caused by elevated traffic noise after dismissal of the Kalama Intermediate School or a disturbance to the meter by passing pedestrians. Noise measurements taken 20 feet from Makani Road were used to calculate a day-night level, L_{dn}, of 68 dBA.

Noise levels 15 feet from Makawao Avenue (L2) range from 64 dBA to 70 dBA during the daytime hours and 52 dBA to 68 dBA during the nighttime hours. Noise measurements taken 15 feet from Makawao Avenue were used to calculate an L_{dn} of 70 dBA.

The dominant and secondary noise sources at the project site are described below:

Dominant: Vehicular traffic on Makani Road and Makawao Avenue

Secondary: Wind, birds, landscaping equipment, aircraft flyovers, and residential noises such as dogs, pedestrians, children playing, etc.

5.0 POTENTIAL NOISE IMPACTS

5.1 Project Construction Noise

Properties along Makawao Avenue and Makani Road within the project limits are mostly residential and also include one park and one intermediate school. Most of the homes are located more than 50 feet from the roadway, however some are located less than 30 feet from the roadway. For this reason, most of the project site should be considered noise sensitive and will be impacted by construction noise. 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.

Construction methods may include cutting of existing pavement, grading, filling, compacting, paving, etc. and may utilize equipment such as jackhammers, saw cutters, backhoes, front loaders, dump trucks, generators, and compressors. The various construction phases of the project may generate significant amounts of noise that could impact residences, the park, and the school. Pavement cutters, jackhammers, backhoes and earthmoving equipment, e.g., bulldozers and diesel-powered trucks will probably be the loudest equipment used during construction.

5.2 Vehicular Traffic Noise Impacts

A vehicular traffic noise analysis was completed for the existing conditions (2007), future year 2030 projections both with and without the project using the FHWA Traffic Noise Model Look-up Tables Software Version 2.5 (2004) [Reference 7]. The traffic noise analysis is based on the traffic counts provided by the Traffic Consultant [Reference 8] and the most recent roadway alignment. It was assumed that traffic volumes increase at a rate of 2% per year and the future traffic volumes will not change due to the proposed improvements to the roadway. The short-term noise measurement and corresponding traffic counts were used to validate the software at the noise prediction locations. Vehicular traffic noise level contours were calculated for the homes adjacent to Makawao Avenue and Makani Road. The results of the traffic noise analysis for the existing and future year projections are described below and summarized in Table 1.

5.2.1 Vehicular Traffic Noise Impacts

<u>Existing Vehicular Noise Levels</u>

For residences located within 35 feet from the edge-of-pavement of the current alignment of Makawao Avenue, existing vehicular noise levels were calculated to be below the FHWA/DOT maximum noise limit of 67 dBA during peak traffic hours. For the residences adjacent Makani Road, existing traffic noise levels were calculated to be well below the FHWA/DOT maximum noise limit of 67 dBA during peak traffic hours.

Future Vehicular Noise Levels without the Project

Vehicular traffic noise levels along Makawao Avenue and Makani Road are expected to increase by approximately 2 dB in 2030 due to the 2% per year increase in traffic volume. Future year 2030 noise levels (without the project) were calculated to exceed the FHWA/DOT maximum noise limit of 67 dBA during peak traffic hour where residences are located within 35 feet from the edge-of-pavement of the current alignment of Makawao Avenue. For the residences adjacent Makani Road, future noise levels were calculated to be well below the FHWA/DOT maximum noise limit.

Future Vehicular Noise Levels with the Project

Portions of the roadway at the intersection of Makani Road and Makawao Avenue will be widened to accommodate additional turning lanes. The right turn lane addition along north Makawao Avenue will begin approximately 300 feet after the Tam Memorial Center driveway and will shift the edge-of-pavement closer to several residential lots on the east and west sides of the street where the widening occurs. The widening of Makani Road to accommodate a left turn and right turn lane will shift the edge-of-pavement closer to nearly all residences on the south side of the street and the first several homes closest to the intersection on the north side of the street.

Since the planned improvements to Makawao Avenue and Makani Road will not impact the volume of vehicles along the roadway, the change in traffic noise levels at the surrounding homes is due to the shift in alignment and widening of Makawao Avenue and Makani Road. For these residences, noise levels are expected to increase by less than 1 dB. However, the noise levels at homes located within 35 feet from the edge-of-pavement of the current alignment of Makawao Avenue exceed the FHWA noise limit of 67 dBA. Therefore, noise mitigation should be considered.

Surrounding Community

During the construction period, residences in the surrounding area may experience heavier traffic due to the re-routing of vehicles away from the construction site. The increase in traffic will be short term and only during the hours of construction. Noise levels in these affected areas are expected to be below the FHWA/HDOT maximum noise limit of 67 dBA.

5.3 Compliance with EPA Noise Guidelines

The EPA has an existing design goal of $L_{dn} \leq 65$ dBA and a future design goal $L_{dn} \leq 55$ dBA for exterior noise levels. The results from the long-term ambient noise measurements conducted at the proposed project site show a calculated day-night level, L_{dn}, of 68 dBA along Makani Road, and 70 dBA along Makawao Avenue.

These day-night levels are high due to the close proximity of the sound level meters to the roadway (less than 20 feet). It is expected that the day-night level at the homes and park located more than 40 feet from the edge-of-pavement of Makawao Avenue will be less than the existing EPA design goal but exceed the future EPA design goal. The day-night level at the homes and school adjacent to Makani Road will also be less than the existing EPA design goal but exceed the future EPA design goal.

The day-night level at the project site is expected to increase by approximately 2 dB by the year 2030 due to the projected increase in traffic noise. During the construction of the roadway, higher noise levels may cause the L_{dn} to exceed the EPA goals in the project vicinity. However, noise will be short term and only during the hours of construction.

It is important to note that the EPA noise guidelines are design goals and are not enforceable regulations. However, these guidelines are useful tools for assessing the noise environment.

5.4 Compliance with BOE Noise Guidelines

Board of Education (BOE) Policy 6700 [Reference 10] requires that air conditioning be installed for schools exposed to an exterior noise level of $L_{10} = 65$ dBA. The Kalama Intermediate School is located just outside the project boundaries and is sufficiently for enough from the road that is not likely to experience an L_{10} greater than 65 dBA due to traffic noise in the future year 2030.

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 engines, 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 are restricted to 9:00 a.m. to 5:30 p.m., Monday through Friday. In addition, construction equipment and on-site vehicles or devices whose operations involve the exhausting of gas or air, excluding pile hammers and pneumatic hand tools weighing less than 15 pounds, must be equipped with mufflers [Reference 1].

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 Vehicular Traffic Noise

The consideration of noise abatement as part of a roadway construction project is mandatory if Federal-aid funds are to be used and if traffic noise impact is expected to occur. If traffic noise impacts are identified, noise abatement measures must be considered. Regulations do not require that the FHWA noise abatement criteria be met in every instance. Rather, they require that reasonable and feasible mitigation measures are incorporated into the project to minimize noise impacts.

The projected increase in traffic volume in the year 2030 will increase traffic noise levels such that homes located within 35 feet from the existing edge-of-pavement of Makawao Avenue will exceed the FHWA maximum noise limit. Although the added turning lanes is not expected to substantially increase future traffic noise levels, a traffic noise impact still occurs since the traffic noise levels exceed the FHWA criteria [Reference 9]. Therefore, noise abatement measures must be considered.

Abatement consideration should weigh the abatement benefits, costs, and overall social, economic, and environmental effects. The FHWA considers a 5 dB reduction in noise level to be significant. Per HDOT's standards, mitigation

measures need to be reasonable, i.e., under $35,000 per affected household, and feasible, i.e., acceptable to the affected residents.

Noise mitigation typically includes the construction of noise barriers (including landscaping for aesthetic purposes) whether within or outside the roadway right-of-way. Factors such as distances to roadways and setbacks, intervening ground conditions, barrier construction, barrier height, roadway elevations, etc., will determine the noise reduction afforded by a traffic noise barrier. It may or may not be practical to construct a noise barrier wall for the few homes along Makawao Avenue that may be impacted by roadway improvements.

Although insulation of homes (i.e., upgrading windows, air-conditioning or forced ventilation etc.) is a good practice, this type of noise mitigation is not considered to be an acceptable approach except in cases where a sever impact is identified. The Makawao Avenue and Makani Road Improvements project does not qualify as a severe impact. Other possible measures may include traffic management measures, creating buffer zones, alteration of horizontal and vertical alignments, or relocating the highway.

6.3 Mitigation of Noise at the Proposed Elementary School

The Kalama Intermediate School located just outside the boundaries of the project site is not likely to experience an L_{10} greater than 65 dBA, therefore noise mitigation is not required. Temporary noise mitigation measures may be required if construction activities occur in the vicinity of the school.

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. *Policies and Standards for School Facilities Design*, Board of Education, Policy 6700, Appendix A, Acoustical and Environmental Control, March 1995.

7. *Federal Highway Administration's Traffic Noise Model Look-up Tables Software*, Ver. 2.5; U.S. Department of Transportation, December 17, 2004.

8. *Memorandum: Makani Road – Makawao Avenue Field Observations,* Julian Ng, Inc., September, 2007.

9. Highway Traffic Noise Analysis and Abatement Policy and Guidance, U.S. Department of Transportation, Federal Highways Administration, June 1995.

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 A[*] (Makawao Avenue)		Location B[*] (Makani Road)	
	AM	**PM**	**AM**	**PM**
Existing (Calculated)	65.3	64.6	59.0	56.0
Future Without Project (2030)	67.3	66.6	61.0	58.0
Future With Project (2030)	67.8	67.1	61.8	58.6
Future Increase Without Project (2030)	2.0	2.0	2.0	2.0
Future Increase With Project (2030)	2.5	2.5	2.8	2.6
Increase Due to Project	0.5	0.5	0.8	0.6

[+] The noise level calculations were based on the traffic noise memorandum provided by Julian Ng, Inc. [Reference 8].

[*] Location A - 35 feet makai of Makawao Road existing edge-of-pavement
Location B - 35 feet of north Makani Avenue existing edge-of-pavement

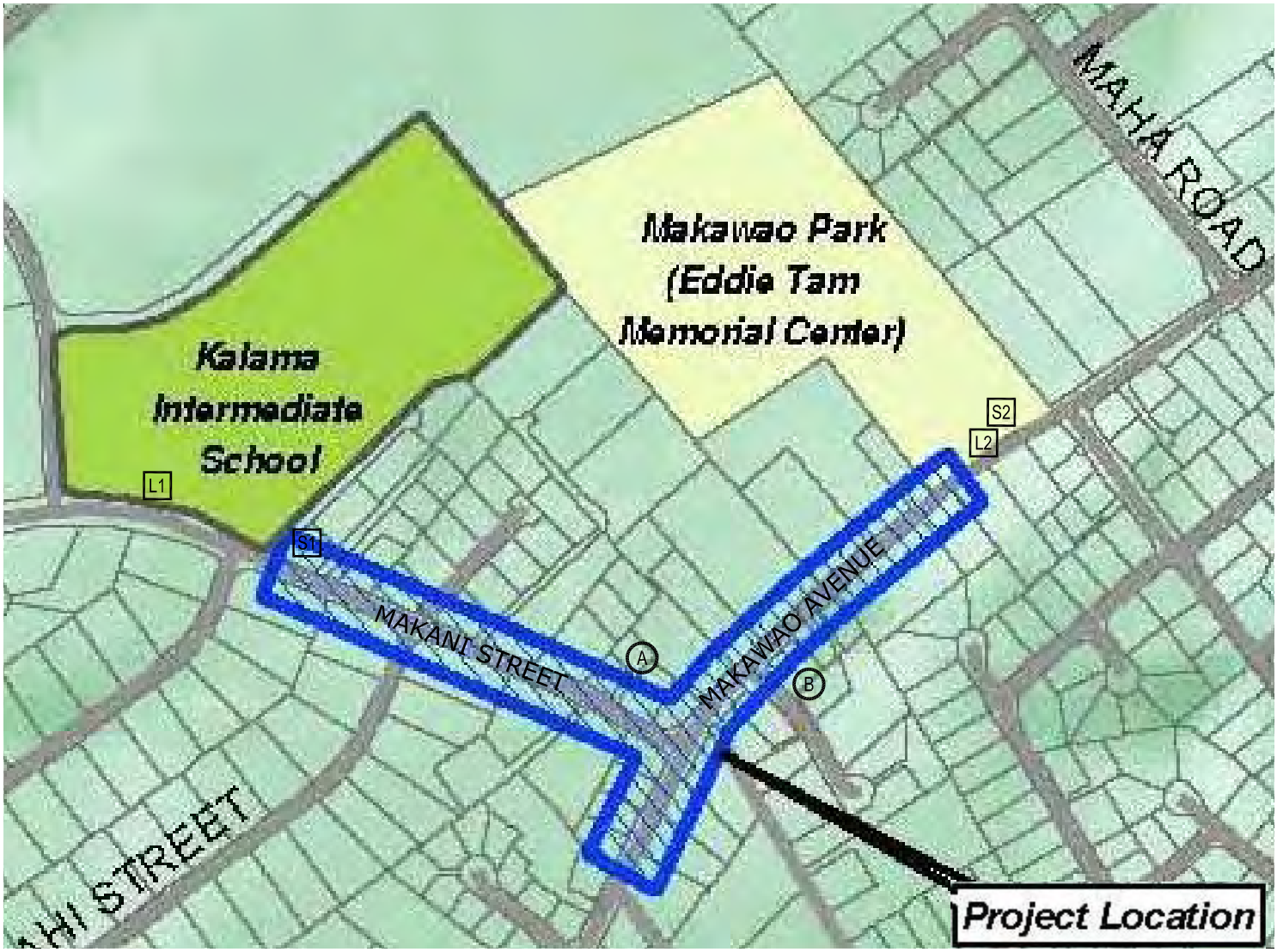
LEGEND

L1 Long Term Noise Measurement Location

S1 Short Term Noise Measurement Location

A Noise Prediction Locations

N



D. L. ADAMS ASSOCIATES, LTD.
970 N. KALAHEO AVE, A-311
KAILUA, HAWAII 96734
808/254-3318 FAX 808/254-5295

Project and Noise Measurement Locations

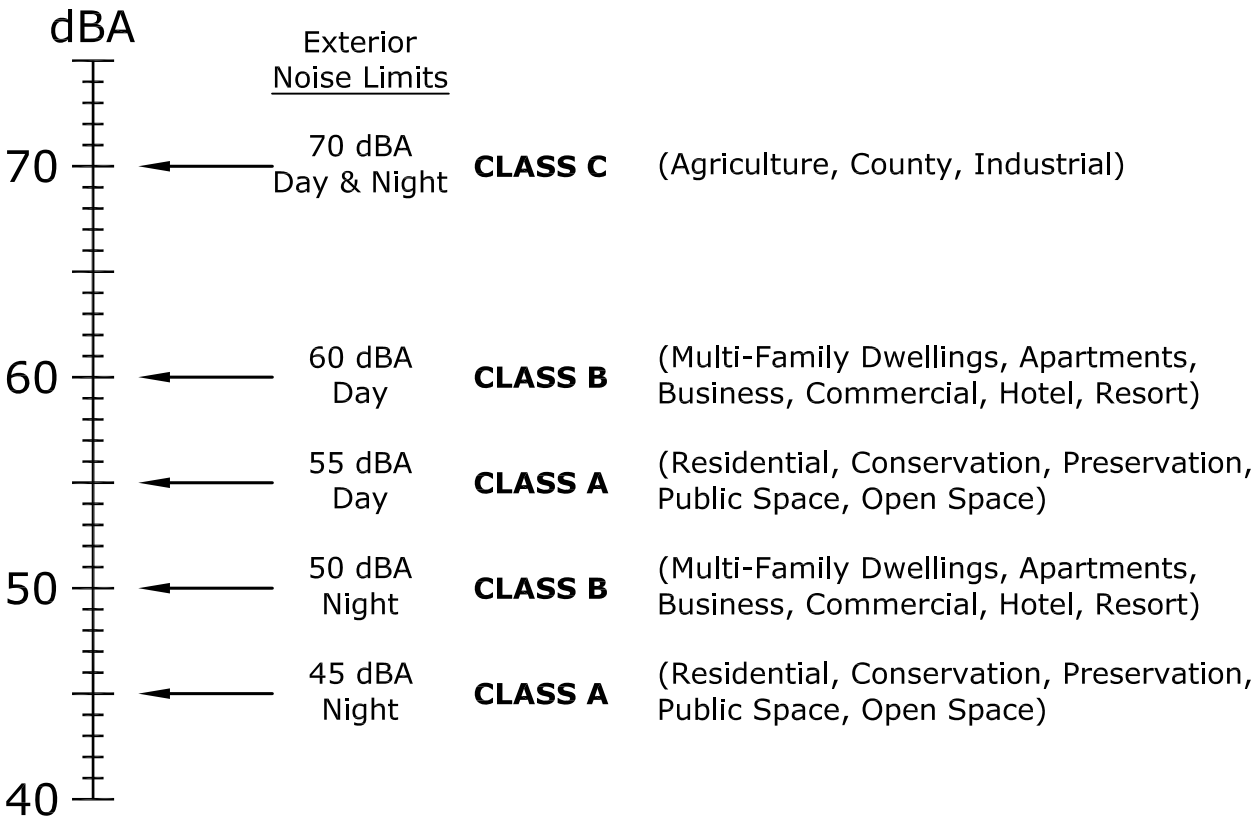
Makawao Avenue/Makani Road Improvements

Not to Scale

Date	Project No.	Drawn By
May 2008	08-05	DFD

Figure No
1

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, Country, 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

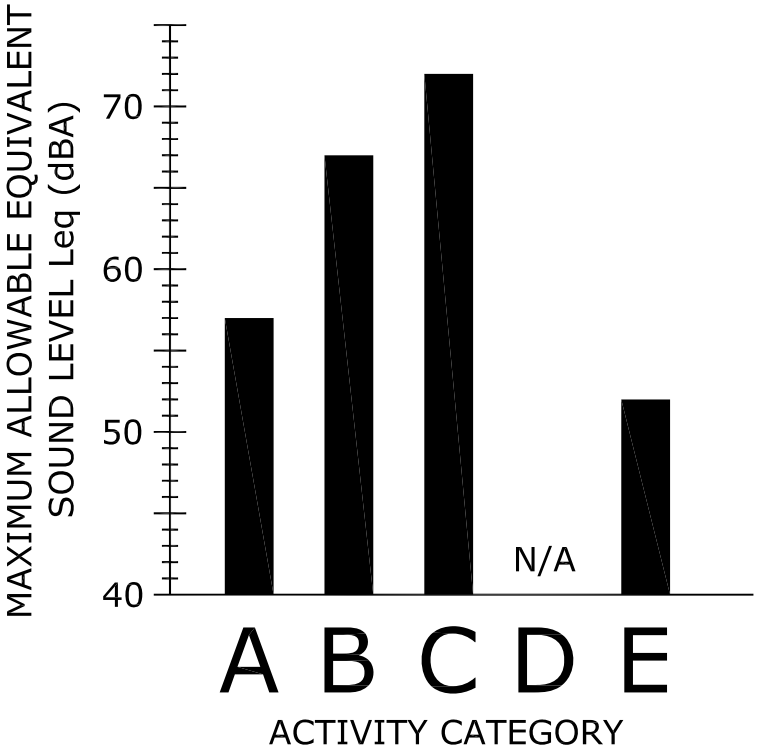
Makawao Avenue/Makani Road Improvements

Not to Scale

Figure No 2

Date	Project No.	Drawn By
May 2008	08-05	TRB

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, SCHOOLS, 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

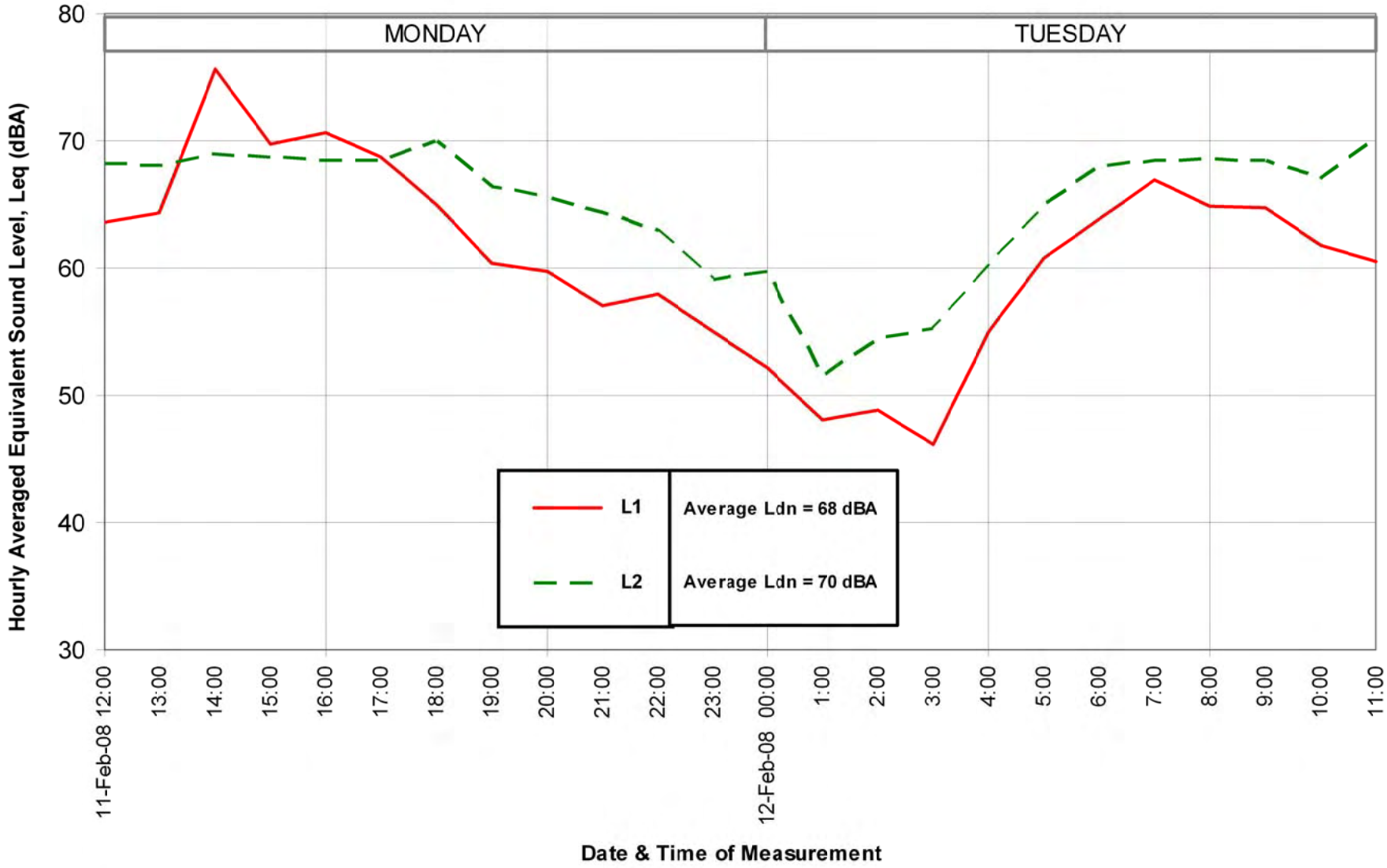
Federal Highways Administration Recommended Equivalent Hourly Sound Levels Based on Land Use

Makawao Avenue/Makani Road Improvements

Not to Scale

Figure No 3

Date	Project No.	Drawn By
May 2008	08-05	TRB



D. L. ADAMS ASSOCIATES, LTD.
970 N. KALAHEO AVE, A-311
KAILUA, HAWAII 96734
808/254-3318 FAX 808/254-5295

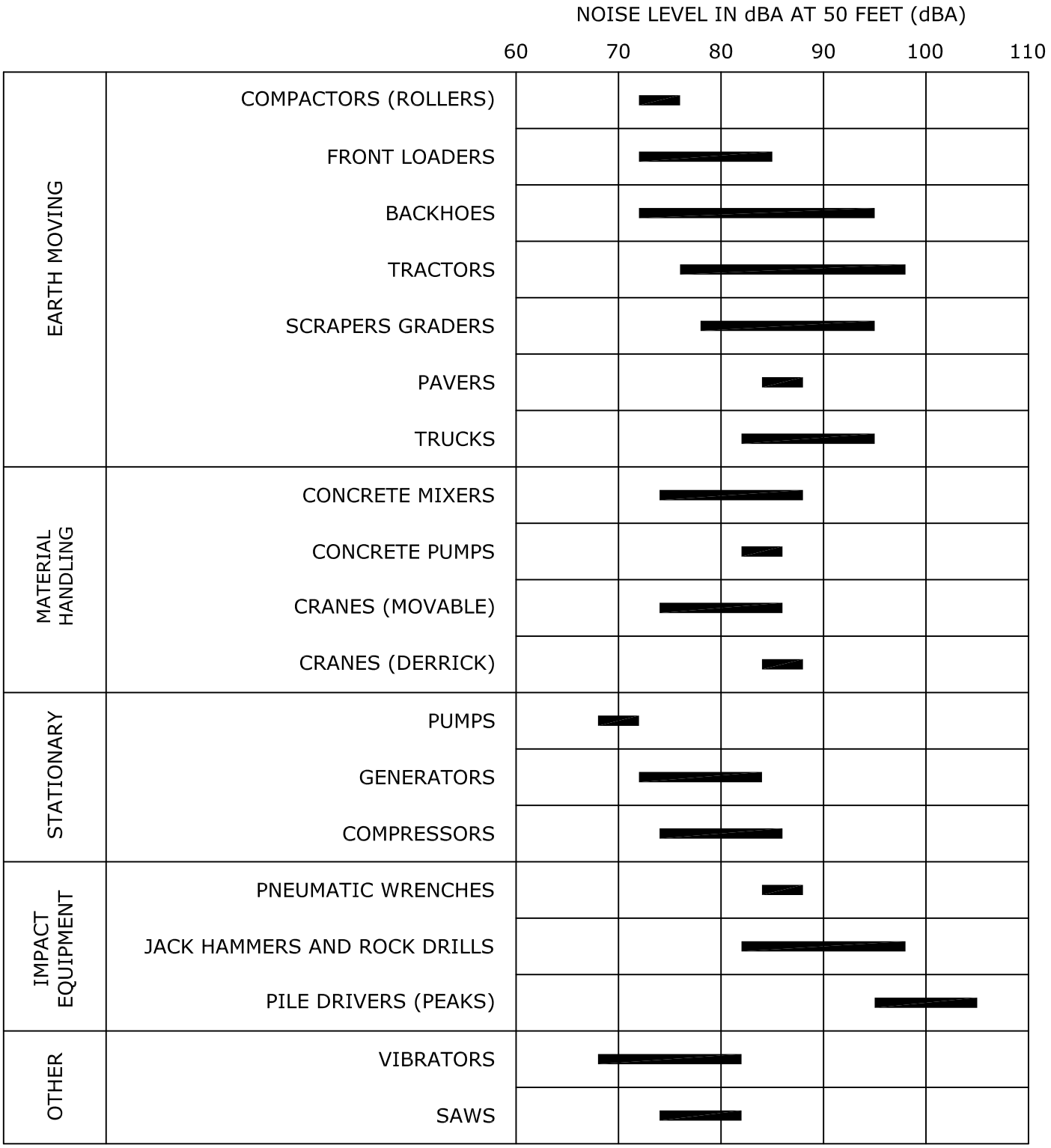
Graph of Noise Measurements

Makawao Avenue/Makani Road Improvements

Not to Scale

Date	Project No.	Drawn By
May 2008	08-05	DFD

Figure No
4



NOTE: BASED ON LIMITED AVAILABLE DATA SAMPLES

Typical Sound Levels from Construction Equipment

D. L. ADAMS ASSOCIATES, LTD.
970 N. KALAHEO AVE, A-311
KAILUA, HAWAII 96734
808/254-3318 FAX 808/254-5295

Makawao Avenue/Makani Road Improvements

Not to Scale

Figure No 5

Date	Project No.	Drawn By
May 2008	08-05	TRB

APPENDIX A

Acoustic Terminology

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

[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.

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.

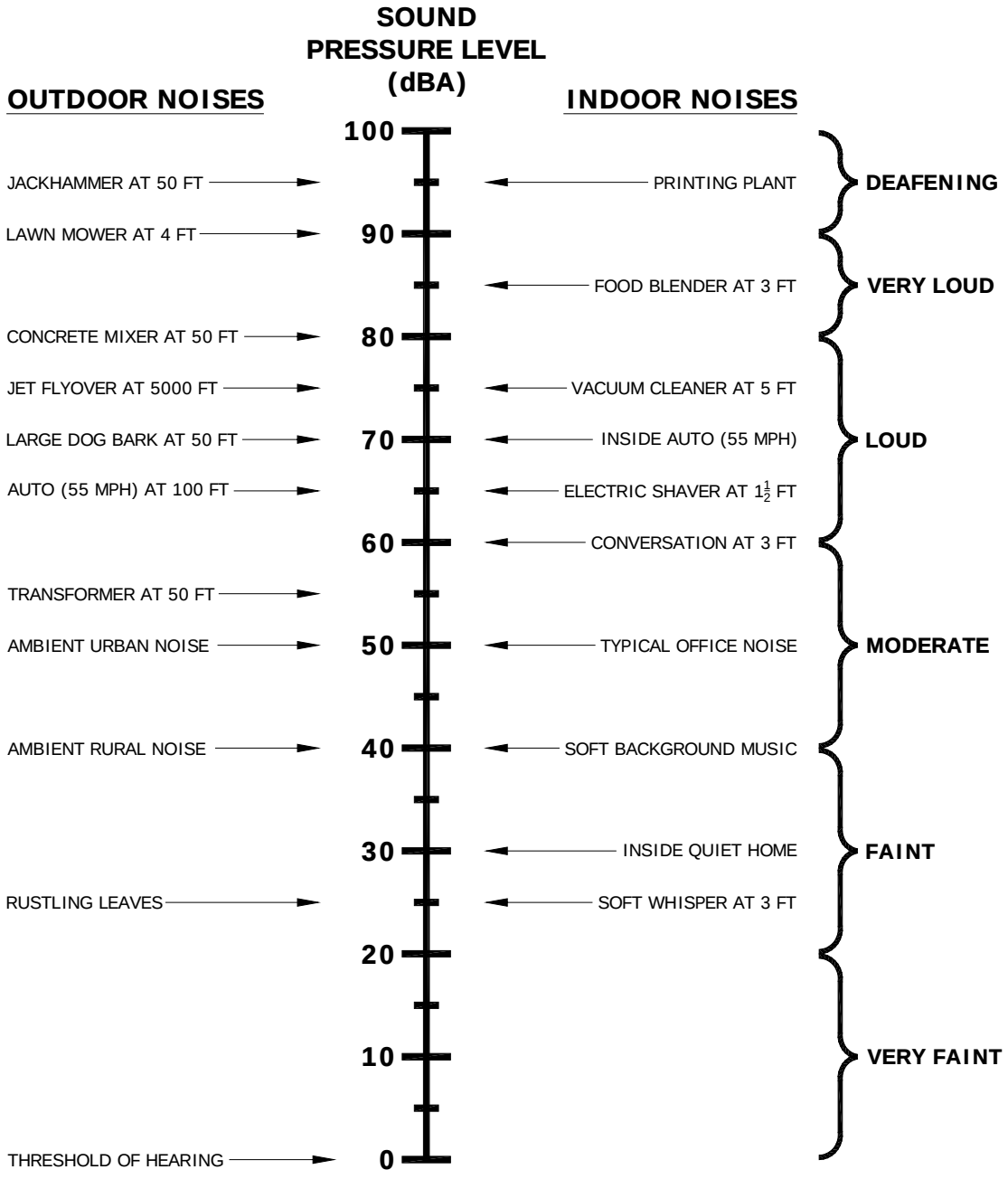


Figure A-1. Common Outdoor/Indoor Sound Levels

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.

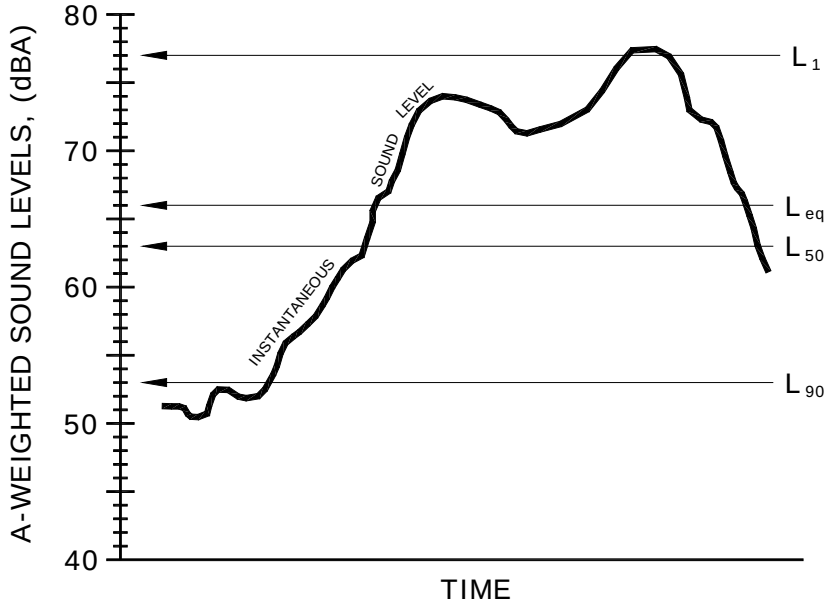


Figure A-2. Example Graph of Equivalent and Statistical Sound Levels

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.

Appendix E

Makani Road-Makawao Avenue Traffic Study
September 2007

Julian Ng, Incorporated Memorandum

To: Stacy Armstrong, RM Towill Corporation

Date: September 23, 2007

From: Julian Ng

Subject: Makani Road – Makawao Avenue Field Observations

Field observations at the project site were made and peak period traffic counts were taken on Thursday, September 20, 2007, in accordance with the guidance provided by the County of Maui. Manual counts were scheduled at the intersection of Makani Road and Makawao Avenue, and the driveway to Kalama Middle School from Makani Road. At both locations, manual counts were taken for a two-hour period, from 6:30 AM to 8:30 AM. At the intersection of Makani Road and Makawao Avenue, the afternoon count, scheduled from 1:30 PM to 5:30 PM, was extended to 6:00 PM to ascertain that the afternoon peak hour was captured. The afternoon count at the school driveway was scheduled for two hours, from 1:30 PM to 3:30 PM. Tabulations of the count data are attached.

A Thursday had been selected in an attempt to capture a "typical" day; however, upon arrival at the site for the afternoon counts at 1:25 PM, we realized that an earlier dismissal had occurred, as a crossing guard was in place at the Makawao Avenue intersection and many school buses were observed already leaving the campus. Subsequent to completing the two-hour count at the school driveway, the school office was contacted and the early dismissal was verified (the school has early dismissal on both Wednesdays and Thursdays). In reviewing the data, however, the following traffic characteristics indicate that conditions in an early-afternoon peak hour with the addition of school-related traffic can be expected to be no worse than conditions in the normal commuter peak hours:

a. School-related traffic in the morning peak hour to and from Makawao Avenue totaled 208 vehicles per hour. If this volume were added to the total count at the intersection of Makawao Avenue and Makani Road in the early-afternoon (2:00 PM to 3:00 PM) of 1,274, the total would be 1,482, less than the 1,510 counted in the morning peak hour.

b. A simulation of afternoon traffic volumes at the school driveway and Makani Road was done by adding the reverse of the turn volumes from the morning peak hour to the counted volumes for the hour 2:00 PM to 3:00 PM to evaluate potential afternoon peak hour conditions at the driveway; the results (shown below) indicate that conditions in the simulated PM Peak Hour are similar to those during the counted AM Peak Hour.

c. Afternoon school-related traffic volumes are expected to be less than morning school-related traffic volumes, since many students are dropped off by parents on their way to work. Concurrent staff arrivals (with student arrivals) in the morning are more likely than concurrent staff departures in the afternoon. Observations on-site confirm these characteristics, as most staff members were still on campus after 3:30 PM and more students were observed walking from school in the afternoon than walking to school in the morning. The simulation, therefore, would be conservative.

The *Highway Capacity Manual* procedure for unsignalized intersections was used to evaluate conditions at each intersection. The analysis assumes that the turns from the stopped stem of the "T"-intersection (minor street) would be made through gaps in the main street traffic. However, field observations indicate that many drivers on the main street yielded to stopped traffic, either due to the narrowness of the departure lane on the minor street (at the school driveway, school buses and larger cars could not turn right into the driveway without crossing the centerline) or in empathy with the delayed traffic at the stop sign. The analyses, therefore, would be expected to over estimate the delays at the stop sign. Results are:

Table 1 – Results of HCM Analyses

	AM Peak Hour		PM Peak Hour	
	Left Turn from major street	Minor street Shared Lane	Left Turn from major street	Minor street Shared Lane
Kalama School Driveway to Makani Road				
Volume/capacity ratio	0.10	0.57	0.11	0.64
Average Delay (seconds)	9.3	24.9	8.2	26.4
Level of Service	A	C	A	D
Makani Road at Makawao Avenue				
Volume/capacity ratio	0.21	1.26	0.21	0.93
Average Delay (seconds)	11.2	214.8	9.2	95.7
Level of Service	B	F	A	F

The traffic counts provide data for six hours of the day. While these data indicates that the warrant volumes for minimum traffic volumes may be met in only three hours (eight needed to satisfy the warrant), the lower required minor street volumes in the warrant for the interruption of continuous traffic may be exceeded in more than eight hours. However, since only six hours of data was collected, the four-hour warrant was evaluated. At the intersection of Makani Road and Makawao Avenue, the existing layout includes a single lane on each approach, each shared by two movements (while there is channelization for the westbound approach on Makawao Avenue, the right turn is so close to the intersection that it operates as if the lane is shared; similarly, while right turns could possibly sneak past a vehicle waiting to turn left from Makani Road to Makawao Avenue, the intersection is so constrained that it effectively has only one approach lane). Figure 1 below shows that a traffic signal is warranted for existing volumes under Warrant 2 (Four-Hour warrant) [for the warrant to be met, the plot of major street and minor street volumes for four or more hours would fall above the warrant line. Figure 1 shows the plots of six hours from the field counts, along with plots of several points from Figure 4C-1 of the *Manual on Uniform Traffic Control Devices for Streets and Highways* which were used to plot a polyline to replicate the warrant line].

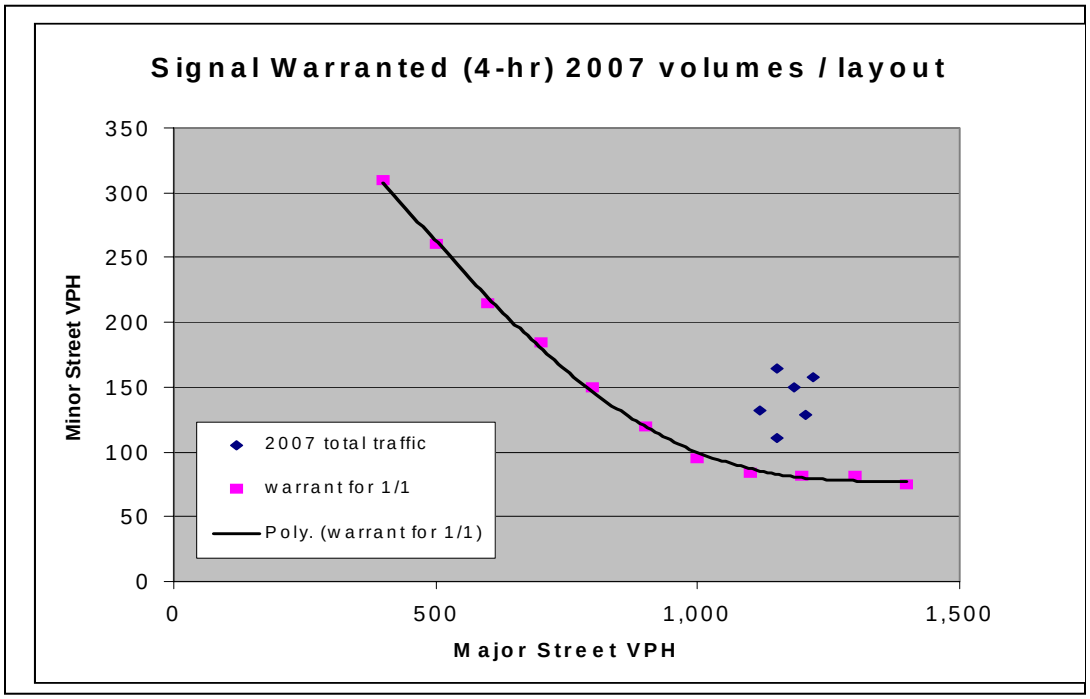


Figure 1 – Signal Warranted at Makani Road and Makawao Avenue

For the future conditions with an improved intersection, a preliminary evaluation was done assuming that traffic volumes increase at a rate of 2% per year. Peak hour traffic volumes in year 2030 would require that each approach at the intersection of Makani Road and Makawao Avenue consist of two lanes, so that each movement has its own lane. With this arrangement, only the left turn volume on the minor street would be considered in the signal warrant; as shown in Figure 2, the four-hour warrant will still be met by the projected volumes for 2010.

The traffic counts and the preliminary analyses indicate that separate turn lanes should be provided on each approach at the intersection of Makani Road and Makawao Avenue. In addition, traffic signals at the intersection are needed and warranted, and would still be needed and warranted with the completion of the improvements to add lanes on each approach. Preliminary recommendations for storage requirements in turn lanes based on assumed cycle lengths of 80 seconds in the AM Peak Hour and 100 seconds in the PM Peak Hour are:

Westbound Left Turn Lane, 8 vehicles (200 feet)
Southbound Right Turn Lane, 5 vehicles (125 feet)
Eastbound Right Turn Lane, 18 vehicles (450 feet)

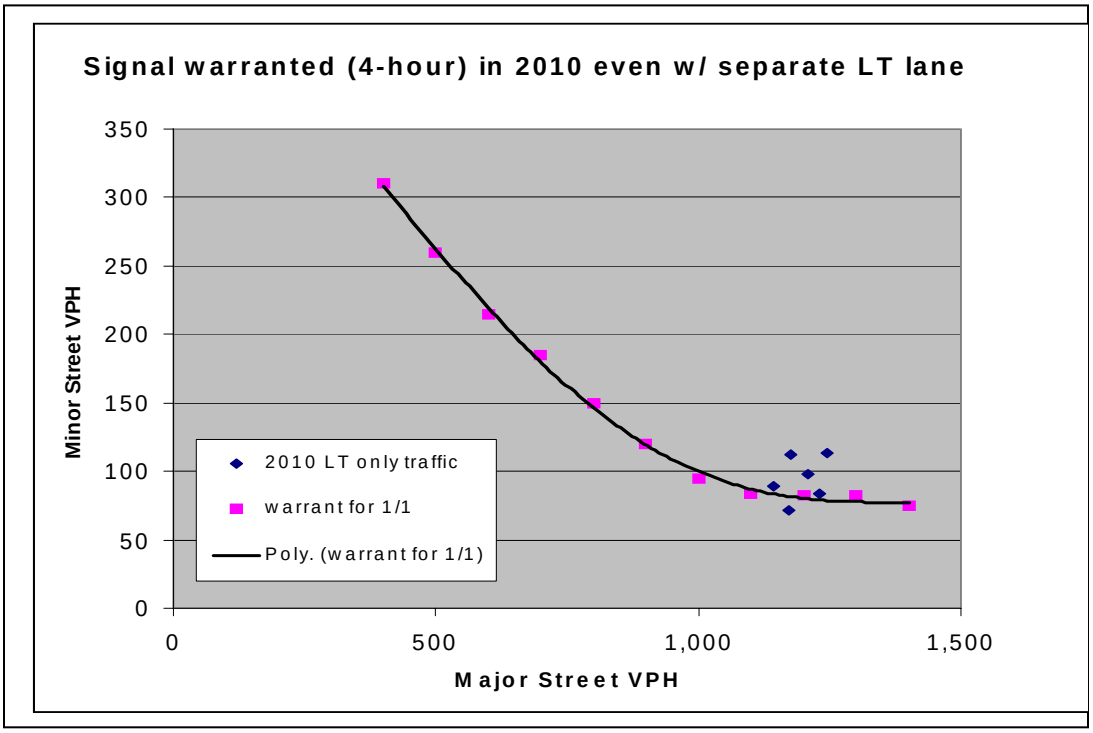


Figure 2 – Signal Warranted at Makani Road and Makawao Avenue with Improvements

The preliminary findings at the Kalama School driveway indicate that a separate left turn lane is not now warranted and will not be warranted in 2030. The probability that an eastbound vehicle would be delayed by a vehicle waiting to make the left turn into the driveway in the future peak hour was computed to be about 1.7%, compared to a published criterion that a probability of 2% or more would warrant consideration of a separate left turn lane on a two-lane highway with an operating speed of 40 miles per hour. Since the operating speed on Makani Road is less than 40 miles per hour, consideration of a separate left turn lane would not be warranted. Further analyses will be done to verify these preliminary findings and to evaluate the need for a separate left turn lane along Makawao Road.

The information contained herein is provided for advance information and is preliminary as the growth rate used will be verified and additional, more detailed, analyses will be performed to develop appropriate signal cycle lengths, which will affect the recommendations for turn lane lengths. Further evaluation will also be made for left turns to the Tam Memorial Center. While the field counts did not capture the traffic due to the early dismissal of the school on the day the counts were taken, an evaluation using available information indicates that the early-afternoon peak hour would be no worse than the commuter peak hours and the collection of additional field data is not recommended.

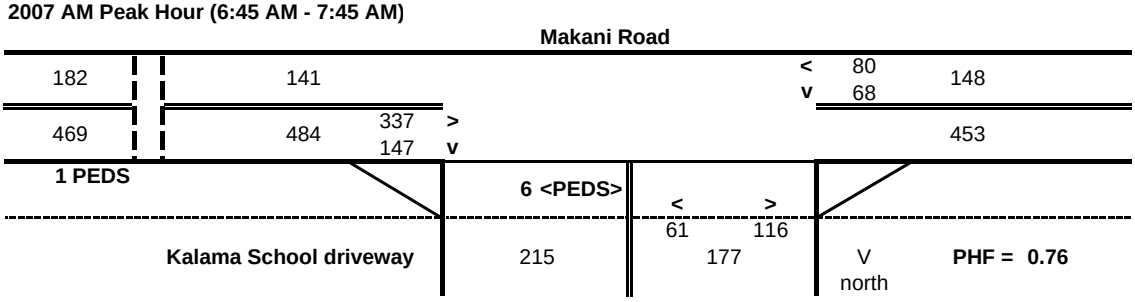
Attachments (Makani KalamaSchool Manual Counts.pdf, Makani Makawao Manual Counts.pdf)

Makani-Makawao Traffic Counts

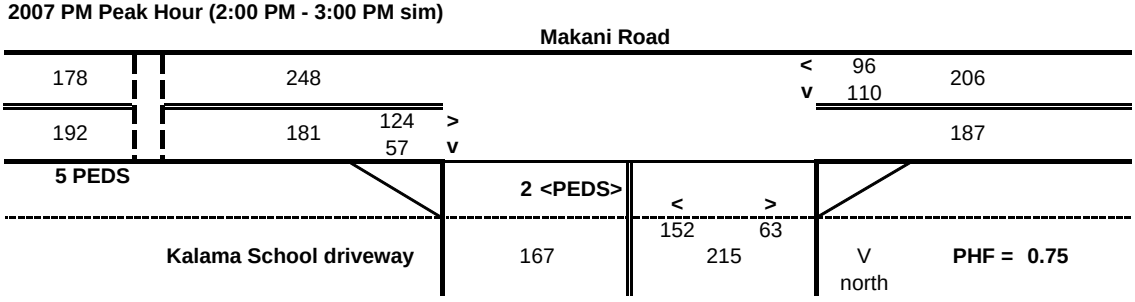
Counter: JN (Jamar D1-1507)

start time	from West		from North (driveway)			from East (Makani Road)					
	Thru	Left	Right	Left	Peds	Right	Thru	Peds			
September 20, 2007 (Thursday)											
6:30 AM	5	5	3	1	0	0	12	0	**26**		
6:45 AM	12	2	7	7	1	21	53	3	**106**		
7:00 AM	15	16	27	10	1	42	74	0	**185**		
7:15 AM	19	26	36	15	0	35	97	0	**228**	545	0.60
7:30 AM	25	19	40	25	2	54	103	1	**269**	788	0.73
7:45 AM	21	7	13	11	3	16	63	0	**134**	**816**	**0.76**
8:00 AM	13	2	1	4	2	4	42	0	**68**	699	0.65
8:15 AM	23	1	3	3	1	6	33	0	**70**	541	0.50
8:30 AM	0	0	0	0	0	0	0	0	**0**		
totals	**133**	**78**	**130**	**76**	**10**	**178**	**477**	**4**	**1,086**		
peak hour	80	68	116	61	6	147	337	1	816		
Note: Kalama Middle School has early dismissal (before 1:30 PM) on both Wednesdays and Thursdays											
1:30 PM	26	5	4	11	5	5	28	18	**102**		
1:45 PM	23	5	3	4	3	8	19	2	**67**		
2:00 PM	21	3	7	5	0	0	31	1	**68**		
2:15 PM	25	1	6	3	2	4	37	1	**79**	316	0.77
2:30 PM	24	0	4	2	0	0	22	2	**54**	268	0.85
2:45 PM	20	1	3	3	0	1	36	0	**64**	**265**	**0.84**
3:00 PM	27	0	1	2	0	2	29	2	**63**	260	0.82
3:15 PM	27	0	3	4	0	0	37	0	**71**	252	0.89
3:30 PM	0	0	0	0	0	0	0	0	**0**		
totals	**193**	**15**	**31**	**34**	**10**	**20**	**239**	**26**	**568**		
peak hour	96	110	63	152	2	57	124	5		**609**	**0.75**

2007 AM Peak Hour (6:45 AM - 7:45 AM)



2007 PM Peak Hour (2:00 PM - 3:00 PM sim)

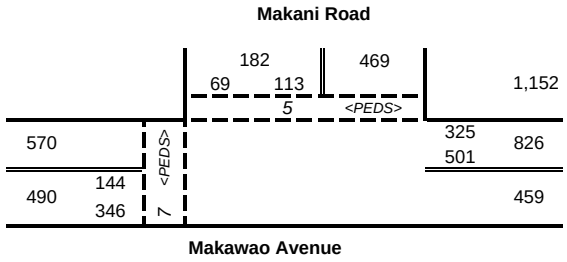


Makani-Makawao Traffic Counts

Counter: Alan Alamida (Jamar D1-2459)

	from West			from North			from East		Total Count			Vehicles only		
start time	Left	Thru	Peds	Right	Left	Peds	Thru	Right	Count	VPH	PHF	Count	VPH	PHF
September 20, 2007 (Thursday)														
6:30 AM	7	52	2	7	14	0	124	31	**237**			235		
6:45 AM	9	66	0	7	19	0	119	65	**285**			285		
7:00 AM	27	79	5	19	21	2	121	84	**358**			351		
7:15 AM	34	85	2	12	33	3	130	87	**386**	1,266	0.82	381	1,252	0.82
7:30 AM	53	78	0	23	29	0	117	102	**402**	1,431	0.89	402	1,419	0.88
7:45 AM	30	104	0	15	30	0	133	52	**364**	**1,510**	**0.94**	364	**1,498**	**0.93**
8:00 AM	13	98	0	10	16	1	128	21	**287**	1,439	0.89	286	1,433	0.89
8:15 AM	6	108	0	6	21	0	111	31	**283**	1,336	0.83	283	1,335	0.83
8:30 AM	0	0	0	0	0	0	0	0	**0**			0		
AM totals	**179**	**670**	**9**	**99**	**183**	**6**	**983**	**473**	**2,602**					
6:45 - 7:45	144	346	7	69	113	5	501	325	**1,510**					
1:30 PM	7	84	4	16	27	2	94	29	**263**			257		
1:45 PM	9	95	3	7	23	1	97	17	**252**			248		
2:00 PM	8	112	1	8	24	5	113	36	**307**			301		
2:15 PM	12	139	0	16	18	2	131	29	**347**	1,169	0.84	345	1,151	0.83
2:30 PM	6	126	0	8	15	0	98	20	**273**	1,179	0.85	273	1,167	0.85
2:45 PM	12	179	1	9	13	5	99	30	**348**	1,275	0.92	342	1,261	0.91
3:00 PM	18	130	0	11	20	1	100	26	**306**	1,274	0.92	305	1,265	0.92
3:15 PM	13	126	0	12	21	1	119	28	**320**	1,247	0.90	319	1,239	0.91
3:30 PM	15	130	2	9	22	0	133	24	**335**	1,309	0.94	333	1,299	0.95
3:45 PM	19	159	2	15	19	2	127	40	**383**	1,344	0.88	379	1,336	0.88
4:00 PM	27	128	1	11	17	1	106	35	**326**	1,364	0.89	324	1,355	0.89
4:15 PM	14	156	0	14	30	0	97	24	**335**	1,379	0.90	335	1,371	0.90
4:30 PM	11	126	3	11	35	5	143	27	**361**	1,405	0.92	353	1,391	0.92
4:45 PM	17	151	2	11	29	0	119	39	**368**	1,390	0.94	366	1,378	0.94
5:00 PM	16	154	0	20	28	2	107	44	**371**	**1,435**	**0.97**	369	**1,423**	**0.96**
5:15 PM	18	143	2	12	24	4	101	20	**324**	1,424	0.96	318	1,406	0.95
5:30 PM	18	156	0	12	36	0	101	26	**349**	1,412	0.95	349	1,402	0.95
5:45 PM	12	126	2	10	22	1	87	24	**284**	1,328	0.89	281	1,317	0.89
6:00 PM	0	0	0	0	0	0	0	0	**0**					
PM totals	**252**	**2,420**	**23**	**212**	**423**	**32**	**1,972**	**518**	**5,852**					
4:00 - 5:00	58	587	5	56	122	7	466	134	**1,435**					

2007 AM Peak Hour



2007 PM Peak Hour