WAILUKU II ELEMENTARY SCHOOL

Wailuku, Island of Maui

TMK: (2) 3-5-001:67, (2) 3-5-001:77, and (2) 3-5-001:78 (pors.)

Draft Environmental Assessment
and
Project District Phase II Application and Amendment

GROUP 70 INTERNATIONAL

March 2010

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Draft Environmental Assessment (EA)
and
Project District Phase II Application and Amendment

This environmental document is prepared in accordance with the requirements of Chapter 343, HRS, Hawai'i Administrative Rules, Title 11, Department of Health, and Maui County Code Chapter 19.45 Project District Processing Regulations.

Applicant:
State of Hawai'i Department of Education
Facilities Development Branch
P.O. Box 2360
Honolulu, HI 96804

Applicant
State of Hawai'i Department of Education,
Facilities Development Branch

3/4/10
Date

Approving Agency:
State of Hawai'i Department of Education
Facilities Development Branch (EA)
and
County of Maui Department of Planning and Permitting
(Project District Phase II Application and Amendment)

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March 2010

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1.0
Introduction

1.0 INTRODUCTION

This Draft Environmental Assessment (EA) has been prepared in accordance with the requirements of Chapter 343, HRS, Hawai'i Administrative Rules, Title 11, Department of Health, and Maui County Code Chapter 19.45 Project District Processing Regulations. The proposed action involves the use of State funds toward the construction of the school campus by the State of Hawai'i Department of Education (DOE).

1.1 PROJECT INFORMATION SUMMARY

Type of Document:	Environmental Assessment (EA) and Project District Phase II Application and Amendment
Project Name:	Wailuku Elementary School II
Applicant:	State of Hawaii Department of Education Office of Business Services Facility Development Branch P.O. Box 2360 Honolulu, HI 96804
Accepting Authority (EA):	State of Hawaii Department of Education
CH. 343, HRS Trigger:	Use of State Funding (DOE).
Project Location:	Kehalani Muaka west of Honoapiilani Hwy, Wailuku, Maui, Hawai'i *(Figure 1-1)*
Tax Map Key:	(2) 3-5-001:67 (por.), (2) 3-5-001:77 (por.), and (2) 3-5-001:78 (por.) *(Figure 1-2)*
Land Court Lot:	Lot 3-A-2, Lot P-1 (por.), and Lot R-6 (por.)
Fee Landowner:	Kehalani Mauka, LLC 1100 Alakea Street, 27th Floor Honolulu, Hawai'i 96813
Project Area:	Approximately 14 Acres
State Land Use District:	Urban District
Maui Island Plan (Draft 2030):	Elementary School *(Figure 1-3)*
Wailuku-Kahului Community Plan:	Project District 3 (Wailuku)

County of Maui Zoning: Project District 3

PD-WK/3 Subdistrict: Village Mixed-use

Special Management Area: Outside SMA *(Figure 1-4)*

Flood Zone: Zone X (outside 500-Year Flood) *(Figure 1-5)*

Anticipated Determination: Finding of No Significant Impact (FONSI)

1.2 OVERVIEW OF PROPOSED PROJECT

Kehalani Mauka is located on the slope of the West Maui mountains in Wailuku on the Island of Maui. Kehalani Mauka will provide a total of 2,400 homes on 550 acres upon completion. Approximately 30% of the project has been completed. The master plan includes single family and multi-family residences, commercial retail, parks, and a community center.

The school site is centrally located within the Kehalani Mauka development, and has the design enrollment of 550 students. The proposed project consists of the construction of Grades K-5 Classroom Buildings, a Library, a Dining Hall, an Administrative Building, a Covered Playcourt, a Playfield, and a total of 133 Parking Stalls. The school strives to achieve LEED-Silver certification. The school will provide various safe and welcoming gathering places of multiple types and sizes, and will serve as the center of the community. The school's cafeteria and the south parking lot will be dedicated for after-school community uses. School hours typically extended from 8:00 AM to 3:00 PM, Monday through Friday.

1.3 PROJECT SITE

The Wailuku II Elementary School project site consists of approximately 14 acres of former sugarcane plantation land located in the Kehalani Mauka development, immediately south of historic Wailuku town *(Figure 1-1)*. The site is identified as portions of Tax Map Key (2) 3-5-001:67, (2) 3-5-001:77, and (2) 3-5-001:78 (*Figure 1-2)*. Kehalani Mauka, LLC is the owner of the proposed site. The site is to be dedicated to DOE for Wailuku II Elementary School development.

1.4 REASONS FOR PREPARING THIS ENVIRONMENTAL ASSESSMENT

Kehalani Mauka, LLC is dedicating the site for Wailuku II Elementary School development by DOE. This Environmental Assessment (EA) is required pursuant to Chapter 343, Hawai'i Revised Statutes (HRS); the Environmental Impact Statement Rules, Title 11, Chapter 200 of the Hawai'i Administrative Rules (HAR); and Maui County Code Chapter 19.45 Project District Processing Regulations. The EA provides a written evaluation of the technical, environmental, social and economic aspects of the proposed project. In addition, the EA identifies the anticipated impacts resulting from the proposed project and their significance. Strategies to mitigate potential impacts and possible alternatives to the proposed project are also identified.

The assessment includes a comparison of the project impacts against 13 significance criteria listed in §11-200-12, to provide determination as to whether an Environmental Impact Statement shall be required or not.

1.5 AGENCIES AND PUBLIC CONTACTED IN PRE-CONSULTATION

The State Department of Education has committed to involve the community in the planning for Wailuku II Elementary School. A Charrette process was conducted as a series of focused planning and intensive on-site decision-making sessions by a team of interested "stakeholders". Four main goals were accomplished from the process: (1) a common vested interest in the design and support of the project's vision; (2) prudent decisions as a result of input gathered from all stakeholders'; (3) collaborative effort in producing a set of documents that address all aspects of design; and (4) efficient and cost-effective end product as a result of the collaborative process.

Listed below are the agencies and other parties contacted regarding the proposed project prior to the publication of the Draft EA.

The agencies and organizations contacted and/or participated in the Charrette process during the pre-consultation period include:

Federal Agencies
U.S. Fish and Wildlife
U.S. Army Corps of Engineers

State of Hawai'i Agencies
State Department of Education, Maui
State Department of Education, Facilities Development Branch
State Department of Accounting and General Services (DAGS), Maui
Department of Accounting and General Services
Department of Business, Economic Development & Tourism (DBEDT)
Department of Business, Economic Development & Tourism (DBEDT), Office of Planning
Department of Transportation
Department of Agriculture
Department of Health
Department of Health, Clean Water Branch
Department of Health, Environmental Health
Department of Land and Natural Resources (DLNR)
Department of Land and Natural Resources (DLNR), Historic Preservation Division
Office of Environmental Quality Control
Office of Hawaiian Affairs
Department of Hawaiian Homelands
Department of Defense
Hawaii State Civil Defense
Department of Human Services
Department of Labor and Industrial Relations
University of Hawai'i, Environmental Center

Hawaii Housing Finance & Development Corporation
Department of Education, School Complex Superintendent's Office (Baldwin-Kekaulike-Maui)
Wailuku Elementary School

County of Maui Agencies
County of Maui Department of Parks and Recreation
County of Maui Department of Public Works
County of Maui Department of Water Supply
County of Maui Planning Department
Fire Department
Police Department
Office of the Mayor
Maui Civil Defense Agency
Office of Economic Development

Elected Officials
State Senator Shan S. Tsutsui.
State House Representative Joseph Souki
State House Representative Gilbert Keith-Agaran
Council Member Michael Victorino

Other Parties and Associations
Wailuku Public Library
Kahului Public Library
Hawai'i State Library
Kehalani Community Association
Wailuku Main Street Association

Maui Community
Kahu Charles Kauluwehi Maxwell Sr.
Leslie James Aupuni Vida 111
Ms. Kathy Juan
Ms. Yaeko Mabe Sasaki
Richard Komo
Felipe Barroga
Susan Asato
Leslie James Vida Jr.

Developer
Kehalani Mauka LLC

The agencies and organizations contacted and/or participated in the Charrette process during the pre-consultation period include:

State of Hawai'i Agencies
State Department of Education, Maui
State Department of Education, Facilities Development Branch
State Department of Accounting and General Services (DAGS), Maui

Maui Community
Joella Taguchi, Wailuku Resident & Parent
Dallas Taguchi, Iao School Student
Quincee Taguchi, Wailuku Elementary Student
Wendy Kobashigawa, Wailuku Elementary Parent
Spencer Powell, Iao School Student
Kalena Potter, Wailuku Elementary Student (Grade 5)
Makana Keola-Igarta, Wailuku Elementary Student (Grade 5)

Developer
Jay Nakamura, Kehalani Mauka LLC
Rik Papa, Stanford Carr Development

Figure 1-1: Project Location

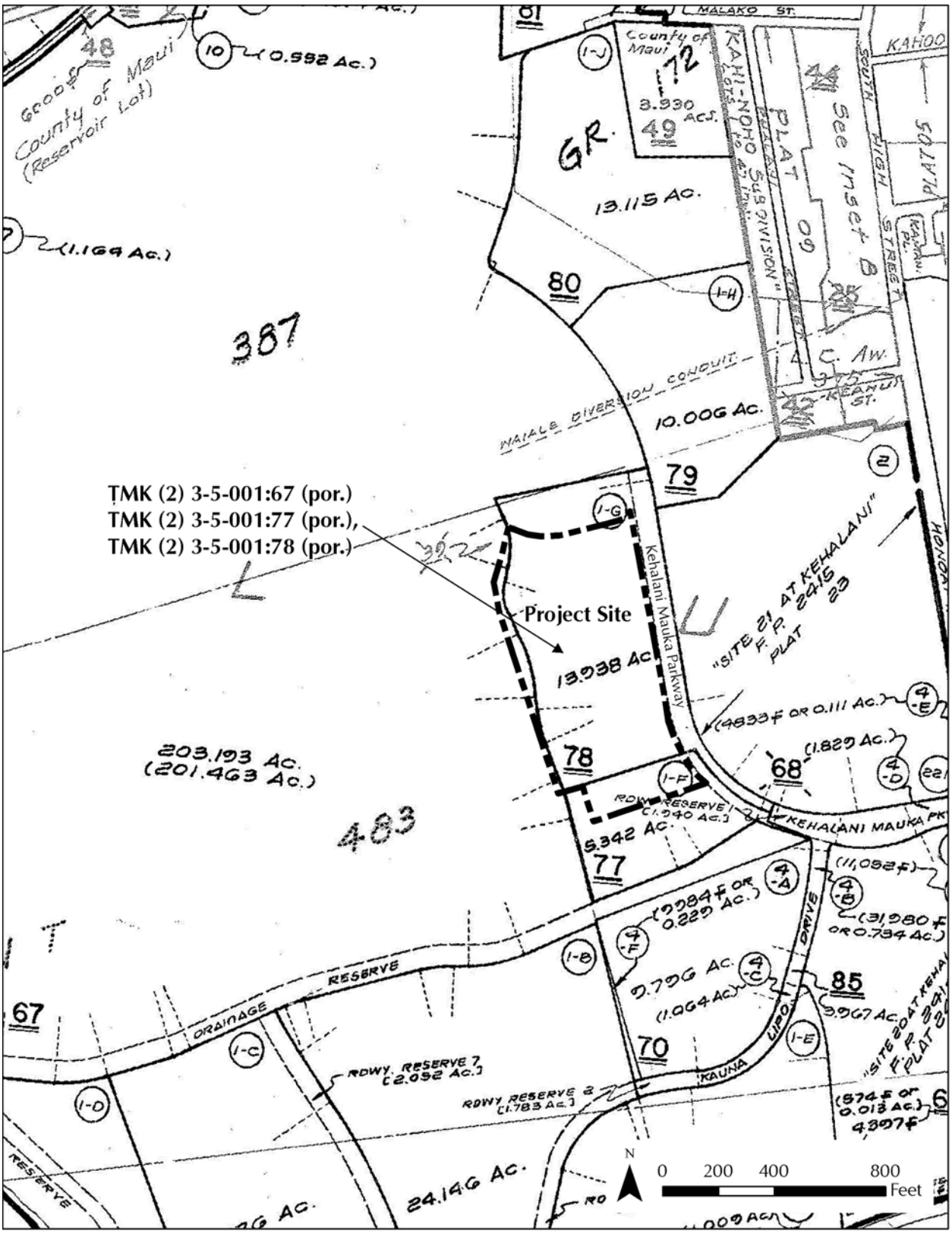

Figure 1-2: Tax Map Key

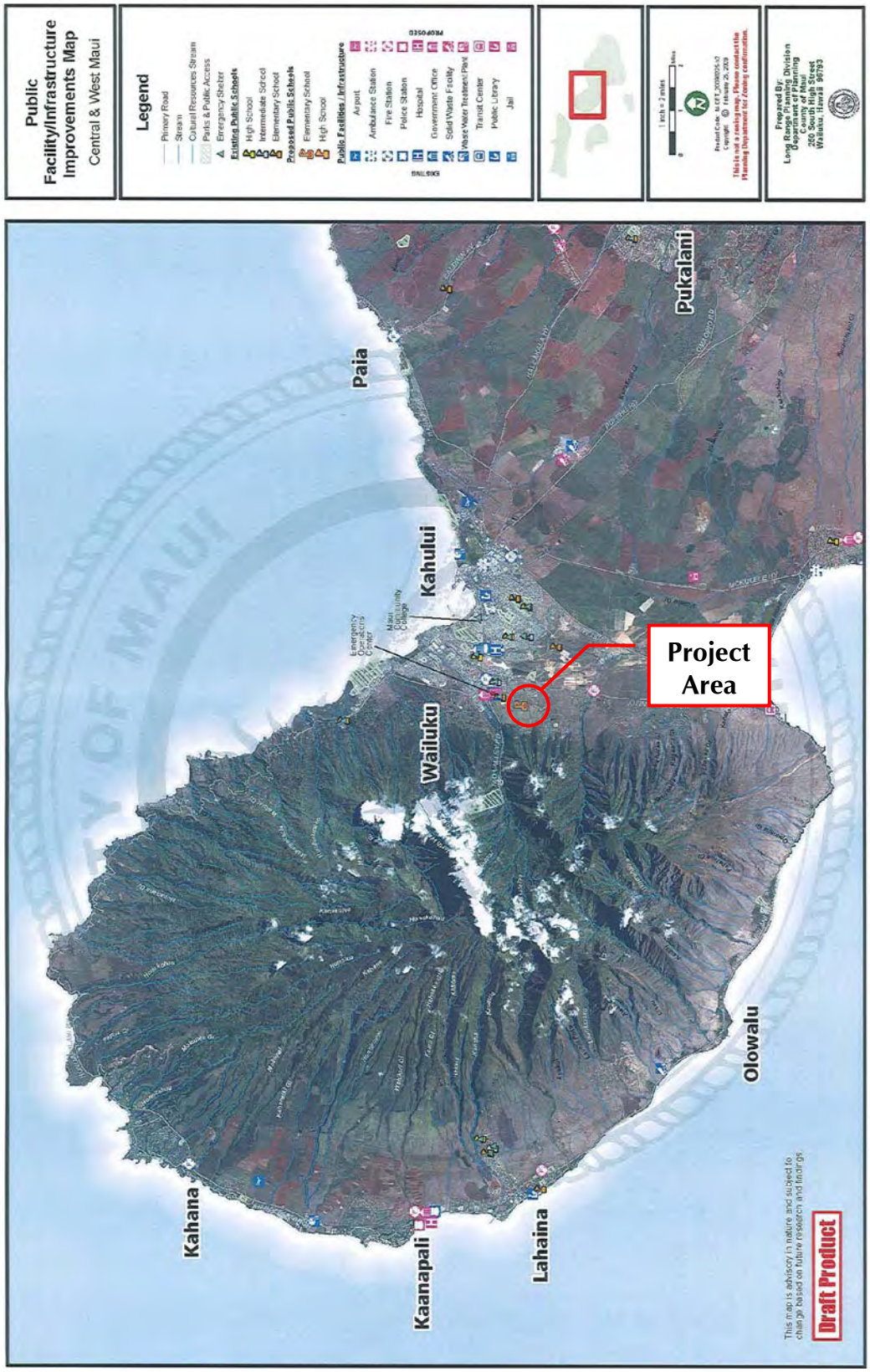

Figure 1-3: Island Plan (Draft 2030) Map

Figure 1-4: Special Management Area Map

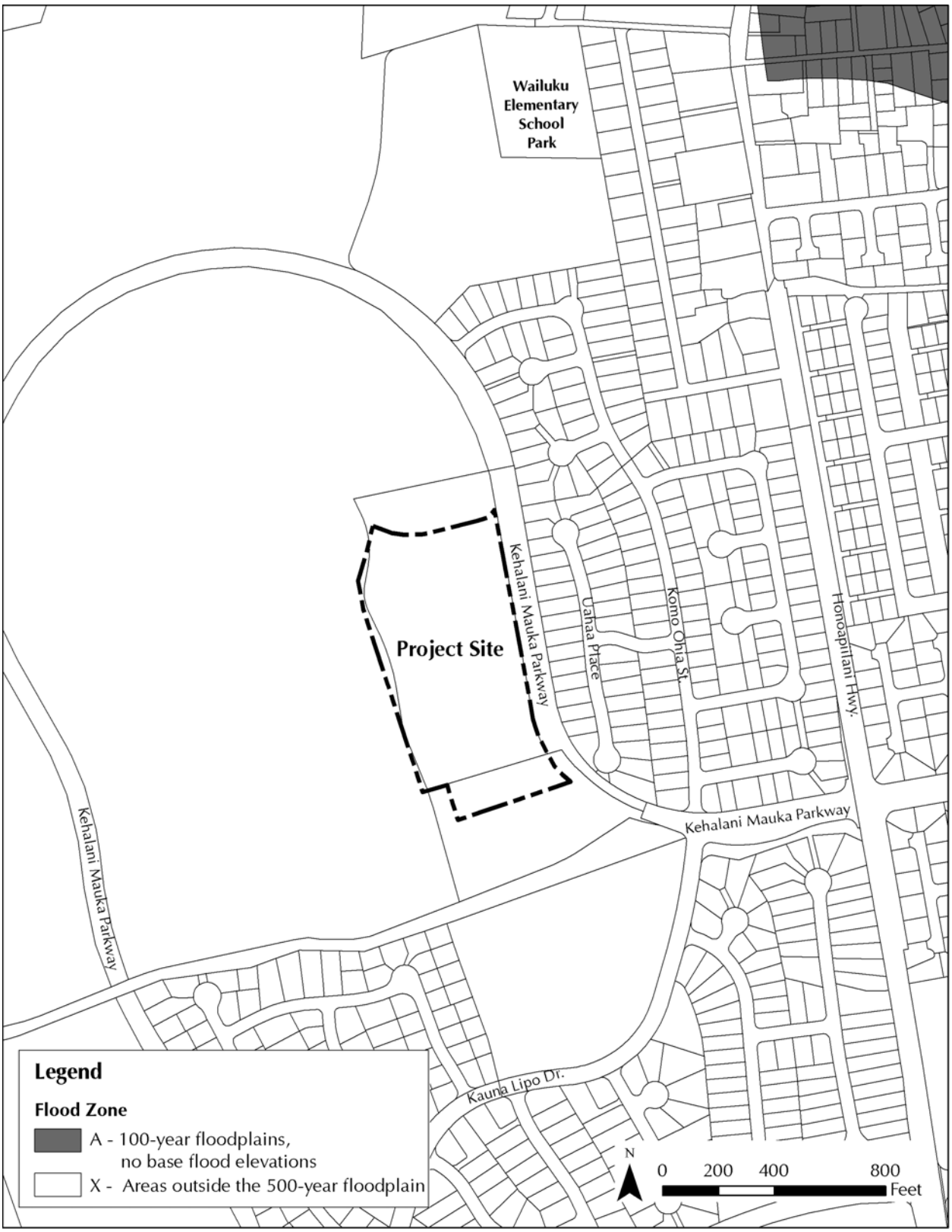

Figure 1-5: Federal Emergency Management Agency Flood Insurance Rate Map (FIRM)

2.0
Project Description

2.0 PROJECT DESCRIPTION

2.1 PROJECT LOCATION AND SITE CHARACTERISTICS

The project site being reviewed in this Environmental Assessment is part of Kehalani Mauka master planned community, located in Wailuku-Kahului Project District 3 on the Island of Maui. The project site parcel is identified as Tax Map Key (2) 3-5-001:67 (por.), (2) 3-5-001:77 (por.), and (2) 3-5-001:78 (por.) and consists of approximately 14 acres which is owned by Kehalani Mauka, LLC. However, the site is to be dedicated to the State of Hawai'i Department of Education. The Kehalani Mauka master planned community is located between Honoapiilani Highway, Kauikahi Drive, and Main Street. It's location along the east side of the West Maui mountains provides one of the coolest climates in central Maui and panoramic vistas of the Maui plains and Haleakala. The district of Wailuku is generally warm and sunny throughout the year with temperatures ranging from 70 to 80 degrees Fahrenheit. Wailuku is exposed to prevailing tradewinds occur mainly through the dry seasonal months of May through September. Rainy seasonal months of October through April produce strong wind conditions varying from trades from the northeast to southerly winds known as "Kona winds". Average annual rainfall for Wailuku ranges between 20 to 40 inches.

The school site is bordered by planned multi-family residential complex, which is also part of the Kehalani Mauka master planned community, and a vehicle access easement to the north. To the east, the parcel is bordered by Kehalani Mauka Parkway. The east is bordered by Kehalani Parkway, the main connector road for the development. The south property line is shared with a future community center for the development. Along the western edge of the site, there is an existing irrigation ditch. The ditch is still active and serves agricultural lands to the south and will be relocated offsite by the Kehalani Mauka developer.

The site generally oriented along a north-south axis. The project site slopes from east to west, from an elevation of 389 feet above mean sea level (MSL), at the midpoint of the parcel by Kehalani Mauka Parkway, up to 461 feet MSL at the midpoint of the western edge of the site. The topography of the site has an average slope of 11%. Along Kehalani Parkway the slope is very steep at nearly 1:1 for the first 15-20 feet and then levels to a more consistent 11% slope. Since the site was formerly agriculture land, there are no trees or significant land features other than an occasional mound and gully. The terrain is composed of 'Īao series soil derived from basic igneous rock. The site is presently unoccupied. The Maui Community College resides approximately two miles away to the northeast of the project site. Urban areas, in proximity to the site, include the commercial district of Wailuku and Kahului, located approximately one mile and two miles to the north and east, respectively. The surrounding residential communities include Wailuku, Waikapu, and Kahului.

2.2 OVERVIEW OF NEED

Kehalani Mauka is located in Wailuku-Kahului Project District 3, which requires the developer to provide its fair and equitable share for the impact the project has upon public educational facilities as is deemed necessary by the Department of Education. According to the Department of Education, Facilities Development Branch the growing residential development in Central Maui, including Kehalani Mauka, will increase demand for educational facilities as follow:

2.2.1 Residential Development - Baldwin Complex

In the Central Maui area, approximately 27 newly completed or proposed residential projects which will eventually affect the two elementary schools in the Baldwin High School complex at Waiheʻe and Wailuku. Many of the projects are larger, rural or agricultural lots which will be developed at a slower, individual builder pace. The largest master-builder project is the Kehalani project with 2,400 homes. Construction in Kehalani is expected to continue through 2017, with 314 residential units expected to be completed in 2009, 174 in 2010, 154 units in 2011, and 265 in 2012 (providing market conditions).

The total count of planned, but not yet built, units is approximately 3,918 single family units and 3,071 multi-family units. The largest project in the list of proposed residential projects is the A&B Waiʼale project which will include approximately 1,400 units. Also, Māʻalaea Mauka is expected to have up to 1,100 units.

2.2.2 Residential Development - Maui High Complex

There are 13 residential projects that would affect the three elementary schools in the Maui High School complex: Kahului, Lihikai and Pōmaikaiʻi. The total count of proposed but not yet constructed units is 3,280 single family units and 1,447 multi-family units. The largest of these projects is the Maui Lani development which expects to build a total of 2,815 units. Construction is expected to be roughly 200 homes per year in Maui Lani during the peak years of 2010 through 2012. That does not include development by HRT, Ltd. which has plans for 926 units in Maui Lani (no announced construction time line). Based on the projected total number of units in both complexes, at build out, the project would generate approximately 3,200 elementary students. That would translate into a need for four to eight additional elementary schools in Central Maui.

2.2.3 Recent Enrollment Patterns

Waiheʻe and Wailuku are older schools on smaller campuses. Waiheʻe has exceeded its facility capacity of 765 since the mid-1990ʼs. Its enrollment of approximately 850 students since the mid-90ʼs has declined slightly in the past four years. Enrollment projections are expected to range between 750 and 800 in the next six years. Wailuku is a small campus of six acres with a large facility capacity of 1,078. Enrollment averaged around 900 since the mid 90ʼs and enrollment projections range between 900 and 950 students for the next six years.

The service area of Pōmaikaiʻi was designed in 2007 with the idea that some areas would be temporarily served by Pōmaikaiʻi in the Maui High School complex and then move to the

Wailuku II Elementary School campus, which is in the Baldwin complex.

2.3 DESCRIPTION OF THE PROPOSED PROJECT

The proposed project consists of the construction of Grades K-5 Classroom Buildings, a Library, a Dining Hall, an Administrative Building, a Covered Playcourt, a Playfield, and a total of 171 Parking Stalls. DOE strives to achieve LEED-Silver certification for this school. Access and egress will be from Kehalani Mauka Parkway. The school will provide various safe and welcoming gathering places of multiple types and sizes, and will serve as the center of the community. The school's cafeteria and the south parking lot will be dedicated for after school community uses. School hours would be held from 8:00 AM to 3:00 PM, Monday thru Friday. This proposed project will require infrastructure improvements, including the development of parking spaces to accommodate public and employee vehicles, driveways and accessibility, and use of utilities. Landscaping will also be installed to minimize paved areas and enhance the overall appearance of the proposed project. Construction is planned to begin in 2011 and the school can accommodate the maximum enrollment of 550 students. Full enrollment is projected to be in 2015.

The following is a brief description of the proposed functional plan for the Wailuku II Elementary School from the *Wailuku II Elementary School Draft Pre-design Report (2009)*. *Figure 2.1* shows the site plan for the new school.

2.3.1 Site Plan

In response to these themes, the team arrived at the following design strategies. The site is organized around a large playfield called "The Gathering Place". The Administration, Cafeteria and Library buildings are positioned as anchors around this field and connected by a tree-lined pedestrian walkway called the "Street". Interspersed along the street are classroom buildings which we called "Houses". General parking areas are located on the north and south ends of the site. Connecting the parking areas is an access drive along the rear of the site that also contains staff parking.

The classroom buildings are designed to appear residential. To accomplish this, the buildings have been arranged in clusters rather than linear massings. Grades K-1 forms one cluster. Grade 2 and 3 have adjacent clustered buildings and Grades 4-5 are housed in the only 2-story building on campus. Clusters will be interconnected by covered walkways that also double as lanais.

Moreover, the overall campus organization is intended to reflect the character of Wailuku where residential houses are interspersed amongst historic buildings. The more iconic anchor buildings also provide a form of way finding for students, staff and visitors. The "Street" connecting these buildings will be tree-lined like the Main Street and High Street in Wailuku.

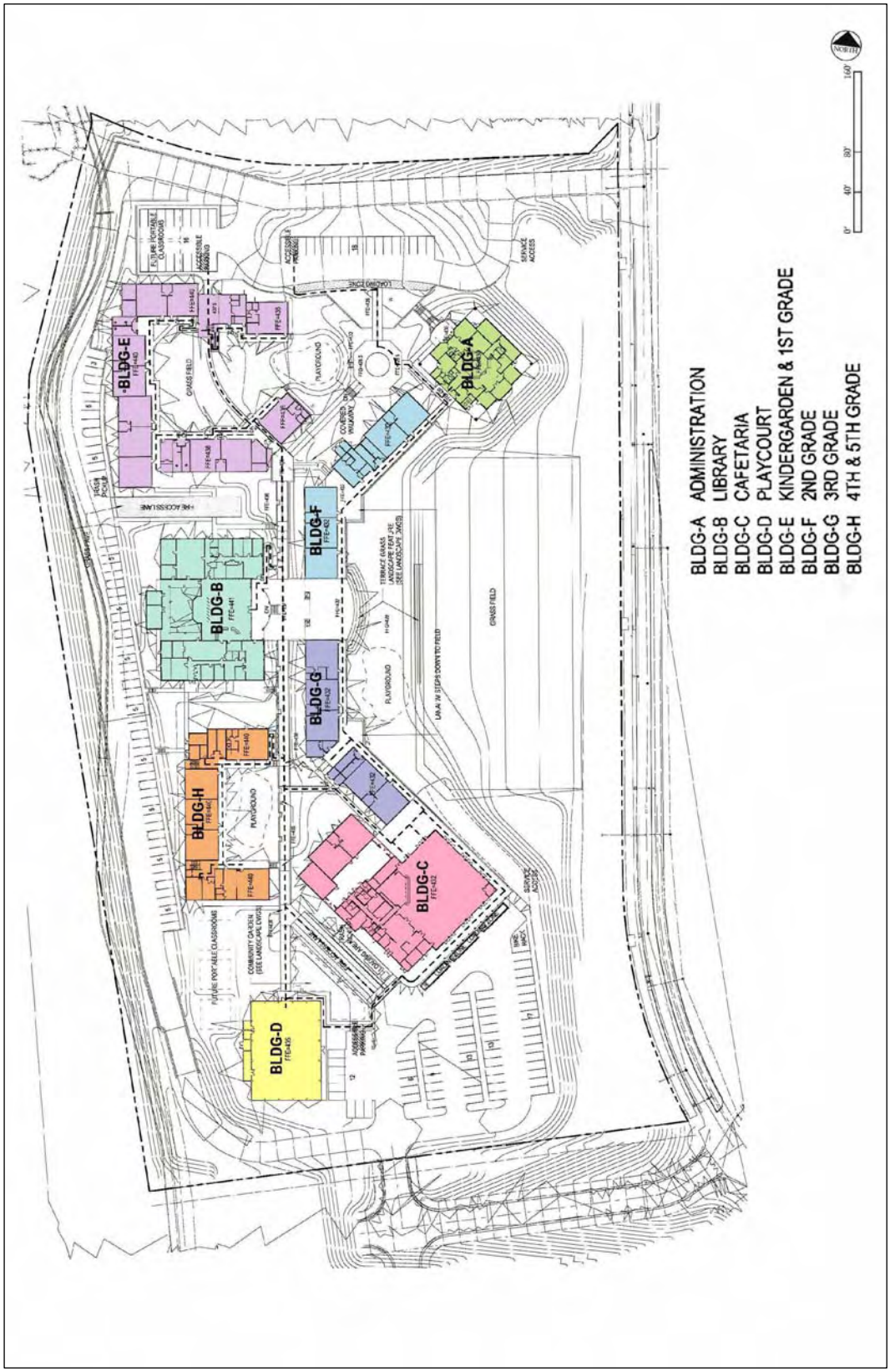

Figure 2-1: Wailuku II Elementary School – Site Plan
(Source: Group 70 International, Inc.)

2.3.2 Support Buildings

Building A: Administrative Building: With its pyramidal form and lantern-like cupola, the Administration Building will be a beacon for the school. Signaling to the community that the importance of learning and also reaching out to the neighborhood as a place of gathering. Placed upon a terrace, the new school will be a prominent site for Kehalani community who drive along the parkway. Its form and massing is akin to the historic Wailuku Courthouse building whose symmetrical façade and red tile roof are certainly well-known in Wailuku town.

Directly adjacent to the admin building is a trellised courtyard. The octagonal-shaped arbor marks the entry to the school campus from the drop-off area. Students, staff and visitors are guided to this entry by landscaping and walls. It signifies the start of the pedestrian walkway and entry node. Benches in the arbor are envisioned for students and guests. In Wailuku, it is common to see grandparents arrive early to pick-up their grandchildren. The census notes that nearly 30% of grandparents in Wailuku are caregivers for grandchildren. The arbor will provide a place for them to wait away but near the Administration lobby and in close proximity to the K-1 playground.

Building B: Library Building: Aligned with the plaza and "Gathering Place", the library is the center of the campus. Besides the library and computer resource center, the library contains student activities and counseling functions for the school. So it will be both figuratively and literally, it will be a focal point to student lifestyle. A covered entry loggia provides a gathering location as well as signifies the entrance to the building. The building's location along the "Street" will create opportunities for exterior activities, social and educational. Behind the story reading room, there is an opportunity to create a courtyard. This courtyard will provide another learning venue from which there will be notable views of the West Maui Mountains.

Building C: Cafeteria Building: With more than 6,000 SF, the dining area of this building is the main interior gathering space of the school. It will contain a stage, serving kitchen, dressing rooms, storage area, custodial center and restrooms. The pyramidal form of this building mimics the Admin Building and acts as the southern terminus for the "Street".

Adjacent to this facility will be a cluster of 2 supplemental classrooms and the staff dining room. Connected by an open courtyard, these spaces provide flexibility and unique learning spaces. Combined with the playcourt and large playfield, this complex is intended to be available for public use. The variety of size and number of spaces will provide opportunity for multiple public uses to occur simultaneously while allowing the remainder of the campus to be secured. There is even a location for a future community garden.

Building D: Covered Playcourt: The multi-purpose court combines a basketball court and three volleyball courts. With more than 7,485 SF, the building also includes a boy's restroom, a girl's restroom, storage, and an electrical room.

2.3.3 Classroom Buildings

The classroom buildings appear as "houses", providing a child-friendly welcoming environment. This is especially important for kindergarten students for whom Wailuku II may

be their first educational experience. While they look like the single-wall plantation style residences, common to Wailuku, these classroom building will be built using durable construction materials. Fiber cement board with a battens over metal framing will provide a "board and batten" appearance for the walls. We propose using heavy duty asphalt shingle roofing with different colors to reinforce the residential appearance. By designing the lanai/walkways into the buildings, we avoid the potential for these walkways to be removed as value engineering items. It also provides seating and gathering areas for students.

Building E: Kindergarten & First Grade: The K-1 cluster surrounds their playfield and playground creating an environment of safety which is especially important for these students. Classrooms and the faculty center are dispersed throughout to provide for supervision of the outdoor areas. The cluster is located at the entry to the school and has its own parking area to facilitate parent drop-offs.

Building F: Second Grade & Third Grade: The grade 2 and 3 classroom buildings are on a terrace overlooking and reaching out to the main playfield, we have called the "Gathering Place". Between the two buildings is a plaza. The plaza and the terraced playfield can serve as a stage for events. Students will be able to use the covered walkways for fellowship or watching other students playing in the field. Moreover, this play field also serves as a gathering place the entire school and even for large community events. The vistas from this location will be remarkable in either mauka or makai direction.

Building G: Fourth Grade & Fifth Grade: The grade 4-5 classroom building is located adjacent to the cafeteria and covered playcourt. As upper elementary students, we envisioned that this building should provide some special features as privileges for the "senior" students on campus. The building will be the only 2-story building on campus. It will have its own dedicated courtyard, proximity to the playcourt and the highest views on campus.

2.3.4 Parking Areas

Parking is organized to provide for different types of vehicular access to the campus. The north parking area provides drop-off/pick-up for parents who drive and parking for visitors. Located adjacent to the Administration Building, this area provides parking for visitors and also campus deliveries. Furthermore, the circulation is arranged to utilize the former access road for queuing. While the developer has included this land to the school, there is a requirement to maintain an easement through this former road for utilities to mauka properties. As such, it seems logical to maintain this as an access road for the campus so as to allow future access to the easement and queuing as mentioned.

The south parking area is accessed from a shared driveway with the future community center. The State Department of Education intends to acquire ownership of the shared driveway parcel. It will provide drop-off/pick-up areas for buses that service communities beyond walking or biking distance from the school. This area will also be used by buses for field trips. The playcourt or cafeteria can provide staging areas for field trip events. The south parking provides the largest number of vehicular parking stalls in order to service events at the cafeteria. Total on-site parking capacity is 133 vehicles.

The future community center to the south sits on approximately 6 acres and shares a common property line with the school. The developer has agreed to share the community center parking with the school for larger events which might occur on either parcel. This is important since no street parking is allowed along Kehalani Parkway.

2.4 PHYSICAL CHARACTERISTICS OF THE PROJECT

2.4.1 Lot Characteristics

The proposed site is Lot 3-A-2 and portion of Lot P-1 and Lot R-6 of Tax Map Key (2) 3-5-001:67 (por.), (2)3-5-001:77 (por.), and (2)3-5-001:78(por.). The proposed site consists of approximately 14 acres and is part of the Kehalani Mauka master planned community in Wailuku. The site is approximately 1,100 feet wide and 560 feet deep. The project site slopes from east to west, from an elevation of 396 feet above mean sea level (MSL), at the midpoint of the parcel by Kehalani Mauka Parkway, up to 462 feet MSL at the midpoint of the western edge of the site.

2.4.2 Floor Plans

As described by *Figures 2-1* the floor plan design of the buildings surround a central "Gathering Place". The overall campus organization is intended to reflect the character of Wailuku where residential houses are interspersed amongst historic buildings. Iconic anchor buildings will provide a form of wayfinding for users. *Table 2-1* provides a summary of the proposed floor plan for each program space.

Table 2-1: Program Space Summary

Program Spaces	Gross Area` (SF)
Building A - Administrative Building	6,812
Building B - Library	14,396
Building C - Cafeteria	15,924
Building D - Covered Playcourt	7,485
Building E - Kindergarten & First Grade	19,883
Building F - Second Grade Building	8,797
Building G - Third Grade Building	8,461
Building H - Fourth and Fifth Grade Building	17,091
Total	**98,849**

Building Height: The school site is designated as Village Mixed-use subdistrict within the Wailuku-Kahului Project District 3. According to the Maui County Code Section 19.80.030, the height limits in the Village Mixed-use subdistrict shall be four stories or forty-five feet. The school campus composes of one and two stories structures, with the maximum height of 38-ft. (Building C) which is very well within the Maui County Code height limits.

2.5 INFRASTRUCTURE

The purpose of this assessment is to provide an overview of the preliminary civil engineering design of the Wailuku II Elementary School project. This assessment evaluates the existing site conditions and presents proposed site grading, drainage, water, fire, wastewater, and roadway improvements.

Grading Plan

The subject project will require both excavation and embankment for the construction of the entire site. The estimated amount of earth work for excavation and embankment is 98,700 and 23,200 cubic yard, respectively. Majority of the project site will be in a "cut" condition due to building height envelopes and roadway grade restrictions. Proposed grading will generally slope downward from the west to east. The use of retaining walls will be implemented throughout the site to help with grading. Retaining walls will vary in height ranging from two to six feet.

Severe erosion hazards are not expected during construction due to the existing topography and location of the project site. However, erosion control measures will be incorporated before and during construction to minimize soil loss.

Infrastructure

Domestic Water: The project site currently has no existing domestic water service. DOE is currently working with the Department of Water Supply to identify potential water source for the project. An existing 12-inch ductile iron water distribution line owned and maintained by the County of Maui is located within Kehalani Mauka Parkway fronting the site. Proposed water service for Wailuku II Elementary School will tie into the existing 12-inch water line.

Fire Protection Water: Like the domestic water system, water for fire protection will tie into the existing 12-inch waterline within Kehalani Mauka Parkway. Several existing fire hydrants along Kehalani Mauka Parkway will be reinforced by a proposed fire protection system within the project site. A proposed dedicated fire line will be the main feed for fire protection water. Fire hydrants will also be located throughout the project site.

Sewer: The project site currently generates no wastewater flow. An existing 12-inch sewer line runs along Kehalani Mauka Parkway fronting the site. An existing 8-inch sewer stub-out will be the connection point for the proposed sewer system that will service Wailuku II Elementary School. Sewage from the project will be transmitted to the Kahului Wastewater Treatment Facility.

Drainage: The existing onsite storm water runoff generated by the site flows in a west to east direction and enters the drainage system constructed within Kehalani Mauka Parkway. The existing offsite runoff generated mauka of the project site is currently intercepted by the Waiheʻe Ditch located along the western boundary of the project site. The Kehalani Master Plan drainage design makes provisions to intercept proposed runoff generated by developments within the Kehalani Community. The Waikapu retention basin serves as the main retention

area. Runoff generated by Wailuku II Elementary School will also connect to this system. An onsite underground detention system will also help detain runoff generated by the project site. Offsite runoff will be allowed to enter the project site. Although it is anticipated that future roadways mauka of the project site will intercept offsite flows from entering the project site, the onsite drainage system will be designed to accommodate offsite flows and allowed to pass through.

Roadway: Roadways that will service Wailuku II Elementary School will connect to existing Kehalani Mauka Parkway. There are two roadways connecting the site to the Parkway, one along the northern boundary and one along the southern boundary. The two accesses will provide adequate fire access circulation and provide access to buses, faculty and parents dropping off children. Maximum slope for roadways within the project will be held at 12%. The roadway accesses will be designed to provide the maximum sight distance in accordance with county and American Association of State Highway and Transportation Officials (AASHTO) standards.

Access Roads

Kehalani Parkway has a divided median along the southern portion of the school site and the County will not allow an additional curb cut. However, DOE school campuses typically require two vehicular access points at opposite ends of the campus for drop-off/pick-up, deliveries and fire access. The developer has agreed to share the existing curb cut as a common driveway servicing the school and community center. Since the school will be built before the community center, DOE intends to purchase a portion of the community center parcel and develop the driveway with an easement to the developer for future use.

The Kehalani master plan originally provided for an access road adjacent to the north property line of the school. This road would have serviced mauka neighborhood communities. However, subsequently, the developer decided not to connect those mauka neighborhoods using this road and included this parcel in the school site. The developer does require an easement for utilities in this portion of land as there are existing connection points in Kehalani Parkway that service the mauka neighborhoods.

The potential impacts associated with short-term construction activities, including mitigation to minimize potential impacts, are addressed in *Chapter 3.0* of this document.

2.6 DEVELOPMENT SCHEDULE AND SUMMARY OF PROJECTED COSTS

Project development and implementation is scheduled to begin immediately following approval of necessary land use permits and available funding. The development of the project will be in one phase. The construction is expected to begin in summer 2011 and the school is schedule to open in fall 2012.

The proposed project will have a project cost/investment of $37.5 million. Of these costs the major items are construction, building design consultants, furnishings and equipment, site design consultants, infrastructure, and utilities. All of the project costs will be funded by the State of Hawai‘i Department of Education’s approved Capital Improvement Project budget.

2.7 REQUIRED APPROVALS AND PERMITS

The County of Maui will require the following permits: Project District Phase II & III permits; Plan Approval; Building Plan Approval (Fire); Electrical Permit; Plumbing Permit; Grubbing & Grading Permit; and Water Use Permit.

2.8 SUSTAINABILITY

Wailuku II Elementary is required to be certified as silver or higher under the Leadership in Energy & Environmental Design (LEED) program as administered by the United States Green Building Council (USGBC). The current version of this program is LEED for Schools Version 3.0 which was launched in April 2009.

According to the *Wailuku II Elementary School Draft Pre-design Report (2009) t*he sustainable design strategy for this campus was initiated through an eco-charrette on April 9, 2007. The charrette brought together a wide variety of stakeholders from DOE, DAGS, and design and consultant teams. This section will discuss important strategies and concepts derived from the eco-charrette.

Energy & Atmosphere

Every sustainable design strategy should start with a discussion about reducing energy use. Energy use directly affects the use of fossil fuels, heat gain and is the single highest contributor to carbon footprint. Reducing the energy use of a campus also has the greatest impact in reducing operating costs.

Reducing energy use starts with building orientation. For educational buildings, energy use can be significantly impacted by using natural sunlight to replace artificial illumination from electrical fixtures. This strategy is called daylighting. When reflected indirectly, natural sunlight does not cause heat gain to spaces. Ideally, buildings should be orientated along the east-west axis to maximize daylighting from the sun as it travels from east to west. The Wailuku II site is elongated along the north-south axis and slopes from west to east. Buildings orientated along the east-west axis would have required significant terracing and foundation wall which would have added a great deal of cost and accessibility challenges. The existing orientation and slope of this site dictates that buildings be orientated along the north-south axis.

Another aspect of the site is its proximity to the West Maui Mountains. The mountains cut off late afternoon sun, keeping low angle heat gain from the west facing walls. As such, west facing windows can be larger and do not need sun shading devices.

Tradewinds are predominant for the site from the typical ENE direction. However, charrette participants from Wailuku Elementary said that in the afternoon there commonly occurs a strong wind from the north direction.

The area is noted as one of the coolest for Maui. As such, there are times when temperature and

humidity are comfortable without air conditioning. DOE is willing to consider mixed mode air conditioning (AC) for Wailuku II. Mixed mode uses AC when temperature and humidity are outside the comfort zone on a psychrometric chart, and then shuts down AC when climate factors are within the comfort zone. The use of mixed mode AC will provide substantial savings in energy use. Use of this strategy is dependent on providing cross ventilation and ceiling fans to maximize natural ventilation.

The following is a summary of the strategies that will be considered in the design process.

1. Utilize skylights and/or light pipes: These elements bring light from the roof directly to ceiling light fixtures and are not affected significantly by sun orientation. The Cafeteria and Library provide excellent opportunities to use large skylights. Products such as Kalwall should be considered as they provide substantial daylighting while blocking UV and are hurricane resistant.
2. Block early morning eastern sun: The early morning sun can increase heat within spaces, so blocking it is vital to keeping spaces cooler and avoid dependence on air conditioning. Buildings with east facing walls should minimize windows and use wall insulation. Where appropriate, covered corridors will be located on the east side of buildings to create a buffer for enclosed spaces.
3. West facing windows: Consider the use of larger west facing windows to provide daylight and views. The West Maui Mountains block low angle sunlight creating an opportunity for normally protecting west walls.
4. Incorporate light shelves and sun shades for south facing windows: While the general building orientation is north-south, courtyards create several opportunities for south facing glazing. The strategy uses larger windows with two vertical projections: a light shelf which reflects sunlight into the space and a shade shelf above which blocks sunlight from directly entering spaces. The Grade 4-5 and the K-1 buildings both have two potential wings which can accommodate this feature.
5. Renewable Energy: The site offers potential opportunity for renewable energy generation. There is substantial sunlight and numerous potential locations for PV locations (cafeteria, playcourt, grade 4-5 building, etc).
6. Mixed Mode AC System: Consider the use of a mixed mode AC system which incorporates both natural ventilation and mechanical air conditioning. The cooler climate of Wailuku heights seems ideal for this strategy. Design spaces with cross ventilation and ceiling fans to promote natural ventilation when AC is off.
7. Enhanced Commissioning: Commissioning is a quality control process in which a third party engineer peer reviews the mechanical and portions of the electrical engineering design, confirms the subcontractor submittals and oversees the training and startup of these systems. It has been shown that commissioning improves the energy efficiency of a building and reduces operating costs.

Sustainable Sites

1. Site selection: Because the project is part of a master planned community, this credit is anticipated to be obtainable. There is an existing EIS for the development which addressed the land selection.
2. Bicycle storage and changing rooms: these spaces can be provided since the Education Plan *(Appendix L)* required both showers and bicycle racks on campus.

3. Low-emitting and fuel efficient vehicles: Providing dedicated parking stalls for these environmentally friendly vehicles can be easily done.
4. Maximizing open space: The intent is to provide a substantial amount of open space for playgrounds and playfields, therefore this credit may be achievable.
5. Stormwater Design: Two credits in this category may be achievable. There is ample opportunity to retain stormwater within the site and provide some quality treatment thru bioswales or other passive methods.
6. Light pollution: Use of cut-off exterior light fixtures typically achieves this credit.
7. Site master plan: DOE requires us to plan for future expansion by locating 5 potential portable classroom locations on campus.
8. Joint use of facilities: DOE requires their new school campuses to accommodate some level of public use of their facilities. As stated in the conceptual design, the Wailuku II site plan proposed to make the playcourt, cafeteria, two supplemental classrooms and playfield available for joint use.

Water Efficiency

1. Water efficient plumbing fixtures: Building water conservation can be achieved by simply committing to using water efficient plumbing fixtures. The market provides a wide range of these fixtures including low-flow and ultra low-flow water closets, dual flush water closets, waterless urinals and automated lavatory faucets. It has been observed that use of these fixtures throughout the project can result in 30% or more in water efficiency. Achieving higher levels will require additional water efficiency commitments.
2. Site water conservation: controlled mitigation is dependent upon the use of high efficiency or drip irrigation systems as well as the use of drought tolerant landscaping. The challenge here is that these decisions can increase project first costs. Since there is a finite budget for the project, these will be considered in greater depth during design.
3. Wastewater innovation: this credit can be achieved by using alternative wastewater treatment systems such as constructed wetlands which use specific plants to remove pollutants. Unfortunately, Maui County and State of Hawaii Dept of Health will not consider alternative wastewater treatment for this site.

Materials & Resources

1. Construction waste management: management of construction waste is achievable to various degrees depending on the island. Recycling programs and non-profit savage organizations are well-established on Oahu but less of these resources exist on Maui. However, it is realistic to expect a contractor to at least achieve 50% diversion.
2. Recycled content: use of materials with recycled content to obtain two credits can be reached. The construction industry continues to do a good job in increasing the breadth and depth of products in this category. Attention needs to be paid to substitution requests which lack high recycled content.
3. Regional materials: this credit category will be difficult to obtain more than one credit. Materials in this category must be harvested in Hawaii. That typically limits projects to the use of aggregate in concrete and CMU, landscaping and stone.

Indoor Environmental Quality

1. Construction Indoor Air Quality Management: air quality management during construction and before occupancy can be achieved by a responsible contractor.
2. Low-emitting materials: the construction industry has a plethora of products whose performance equals or exceeds the LEED standards for Low Volatile Organic Compound.
3. Indoor chemical and pollutant control: typically, this category can be achieved by providing door mats to every exterior entry and separate ventilation system for chemical storage a large copier rooms.
4. Controllability of lighting: projects can achieve this credit by providing multiple lighting controls for each space.
5. Thermal Comfort and Design: buildings meeting the Hawai'i State Energy Code normally exceeds the requirements of this credit.
6. Daylight and Views: A majority of spaces will have daylight and views in order to reduce energy allowing some credits to be obtained.

LEED 2009 for Schools New Construction and Major Renovations Checklist

The eco-charrette concluded by completing a LEED 2009 for Schools New Construction and Major Renovations credits spreadsheet. At the time, LEED for Schools V2.2 was in effect. However, the analysis reflects the current V3.0 system. The proposed credits are only suggestions for investigating further during design. Each credit needs to be vetted through studies, computer modeling, cost assessment and collaboration with the design team. The proposed credits are anticipated to be generally achievable. The non-achievable credits are those which appear beyond reach due to any number of reasons. The possible credits are still under consideration but require more study.

According to the preliminary review, the following LEED for School V3.0 credits are projected:

52	Proposed LEED for School Credits
7	Non-achievable LEED for School Credits
52	Possible LEED for School Credits
52	Total anticipated credits and rating = LEED Silver (50-59 credits required)

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3.0
Description of the Environmental Setting, Potential Impacts and Mitigation Measures

3.0 DESCRIPTION OF THE ENVIRONMENTAL SETTING, POTENTIAL IMPACTS AND MITIGATION MEASURES

3.1 CLIMATE

Existing Conditions – Maui's climate varies by terrain but relatively uniform year-round with mild temperatures, moderate humidity, and relatively consistent northeasterly tradewind. Average annual rainfall for Wailuku is approximately 31 inches. The 50-year, 1-hour rainfall is 3.0 inches at Wailuku. Rainy seasonal months of October through April produce strong wind conditions varying from trades from the northeast to southerly winds known as "Kona winds". The project area's location along the east side of the West Maui mountains provides one of the coolest climates in central Maui. The annual variations in temperature encountered in the area (based on temperatures recorded at Kahului Airport) range between 70 and 80 degrees Fahrenheit on the average (Maui County Data Book, 2008).

Impacts and Mitigation – The proposed project will have no effect on climate conditions, therefore, no mitigation measures are required.

3.2 GEOLOGY AND TOPOGRAPHY

Existing Conditions – The proposed project site is located along the east side of the West Maui mountains at about 400 feet above mean sea level (MSL). Geologically, the terrain is composed of 'Īao series soil derived from basic igneous rock. See *Section 3.3* for a further discussion on soils.

The ground surface of the site is currently covered with overgrown brush and weeds. The project site generally slopes in an easterly direction toward the existing Kehalani Mauka Parkway with an average slope of approximately 11 percent. Onsite elevations range from 461 to 389 feet mean sea level (MSL).

Moderate earth movement will be required in order to implement the plan.

Impacts and Mitigation – Of the 14-acre site, approximately 98,849 sq. ft. of buildings and support facilities will be developed. The balance of the remaining will be open space, parking, and access easements. Surrounding the proposed buildings, open space will be preserved for outdoor classroom activities. The proposed project intends to take advantage of existing terrain and design buildings and landscape in such a way that will take advantage of existing natural conditions. Therefore, the proposed project will not substantially alter the overall existing topography of the project site. The proposed facility and parking areas will be flattened and smoothed along with the area for the playground and walkways. No substantial fill or excavation is being proposed for the project. The geology and topography of the area will not be significantly affected. Mitigation measures related to soils and grading are described in the following section.

3.3 SOILS AND GRADING

Existing Conditions – According to *Soil Survey of the Island of Hawai'i* (USDA, 1972), soils at the project site belong primarily to the IbC ('Īao Cobby Silty Clay, 7 to 15 percent slopes) and IcC ('Īao Clay, 7 to 15 percent slopes), refer to *Figure 3-1*. The 'Īao series consists of well-drained soils on valley fill and alluvial fans developed from basic igneous rock. They are nearly level to moderately sloping. In a representative profile the surface layer is dark-brown clay about 15 inches thick. The subsoil, about 45 inches thick, is very dark brown, dark-brown, and very dark grayish-brown clay and silty clay. The substratum is clay alluvium. The soil is neutral in the surface layer and subsoil. In places roots penetrate to a depth of 5 feet or more. Permeability is moderately slow, runoff is medium, and the erosion hazard is moderate.

Impacts and Mitigation – The proposed project will require both excavation and embankment for the construction of the new roadways and relatively flat, terraced buildable areas for the proposed building structures. The majority of the project will be in a "cut" condition due to building height envelopes and roadway grade restrictions. Overall, the site will be graded to maintain the existing drainage patterns. Finish grades throughout the site will vary in elevation from 389 feet to 461 feet mean sea level (MSL). Slopes will vary between 0 to 12% after improvements with maximum 2:1 slopes along the embankments. Retaining walls will vary in height from 2 to 6 feet.

Temporary erosion control measures will be incorporated during the construction to minimize soil loss and erosion hazards. Best Management Practices will include temporary sediment basins, temporary diversion berms and swales to intercept runoff, silt fences, dust fences, inlet protection, slope protection, stabilized construction entrances and truck wash-down areas. Periodic water spraying of loose soils will be implemented to minimize air-borne dirt particles from reaching adjacent properties. An application for a National Pollution Discharge Elimination System (NPDES) permit will be submitted to the State Department of Health for review and approval. Permanent sediment control measures will be used once construction is completed.

3.4 SURFACE WATER AND STORM WATER RUNOFF

Existing Conditions – There are no existing sources of surface water located on the proposed site. An existing concrete ditch (Waihe'e Ditch) meanders along the western border of the site and intercepts offsite runoff generated mauka of the site. The ditch is still active and services agricultural lands to the south. There are plans to construct temporary diversion ditches to the west of the project site when the existing Waihee ditch within the project site is removed. Per the Kehalani Drainage Master Plan, the diversion ditches are designed to intercept a large majority of the runoff before it enters the school site. When the properties mauka of the project site are developed with their own permanent drainage system, the temporary diversion ditches will be removed. An underground 60-inch drainpipe to the west of the site will be constructed to convey existing irrigation water through Waihee ditch. The nearest major surface water source, in proximity to the proposed site, is Waiale Reservoirs, which is located about 0.7 miles east of the site. there is no perennial, intermittent stream, or wetland presented in or adjacent to the proposed project area. Direct and indirect impact to the Waters of the United States

(WOUS) by construction of project structures and associated ground disturbing activities is not anticipated. The project site is not located in the Ground Water Management Area.

Runoff on the site is medium, erosion hazard is moderate, and permeability is moderately slow. The on-site flows naturally drain in an easterly direction toward the existing Kehalani Mauka Parkway (Austin, Tsutsumi & Associates, Inc, 2009).

Impacts and Mitigation – In addition to reducing peak flow rates, the proposed storm water management system will provide water quality treatment and reduce the discharge of pollutants to the maximum extent practicable. To attain LEED credits for water quality, 90% of the annual storm runoff volume must be treated. The focus is on treating the more common smaller storms rather than just the infrequent peak storm events, since the smaller storms contain most of the runoff pollutants. The project will incorporate natural and structural Best Management Practices (BMPs) to control storm water quality as follow.

- Grass Swales and Landscape Areas: The surface storm water runoff from road and parking areas will be directed to grass and landscaped areas where possible to provide vegetative filtration and allow percolation into the underlying soil.

- Structural Filtration Systems: These underground units remove pollutants by having storm water flow through specialized filtration media contained within cartridges. The selected filtering device will be rated for removal of at least 80% of the total suspended solids.

An appropriate maintenance plan will be developed for each BMP which will require accumulated debris and sediments to be removed during regularly scheduled maintenance and disposed at a County approved disposal site.

LEED and the EPA accept the above methods of storm water quality control as storm water best management practices that reduce the pollutant loads associated with storm water runoff. Maui County does not specifically require water quality treatment of storm water.

No significant impact to groundwater underlying the project site is anticipated during the construction and operation of the proposed school. Construction of the proposed facility is unlikely to introduce or release any substance into the soil that could adversely affect groundwater quality.

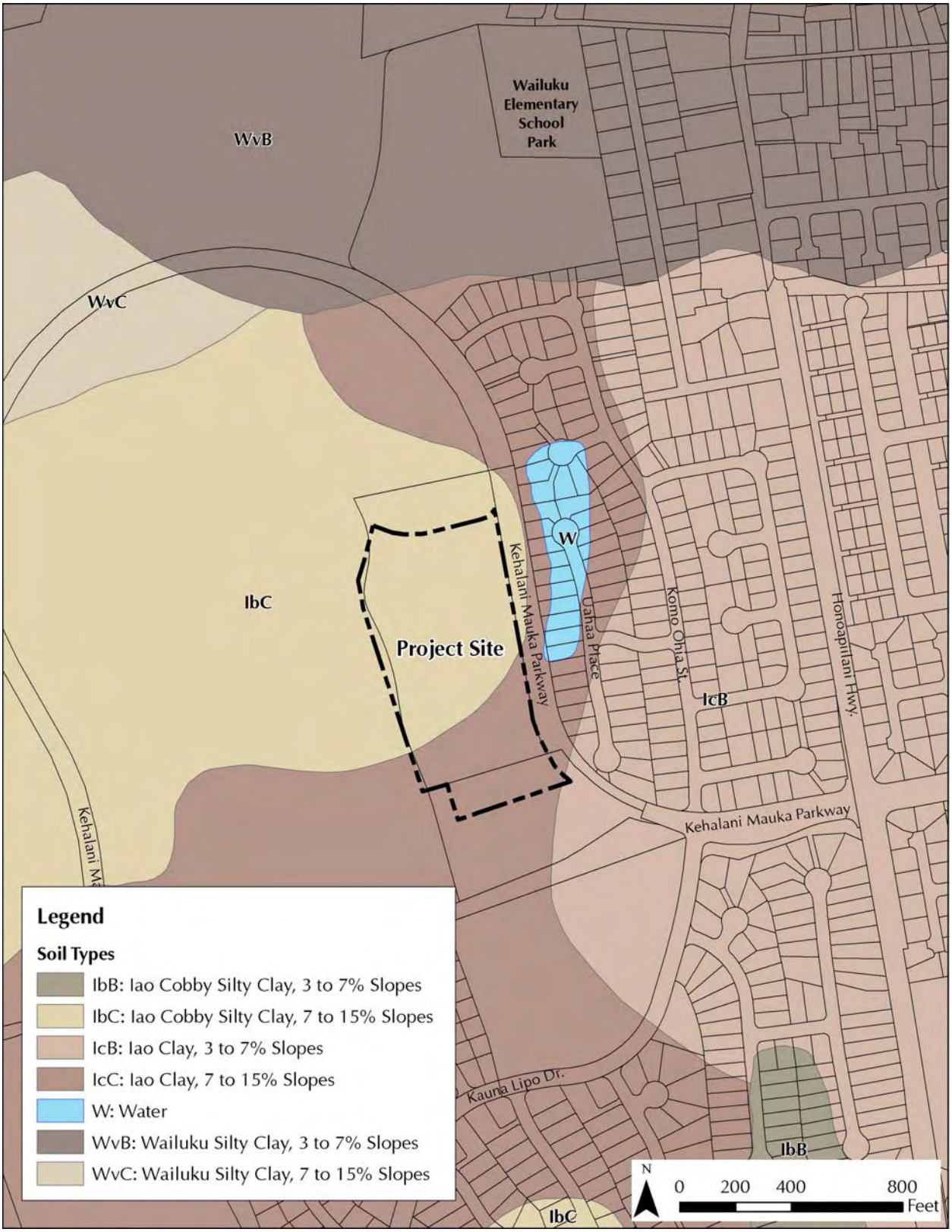

Figure 3-1: Natural Resources Soil Conservation Survey (NRCS) Map

3.5 FLOOD AND GEOLOGIC HAZARDS

Existing Conditions – The Federal Emergency Management Agency's *Flood Insurance Rate Map (FIRM)*, Panel No. 150003 0170B identifies the proposed project site within Zone C designation (areas of minimal flooding) refer to *Figure 1-5*. The Flood Insurance Program does not have regulations for development within this district.

In terms of seismic risk, the Island of Maui is rated Zone 2B Seismic Probability Rating (*Uniform Building Code*, Volume II, Chapter 16, Division IV). Zone 2B areas are at moderate-to-severe risk from major earthquake damage, especially to poorly designed and/or built structures.

Impacts and Mitigation – In general, geologic and flood conditions impose no major constraints on the project. As required, all of the buildings will be constructed in compliance with Federal Building Ordinance Regulations and meet County Building Code under the *Uniform Building Code* appropriate to the Zone 2B Seismic Probability Rating.

3.6 FLORA

Existing Conditions – A botanical survey was conducted by Rana Productions, Ltd (2009). The survey identified existing flora species and habitat on site. The survey also determined if the site contains plant species which are currently listed, or proposed for listing as endangered or threatened under either the federal or the State of Hawai'i's endangered species programs. The project area is former sugarcane plantation land, and currently supports vegetation that is associated with natural growth on highly disturbed land. The majority of the property has transitioned from barren field to grassland, completely dominated by Guinea grass. Some shrubs are starting to appear, such as castor bean (*Ricinus communis*), slender mimosa (*Desmanthus virgatus*), koa haole (*Leucaena leucocephala*), and hairy abutilon (*Abutilon grandifolium*). If left alone, the vegetation would likely shift gradually to a mixed Guinea grass/shrubland.

Recently disturbed small areas along the roadway are leveled areas being used to store construction supplies, and temporary access roads. These areas support the greatest variety of plants, whose growth is a response to the disturbance of the dominant Guinea grass ground cover. A majority of the 59 species recorded are ruderal weeds with low occurrence values (Uncommon or Rare). Only one species recorded, 'uhaloa (*Waltheria indica*) is regarded as a native plant. This species is a common indigenous plant found throughout the islands, particularly on drier sites. This gives a ratio of 1.6% of the plant species on the property as native.

The vegetation present on the site is almost completely alien as demonstrated by the fact that only one native plant species was recorded during course of this survey. The lands surveyed are former sugar canes lands on which the vegetation is in the early successional stages of changing from former sugar cane fields, to fallow fields, to grassland and if not further disturbed would eventually become shrublands. From a botanical perspective there are no resources that are special or unique present on the site. No plant species currently listed, or proposed for listing

under either the federal or the State of Hawai'i endangered species programs were detected during the course of this survey.

Impacts and Mitigation – Site grading for construction will disturb vegetation at the site. Temporary ground cover vegetation will be used during this period. Landscaping will establish new vegetation as turf grass ground cover and landscape plants and trees. It is recommended that where appropriate and practicable native plant species be used in landscaping efforts. Not only is this ecologically prudent, but if the appropriate plants are used will also likely save maintenance and water costs over the long term.

3.7 FAUNA

Existing Conditions – An avian and mammalian survey of the project site was conducted by Rana Productions, Ltd (2009). The survey identified existing fauna species and habitat on site. The survey also determined if there are avian or mammalian species or habitat for such species which are listed as endangered, threatened or proposed for listing under either the federal or the State of Hawai'i's endangered species programs. A total of 91 individual birds of nine different species, representing five separate families, were recorded during station counts. Bird species detected during the course of time spent on the project site are considered to be alien to the Hawaiian Islands. There were no avian species detected during the course of this survey which are currently listed, or proposed for listing under either the federal or State of Hawai'i endangered species statutes. Avian diversity is low, in keeping with the habitat at the project site. The Zebra Dove (*Geopelia striata*) accounted for slightly less than 64 percent of the total number of birds detected. An average of 18 individual birds was recorded per station count. No mammalian species currently listed, or proposed for listing under either the federal or State of Hawai'i endangered species statutes was detected during the course of this survey.

Although not detected during this survey, both the endangered Hawaiian Petrel (Pterodroma sandwichensis), and the threatened endemic sub-species of the Newell's Shearwater (Puffinus auricularis newelli), may over-fly the project area between April and the end of November each year. Both species have been recorded flying to and from their nesting colonies located in the mountains to the west and east of the project site. Both of these pelagic seabird species nest high in the mountains in burrows excavated under thick vegetation, especially uluhe (Dicranopteris linearis) fern. There is no suitable nesting habitat for either of these seabird species on, or close to the proposed school site.

Impacts and Mitigation – Site grading for construction will disturb avian and mammalian at the site. Temporary ground cover vegetation will be used during this period. Landscaping will establish new habitat as turf grass ground cover and landscape plants and trees. The principal potential impact that construction and operation of the proposed school poses to Hawaiian Petrels and Newell's Shearwaters is the increased threat that birds will be downed after becoming disoriented by lights associated with the project during the nesting season. The two main areas that outdoor lighting could pose a threat to these nocturnally flying seabirds is if, 1) during construction it is deemed expedient, or necessary to conduct nighttime construction

activities, 2) following build-out the potential operation of streetlights and athletic field lighting during the seabird nesting season.

Nighttime construction is not currently planned. If nighttime construction activity or equipment maintenance occurs, the associated lights should be shielded. Large flood/work lights should be placed on poles that are high enough to allow the lights to be pointed directly at the ground.

If streetlights or facility lighting is installed in conjunction with the school, it is recommended that lights be shielded to reduce the potential for interactions of nocturnally flying Hawaiian Petrels and Newell's Shearwaters with external lights and man-made structures (Reed et al. 1985, Telfer et al. 1987). This measure would serve the dual purpose of minimizing the threat of disorientation and downing of Hawaiian Petrels and Newell's Shearwaters, while at the same time complying with the Maui County Code § 20.35et seq.that requires that exterior lights on Maui be shielded.

3.8 AIR QUALITY

Existing Conditions – B.D. Neal and Associates completed an air quality assessment at the project site (2010) (*Appendix B*). Regional and local climate together with the amount and type of human activity generally dictate the air quality of a given location. The climate of the project area is very much affected by its elevation near sea level and by nearby mountains. The predominant trade winds tend to be channeled through the area by the mountains to the east and west. Except for periodic impacts from volcanic emissions (vog) and possibly occasional localized impacts from traffic congestion and local agricultural sources, air quality at the project area is relatively good. There is very little air quality monitoring data from the Department of Health for the project area, but the limited data that are available indicate that air contaminant concentrations are generally well within State and national air quality standards.

Impacts and Mitigation – Short-term impacts from fugitive dust will likely occur during the project construction phase. To a lesser extent, exhaust emissions from stationary and mobile construction equipment and from the disruption of traffic may also affect air quality during the period of construction. A dust control management plan will be developed which identifies and addresses activities that have a potential to generate fugitive dust.

The short-term effects on air quality during construction will be mitigated by compliance with provisions of Hawai'i Administrative Rules, Section 11-60.1-33 on Fugitive Dust. Fugitive dust emissions will be controlled to a large extent by watering of active work areas, using wind screens, keeping adjacent paved roads clean, and by covering of open-bodied trucks. Other dust control measures may include limiting the area that can be disturbed at any given time and/or mulching or chemically stabilizing inactive areas that have been worked. Paving and landscaping of project areas early in the construction schedule will also reduce dust emissions. Excess exhaust emissions from traffic disruption can be mitigated by moving construction equipment and workers to and from the project area during off-peak traffic hours, and by minimizing road closures during peak traffic periods.

The proposed project will have no long-term impact on air quality from the increase in air pollution emissions in the project area (Neal, 2009). With the project in the year 2015, carbon monoxide concentrations were estimated to remain well within State and federal standards.

3.9 LAND USE

Existing Conditions – The surrounding region has historically been used for agriculture. The proposed project site is currently unoccupied and is a part of the on going Kehalani Mauka community master plan development. Thus, the project site is bordered by developed urban residential neighborhoods.

Development patterns on the Island of Maui are set by State Land Use District designations, by the County of Maui General Plan, and County Zoning District designations. The principal function of these land use classifications is to specify where land uses such as commercial, residential, industrial, agricultural, open and public areas are permitted. The existing land use designations of the project site and surrounding area are briefly summarized below.

State Land Use Designation - The proposed site is situated within the State Land Use Urban District. According to the Land Study Bureau Detailed Land Classifications, the area has not been classified for Agricultural use as it was reclassified to State Land Use Urban District for the Kehalani Mauka master planned community devlopment.

County of Maui General Plan (Draft 2030) - The Maui County General Plan Public Facility/Infrastructure Improvement Map designates the project area as Elementary School Use *(Figure 1-3)*.

County of Hawai'i Zoning - The County of Maui designates the proposed project area as Project District 3.

Coastal Zone Management Program - The parcel is not located in the Special Management Area established to administer the Coastal Zone Management (CZM) Program (*Figure 1-4*).

Impacts and Mitigation – The 14-acre site, approximately 98,849 square feet will be developed. The balance of the remaining acres will be open space, parking, and access easements. Surrounding the proposed buildings, open space will be preserved for outdoor classroom activities.

State Land Use Designation – the planned use of the project for a public school is consistent with the State land use classification. The State Land Use Urban District designation permitts school use on the site.

County of Maui General Plan (Draft 2030) – The proposed elementary school corresponds with the future public facility/infrastructure improvements goal of the Draft 2030 Maui County General Plan.

County of Hawai'i Zoning – Elementary School Use is permitted within the PD-3 (Wailuku-

Kahului Project District 3) zoning. The existing Project District Phase II for Kehanali Mauka must be amended, and a new Project District Phase II and Phase III permits are required for the new school site.

3.10 AGRICULTURE

Existing Conditions – The agricultural land on the proposed project site has been designated as "prime agricultural lands" *(Figure 3-2)*. Prime Agricultural Lands are defined by the State of Hawai'i Agricultural Lands of Importance to the State of Hawai'i (ALISH) Classification System as land best suited for the production of food, feed, forage and fiber crops. The land has the soil quality, growing season, and moisture supply needed to produce sustained high yields of crops economically when treated and managed, including water management, according to modern farming methods.

Impacts and Mitigation – The project will result in the immediate loss of 14 acres of Prime Agricultural Land. The land was reclassified to allow for urban uses over 15 years ago, with the recognition that substantial amount of agricultural lands remain available on Maui.

3.11 ARCHAEOLOGICAL RESOURCES

Existing Conditions – Archaeological Services Hawai'i, LLC produced a summary report on archaeological resources at the project site (2009). An archaeological assessment of TMK 3-5-001:portion of 001 (Lots 2, 3, 5-14, 16-19, 20, 22, and 23) was conducted by Scientific Consultant Services, Inc (SCS) in 2004 . The survey was conducted to determine the presence/absence, nature, and extent of archaeological resources in the project area and evaluate their significance, and ensure compliance with the National Historic Preservation Act of 1966, as amended, Chapter 6E of the Hawai'i Revised Statutes (HRS), and in accordance with the guidelines established by the State Historic Preservation Division (SHPD), State Department of Land and Natural Resources (DLNR). This was the second Archaeological Inventory Survey report produced for Kehalani Mauka Subdivision area.

The project area is located in Lot 16 of this survey. *Figure 3-3* presents the archaeological resource locations. State Site Numbers have been assigned to the identified features. However, several of the site numbers pertain to more than one feature composing the site (for example site -5490 pertains to T-15, T-16, and T-19) and not all temporary sites (T-#) were assigned permanent site numbers.

The Inventory Survey (SCS, 2004) includes historic background research and settlement pattern analysis prior to field work, a complete pedestrian survey of the surveyed areas, representative subsurface testing, and reporting. Eight historic sites, designated as State Site Number 50-50-04-5473 (Hopoi Reservoir), -5474 (Kama Ditch), -5197 (Waihee Ditch), -5489 (historic-modern roadways), -5490 (historic ditches), -5491 (historic artifact), -5492 (clearing mounds from plantation era), and -5493 (unnamed ditch), were documented during the survey. Two of the sites, 50-50-04-5473 (Hopoi Reservoir), and 5474 (Kama Ditch), were previously recorded during the previous study.

Lot 16, where the project site is located, was subjected to the most intensive excavations for remnants of Hopoi Camp. Several important sites were recorded in this parcel. T-13, Waihee Ditch (Site -5197) which was constructed between 1905 and 1907 was the major site of this lot. Waihee Ditch runs north-south through the entire survey area for approximately 1,515 meters, and its width varies from 2 to 5 meters. The ditch runs along the western border of Lot 16 and continues far past Waikapu towards Ma‘alaea. Waihee Ditch is currently in use, as substantial column of water is observed flowing through the channel. T-16 (Site -5490), a small, east-west running ditch (approximately 2-meter wide x 2-meter deep) also intersects Waihee Ditch. T-18 (Site -5489) a small, unpaved road segment along the northern boundary of Lot 16, T-20 (Site -5492) a clearing mound of linear basalt rock pile, and T-25 a modern, mechanically-created, earth berm (no State Site number designated) were also recorded in Lot 16.

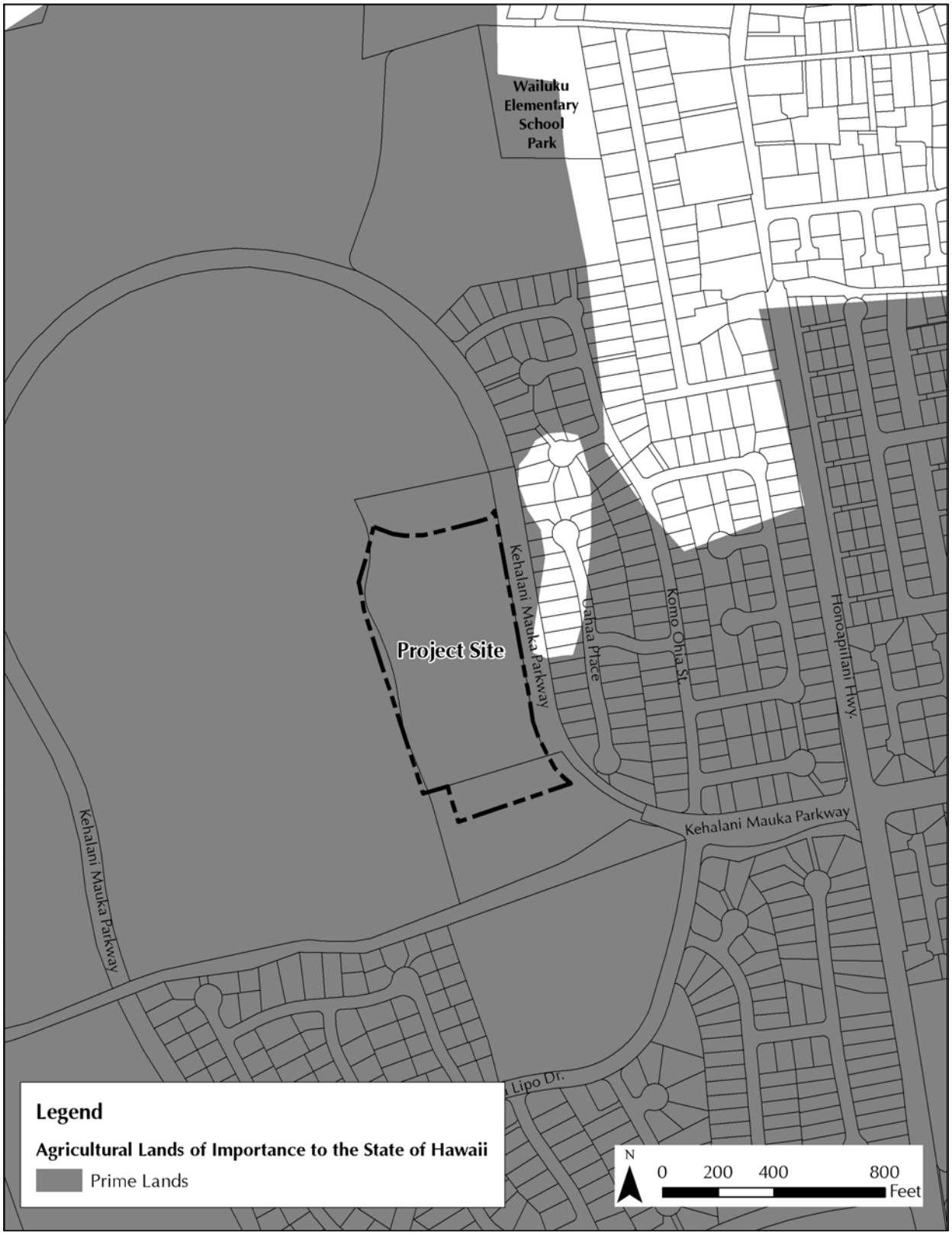

Figure 3-2: Agricultural Lands of Importance to the State of Hawai'i (ALISH) Map

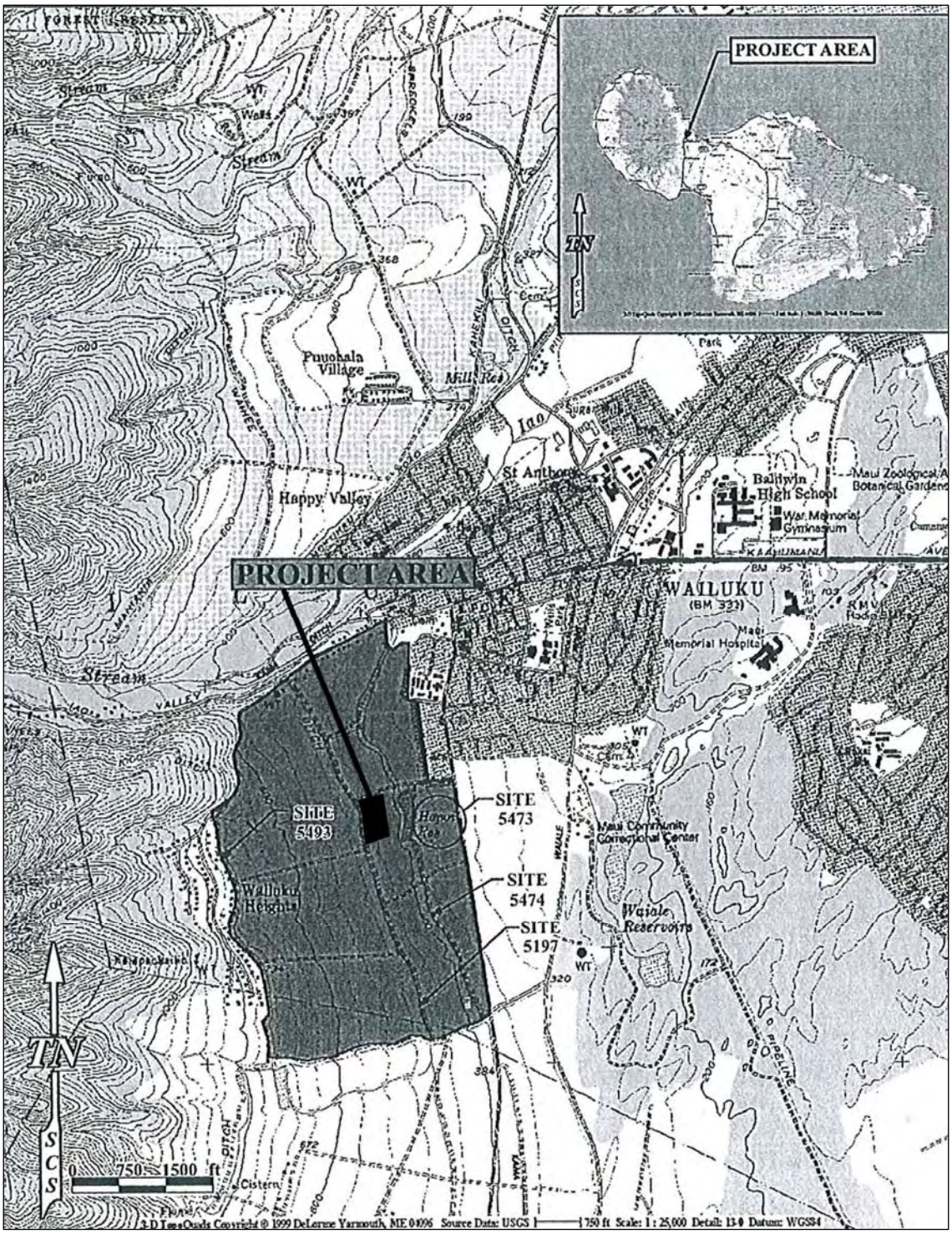

Figure 3-3: Locations of Archaeological Resources
(Base Map Source: SCS, 2004)

Seven historic glass and ceramic fragment (composing IF-6) were recovered from the surface near the northwestern flank of Hopoi Reservoir. Although considerable testing was conducted on Lot 16, the lot on which remains of the Hopoi Camp are anticipated, Hopoi Camp was not identified during this survey (SCS, 2004).

All eight sites, representing historic period activities on the survey area, were assessed as significant under Criterion D (SCS, 2004).

Impacts and Mitigation – Per SHPD's comments on the study by SCS (2004), no additional archaeological mitigation was recommended for the survey area. However, periodic field inspections of Lot 16 were recommended and when large-scale ground work is scheduled for Lot 16, SHPD and SCS shall be notified by the contractor so that SHPD and an assigned archaeologist may inspect the area for any remnants of Hopoi Camp. SHPD also recommended that the construction crew be made aware that remnants of the camp may exist and may be discovered during construction. Should any indication of the camp be identified, all work shall be stopped and SHPD and the responsible archaeologist will be notified. A monitoring plan for construction-related activities associated with the project site, prepared by Archaeological Services Hawaii, LLC (2009) is included as *Appendix C* of this report.

3.12 HISTORICAL AND CULTURAL RESOURCES

As part of this project, a cultural assessment was completed of the project area by CKM Cultural Resources LLC (2009). This assessment consisted of examination of historical documents, a review of existing cultural information, interviews, and preparation of the actual summary report. The complete report is included as an *Appendix D* of this report.

3.12.1 Historical Background

Wailuku is a vast area much of its surroundings and topographical features are common throughout this vast ahupua'a. The history of this ahupua'a heavy laden with much historical facts of war, rural life, the paradigm of lifestyles and much more. Wailuku's boundaries are large. The area of Wailuku begins near the 'ili[1] of Waihe'e extents out to the beginning of Pā'ia and is also bordered by the beginning of Mā'alaea and Lāhaina. This project site of which this report is compiled for is currently located beneath 'Īao Valley.

There are many 'ili within the ahupua'a of Wailuku which stretches from the shore to the peak of the mountains. This specific site is located on the lower portion of Wailuku. Such 'ili as Waiehu, Kahului, Waihe'e and Waikapū.

Waiehu: Today a common surf spot, Waiehu is near to the ocean making this area great for farming and ocean activities at the same time. Waiehu is part of the famous "Nā Wai 'Ehā." Waiehu's location made this area great for lo'i kalo or taro patches. Waiehu literally means "water spray." On a rough day in the ocean, Waiehu's atmosphere would seem a bit foggy; however, it is only the presence of the ocean's mist.

[1] Land division within Ahupuaʻa

Kahului: Kahului can be likened as Maui's metropolis today. As Kahului is the basis of most of Maui's population, many in traditional time resided here as well. Kahului was the area of where Wailuku's water exited. However, the ocean has eroded the stream mouth. Much of Kahului's landscape in traditional Hawai'i was the common communal living and farming. Kahului literally means "the winning." There is no explanation for this title; furthermore there is no direct translation for this area.

Waihe'e: The term comes from the taro patches that laden the valley walls and the basin of Waihe'e valley. Waihe'e was also part of the four famous waters. This valley like the other three provided much water to produce thousands of acres of taro. There really is no proper translation for Waihe'e as it was the name of a lo'i and the mana'o of someone who has long passed.

Waikapū: This area is also one of the four famous waters, this stream provided for much of the taro fields near upper Wailuku as well as Mā'alaea. The literal translation for Waikapū means, "The water of the conch." It was said that in traditional Hawai'i a conch shell resided in one of the caves and when used could be heard through out Hawai'i. However, one day a "mystical" dog by the name of Puapualenalena stole this pū.

These are some of the 'ili within this ahupua'a. As seen through the description of these 'ili, the Wailuku ahupua'a used the water that it was given. Nā wai 'ehā or the four waters converged on this plain and created some of the healthiest farming environments in all of traditional Hawai'i.

This ahupua'a is also home to "Nā Wai 'Ehā" or the four waters which will be mentioned at a later point in this compilation. Wailuku means "destructive water." There are many mo'olelo as to why such a beautiful and serene place can have such a negative connotation in its name. One such reason that this area may be called Wai-luku because of the numerous battles that has taken place in this area, refer to *Appendix D* for further detail. Another account is said to be because of the waters that rush down from 'Īao Valley. Much of Wailuku town is built on 'Īao Valley's streambed.

3.12.2 Cultural Background

The lifestyle of Wailuku was unlike that of anywhere else in traditional Hawai'i. There were the farmers, the fishermen, the mākua, the kūpuna and the keiki. It was one of the most communal societies on Maui. The topography of this area was abundant with lo'i kalo or taro patches. From Waihe'e to Waikapū much of the topography was fit for planting and farming large crops to feed large numbers of people. The bays and valleys of these areas were known as Nā Hono a Pi'ikea, much like the term Nā Hono a Pi'ilani . The saying meant the valleys and bays of Pi'ikea, sister of Pi'ilani. The Western portion of Maui is commonly referred to as the bays and valleys of Pi'ilani. However, in the Wailuku district, Pi'ilani's sister, Pi'ikea, claimed this portion.

Today, Wailuku is a fast changing society, even much different from its scene ten years ago. The area is largely residential and commercial properties. The water that once furnished all of Wailuku seldom flows through its streams, if it has not been filled in yet. Much of the water and

its sources has fallen victim to the Sugar Cane Era and the Golf Course Era. Many of the culturally significant sights, such as heiau and ahu, no longer exist due to these two eras. During these periods much of the land was cleared for sugarcane or golf course use as well as the abundant residential and commercial properties that exist to this day.

The term "aloha 'āina," was best shown in the Wailuku ahupua'a. 'Āina means land and Aloha generally means love, however always implies a relationship of reciprocity. In simple terms aloha 'āina means that you take care of the land and the land will reciprocate the favor. Wailuku's abundance of water helped in this process for the land to take care of Wailuku's people. The native vegetation that grew in the Wailuku district was filled with many common indigenous native introduced plants and endemic plants. However, none could have been more common than the terraces of lo'i kalo. No amount of emphasis can portray the importance of kalo in the lives of Hawaiians.

One essential plant used to construct thatched homes was the Pili grass (*heterogon contortus*). This grass was also quite common in these areas because of the arid climate conditions in near the Kahului coastline. Pili liked to grow in arid and dusty conditions. This grass was useful to Hawaiians by bunching dried clumps of grass to create a waterproofed house.

A well-known tree that grew in the uplands of Wailuku is the sandalwood (*Santalum freyecinetianum*), known in Hawaiian as 'Iliahi. The wood was traditionally used to scent kappa cloth. It was sometimes used to make 'ukeke, a musical bow, the only traditional Hawaiian stringed instrument. The leaves and wood of the sandalwood trees were also medicinally used, often in combination with 'awa and other woods.

Common to the Wailuku area was 'Iliahi's bastard. The naio (*myoporum sandwicense*) tree was the bastard sandalwood tree. This native tree had a hard, dark yellow green wood, scented like sandalwood. The leaves are narrow-oblong, pointed, grouped at the branch ends. The flowers are small, pink and/or white. This tree bears a small, white, round fruit.

Much of the ground cover near the coastal line was Pā'ū 'O Hi'iaka (*Jacquemontia Ovalifolia*). This was a ground-covering vine with abundant tubular flowers that range in color from light blue, purple, to white. This plant did not need much water, which in turn made the coastal lines and its surrounding areas a perfect place of growth for this plant.

While Hawaiians of the past used Pā'ū 'O Hi'iaka for curing keiki (children) of ea (thrush, a mouth disease), this plant is better known for the mo'olelo or story that explains its name. Long ago, Pele, volcano goddess, took her youngest sister, Hi'iaka, to the ocean. As Pele was out amongst the waves fishing, or some say surfing, the sun climbed higher and hotter in the sky. Meanwhile, Hi'iaka waited patiently on the shoreline for her sister. A plant near Hi'iaka, seeing that the sun's merciless rays were burning the keiki's tender young skin, took pity upon Hi'iaka and extended its vine branches to shield her. When Pele returned and saw that she was protected by the plant. In gratitude, Pele gave the plant its name, Pā'ū (skirt) o Hi'iaka (of Hi'iaka, my baby sister).

Another blossoming plant that may have resided in this area is the 'a'ali'i (*Dodonaca Viscosa*) bush. This hard wood native shrub is indigenous to the islands. This plant also grows well in

dryer climates. Ranging in heights of one to thirty feet, this shrub to tree is found growing in elevations up to 8,000 feet and wind swept open country. In today's day and age, 'a'ali'i is being used to reforest the island of Kaho'olawe. This island's water plate is cracked in half from missile testing by the U.S government in the late 1960's and '70's. Kaho'olawe is not able to retain water because of the cracked water plate, yet the 'a'ali'i is doing well in growing and flourishing on the island.

Another plant that grew in the area is called Huehue (*cocculus trilobus*) or 'Inalua. This plant produced an extremely purple berry, which when collected and smashed would be used to dye kappa (bark cloth made from the wauke tree- *broussonetia papyrifera*) with colors ranging from a deep dark purple hue to a light periwinkle.
Native trees of these areas would have been the Hau (*Hibiscus tiliaceus*), Loulu (*Pritchardia*), Kukui (*Aleurites moluccana* – candle nut tree: as can be seen growing on the ridges of Kahalawai).

Impacts and Mitigation – Based on the documentary research, there were no previously identified historic properties located within the project area. No specific documentation was found regarding, *iwi* (ancestral remains) in the project area. However, the cultural and historical setting of the project area indicates that there may be possible discovery of archaeological sites related to native Hawaiian cultural practices associated with settlement as well as historic sites related to agricultural practice during the course of development. The establishment of the burial laws (specifically the State of Hawai'i burial laws (1990), should be used to facilitate a process that provides a guideline for agencies and communities to derive an appropriate plan of action in the preparation and preservation of ancestral remains.

It is also highly recommended that native plants that are compatible to the surroundings should be used where possible for the proposed project.

Based on the interviews, the absence of cultural remains in the project area due to extensive previous disturbances of the site from sugarcane plantation and cattle grazing activities, no negative impacts are anticipated. The proposed developments will likely have "no effect" on significant cultural resources.

3.13 SOCIO-ECONOMIC CHARACTERISTICS

Existing Conditions – The estimated resident population for the island of Maui to grow from 129,471 in 2005 to 186,254 in 2030 (Draft Maui County 2030 General Plan Update, 2009). For the Wailuku-Kahului Community Plan region, the estimated year 2000 population was 41,503. The region's population is estimated to increase to 60,877 by the year 2020 (Maui County Planning Department, 2006). A mix of activities employs Wailuku residents ranging from service industries, agriculture, commercial, and government sector. Overall, Wailuku exhibits a higher proportion of service, trade, and government sector as Wailuku is the Island's center of governmental activity. With continued growth projected for the Maui County, as forecasted by the Department of Business Economic Development and Tourism, demands for education facilities within Wailuku District will likely grow.

Major public facilities located within vicinity of the proposed site include Wailuku Elementary School, Lihikai Elementary School, Kahului Elementary School, Waihee Elementary School, Wailuku Public Library, Maui County Police Department, Wailuku Fire Station, Maui Memory Medical Center, Wailuku War Memorial Park and Center, Wailuku Civic Center, Wells Park, Mokuhau Park, Maui Memorial Park, Keopuolani Park, and Maui Zoological and Botanical Gardens. Other private educational facilities located in Waimea include St. Anthony Grade School, Emanuel Lutheran School, Victory Christian Acdemy, and Isaiah Academy for Excellence.

Impacts and Mitigation – The project will create short-term benefits as a result of design and construction employment. The project will create jobs for local construction personnel. Local material suppliers and retail businesses can also be expected to benefit through a multiplier effect from the increased construction activities.

The principal socio-economic impact of the proposed project will be the creation of a public school which will provide educational services and community-gathering facilities. Long-term benefits of the proposed project will also include jobs for education instruction and administration. In addition to the creation of jobs, the State of Hawai'i and County of Maui will receive excise tax revenues on finished development and building materials, conveyance taxes, and income taxes on wages. The socio-economic impacts will be positive for the local community, as well as the City and State. No specific socio-economic mitigation actions are recommended.

3.14 VISUAL RESOURCES

Existing Conditions – The project site is located on vacant land in the center of Kehalani Mauka, a planned residential community. The existing views consist of the open space and West Maui Mountains to the west, open space to the north and south, and the surrounding residential neighborhood, Kahului Harbor, and Haleakala to the east *(Figures 3-4, 3-5, 3-6, and 3-7)*. The project site does not lie within a designated scenic corridor.

Impacts and Mitigation – The project scale and design will not significantly impact area views, views. Landscaping will be used to improve the visual character of the project site, along with building design incorporated with the surrounding environment. The elementary school will be designed in a cluster concept with mostly single story structures. The new complex will result in a beautifully designed elementary school campus, which will be a visual amenity to the community.

Figure 3-4: Existing Views to the South

Figure 3-5: Existing Views to the West

Figure 3-6: Existing Views to the East

Figure 3-7: Existing Views to the North

3.15 UTILITIES

Water System: Domestic water for the Wailuku-Kahului region is provided by the Department of Water Supply (DWS)'s Central Maui System. 'Īao Aquifer is the major source of water for this system. This well draws from the 'Īao basal groundwater aquifer, which is already producing up to its recommended sustainable yield. Therefore, it will not contribute additional new sustained water source capability to the DWS system (*Department of Water Supply, Draft Water Use and Development Plan 2009*). The project site currently has no existing domestic water service. DOE is currently working with the Department of Water Supply to identify potential water sources for the project. The County of Maui has been aware of and supportive of the proposed school project. Therefore, the Applicant is confident that water will be made available to the project.

An existing 12-inch ductile iron distribution waterline and 16-inch ductile iron transmission waterline are located within Kehalani Mauka Parkway fronting the site. An existing 12-inch waterline stub-out connection has been installed at the northeastern corner of the project site and a future 12-inch waterline is planned to run along the northern boundary within the existing 25 ft. wide utility easement "E-12" and service future mauka developments by Kehalani Mauka LLC. There are four (4) existing fire hydrants fronting the site along Kehalani Mauka Parkway.

Impacts and Mitigation – Onsite water system improvements will include a domestic water system, fire line system, and an irrigation system. The domestic system consists of a water meter, reduced pressure backflow preventer, and copper and ductile iron waterlines. The fire line system consists of a 10-inch double detector check assembly, fire hydrants and 12-inch ductile iron fire lines. Fire department connections will also be installed to supplement the project's fire system as most buildings within the project will have a fire sprinkler system. The proposed domestic water, fire, and irrigation meter lateral will connect to the existing 12-inch distribution waterline within Kehalani Mauka Parkway at the northeast corner of the site.

Per DWS's comment letter dated December 30, 2009, a temporary construction meter will not be issued for any Central Maui project. Non-potable water will be used for allowable construction activities. Reclaimable water from Kahului and Kihei Wastewater Treatment Plant and water from Waihe'e Ditch have been identified as possible sources for non-potable water. The use of reclaimable/non-potable water for construction dust control and will comply with applicable State Department of Health regulations.

Preliminary domestic water contributions are calculated at approximately 31,958 gallons per day (gpd), which is the average daily demand for domestic and irrigation use. Refer to *Appendix B of Appendix E* for preliminary water demand calculations. Fire hydrants are required to be installed at a maximum of 250 ft. intervals within the site.

Required fire flow within the project site is 2,000 gallons per minute (gpm) for duration of two hours, and fire hydrants are required to be installed at a maximum of 250 ft. intervals.

The proposed project will comply with the Hawai'i Administrative Rules (HAR) Chapters 11-54 and 11-55. This project will incorporate water efficient technology and design, and appropriate

vegetation and landscaping to moderate water irrigation demands. Low-flow water conserving fixtures will be used and ground cover which does not require irrigation will be used in large quantities. Appropriate native Hawaiian and Polynesian-introduced plants will be used where practicable where they do not raise safety and maintenance concerns. This follows recommendations in the Maui County Planting Plan for Plant Zone 4. Automated irrigation controllers will be equipped with rain-sensors or similar devices that allow real-time adjustments to the irrigation schedule based on hourly weather information.

Wastewater: The project site currently generates no wastewater flow. An existing 12-inch sewerline runs along Kehalani Mauka Parkway fronting the site. There are also two existing 8-inch sewer stub-outs to the site. One stubout is located at the northeastern corner of the site and a future 8-inch sewerline will run within existing easement "E-12" along the northern boundary of the site and service future mauka developments. The second 8-inch sewer stub-out is located at the southeastern corner of the site and will serve as the primary sewer connection point for the school. Wastewater from the project will be treated at the Kahului Wastewater Treatment Facility.

Impacts and Mitigation – An onsite sewer system will be installed to provide wastewater collection service to all proposed buildings. The collected sewage will be routed via gravity flow to the existing 8-inch sewer line stub-out at the southeastern portion of the site. This line connects to the 12-inch sewer line within Kehalani Mauka Parkway and is eventually treated at the Kahului Wastewater Treatment Facility. Preliminary wastewater contributions are calculated at approximately 9,435 gpd (average daily demand). Refer to *Appendix C of Appendix E* for preliminary wastewater contribution calculations.

Electrical, Telephone, and Cable Television Systems: Electrical power on the Island of Maui is provided by Maui Electric Company (MECo). Telephone and cable services for the project vicinity is provided by Hawaiian Tel (HTel), and Oceanic Time Warner Cable, respectively. Underground electrical, telephone, and cable lines are located along Kehalani Parkway and Kuikahi Drive.

Impacts and Mitigation – Since the project site is currently undeveloped, utilities will need to be brought on site. Electrical, telephone, and cable television transmission lines will be installed underground and connect with existing system on Kehalani Parkway. According to MECo, there is sufficient capacity to service the school. This project will likely use green/climate appropriate architecture incorporating energy efficient technology and design, and appropriate vegetation and landscaping to moderate climatic effects.

Solid Waste: Solid waste generated in Central Maui is disposed of at Central Maui Sanitary Landfill in Pu'unēnē, situated approximately six miles from the project area, or four miles southeast of Kahului airport. Recycling facility is also located in the landfill facility.

Impacts and Mitigation – Solid waste from construction activities are anticipated to have no significant short-term impacts on the existing solid waste collection and disposal system or the environment. There will be no demolition waste, as the property is currently undeveloped. The majority of pre-construction waste will be green waste from site clearing. Green waste will be recycled. The nature of the waste that will be generated by the construction of the proposed

school will be minimized by emphasizing full use of materials and recycling, and proper disposal of all solid waste will be specified.

After build-out, solid waste generated by operation activities on site will be collected and disposed at approved County solid waste disposal facilities. Recycling of solid wastes will be accommodated and implemented to the extent practicable. Composting of green waste will be encouraged and landscape maintenance will recycle as much as possible. Solid waste systems will be designed to comply with the applicable DOH and County requirements.

Drainage: The existing onsite storm water runoff generally flows in an easterly direction, through the project site and into the existing Kehalani Mauka Parkway drainage system. The Kehalani Mauka Parkway drainage system fronting the site consists of 24-inch and 36-inch drainpipes with 2 ft. curb/gutter and catch basins. There are two existing drain stub-outs to the site. The first stub-out consists of a 24-inch drainpipe and is located at the northeast corner of the site. A future drainline will run within easement "E-12" along the northern boundary of the site and service future mauka developments. The second stub-out consists of a 30-inch drainpipe and is located near the southeastern corner of the site. This stub-out will serve as the primary drainline connection point for the school.

There is existing runoff generated mauka of the project site, however, a portion of this runoff is currently intercepted by Waihe'e Ditch which meanders above and within the western boundary of the project. There are plans to construct temporary diversion ditches to the west of the project site when the existing Waihee ditch within the project site is removed. Per the Kehalani Drainage Master Plan, the diversion ditches are designed to intercept a large majority of the runoff before it enters the school site. When the properties mauka of the project site are developed with their own permanent drainage system, the temporary diversion ditches will be removed. An underground 60-inch drainpipe to the west of the site will be constructed to convey existing irrigation water through Waihee ditch. Construction of the temporary diversion ditches and 60-inch drainpipe will be constructed "by others" and are scheduled to be completed before construction of the school starts.

The Kehalani Master Plan drainage design makes provisions to intercept proposed runoff generated by developments within the Kehalani Community. The large 490 ac-ft Waikapu Retention Basin serves as the main retention area for the Kehalani Community and is designed to completely retain the increase in runoff per Maui County Standards. While no outflow is expected, an emergency overflow is provided and connects to Waikapu Stream.

Pre-development onsite runoff is estimated to be approximately 22.04 cubic feet per second (cfs), based on a 50-year/1-hour storm recurrence interval. The existing mauka offsite runoff is estimated to be 4.77 cfs, based on a 50-year/1-hour storm recurrence interval. Refer to *Appendix A of Appendix E* for preliminary hydrology calculations.

Per County of Maui Department of Water Supply (DWS)'s preconsultation letter dated December 30, 2009 the entire project site is within the two-year time of travel wellhead protection area (WHPA) of DWS sources overlying the 'Īao aquifer.

Impacts and Mitigation – The Rational Method is used to determine stormwater runoff quantities for drainage areas less than 100 acres, based on a 50-year/1-hour storm. The proposed onsite drainage system will be designed to manage the 50-year/1-hour storm runoff from onsite and offsite drainage areas. Post-development onsite runoff for a 50-year/1-hour storm is calculated at 53.69 cfs, which is an increase of 31.65 cfs over existing conditions. The increase in runoff has been accounted for in the Kehalani Drainage Master Plan and will be retained in the offsite Waikapu Retention Basin.

The proposed drainage system improvements will include grated drain inlets, catch basins, area drains, manholes, underground drain lines, and water quality treatment systems. Runoff on the school grounds will be collected by drain inlets, catch basins, area drains, or swales and conveyed to the existing drainage system along Kehalani Mauka Parkway which eventually carries the flows to the Waikapu Retention Basin. A small portion of offsite runoff, calculated to be 4.77 cfs from the west is anticipated to enter the project site. The proposed onsite drainage system will be designed to accommodate these flows.

The State of Hawaii Department of Education has also indicated interest in making the project a Leadership in Energy and Environmental Design (LEED) Silver certified project. As such, the project will be designed to meet storm water quality measures. LEED projects are designed to minimize environmental impacts and ensure that development is done in a sustainable manner.

The following Best Management Practices (BPMs) to minimize infiltration and runoff will be implemented during construction:

- Designate a person on site during operating hours who will be responsible for supervising the use, storage, and handling of hazardous materials and take appropriate mitigation actions necessary in the event of a fire or spill
- Hazardous materials left on site when the site is unsupervised will be inaccessible to the public by the use of locked storage sheds, locked fencing, locked fuel tanks on construction vehicles or other techniques
- Construction vehicles and stationary equipment that are that are found to be leaking fuel, hydraulic fluid, and/or other hazardous materials will be removed from the site and from Well Head Protection area. If the vehicle/equipment is to be repaired in place, the leakage will be completely contained
- Storage and dispensing of flammable and combustible liquids from tanks, containers, and tank vehicles into the fuel and fluid reservoirs of construction vehicles or stationary equipment on the construction site will be in accordance with these standards and County Fire Code Chapter 16.04A
- Hazardous materials and other deleterious substances will not be allowed to enter stormwater systems.

3.16 ROADWAYS AND TRAFFIC

Existing Conditions – As part of this project, a traffic impact analysis was completed by AECOM (2009) (*Appendix F*). The school is scheduled to open for the 2012-2013 school year and reach its full occupancy of 550 students in the 2015-2016 school year. For this reason, the year

2015 was used as the forecast year for this study. This traffic analysis evaluated existing traffic operations, trip generation characteristics of the proposed project, analysis of the Year 2015 traffic conditions without the proposed project, identification and analysis of traffic impacts resulting from the proposed project, and recommendations.

Two roadways provide access to the Kehalani Mauka subdivision. The Kehalani Mauka Parkway provides direct access into the subdivision from Honoapiilani Highway and becomes a loop collector roadway within the subdivision. Kuikahi Drive intersects Honoapiilani Highway about a quarter mile south of Kehalani Parkway and goes mauka (westbound) to the Wailuku Heights subdivision. The Kehalani Mauka Parkway intersects Kuikahi Drive about a half mile mauka of Honoapiilani Highway and provides a second access route into the subdivision. The following intersections were selected for analysis in this study:

- Honoapiilani Highway and Kehalani Parkway
- Honoapiilani Highway and Kuikahi Drive
- Honoapiilani Highway and Waiko Drive
- Waiale Drive and Olomea Street
- Waiale Drive and Kuikahi Drive
- Waiale Drive and Waiko Drive
- Kuikahi Drive and Kehalani Parkway
- Kuikahi Drive and Alu Street Street

The locations of these intersections are identified in *Figure 3-8* in relationship to the project site.

Honoapiilani Highway is a two-lane primary arterial highway that connects West Maui to the Central Valley area. It is identified as Route 30 and is under the jurisdiction of the State of Hawai'i Department of Transportation (HDOT). The major intersections on this highway within the study area are signalized and have separate turning lanes. The roadway becomes a major collector road named High Street, and provides access to the government and commercial areas of Wailuku. The posted speed limit is 35 miles per hour (mph) through the study area with a section between Kuikahi Drive and Pilikana Street posted at 45 mph. The Maui Long Range Land Transportation Plan, prepared by Kaku Associates, Inc., (February 1997) deemphasizes the segment of Honoapiilani Highway between the Kuihelani Highway junction and Wailuku. The four lane Kuihelani Highway is identified as the arterial to handle regional traffic between Central and West Maui.

Waiale Drive is a two lane lane collector roadway that parallels Honoapiilani Highway on the east side between Waiko Drive and Kaahumanu Avenue. It serves existing developments along its route and provides another access route to Wailuku Town and Lower Main Street.

Kuikahi Drive is a two lane collector roadway aligned on an east-west orientation and intersects Honoapiilani Highway and Waiale Drive at right angles. West of Honoapiilani Highway it provides access to the Wailuku Heights subdivision and a second route to the Kehalani Mauka subdivision. It serves as a connecting link on the Honoapiilani Highwy-Kuikahi Drive-Waiale Drive route. Kuikahi Drive is being extended eastward from Waiale Drive as part of a new development project.

Kehalani Parkway serves as a collector roadway for the Makai and Mauka sections of the Kehalani Subdivision. The roadway section makai of the highway is named Kehalani Makai Parkway and serves the completed Makai subdivision. It terminates at the north-south aligned Kamole Street. Continued access to Waiale Drive is provided by Olomea Street and Kaupo Street. The mauka roadway section named Kehalani Mauka Parkway would be completed as the Mauka subdivision is completed. It is designed as a loop that will eventually connect with Kuikahi Drive about a half mile mauka of Honoapiilani Highway.

Waiko Drive is a two lane collector roadway on a east-west orientation about one and a quarter mile south of Kuikahi Drive. The mauka roadway serves the older Waikapu residential community while the makai roadway serves industrial uses on its route to the Kuihelani Highway.

Alu Drive is a two lane local street through the Wailuku Heights subdivision and provides a second route into Wailuku town.

The three study intersections on Honoapiilani Highway are controlled by traffic signals. All three intersections have separate turning lanes on the highway approaches with protected/permitted left turn movements. The traffic signal at the Kehalani Parkway intersection operates on an eight-phase timing plan while the other two intersections have simultaneous green phases for the side streets. The remaining study intersections not on the highway are stop controlled. All but one has stop signs on their minor street approaches. The Kuikahi Drive/Waiale Drive intersection is currently an all (three) way stop and is being improved to add traffic signals and a fourth approach for the Maui Lani 100 VMX project.

The Statewide Transportation Improvement Program (STIP) for FY 2008 thru 2013 does not list any roadway improvements in the study areas.

The peak morning direction of traffic flow on Honoapiilani Highway is toward Wailuku at Kehalani Parkway and toward West Maui at Waiko Drive. The afternoon traffic flow is toward Wailuku. There is a strong travel pattern from Honoapiilani Highway to Kuikahi Drive to Waiale Drive in both directions in both peak hours, creating high turning volumes at these intersections. The traffic volumes on Waiale Drive are higher than those on the highway.

Traffic counts were taken at the same study intersections in May 2007 for an earlier study. Comparison of the two sets of traffic counts shows that traffic on Honoapiilani Highway has remained stable or decreased in the two year period for two reasons. Traffic decreases have been noted on other highways in the State during the current economic downturn. Traffic volumes have also decreased on the highway and increased on Waiale Drive as more commuters utilize Waiale Drive to access Wailuku Town. Traffic volumes into and out of the Kehalani Mauka subdivision has increased on Kehalani Parkway and Kuikahi Drive with the growth of the mauka subdivision. Traffic volumes on Waiale Drive between Kuikahi Drive and Waiko Drive have also increased with the completion and occupancy of the Waikapu Gardens subdivision in the period.

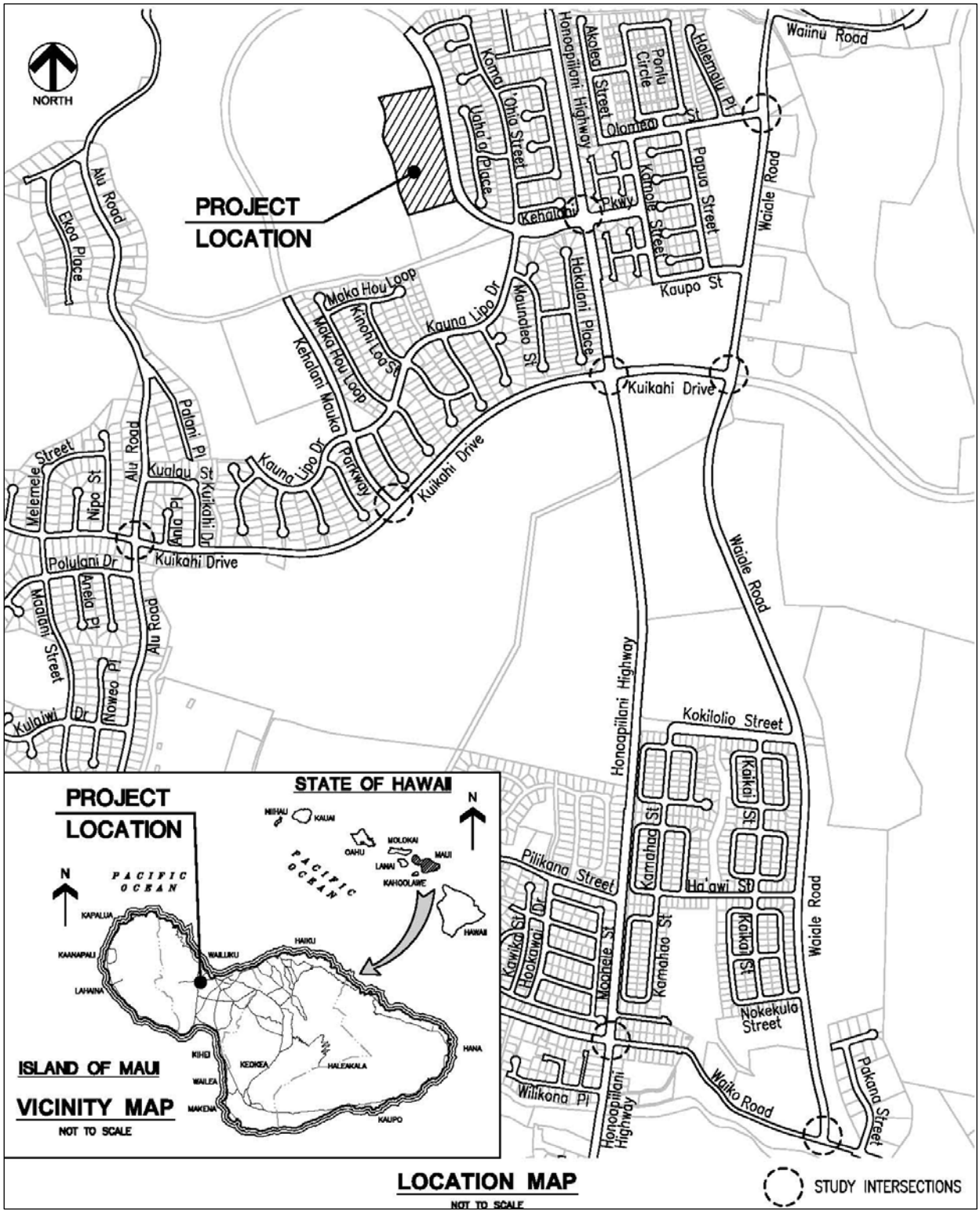

Figure 3-8: Project Site and Traffic Impact Study Intersections
(Source: AECOM 2009)

Impacts and Mitigation – As part of this project, a traffic impact analysis was completed by AECOM (2009). Traffic growth in the study area will come from regional growth in other areas whose traffic passes the project site and other projects planned in the vicinity of the proposed project. Therefore, the traffic which would be generated by these future projects was added to the estimate of regional traffic growth to obtain the ambient traffic forecast. Several projects are planned in the Wailuku/Kahului area including:

- The residential growth in the Kehalani Mauka subdivision
- The 180,000 sf commercial center in the Kehalani Makai subdivision
- A church school and preschool on Waiale Drive
- The Maui Lani 100 VMX/Affordable Housing Development

The forementioned Maui Long Range Land Transportation Plan forecasts an annual island wide growth rate of 1.6% in its 20 year forecast. Compounding this annual growth rate for a six year period (2009-2015) resulted in a 10.0% growth factor.

According to the study, the three signalized intersection's (Honoapiilani Highway and Kehalani Parkway, Honoapiilani Highway and Kuikahi Drive, and Honoapiilani Highway and Waiko Drive) levels of service (LOS) analysis will not change from the ambient to total with project forecasts. The Kuikahi Drive intersection will require mitigation to operate at LOS C during both peak hours - both Kuikahi Drive approaches would require separate left turn, through and right turn lanes. The Kuikahi Drive eastbound approach is forecast to operate at LOS D in both peak hours since its green phase would be shortened by the high volumes of opposing left turns. The two Waiko Drive approaches are currently operating at LOS D in the morning peak hour, and are forecast to remain so in forecast future. During the future afternoon peak the intersection is forecast to operate at LOS D due to the single lane on the Waiko Drive westbound approach. This also causes the northbound approach of Honoapiilani Highway to operate at LOS E.

The Waiale Drive/Olomea Street and Waiale Drive/Kuikahi Drive intersections (to be signalized by 2015) were also analyzed as traffic signal controlled intersections for the future ambient and total with project. With traffic signals, the Waiale Drive/Olomea Street intersection is forecast to operate at LOS C and B in morning and afternoon peak periods, respectively. Maui Lani Partners is currently improving the Waiale Drive/Kuikahi Drive intersection and installing traffic signals for their VMX project. With traffic signals, the intersection is forecast to operate at LOS C in the morning peak and at level D in the afternoon peak. Therefore, the proposed school project would not have an adverse traffic impact at both intersections.

The Levels of Service analysis for the unsignalized intersections, which include Waiale Drive and Waiko Drive, Kuikahi Drive and Kehalani Parkway, and Kuikahi Drive and South Alu Road indicate that the proposed school will not change the ambient and the total with project forecasts levels of service. The Waiale Drive approach to Waiko Drive is forecast to be operating at LOS F and E in the morning and afternoon peak hours, respectively. The Kuikahi Drive/Kehalani Parkway intersection is forecast to operate at LOS C in both peak hours. The two mauka intersections of Kuikahi Drive are forecast to be operating at LOS A and B in both peak hours.

The report concludes that the proposed elementary school project is forecast to add a small number of trips to the roadway system outside the Kehalani Mauka subdivision and would not have an adverse impact on traffic operations. The roadway system is expected to accommodate the increase in ambient traffic and school generated traffic with adequate mitigation.

Several locations were identified as needing mitigation in the future regardless of the proposed project. The report recommended mitigation measures for those locations as follow:

- Honoapiilani Highway and Waiko Drive- provide separate left turn lanes and traffic signal phases on Waiko Drive approaches.
- Honoapiilani Highway and Kuikahi Drive- provide separate left turn lanes and traffic signal phases on Kuikahi Drive approaches.
- Waiale Drive and Olomea Street- install traffic signals to mitigate long delays on Olomea Street.
- Kuikahi Drive and Waiale Drive- roadway improvements and traffic signals being installed for a new development.

3.17 NOISE

Existing Conditions – A traffic noise assessment was completed by Y. Ebisu and Associates (2010). The existing background ambient noise levels within the project area are relatively low and controlled by construction activities in the project area, and distant traffic and local traffic on roadways in the project area. Traffic and background ambient noise measurements were obtained in January 2010 at seven locations *(see Appendix G).* The existing traffic noise levels in the project environs along Honoapiilani Highway and Waiale Road are in the "Significant Exposure, Normally Unacceptable" category and greater than 65 Day-Night Sound Level (DNL) within 50 feet of the roadway's centerline. Along Kehalani Mauka Parkway (removed from Honoapiilani Highway), Olomea Street, and Kuikahi Drive, existing traffic noise levels are in the "Moderate Exposure, Acceptable" category at 50 feet or greater distance from the roadways' centerlines. The existing residual background noise levels at the school site were estimated to be approximately 40 dBA.

Impacts and Mitigation – No significant increases in traffic noise are predicted to occur as a result of project traffic following project build-out by CY 2015. Along Kehalani Mauka Parkway fronting the school site, traffic noise levels are expected to increase from approximately 56 to 59 DNL at 50 foot distance from the centerline in CY 2015. This 3 DNL increase is relatively small due to the present use of this roadway for access to a nearby construction site. Along Honoapiilani Highway, traffic noise levels are expected to increase by 1.1 to 2.5 DNL by CY 2015 as a result of project and non-project traffic. Along Kuikahi Drive and Waiale Road, traffic noise levels are expected to increase by 1.2 to 3.8 DNL by CY 2015 as a result of project and non-project traffic. Project traffic will account for less than 0.4 DNL additional units of noise along Kehalani Mauka Parkway, Honoapiilani Highway, Kuikahi Drive, and Waiale Road in the immediate vicinity of the project. These levels of traffic noise increases resulting from project generated traffic are not considered to be significant. Therefore, traffic noise mitigation measures should not be required.

However, the noise from potential playground activities at the planned elementary school may be noticeable to neighboring residents. Anticipated noise levels at the closest residences to the project can be expected to reach 54-84 dBA. Locating playground equipment and playcourts as far as possible from existing residences is a noise mitigation measure which has been considered. In addition, most of the playground areas are located within the courtyards of classroom buildings, which should provide between 15 to 20 dBA of additional sound attenuation due to noise shielding effects from the buildings.

Short term impact from construction activities of the proposed project, particularly during the excavation and earth moving activities, is expected. Because construction activities are predicted to be audible within the project site and at adjoining properties, the quality of the acoustic environment may be degraded to unacceptable levels during periods of construction. The existing residences across Kehalani Mauka Parkway east of the school site are predicted to experience the highest noise levels during construction activities due to their closer proximity to the construction site. Adverse impacts from construction noise are not expected to be in the "public health and welfare" category due to the temporary nature of the work, and due to the administrative controls available for regulation of construction noise. The use of quiet equipment and properly muffled construction equipment should be required on the job site. Compliance with State Department of Health construction noise regulations are recommended as standard mitigation measures.

4.0
Alternatives to the Proposed Project

4.0 ALTERNATIVES TO THE PROPOSED PROJECT

Alternatives to the proposed action are addressed in this section. The potential benefits and impacts of alternative development schemes are evaluated along with the no-action alternative.

4.1 NO ACTION ALTERNATIVE

"No Action" means Wailuku II Elementary School would not be constructed. Instead, Kehalani Mauka, LLC, would retain ownership of the parcel and may use it for other purposes. The No Action alternative would not provide the additional elementary school capacity that DOE forecasts have identified for Central Maui region, and therefore would not meet the objectives of the proposed action. The "No Action" alternative is addressed in this EA as required by Chapter 343 and HAR §11-200. It also provides a baseline against which to measure the environment and social impacts of the proposed action. The "No Action" alternative would not create site construction impacts such as grading, vegetation disturbance, wildlife disturbance, traffic, noise and air emissions. Beneficial aspects of the project will also not be created, such as construction expenditure, construction employment, and related government revenues.

4.2 ALTERNATIVE SITES

The original school site, approved as part of the 1992 Phase II Project District Land Use Plan, was located to the south of the previous approved Kehalani Parkway alignment. Due to its location adjacent to the Parkway, the anticipated noise, traffic, and pedestrian safety concerns prompted the developer to relocate the school site to the current location. Also, the location of the original site was not centrally located and only connected to the residential community on one side and was not linked by a bike/pedestrian way. Therefore, the original site was not easily accessible from residential neighborhoods by foot/bike, and would not offer visibility and safety as the current site. Locating the school on the previously approved site would not be a desirable option. The environmental impacts at the alternative site in Kehalani Mauka would be greater than the proposed action.

4.3 ACTIONS OF A DIFFERENT NATURE PROVIDING SIMILAR BENEFITS

There are actions of a different nature that could potentially provide educational system benefits in comparison to the new Wailuku II Elementary School. Existing public elementary schools in the region could be temporarily supported with temporary portable facilities and affiliated staff to accommodate anticipated increased enrollment. Vouchers to private schools program would not increase the available classroom spaces. However, private schools would also need to provide suitable excess space to accommodate the projected enrollment demands. Increasing the enrollment at existing public and private schools in the Wailuku region is not a desirable option. For these schools, there will be economic cost of providing for the surge in enrollment. Depending on the location, the potential environmental impacts as a result of the permanent improvements to support the expanded enrollment could be similar or greater than the proposed action.

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5.0
Plans and Policies

5.0 PLANS AND POLICIES

The proposed action for development of a new elementary school may conform or conflict with established land use plans, policies and controls for the affected area. Conformance of the proposed project with State and County plans and public management strategies is also discussed in this section.

5.1 HAWAIʻI STATE PLAN

Chapter 226 Hawaiʻi Revised Statutes is the basis of the Hawaiʻi State Plan, a long-term comprehensive plan that guides development through establishment of goals, objectives, policies, priorities and implementation measures. It is the goal of the Hawaiʻi State Plan, to achieve the following:

- A strong, viable economy, characterized by stability, diversity, and growth, that enables the fulfillment of the needs and expectations of Hawaiʻi's present and future generations.
- A desired physical environment, characterized by beauty, cleanliness, quiet, stable natural systems, and uniqueness, that enhances the mental and physical well-being of the people.
- Physical, social, and economic well-being, for individuals and families in Hawaiʻi, that nourishes a sense of community responsibility, of caring, and of participation in community life (Chapter 226-4, HRS).

The objectives and policies of the State Plan that are relevant to the Wailuku II Elementary School project are discussed below.

5.1.1 Population

The objectives for planning for the State's population include increasing and diversifying employment opportunities to provide a better economic quality of life for Hawai'i's people. It is also the objective of the State to manage population growth, increase socio-economic opportunity for Hawaiʻi's population, increase awareness regarding Hawaiʻi's limited capacity to accommodate population needs, balance growth of immigrant populations and pursue federal assistance. It is the policy of the State to:

- Plan the development and availability of land and water resources in a coordinated manner so as to provide for the desired levels of growth in each geographic area. (Chapter 226-5, HRS).

The Wailuku II Elementary School project is consistent with the State's goals to develop land resources to meet the level of growth in the Central Maui region. Development of the land will provide necessary educational services to population in the region.

5.1.2 Economy: General

The objectives for planning the State's economy include increasing and diversifying employment opportunities to provide a better economic quality of life for Hawai'i's people. It is also the objective of the State to create a diversified economic base that is not overly dependent on a few industries, and includes the development and expansion of industries on the neighbor islands. It is the policy of the State to:

- Increase effective communication between the educational community and the private sector to develop relevant curricula and training programs to meet future employment needs in general, and requirements of new, potential growth industries in particular (Chapter 226-6, HRS).

Wailuku II Elementary School is part of an educational system that will prepare Maui residents for future job markets. Without proper fundamental education, Maui residents would be unable to compete with other areas and the economy would stagnate. The school facilities can also facilitate public-private partnership in job trainings programs and curriculum planning. Development of the school will also provide short-term construction employment and expenditures.

5.1.3 Socio-Cultural Advancement: Education

Planning for the State's socio-cultural advancement with regard to education shall be directed towards provision of a variety of educational opportunities. It is the policy of the State to:

- Support educational programs and activities that enhance personal development, physical fitness, recreation, and cultural pursuits of all groups.
- Ensure the provision of adequate and accessible educational services and facilities that are designed to meet individual and community needs.
- Promote programs and activities that facilitate the acquisition of basic skills, such as reading, writing, computing, listening, speaking, and reasoning (Chapter 226-6, HRS).

The new elementary school project will directly support the educational policies of the State through provision of educational and recreational facilities.

5.1.4 Physical Environment: Land Based, Shoreline & Marine Resources

It is the objective of the State to make prudent use of Hawai'i's land-based, shoreline, and marine resources as well as to establish effective measures to protect Hawai'i's unique and fragile environmental resources. It is the policy of the State to:

- Exercise an overall conservation ethic in the use of Hawai'i's natural resources.
- Take into account the physical attributes of areas when planning and designing activities and facilities.
- Pursue compatible relationships among activities, facilities, and natural resources (Chapter 226-11, HRS).

The project will be designed to include environmental preservation and energy conservation measures in accordance with the USGBC's LEED for Schools certification requirements.

5.2 HAWAI'I STATE FUNCTIONAL PLANS

The Hawai'i State Plan is further defined by twelve State Functional Plans. While the Hawai'i State Plan establishes long-term objectives for Hawai'i, the Functional Plans further define the State Plan by identifying major statewide concerns, defining current strategies for the functional area, and providing strategies for departmental policies, programs, and priorities. The twelve areas addressed by the plans are: agriculture, conservation lands, employment, energy, health, higher education, historic preservation, housing, recreation, tourism, transportation and water resources development.

The State Education Function Plan is guided by the Board of Education directives and the programs of the State Department of Education. The following categories are addressed in the plan: academic excellence, basic skills, education workforce, facilities and services, alternatives for funding and delivery, autonomy and flexibility, increased use of technology, personal development, students with special needs, early childhood education, Hawai'i's cultural heritage, research programs and communication activities.

Objective A(4): Services and Facilities.
Ensure the provision of adequate and accessible educational services and facilities that are designed to meet individual and community needs.

The proposed project will directly meet this objective through provision of accessible educational facilities and services to Wailuku students as well as providing a gathering place for the community and a venue for community events.

5.3 HAWAI'I ADMINISTRATIVE RULES, CHAPTER 15-15, LAND USE COMMISSION RULES

Hawai'i Administrative Rules, Title 15, Subtitle 3 State Land Use Commission, Chapter 15 Land Use Commission Rules provides for the establishment of State Land Use Districts. The project site is currently designated Urban. Section 15-15-18 sets forth the following standards for determining "U" or Urban district boundaries (paraphrased).

- Bounded by lands characterized by "city-like" concentrations of people, structures, services and infrastructure.
- Availability to basic services such as schools and parks.
- Satisfactory location free from flood zones and other adverse environmental effects.
- Contiguous with existing urban areas.
- Land in appropriate locations for new urban concentrations, such as designated urban growth areas on the County General Plan.
- Land that will not contribute to scattered urbanization patterns.

The project site meets the standards of HAR Section 15-15-18 as it is adjacent to existing "city-like" development, services and infrastructure. The site is designated for development as a Project District in the County's Wailuku-Kahului Community plan and designated for a future elementary school in the County's Draft Maui Island Plan Public Facility/Infrastructure Improvements Map (February 25, 2009). Project lands will not contribute to scattered development and are not located within a flood zone.

5.4 COASTAL ZONE MANAGEMENT PROGRAM

In 1972, the Federal government enacted the Coastal Zone Management (CZM) Act to protect and preserve the natural resources, land and water uses of the coastal zone. This process is achieved by providing assistance to coastal states, to develop and manage Coastal Management Programs. Implementing authority for the Federal CZM Program (Public Law 104-150, as amended in 1996) has been delegated to the State of Hawai'i under Chapter 205A, HRS.

The proposed project area is not designated, nor located within a Special Management Area as delineated by the County of Maui. Therefore, the project is not subject to Chapter 205A, HRS.

5.5 COUNTY OF MAUI GENERAL PLAN

The General Plan for the County of Maui was last adopted in 1980, and has been subsequently updated, most recently in 1990. The purpose of the General Plan is to recognize and state the major problems and opportunities concerning the needs and the development of the County and the social, economic, and environmental effects of such development. The Plan seeks to guide the sequence, patterns and characteristics of Maui County development.

The Maui County General Plan is guided by five major themes: 1) Protect Maui County's agricultural land and rural identity; 2)Prepare a directed and managed growth plan; 3) Protect Maui County's shoreline and limit visitor industry growth; 4) Maintain a viable economy that offers diverse employment opportunities for residents; and 5) Provide for needed resident housing. The proposed project is supportive of Theme No. 2: Prepare a Directed and Managed Growth Plan. This theme supports quality of life for residents through balancing growth demands with provision of human services and physical infrastructure.

The project is relevant to the following applicable policies and objectives defined in the Maui County General Plan:

I. A. Population

Objective 1
To plan the growth of resident and visitor population through a directed and managed growth plan so as to avoid social, economic and environmental disruptions.

Policy 1b
Balance population growth by achieving concurrency between the resident employee work force, the job inventory created by new industries, affordable resident/employee housing,

constraints on the environment and its natural resources, public and private infrastructure, and essential social services such as schools, hospitals, etc.

II. B. Visitor Industry

Policy 4a
Cooperate with the State Department of Education and the University of Hawaii to provide educational and training facilities to residents employed in the visitor industry.

IV. D. Energy

Objective 1
To make Maui County more self-sufficient in its need for non-renewable energy and more efficient in its use of energy.

Policy 1e
Seek to incorporate energy-saving building design concepts and devices in government buildings.

V. B. Recreation and Open Space

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

Policy 1d
Develop facilities that will meet the different recreational needs of the various communities.

Objective 2
To provide a wide range of recreational, cultural and traditional opportunities for all our people.

Policy 2h
Support Federal, State and County and community initiatives to preserve open space, expand recreational facilities and provide after school programs for youth.

The proposed project demonstrates overall support to the applicable plans and policies of the Maui General Plan. It will contribute to managed growth by providing essential public services to a growing community. The multipurpose facility at the school will be available for community uses and a place that could accommodate educational programs that address the needs of the greater community. Emphasis on sustainable building practices and energy consumption will be given through conformance to the LEED Silver certification standards. The project will also provide numerous recreational facilities for elementary school students.

5.6 COUNTY OF MAUI GENERAL PLAN 2030 (DRAFT)

The County of Maui Department of Planning has been in the process of updating its General Plan. The General Plan 2030 initiative has put forth that the Countywide Policy Plan, Maui

Island Plan and Community Plans will comprise the future General Plan which will guide future growth and policy creation in the County. Currently (December 2009), draft versions of the Countywide Policy Plan and the Maui Island Plan are available for review. The proposed project will be evaluated further with respect to these Draft Countywide Policy Plan and Draft Maui Island Plan in the FEA. Evaluation of the project with respect to the adopted Wailuku-Kahului Community Plan is provided below.

5.7 WAILUKU-KAHULUI COMMUNITY PLAN

The Wailuku-Kahului Community Plan (March 6, 1998) is one of nine community plans for Maui County. The Plan advances planning goals, objectives, policies and implementation considerations to guide decision-making within the Wailuku-Kahului region through the year 2010. The Plan is based on three key planning themes, 1) Provision of needed public facilities and infrastructure, 2) Preservation and enhancement of significant natural resources, and 3) Enhancement of neighborhoods. The Plan identifies the need for an elementary school as a regional problem. The proposed project supports the following applicable goals, objectives, policies, and implementing actions set forth in the Wailuku-Kahului Community Plan:

Land Use

- Establish a site for future higher educational institution north of the research and technology park project district.

Housing and Urban Design

- Provide landscaped buffer areas between Pi'ilani Highway and adjacent communities to mitigate highway noise and to reduce the visual impact of development. Both Pi'ilani Highway and South Wailuku Road shall be landscaped to achieve a parkway character.

Physical and Social Infrastructure: Education

- Require the delivery of quality educational facilities at the time such facilities are needed. Emphasize advanced planning so that school facilities such as classrooms, playgrounds, libraries, cafeterias, and other appurtenant structures are delivered in a timely manner so as to eliminate the use of portable facilities.
- Build a elementary school to serve the Wailuku region when required to accommodate growth.
- Plan and locate a site for an elementary school to serve the Wailuku region.

The project area is located in the Wailuku-Kahului Community Plan region, which is one of nine Community Plan region established in the County of Maui. Community Plans provide specific recommendations to address General Plan goals, objectives and policies. Both the General Plan and Community Plans guide government action and decision-making. The updated Wailuku-Kahului Community Plan was adopted by the County Council through Ordinance 3061 in May 2002.

The Wailuku-Kahului Community Plan designates the project area within Project District 3 area. According to the Plan, the project district shall provide units of all types, including affordable housing, an easily accessible neighborhood commercial center of at least 20 acres, a continuous system of parks and open space areas which would include pedestrian ways and

green belts with buffer zones along the highway, and public use areas to accommodate a school, park, and any other public facilities that may be required. The 2002 Community Plan recommended a spatial allocation of 10 acres for an elementary school.

The Wailuku-Kahului Community Plan also identifies major problems and opportunities for the region, which provide the underlying basis for the Plan's goals, objectives and policies. The following issues are applicable to the proposed science building project.

1.a. AIRPORTS AND HARBOR FACILITIES AND OTHER PUBLIC FACILITIES.

"…Overcrowding in school facilities is a problem. Sites are needed for new or expanded school facilities."

Although it is unclear whether the statement refers to primary, secondary or post-secondary education, the proposed project will provide a much-needed facility to serve Maui's residents on a site already identified for educational use.

2.a. GEOGRAPHIC LOCATION AND INVENTORY OF DEVELOPED AND DEVELOPABLE LANDS.

"…These attributes create opportunities for commercial and industrial development; public mass transit; residential housing; regional recreational facilities; medical facilities; agricultural diversification; and higher education facilities."

The proposed project will provide a much-needed facility to serve Maui's residents on a site identified for educational use.

The following Wailuku-Kahului Community Plan goals, objectives and policies are applicable to the proposed action:

CULTURAL RESOURCES

Goal: Identification, protection, preservation, enhancement, and where appropriate, use ofcultural practices and sites, historic sites and structures, and cultural landscapes and view planes that:

1. Provide a sense of history and define a sense of place for the Wailuku-Kahului region; and

2. Preserve and protect native Hawaiian rights and practices customarily and traditionally exercised for subsistence, cultural and religious purposes in accordance with Article XII, Section 7, of the Hawai'i State Constitution, and the Hawai'i Supreme Court's PASH opinion, 79 HAW. 425 (1995).

Objectives and Policies (applicable to project):

3. Protect and preserve historic, cultural and archaeological sites and resources through on-going programs to identify and register important sites, and encourage their restoration. This shall include structures and elements that are a significant and functional part of Hawai'i's

ethnic and cultural heritage.

5. Require development projects to identify all cultural resources located within the project area as part of initial project studies. Further, require that all proposed activity include recommendations to mitigate potential adverse impacts on cultural resources.

An archaeological inventory survey was conducted for the proposed project and found no archaeological, cultural or historic properties (See discussion in *Section 3.12*, with full report included in Appendix C). As discussed in *Section 3.12*, the project will not adversely affect traditional Hawaiian rights related to gathering, access, or other customary activities within the project area or its vicinity, or any cultural practices or beliefs.

EDUCATION

Objectives and Policies:

1. Allocate sufficient land areas as part of residential project district specifications to meet future school site needs.

2. Encourage the Department of Education to provide recreation facilities for schools, thus expanding opportunities for public use of presently shared facilities.

3. Coordinate the development of school facilities with the State Department of Education in conjunction with planned residential projects.

This project will accommodate educational facility needs from current and on-going residential development in Wailuku as identified by DOE. The project will also provide recreational facilities for public use.

URBAN DESIGN

Goal: An attractive and functionally integrated urban environment that enhances neighborhood character, promotes quality design, defines a unified landscape planting and beautification theme along major public roads and highways, watercourses and at major public facilities, and recognizes the historic importance and traditions of the region.

Objectives and Policies for the Wailuku-Kahului Region in General (applicable to project):

11. Use native Hawaiian plants for landscape planting in public projects to the extent practicable.

16. Encourage the review of architectural and landscape architectural plans for major government projects by the County's Urban Design Review Board.

The project's landscape plan includes numerous native plant species. The project will be reviewed by the County's Urban Design Review Board.

6.0
Findings Supporting Anticipated Determination

6.0 FINDINGS SUPPORTING ANTICIPATED DETERMINATION

6.1 ANTICIPATED DETERMINATION

After reviewing the significance criteria outlined in Chapter 343, Hawai'i Revised Statutes (HRS), and Section 11-200-12, State Administrative Rules, Contents of Environmental Assessment, it is anticipated that the proposed action will not result in significant adverse effects on the natural or human environment. A Finding of No Significant Impact (FONSI) is anticipated for this project.

6.2 REASONS SUPPORTING THE ANTICIPATED DETERMINATION

The potential impacts of the development and future use after construction of the proposed Wailuku II Elementary School have been fully examined and discussed in this Draft Environmental Assessment. As stated earlier, there are no significant environmental impacts expected to result from the proposed action. This determination is based on the following assessments:

(1) Involve an irrevocable loss or destruction of any natural or cultural resources.

The proposed project does not involve known destruction of existing natural or cultural resources. The subject lands are undeveloped agricultural lands with no significant natural resources. As previously noted, no significant archaeological or historical sites were found to exist within the project site. During the course of construction, if there are any cultural or archaeological remnants unearthed, the Historic Preservation Division (SHPD) of the State Department of Land and Natural Resources will immediately be notified, and their treatment will be conducted in strict compliance with SHPD requirements.

(2) Curtail the range of beneficial uses of the environment.

The proposed action does not curtain the range of beneficial uses of this location on Maui. The project will provide additional educational facilities to meet existing and future requirements of the Central Maui area. The construction of the new Wailuku II Elementary School will provide a beneficial use, to the citizens of the state, and the residents of Maui in particular, by increasing access to public educational programs and providing facilities for community use (cafeteria and shared parking facility with the community center). Construction and operation of the new facilities will be performed in accordance with Federal, State and County regulations, thereby minimizing potential impacts to the air and water quality and ambient noise levels. The project is also consistent with the planned land use and the draft 2030 Wailuku-Kahului General Plan's planned infrastructure and facility improvement for the area.

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

The proposed project will not conflict 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. Construction-related impacts of noise, dust, and emissions will be mitigated by the contractor's compliance with the State Department of Health Administrative Rules.

(4) Substantially affects the economic or social welfare of the community or State.

The proposed action will have positive direct and indirect economic benefits to the State and County through the flow of construction spending and employment incomes through the economy. The project would also improve public educational services to Maui residents. As discussed in Section 3.13, the proposed action is not expected to adversely affect traditional Hawaiian rights related to gathering, access, or other customary activities within the project area or its vicinity or any cultural practices or beliefs. There are no Native Hawaiian (or other ethnic group's) cultural practices customarily and traditionally exercised for subsistence, cultural and religious purposes that are known to occur on the project area. The scale of the new building will not affect regional wind patterns or important mauka-makai views, including those from the ocean to the West Maui Mountains. Design and construction work will generate indirect and induced employment opportunities and multiplier effects, but not at a level that would generate any significant expansion. The project will create short-term and long-term employment that will be beneficial to the local economy.

(5) Substantially affects public health.

The proposed action will not substantially affect public health. Typical short-term construction-related impacts (e.g., noise and air quality) are anticipated, but will be temporary and will comply with State and County regulations. Standard construction best management practices will be used to minimize the temporary impacts. Though none are known, if project area soils are found to contain hazardous or regulated materials, the necessary abatement will be conducted prior to construction in accordance with applicable Federal and State regulations to minimize potential impacts to human health and the environment. Also, the proposed action will not generate sufficient solid waste or other emissions to have a significant adverse effect on public health.

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

The proposed action is part of a planned community, approved in 2002, and will not produce substantial secondary impacts. It is not designed to directly foster population growth or to promote economic development. The project will support existing and future development within the Central Maui region.

(7) Involves a substantial degradation of environmental quality.

The proposed action will not substantially degrade environmental quality. Long-term impacts to air and water quality, noise levels, and natural resources would be minimal. The use of standard construction and erosion control best management practices will minimize the anticipated construction-related short-term impacts.

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

Development of the proposed school is not a commitment to a larger action, and will not promote substantial population growth. Instead, it is intended to partially fulfill anticipated demands for elementary education in an area already approved for growth.

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

There are no endangered plants or animal species nor is their habitat for such species located within the project site.

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

Short-term effects on air, water quality or ambient noise levels during construction will be mitigated by compliance with County of Hawai'i and State Department of Health rules which regulate construction-related activities.

After construction, the potential impacts to air and water quality are anticipated to be minimal. No significant increases in traffic noise are predicted to occur as a result of project traffic following project build-out.

At the Wailuku II Elementary School, DOE has committed itself to utilizing "green architecture" and sustainable design wherever possible. In the design of the school facilities, water efficient appliances and environmentally conscious design efforts will be utilized as much as feasible to reduce minimal impacts on air or water quality.

No detrimental affects to air or water quality or ambient noise levels are anticipated to result with the development of the proposed action.

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

The project site is not 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.

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

The project site is currently undeveloped and the improvements will enhance the appearance of the area. The architecture will be designed to reflect the architectural character of the historic Wailuku town. Landscaping will also be used to improve the visual character of the constructed site and area.

(13) Require substantial energy consumption.

Construction of the project will not require substantial energy consumption relative to other similar projects. After the project is completed, as much as possible energy will be conserved by using modern energy efficient appliances and fixtures and green design concepts.

6.3 SUMMARY

Based on the above findings, further consideration of the project's impacts through the preparation of an Environmental Impact Statement is not warranted. A Finding of No Significant Impact (FONSI) is anticipated for this project. Wailuku II Elementary will provide great public benefits while resulting in minimal impacts to the surrounding environment.

7.0
List of References

7.0 LIST OF REFERENCES

7.1 REFERENCES

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8.0
Agencies, Organizations, and Individuals Receiving Copies of the Draft EA

8.0 LIST OF AGENCIES, ORGANIZATIONS AND INDIVIDUALS CONSULTED AND/OR INFORMED IN THE EA PROCESS

Respondents and Distribution	Pre-Consultation	Pre-Consultation Comments Received	Receiving Draft EA	Draft EA Comments Received	Receiving Final EA/ FONSI
Federal Agencies					
U.S. Fish and Wildlife	x		x		
U.S. Army Corps of Engineers	x				
State of Hawai'i Agencies					
Department of Accounting and General Services	x	x	x		
Department of Accounting and General Services, Maui District Office	x		x		
Department of Business, Economic Development & Tourism (DBEDT), Office of Planning	x		x		
DBEDT	x		x		
Department of Transportation	x	x	x		
Department of Agriculture	x		x		
Department of Health	x		x		
Department of Health, Clean Water Branch	x	x	x		
Department of Health, Environmental Health	x	x	x		
Department of Land and Natural Resources (DLNR)	x	x	x		
DLNR, Historic Preservation Division	x		x		
Office of Environmental Quality Control	x		x		
Office of Hawaiian Affairs	x		x		
Department of Hawaiian Homelands	x		x		
Department of Defense	x	x	x		
Hawaii State Civil Defense	x				
Department of Human Services	x		x		
Department of Labor and Industrial Relations	x	x	x		
University of Hawai'i, Environmental Center	x		x		
Hawaii Housing Finance & Development Corporation	x		x		

Respondents and Distribution	Pre-Consultation	Pre-Consultation Comments Received	Receiving Draft EA	Draft EA Comments Received	Receiving Final EA/ FONSI
Department of Education, Facilities Development Branch	x		x		
Department of Education, Maui District	x		x		
Department of Education, School Complex Superintendent's Office (Baldwin-Kekaulike-Maui)	x		x		
Wailuku Elementary School	x				
County of Maui					
Department of Water Supply	x	x	x		
Department of Public Works	x	x	x		
Department of Planning and Permitting	x		x		
Department of Housing & Human Concerns	x	x	x		
Department of Parks and Recreation	x		x		
Department of Environmental Management			x		
Department of Transportation			x		
Fire Department	x		x		
Police Department	x	x	x		
Office of the Mayor	x		x		
Maui Civil Defense Agency	x				
Office of Economic Development	x				
Elected Officials					
State Senator Shan S. Tsutsui.	x		x		
State House Representative Joseph Souki	x		x		
State House Representative Gilbert Keith-Agaran	x		x		
Council Member Michael Victorino	x		x		
Libraries					
Wailuku Public Library	x		x		
Kahului Public Library	x		x		
Hawai'i State Library	x		x		
Citizen Groups, Individuals & Consulted Parties					
Kehalani Community Association	x		x		

Respondents and Distribution	Pre-Consultation	Pre-Consultation Comments Received	Receiving Draft EA	Draft EA Comments Received	Receiving Final EA/ FONSI
Kehalani Mauka, LLC	x		x		
Wailuku Main Street Association	x		x		
Kahu Charles Kauluwehi Maxwell Sr.	x				
Leslie James Aupuni Vida 111	x				
Ms. Kathy Juan	x				
Ms. Yaeko Mabe Sasaki	x				
Richard Komo	x				
Felipe Barroga	x				
Susan Asato	x				
Leslie James Vida Jr.	x				

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9.0
Project District Phase II Application and Amendment

COUNTY OF MAUI
DEPARTMENT OF PLANNING
250 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793
TELEPHONE: (808) 270-7735 FAX: (808) 270-7634

APPLICATION TYPE: **PROJECT DISTRICT DEVELOPMENT APPROVAL**

DATE: January 25, 2010 **PROJECT VALUATION:** $37.5 Million

PROJECT NAME: Wailuku II Elementary School

PROPOSED DEVELOPMENT: Construction of a new 550-student elementary school requiring Project District Phase II approval and amendment

TAX MAP KEY NO.: (2)3-5-001:67, (2)3-5-001:77, (2)3-5-001:78 (Pors.) **CPR/HPR NO.:** n/a **LOT SIZE:** Approx. 14 Acres

PROPERTY ADDRESS: Kehalani Project District, west of Kehalani Mauka Parkway

OWNER: Kehalani Mauka, LLC **PHONE:(B)** 537-5220 **(H)** n/a

ADDRESS: 1100 Alakea Street, 27th Floor

CITY: Honolulu **STATE:** HI **ZIP CODE:** 96813

OWNER SIGNATURE: See Letter of Authorization

APPLICANT: State Department of Education, Facilities Development Branch

ADDRESS: P. O. Box 2360

CITY: Honolulu **STATE:** HI **ZIP CODE:** 96804

PHONE (B): 586-0408 **(H):** n/a **FAX:** 586-3234

APPLICANT SIGNATURE: Don Kasher

AGENT NAME: Jeffrey H. Overton - Group 70 International, Inc.

ADDRESS: 925 Bethel Street, 5th Floor

CITY: Honolulu **STATE:** HI **ZIP CODE:** 96813

PHONE (B): 523-5866 **(H):** n/a **FAX:** 523-5874

EXISTING USE OF PROPERTY: Vacant Land

CURRENT STATE LAND USE DISTRICT BOUNDARY DESIGNATION: Urban

COMMUNITY PLAN DESIGNATION: Project District 3 **ZONING DESIGNATION:** PD-3

OTHER SPECIAL DESIGNATIONS: none

9.0 PROJECT DISTRICT PHASE II APPLICATION AND AMENDMENT

This section has been prepared in accordance with the requirements of the Maui County Code Chapter 19.45 Project District Processing Regulations.

9.1 EVIDENCE OF LAND OWNERSHIP

State Department of Education, Facilities Development Branch, is the applicant of the Project District Phase II approval for Wailuku II Elementary School. As shown in property tax records in *Appendix K,* Kehalani Mauka, LLC is the current legal owner of the subject land to be developed - TMK(2) 3-5-001:67, 77, and 78 (pors.) However, the land is currently in the process of purchase by the State Department of Education. A notarized letter of authorization from legal owner (Kehalani Mauka, LLC) is provided in *Appendix I,* which provides authorization for the applicant to use the parcel and to apply for the Project District Phase II approval.

9.2 LEGAL DESCRIPTION OF THE LAND BEING DEVELOPED

The Wailuku II Elementary School project site consists of approximately 14 acres of land located in the Kehalani Mauka Development. The project site encompasses Lot 3-A-2 and portion of Lot P-1 and Lot R-6 which located on TMK(2) 3-5-001:67, 77, and 78 (pors.) of the Kehalani Mauka subdivision.

Legal description of Lot 3-A-2, Lot P-1, and Lot R-6 is shown in *Figure 9-1.* Boundary description of portion of Lot-P-1 that is currently in subdivision approval process is shown in *Figure 9-2.*

9.3 LIST OF LANDOWNERS AND RECORED LESSEES OF REAL PROPERTY WITHIN 500 FEET OF THE SUBJECT PARCEL

A list of landowners and recorded lessees of real property within 500 feet of the subject parcel has been obtained from the most current listing as provided via the Maui County Department of Finance, Real Property Division website. The list and a map (drawn to scale) clearly define the 500-feet notification boundary and the parcels affected (refer to *Appendix J).*

9.4 PRELIMINARY SITE PLAN ANALYSIS

9.4.1 Drainage

Storm water drainage will be managed at the project site. Development of the site will manage storm water to avoid an increase in discharge rate to adjoining properties. The existing onsite storm water runoff generally flows in an easterly direction, through the project site and into the

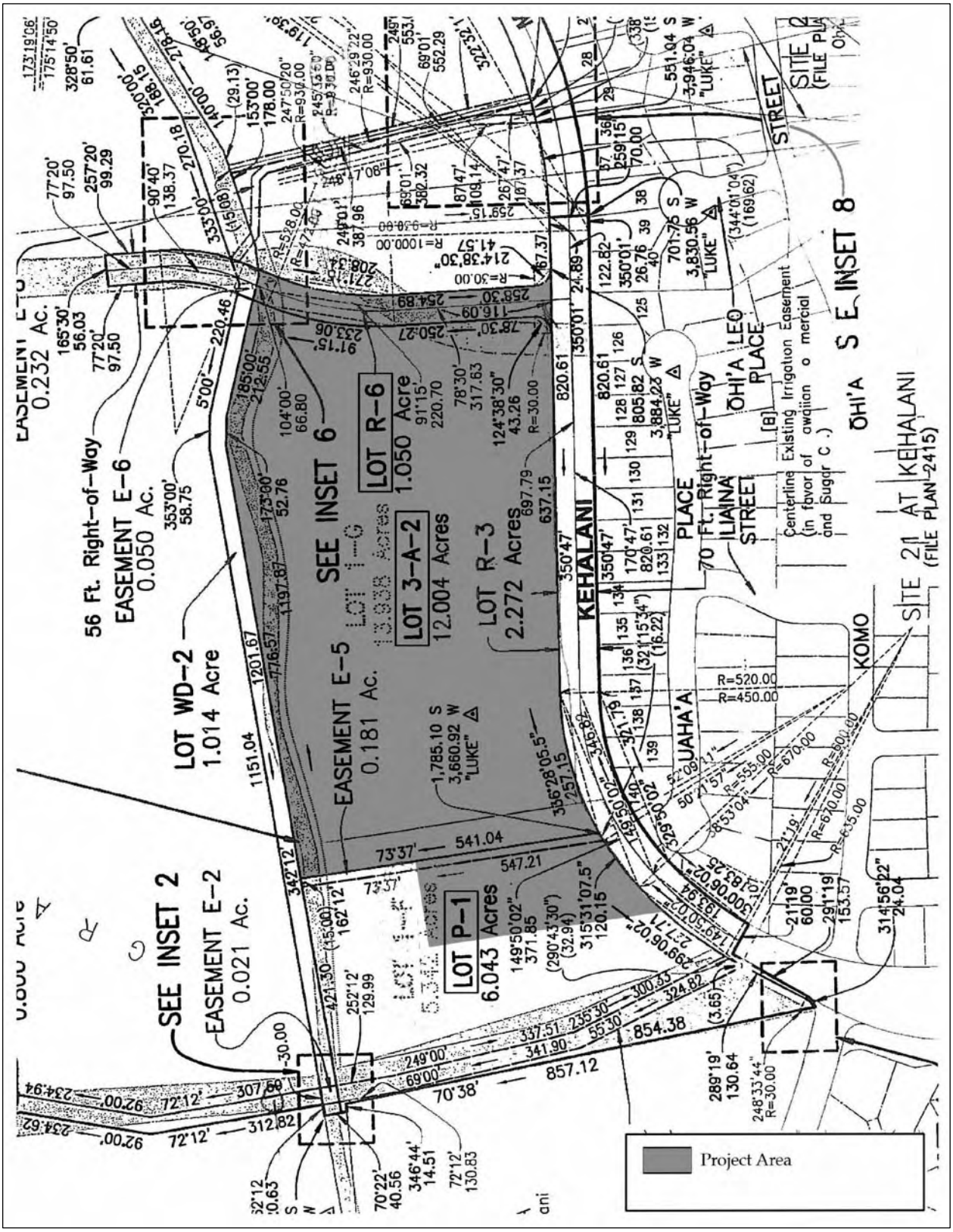

Figure 9-1: Legal Lot Descriptions

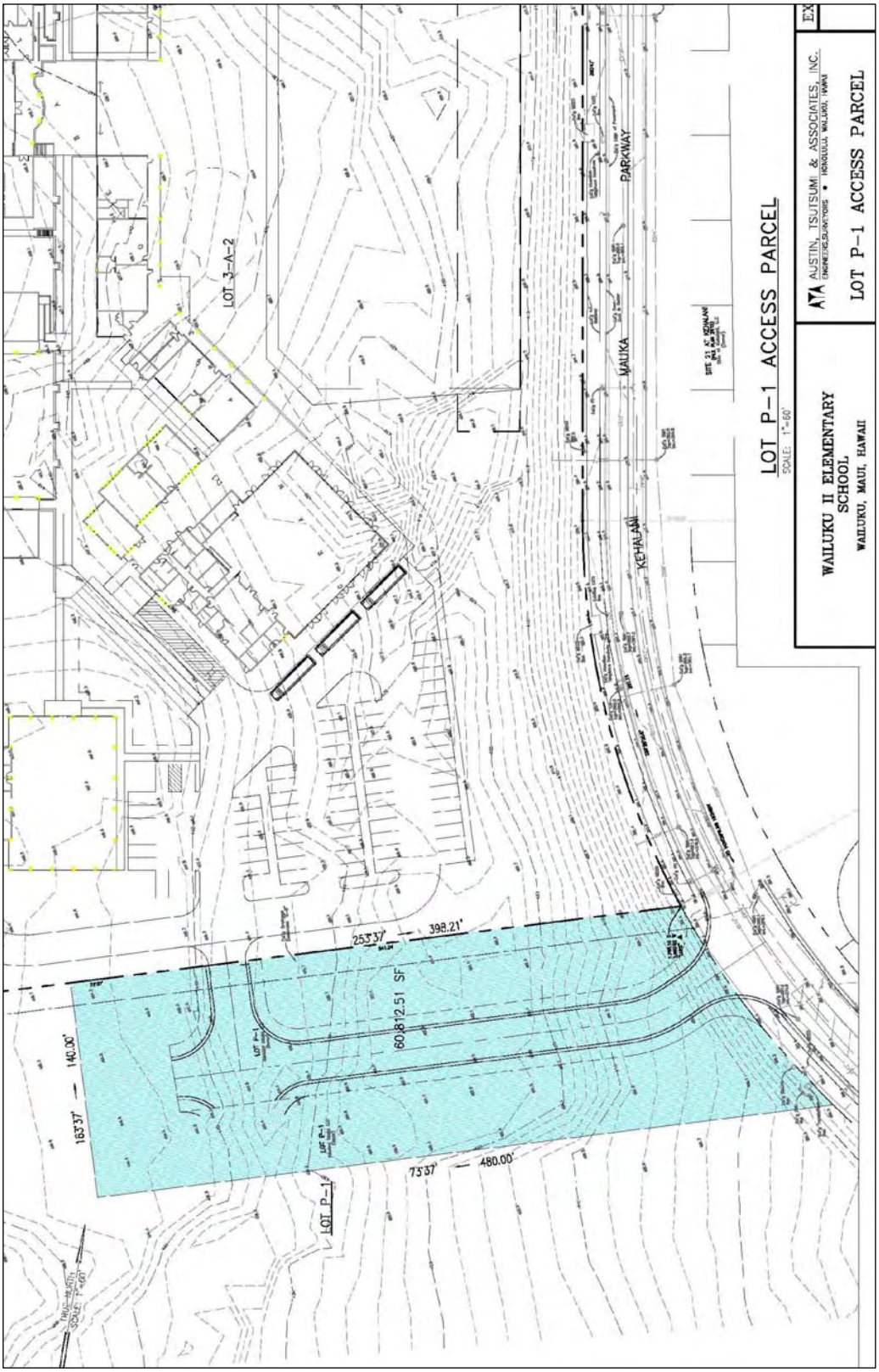

Figure 9-2: Boundary Description of Portion of Lot P-1 (Shared Driveway Parcel)

existing Kehalani Mauka Parkway drainage system. The Kehalani Mauka Parkway drainage system fronting the site consists of 24-inch and 36-inch drainpipes with 2 ft. curb/gutter and catch basins. There are two existing drain stub-outs to the site. The first stub-out consists of a 24-inch drainpipe and is located at the northeast corner of the site. A future drainline will run within easement "E-12" along the northern boundary of the site and service future mauka developments. The second stub-out consists of a 30-inch drainpipe and is located near the southeastern corner of the site. This stub-out will serve as the primary drainline connection point for the school.

There is existing runoff generated mauka of the project site, however, a portion of this runoff is currently intercepted by Waihe'e Ditch which meanders above and within the western boundary of the project. There are plans to construct temporary diversion ditches to the west of the project site when the existing Waihee ditch within the project site is removed. Per the Kehalani Drainage Master Plan, the diversion ditches are designed to intercept a large majority of the runoff before it enters the school site. When the properties mauka of the project site are developed with their own permanent drainage system, the temporary diversion ditches will be removed. An underground 60-inch drainpipe to the west of the site will be constructed to convey existing irrigation water through Waihee ditch. Construction of the temporary diversion ditches and 60-inch drainpipe will be constructed "by others" and are scheduled to be completed before construction of the school starts.

The Kehalani Master Plan drainage design makes provisions to intercept proposed runoff generated by developments within the Kehalani Community. The large 490 ac-ft Waikapu Retention Basin serves as the main retention area for the Kehalani Community and is designed to completely retain the increase in runoff per Maui County Standards. While no outflow is expected, an emergency overflow is provided and connects to Waikapu Stream.

The proposed onsite drainage system will be designed to manage the 50-year/1-hour storm runoff from onsite and offsite drainage areas. Post-development onsite runoff for a 50-year/1-hour storm is calculated at 53.69 cfs, which is an increase of 31.65 cfs over existing conditions. The increase in runoff has been accounted for in the Kehalani Drainage Master Plan and will be retained in the offsite Waikapu Retention Basin.

The proposed drainage system improvements will include grated drain inlets, catch basins, area drains, manholes, underground drain lines, and water quality treatment systems. Runoff on the school grounds will be collected by drain inlets, catch basins, area drains, or swales and conveyed to the existing drainage system along Kehalani Mauka Parkway which eventually carries the flows to the Waikapu Retention Basin.

A small portion of offsite runoff is anticipated to enter the project site, calculated to be 4.77 cfs from the west. The proposed onsite drainage system will be designed to accommodate these flows. Refer to *Figure 9-3* for preliminary drainage improvements.

9.4.2 Street and Parking

There are two roadways connecting the site to the Kehalani Mauka Parkway, one along the northern boundary and one along the southern boundary. The two accesses will provide

adequate fire access circulation and provide access to buses, faculty, and parents dropping off children. Maximum slope for roadways within the project will be held at 12%. The roadway accesses will be designed to provide the maximum sight distance in accordance with county and American Association of State Highway and Transportation Officials (AASHTO) standards.

Parking is organized to provide segregate the types of vehicular access to the campus. General parking areas are located on the north and south ends of the site. Connecting the parking areas is an access drive along the rear of the site that also contains staff parking. The total on-site parking capacity is 157 vehicles. The north parking area, with its location adjacent to Building A or the Administrative Building, provides drop-off/pick-up for parents and serves as visitors parking. The traffic circulation utilizes the former access road (refer to *Section 2.5*) at the connection with the northern part of Kehalani Mauka Parkway.

The south parking area is accessed from the common driveway of the school and the future community center connecting the southern part of Kehalani Mauka Parkway. It will provide drop-off/pick-up areas for buses. The south parking provides the largest number of vehicular parking stalls (84 vehicles) in order to service events at Building C or the cafeteria.

Refer to *Figure 9-4* for parking and roadways alignment.

9.4.3 Utilities

Water System: Currently there are no water source in place to specifically serve the mauka areas of the Wailuku-Kahului Project District 3. Proposed new wells in this vicinity are being planned and may serve as potential water source for the school project and for the future mauka development. Onsite water system improvements will include a domestic water system, fire line system, and an irrigation system. The domestic system consists of a water meter, reduced pressure backflow preventer, and copper and ductile iron waterlines. The fire line system consists of a 10-inch double detector check assembly, fire hydrants and 12-inch ductile iron fire lines. Fire department connections will also be installed to supplement the project's fire system as most buildings within the project will have a fire sprinkler system. The proposed domestic water, fire, and irrigation meter lateral will connect to the existing 12-inch distribution waterline within Kehalani Mauka Parkway at the northeast corner of the site

Preliminary domestic water contributions are calculated at approximately 31,958 gallons per day (gpd), which is the average daily demand for domestic use and irrigation. Fire hydrants are required to be installed at a maximum of 250 ft. intervals within the site. Refer to *Figure 9-5* for preliminary water system improvements.

Required fire flow within the project site is 2,000 gallons per minute (gpm) for a duration of two hours and fire hydrants are required to be installed at a maximum of 250 ft. intervals.

Sewer: An onsite sewer system will be installed to provide wastewater collection service to all proposed buildings. The collected sewage will be routed via gravity flow to the existing 8-inch sewer line stub-out at the southeastern portion of the site. This line connects to the 12-inch sewer line within Kehalani Mauka Parkway and is eventually treated at the Kahului Wastewater Treatment Facility. Preliminary wastewater contributions are calculated at

approximately 9,435 gpd (average daily demand). Refer to *Figure 9-6* for *pr*eliminary sewer system improvements Plan.

Electrical System: The School's electrical service will originate from underground MECO facilities located along Kehalani Mauka Parkway. A pad mounted utility transformer near the Cafeteria building will provide 480 volt, 3 phase power to the School. Energy usage demand is estimated to be between 600,000-700,000 kwh per year. According to MECo, there is sufficient capacity to service the school.

Sustainable Design Strategies:

The following energy conservation measures will be incorporated into the design:

- Daylight Harvesting – Daylighting controls will be provided to dim or switch off lighting in response to available daylight.
- LED Site Lighting – Pole mounted Area (parking lot) and pathway lighting will be LED based for energy efficiency and improved lighting quality over High Pressure Sodium.
- Site Lighting Control – Site lighting will be provided with integral occupancy sensors where appropriate. This will allow the LED based luminaires to dim to a low light level when people are not sensed in the immediate area. In addition, site lighting will be controlled via a programmable lighting relay panel with photocell input. The lighting relay panel will allow for flexibility in setting the time schedule when site lighting is turned on and off.
- Occupancy Sensors – Occupancy Sensors will be provided to control interior lighting during unoccupied periods. Manual wall switches will also be provided to give the occupant control over the lighting within their space.
- Limit or eliminate Interior Night Lights – Emergency Egress lighting will be turned off with the normal lighting within the same space instead of leaving them on 24/7 as Night Lights. Night Lights will only be provided where requested by the Owner.
- Energy Efficient Lamps – Lamp sources will be chosen with an emphasis on energy efficiency. The majority of lighting will be based on High Performance T8, T5 or T5HO fluorescent lamps.
- Reduced Design Illumination Levels – Light levels will be designed to meet but not exceed current IESNA recommendations. In addition to saving energy, this will reduce the amount of heat generated by artificial lighting.
- Maximizing Daylight Penetration – the building will be designed to maximize penetration of indirect sunlight into each space though the use of optimized external shading elements, skylights, cupolas and solar tubes. Direct sunlight will be minimized to limit glare and solar heat gain within the space.
- Educational Metering Systems – Opportunities to provide building occupants with information on their energy usage will be sought out and developed.
- Renewable Energy Ready – At a minimum, the School will be designed with infrastructure ready for Photovoltaic or Wind energy generation systems.

Telephone and Cable Television Systems: Telephone and cable services for the project vicinity is provided by Hawaiian Tel (HTel), and Oceanic Time Warner Cable, respectively. Underground electrical, telephone, and cable lines are located along Kehalani Parkway and Kuikahi Drive.

9.4.4 Grading

The proposed project will require both excavation and embankment for the construction of the new roadways and relatively flat, terraced buildable areas for the proposed building structures. The majority of the project will be in a "cut" condition due to building height envelopes and roadway grade restrictions. Overall, the site will be graded to maintain the existing drainage patterns. Finish grades throughout the site will vary in elevation from 389 feet to 461 feet above mean sea level (MSL). Slopes will vary between 0 to 12% after improvements with maximum 2:1 slopes along the embankments. Retaining walls will vary in height from 2 to 6 feet.

Temporary erosion control measures will be incorporated during the construction to minimize soil loss and erosion hazards. Best Management Practices will include temporary sediment basins, temporary diversion berms and swales to intercept runoff, silt fences, dust fences, inlet protection, slope protection, stabilized construction entrances and truck wash-down areas. Periodic water spraying of loose soils will be implemented to minimize air-borne dirt particles from reaching adjacent properties. An application for a National Pollution Discharge Elimination System (NPDES) permit will be submitted to the State Department of Health for review and approval. Permanent sediment control measures will be used once construction is completed. Refer to *Figure 9-3* for preliminary grading plan.

9.4.5 Landscape Planting

To reflect the landscape context of its surrounding and micro-climates, the Wailuku Project District Design Guidelines divided the site into three landscape zones. The school site falls within the "Mid-slope Zone", which extends the landscape character of the historic Wailuku. The design and structure of landscaping within this zone would be formal in nature but rustic in material and detail and incorporates the use of plants with an "old style Hawai'i" connotation.

Landscape Design Concept: the following landscape elements have been incorporated to reflect the Wailuku Project District landscape concept.

1. A formal layout of the promenade, but with the use of rustic materials such as the planting of Koa and cement rubble masonry walls and pilasters.

2. Use of cement rubble masonry walls for the entry signwalls.

3. Plants to be included in the landscape include species such as Puakenikeni, Plumeria, 'Ohi'a Lehua Mamao, Hapu'u, Gingers, Monstera, Hibiscus, Ti and Naupaka which have an "old style Hawaii" connotation.

4. Plants such as Milo, Kukui, Naupaka and 'Akulikuli which have a more rural character as they can often be seen growing in the wild, whether it is along the shoreline or in more upland areas.

5. Large canopy trees such as "Queen's Hospital" White Shower Trees and Jacaranda to reflect

the rural character and specimen, historic trees of Wailuku.

The landscape design concept, as shown in *Figure 9-5*, is to create an aesthetically pleasing, quality environment. The landscape design will be based on function and simplicity that minimizes erosion, provides shade, enhances opportunities for cultural development, and promotes pride in the school and community. The landscape design will also apply the principles of sustainable design and special consideration will be given to the safety of students and the maintenance of the landscaping. The school's landscaping will consist primarily of grassed areas with accent planting at the campus entry, building entries, and at major gathering areas such as courtyards.

Large, flowering canopy trees such as "Queen's Hospital White" Shower Trees will be planted at the main entry road and parking lot/drop-off, while Jacaranda will be planted at the interior roadway and parking lots. These large trees will not only provide shade and reduce the heat island effect, but will help to reflect the ambiance of the Wailuku area which is characterized by specimen, historic trees.

Native Hawaiian and Polynesian-introduced plants will be used where possible for their cultural significance; the landscape is meant to also serve as outdoor learning spaces where students may learn about the natural environment.

- Accent trees such as Thornless Hala will be planted to highlight the entry.
- Milo will be planted at the parking lot on the south side of the campus.
- Within the heart of the campus, a promenade of Koa will be planted. The formal layout of the trees reflects an extension of the historic Wailuku landscape character, while the use of Koa blends elements of the upland landscape zone.
- Small canopy trees such as 'Ohi'a Lehua Mamo (Yellow 'Ohi'a) and Koai'a will be used for accent.
- Groundcovers such as 'Aki'aki, Naio Papa, Naupaka, Pohinahina and 'Ulei will be planted on slopes and to reduce water consumption.

A combination of native Hawaiian, Polynesian-introduced, and introduced species of shrubs will be used such as Ti, Nanu (Native Hawaiian Hibiscus), Tiare Gardenia, Hibiscus, Monstera and Ginger. These plants will not only provide accent, color and fragrance, but the foliage and flowers can also be used for decoration. Flowering vines such as Bougainvillea will be planted at the trellis to provide shade and color.

Due to the sloping site, retaining walls will be required. Where possible, the walls will be seatwall-height to provide built-in seating opportunities. The use of moss rock will recall the imagery of the dry-laid rock walls found within historic Wailuku.

To minimize maintenance:

- A 120-day maintenance period will be specified to allow the plants to become established

prior to turnover.

- A minimum 2′-6″ wide gravel maintenance strip with geotextile weed control fabric below will be installed around the perimeter of the buildings. The maintenance strip allows convenient maintenance of both the landscaping and the buildings, allows for increased air circulation around the buildings, provides for visual inspections for the entry points of insects and pests into the buildings, and keeps irrigation water away from the buildings. The inorganic mulch will also provide the additional benefit of conserving water by reducing irrigation demand.

- Groundcovers will be planted where slopes exceed 4:1.

- Organic mulch will be installed around the base of trees to reduce the need for trimming and protect plants from string trimmer and mower damage.

Playgrounds:

Playground equipment will be designed for specific age groups and may also include fitness equipment appropriate for children 8 years and older. Play equipment will meet accessibility requirements and safety regulations per the most current editions of the Americans with Disabilities Act guidelines (ADAAG), the American Society for Testing and Materials "Standard Consumer Safety Performance Specification for Playground Equipment for Public Use" (ASTM F 1487), and the latest guidelines of the U.S. Consumer Product Safety Commission (CPSC). Appropriate fall protection surfacing will be provided.

Landscape Irrigation Design Concept: The landscape irrigation design concept is to promote the healthy growth of the plant material while conserving water. The irrigation system will be separated according to grass and groundcover areas, as well as full sun versus shaded areas. This will ensure that plants that require larger amounts of water will be sufficiently irrigated, without over-watering those that are less thirsty.

The irrigation system sprinkler heads will be selected so their precipitation rates do not exceed the infiltration rate of the soil; this will conserve water by eliminating run-off. It will also prevent the leaching of nutrients, pesticides and fertilizers in the soil past the root zone. Fixed-spray, pop-up heads will be used to irrigate smaller planting areas, while gear-driven rotor heads will be used for larger areas. The layout of the sprinkler heads will be designed to provide a uniform distribution pattern. The radius and arc of the irrigation heads will be adjusted to minimize over-spray onto buildings, walkways and roads. Low angle nozzles will be used in high wind areas to reduce the amount of wind drift and pressure compensation and/or regulating devices will be used to reduce misting.

Water flow within the irrigation system will be designed to not exceed 5 ft. per second through any section of pipe. The irrigation system run times will be scheduled to occur during the evenings or early morning hours, to reduce the losses due to evaporation, reduce the amount of diseases in the lawn, and reduce the amount of wind drift as winds are usually lighter. Station run times will be monitored during the maintenance period to prevent over watering which can lead to disease, runoff, and leaching of nutrients and pesticides. Rain sensing devices will be

incorporated in the system for water conservation purposes. The automatic irrigation controllers will be located on the exterior of the buildings for ease of access and installed in stainless steel enclosures for increased vandal resistance. Features like cycle and soak, water budgeting and multiple start times will provide flexibility of scheduling and minimize runoff.

9.4.6 Architectural Design Concepts and Guidelines

The Wailuku Project District Design Guidelines established the overall architectural theme for residential and non-residential architectural structures in the community. The guideline encouraged the use of Hawaiian Plantation "Charles W. Dickey" and Contemporary Hawaiian style. Those two styles are characterized by the use of forms and materials which provide protection from the climate that may include deep set windows and doors, arcades, interior courtyards, hip and gable roofs with broad and split-pitches and extensive overhangs, and covered lanais and patios. Contemporary Hawaiian style using strong, bold lines that emphasizes horizontal planes rather than vertical planes is recommended. A mix of one and two-story masses, use of a focal vertical element, and stepped walls and angles in plan and elevation are desirable. Building materials, per the guideline, may include indigenous stone, wood siding, smooth stucco/plaster, concrete tile roofs, standing-seam metal roofs, and accent materials such as wood shutters, copper, brass, and glass.

Design for the Administration, Cafeteria and Library buildings are inspired by the historic buildings of Wailuku town. While not intending to be historic replications, these buildings are shall be more iconic in massing – incorporating central symmetrical forms. The materials will also reflect the Territorial period Wailuku buildings by utilizing steeper pitched roofs, red concrete or clay tile roofing and cement plaster walls.

Roofing: In keeping with the design parti, there are two distinct roofing materials proposed for the project. The Administration, Library and Cafeteria buildings will be roofed with a "red" metal roof. Akin to the historical buildings in the Wailuku community, the tile roofing will set apart these buildings as iconic structures in the campus, creating a unique sense of place in this primarily residential community. The tile is also fire resistant and a very durable material with very long lifespans.

The classroom buildings will be roofed with asphalt shingle. There will be four different colors of asphalt shingle which will reduce the scale of the buildings and reinforce the idea that the classrooms represent the Wailuku residential neighborhoods.

The covered playcourt will be a metal roof with translucent roof panels to allow for daylight.

Note there are selective locations where low slope roofs will be used. These include the kitchen, custodial and storage portion of the cafeteria, and a center portion of Classroom Building H behind the mansard.

Skylights: We intend to use translucent roof assembly like Kalwall for the cafeteria and library main spaces. This material allows natural daylight into the space while blocking UV sunlight. In addition, it has hurricane resistant properties.

For the classrooms and other areas, light pipes will be incorporated to provide daylighting. These products are simply a polished aluminum cylinder with a plexiglass dome on top and a diffuser at the ceiling level. They are very cost effective.

Ceiling Material: Acoustical ceiling tile will be the primary ceiling material. On sloped ceilings, gypsum board will be installed, although this needs to meet acoustical design requirements.

Wall Material: The Administration, Library, Cafeteria and Classroom Building H are intended to have CMU exterior walls. As cost allows, an EFS or cement plaster coating will b used on the exterior surface in keeping with the design intent of making these buildings follow the historical reference.

The classrooms buildings will have metal stud or wood framed walls. The exterior skin will be a fiber cement board such as Hardi-board or equal. This material is very durable, resistant to weathering and can have high levels of recycled material. The interior of the wall assembly will use impact-resistant gypsum board up to 8′-0″ high. This material is highly resistant to scratching and can also contain recycled material.

Windows: The DOE typical window specifications suggest jalousie windows or operable windows with no more than 12-inch spacing between mullions, to deter vandalism and theft. For this project, operable windows (typically awnings and hoppers) will be used. The glazing will typically be high-performance glass with high visible light transmittance and high insulating values.

Floor Material: Typically, slab on grade will be the primary substrate for all buildings. The DOE Ed Specs govern flooring material for all spaces.

9.4.7 Building Elevations

Refer to Figures 9-6 to 9-13 for building elevations.

9.4.8 Building Sections

Refer to Figures 9-14 to 9-19 for building sections.

9.4.9 Construction Phasing

The school will be constructed in one phase. The construction is anticipated to begin in 2011, with the school opening date in July 2012.

9.4.10 Open Spaces

Approximately 2.7 acres of the site is dedicated as open space use.

9.4.11 Land Uses

Of the 14-acre site, 10 acres will be allocated for school use, 2.7 acres for open space use, and 1.3 acres will be developed for a shared driveway (see *Figure 9-20*). The shared driveway will serve both the school and the future community center.

9.4.12 Signage

The school entry sign wall is shown in *Figure 9-21*. The size of the sign is approximately 22 ft. wide by 6 ft. high. The sign is an arc-shape retaining stone wall with bronze pin letters on precast concrete field.

9.5 PROPOSALS FOR RECREATION AND COMMUNITY FACILITIES

According to the Hawai'i Administrative Rules Department of Education Title 8 Subtitle 2, all public school buildings, facilities, and grounds shall be available for general recreational and community uses when not otherwise used for instructional purposes.

9.6 FLOOR AREA RATIOS, LOT COVERAGE, NET BUILDABLE AREA, OPEN SPACE RATIOS, AND IMPERVIOUS RATIOS

9.6.1 Floor Area Ratio

Per Maui County Code, floor area ratio means the ratio of the total gross floor area of a structure or structures, to the total lot area. Maui County Code section 19.80.030 Wailuku-Kahului Project District 3, Village Mixed Use District allows a maximum floor area ratio of 2.0 (per ordinance 2052, 1991). For this development, the total gross floor area is 98,849 sq.ft. (see *Table 2-1*), which yields the floor area ratio of 0.16.

9.6.2 Lot Coverage Ratio

Per Maui County Code lot coverage means the area of a lot occupied by all roofed structures. Maui County Code section 19.80.030 Wailuku-Kahului Project District 3, Village Mixed Use District allows a maximum lot coverage ratio of 0.6. The approximate lot coverage for this development is 90,000 sq.ft., which yields the lot coverage ratio of 0.15.

9.6.3 Net Buildable Area

Total buildable floor area for Wailuku II Elementary School is 98,849 sq.ft. (see *Table 2-1*).

9.6.4 Open Space Ratios

Per Maui County Code, the open space ratio is obtained by dividing the net lot width into the open-space width. Net lot width (NLW) means the average width of the lots less the required

yard setback, measured parallel to the seaward boundary. Since the site is surrounded by residential subdistrict, the required setback is ten feet. The NLW of the site is therefore 540 ft. Open-space width (OSW) means the net lot width (NLW), less all obstructed space, measured along the same line as the net lot width. The OSW of the site is approximately 120 ft. Thus, the open space ratio is 0.2.

9.6.5 Impervious Surface Ratios

Total impervious surface area which includes pavement, concrete sidewalks, and buildings is approximately 265,443 sq.ft. or 6.09 acres. The imperious surface ratio on the approximately 14-acre site is therefore 0.43.

9.7 STATEMENT ON POTENTIAL ENVIRONMENTAL, SOCIOECONOMIC, AND AESTHETIC IMPACTS

As discussed in details in Chapter 3 of this report no significant impact is anticipated as a result of the development of this project.

9.8 PROPOSED PROJECT DISTRICT PHASE II AMENDMENT

In accordance with Chapter 19.45 of the Maui County Code, this application has been prepared on behalf of the State of Hawaii Department of Education to meet the requirements for a Project District Phase II application in order to amend the boundary of the school, community center, and the location of the open space use affecting approximately 17.7 acres of the project district. The overall scope of the development plan for the subject area has not changed; however, the spatial relationships among the land uses within the 17.7-acre area have been reconfigured to more fully integrate their common use elements.

Standards for the Wailuku-Kahului Project District were established in 1991 through Ordinance No. 2052. The Project District's land use categories and acreages for the Wailuku-Kahului Project District 3 identified in Maui County Code Chapter 19.80 is as follows:

Residential	**364 acres**
Village Mix Use	**71 acres**
to be developed as follows:	
Residential	34 acres
School	10 acres
Community Center	5 acres
Neighborhood Commercial	22 acres
Park/Open Space	**114 acres**
to be developed as follows:	
Parks	20 acres
Open Space/roadways/Drainageways	94 acres
Total Acreage	**549 acres**

As shown in *Figure 9-22*, the 2002 Kehalani Mauka Project District Phase II amendment (Docket No. PH2 2002/0004) was approved for the modification of the following subdistrict categories:

VMX Community Center	5 acres
VMX School	10 acres
VMX/Multi-family Residential	10 acres
Residential/Park/Open Space	20 acres
Park	15 acres
Roadways/Drainageways	5 acres
Total Acreage	**65 acres**

The Applicant is requesting an amendment to the 2002 Kehalani Mauka Project District Phase II in order to amend the boundary of the school, community center, and the location of the open space use affecting 17.7 acres as shown in *Figure 9-23*. The proposed amendment request includes the following:

- 10 acres – School site boundary to include an access road located north of the previously approved school site, to include areas to the south of the previously approved school site, and to exclude areas to the east of the previously approved school site
- 5 acres – Community Center site to exclude the areas to the north of the previously approved Community Center site, and to include the area previously approved for the park site. A shared driveway (1.3 ac.) which will provide second access to the school, per DOE's requirement, and access to the future community center will be located in this area
- 2.7 acres – Open space use to be located east of the proposed school site

Total Acreage 17.7 acres

The above land use categories and acreage are consistent with County Zoning. The overall Kahalani Mauka Project District land use density allocations and public services and utility demands will not be affected by the reconfiguration of the land use boundaries and locations proposed by the Project District Phase II amendment. The proposed spatial reconfiguration will continue to provide an integrated and functional master planned community in accordance with the Wailuku-Kahului Community Plan.

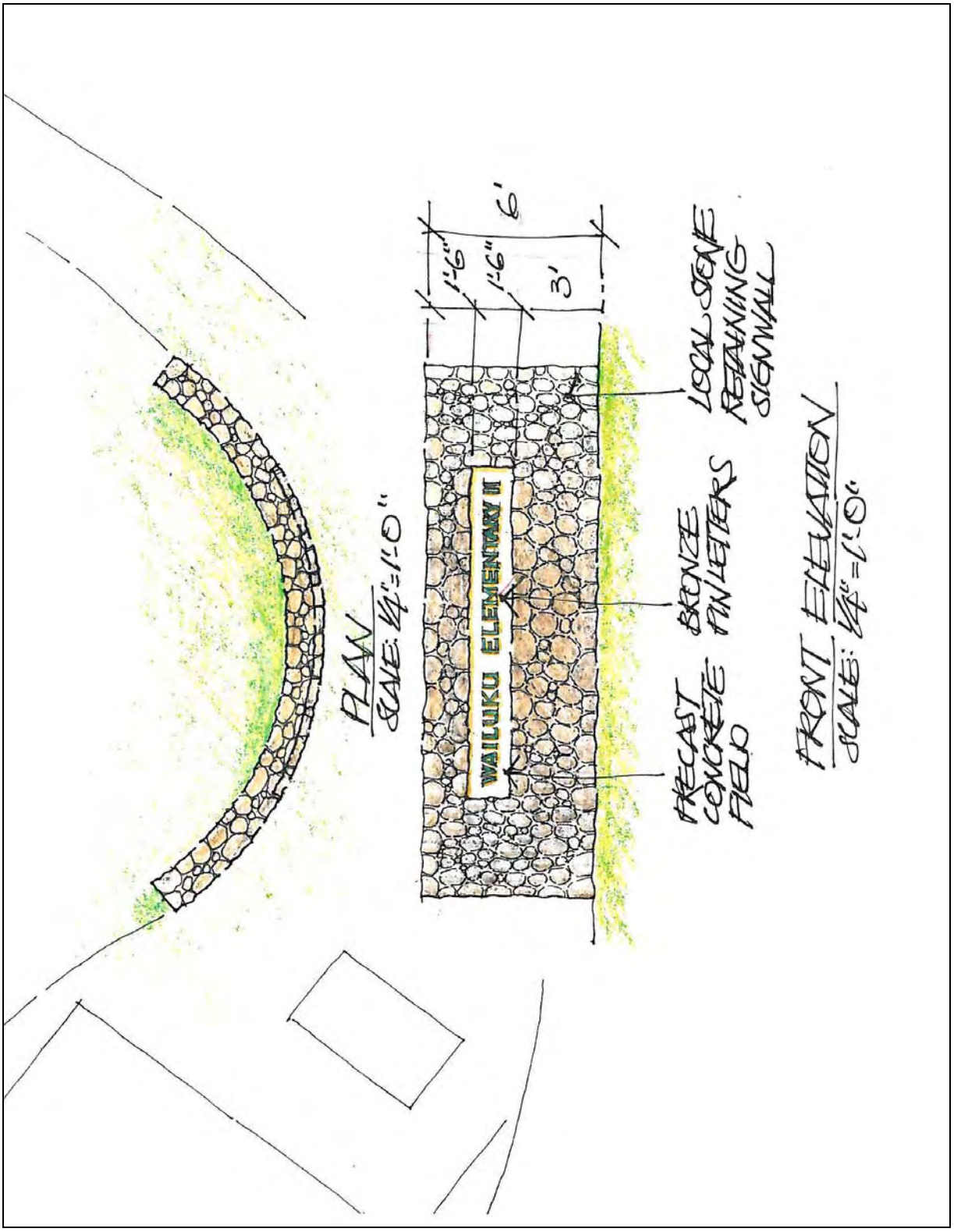

Figure 9-21: Signage
(Source: Walters, Kimura, Motoda, Inc. 2009)

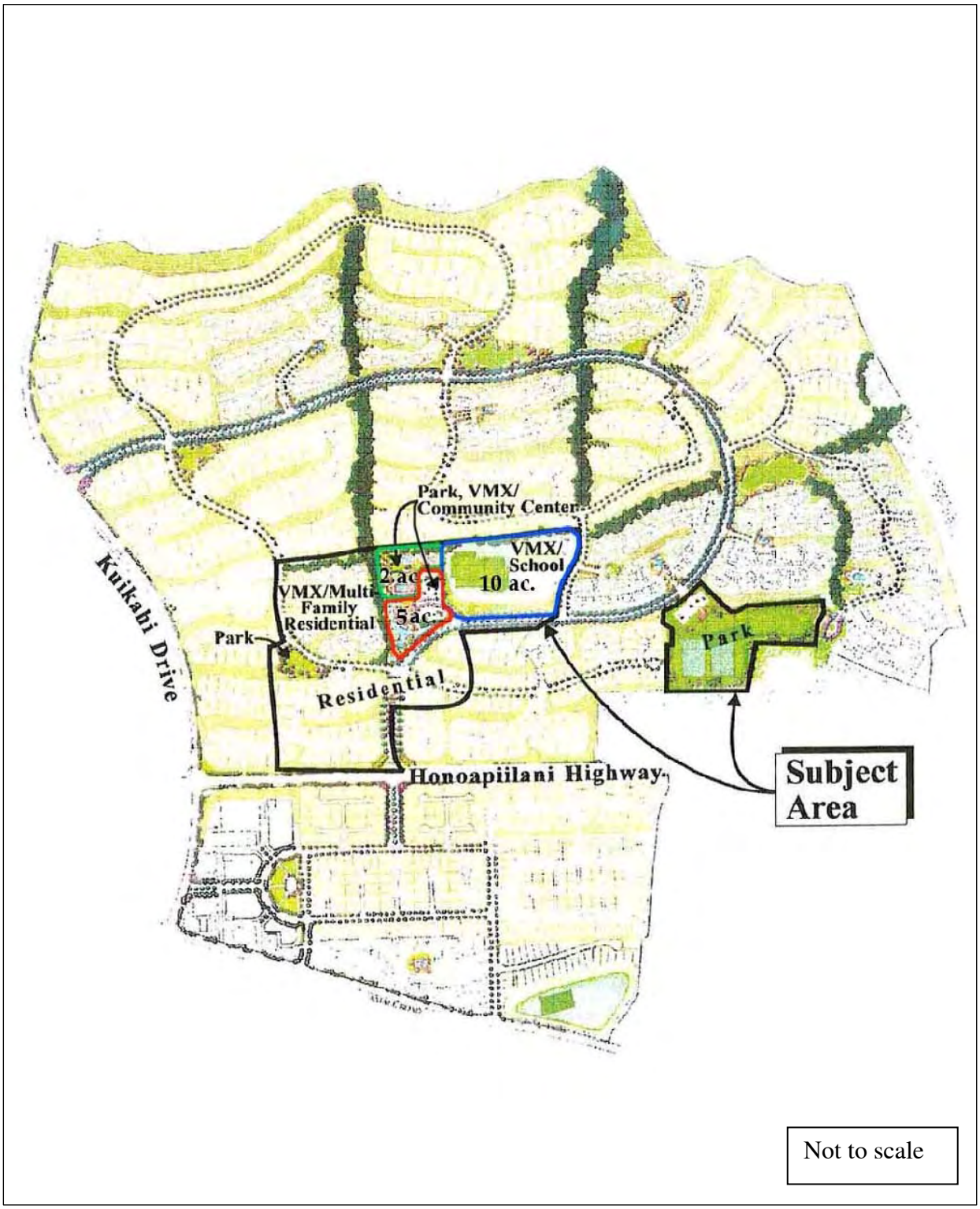

Figure 9-22: Kehalani Mauka Project District Phase II Site Plan Amendment 2002
(Base map Source: Munekiyo & Hiraga, Inc. 2002)

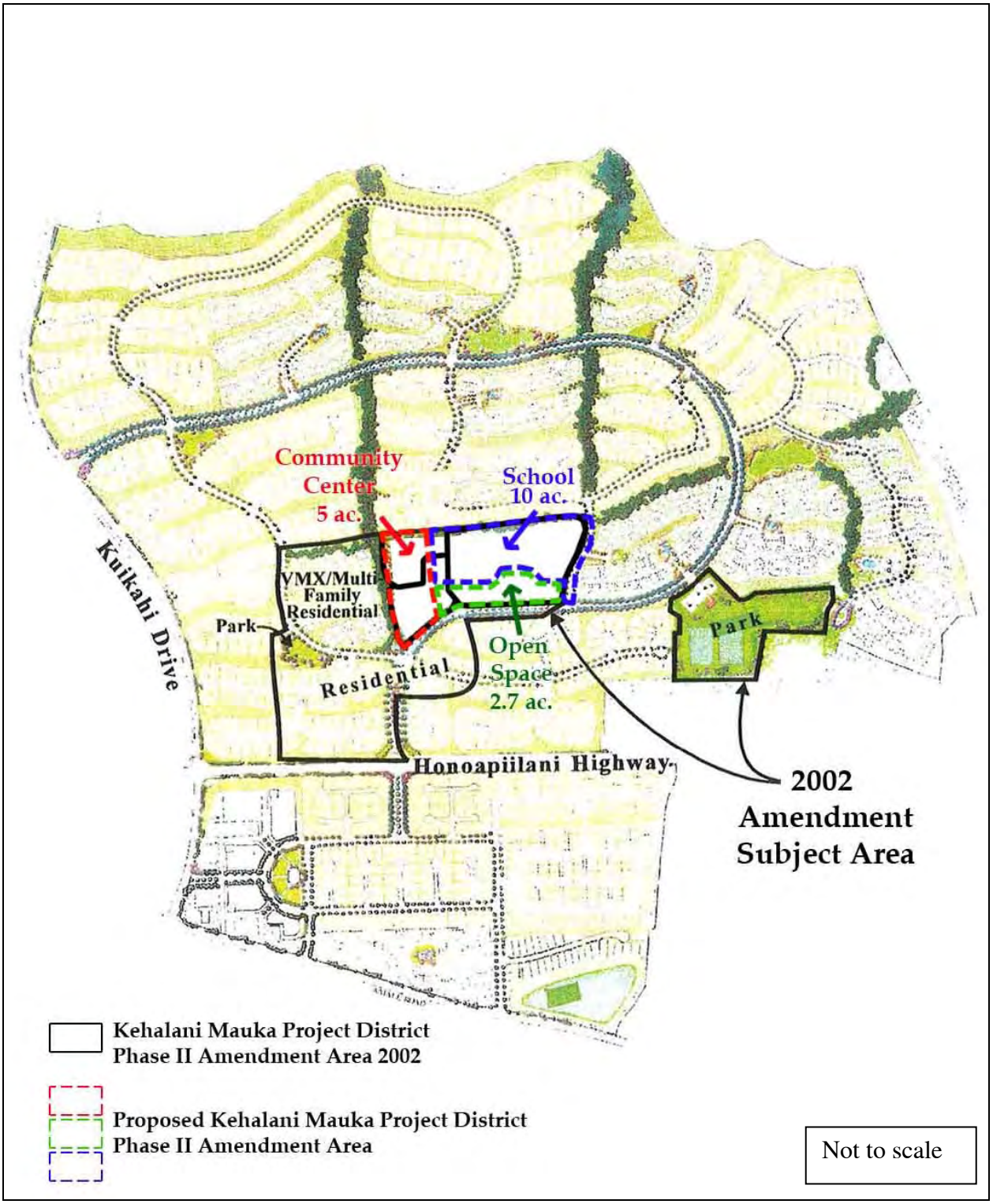

Figure 9-23: Proposed Kehalani Mauka Project District Phase II Amendment
(Base Map Source: Munekiyo & Hiraga, Inc. 2002)

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Biological Surveys Conducted for the Proposed Wailuku Elementary School II, Wailuku, Maui

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December 17, 2009

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Introduction

The State of Hawai‘i Department of Education (DOE) proposes to develop a new elementary school in the Kehalani Mauka Development, south of Wailuku, Maui. The school site is approximately 14-acre in size and is located *mauka* of the Kehalani Mauka Parkway, and west of Honoapi‘ilani Highway (Figure 1). The lands surveyed are identified as TMK: (2) 3-5-001:67 (por.), (2) 3-5-001:77 (por.), and (2) 3-5-001:78 (por.).

The primary purpose of these surveys was to determine if there were any botanical, avian or mammalian species currently listed, or proposed for listing as endangered or threatened under either the federal or the State of Hawai‘i’s endangered species programs on, or within the immediate vicinity of the project depicted on Figure 1. Federal and State of Hawai‘i listed species status follows species identified in the following referenced documents (Division of Land and Natural Resources (DLNR) 1998, Federal Register 2005, U. S. Fish & Wildlife Service (USFWS) 2005, 2009). Fieldwork was conducted on November 17, 2009.

Avian phylogenetic order and nomenclature follows *The American Ornithologists' Union Check-list of North American Birds 7th Edition* (American Ornithologists' Union 1998), and the 42nd through the 50th supplements to *Check-list of North American Birds* (American Ornithologists' Union 2000; Banks et al. 2002, 2003, 2004, 2005, 2006, 2007, 2008, Chesser et al., 2009). Mammal scientific names follow *Mammals in Hawaii* (Tomich 1986). Plant names follow *Manual of the Flowering Plants of Hawai‘i* (Wagner et al., 1990, 1999) for native and naturalized flowering plants, and *A Tropical Garden Flora* (Staples and Herbst, 2005) for crop and ornamental plants. Place names follow *Place Names of Hawaii* (Pukui et al., 1974).

Hawaiian and scientific names are italicized in the text. A glossary of technical terms and acronyms used in the document, which may be unfamiliar to the reader, are included at the end of the narrative text.

General Site and Project Description

The proposed project consists of the construction of Grades K-5 classroom buildings, a library, a dining hall, an administrative building, a covered playcourt, a playfield, and 171 parking stalls. The school and associated infrastructure is being planned to accommodate an enrollment of up to 550 students.

The school site is located within the master-planned Kehalani Mauka Development. The site is bound to the east by Kehalani Mauka Parkway, to the west by former cane fields, and to the north and south by currently undeveloped portions of the master planned community (Figure 1).

The project site slopes from east to west, from an elevation of 396 meters above mean sea level (MSL), at the midpoint of the parcel along the Kehalani Mauka Parkway, up to 462 meters MSL at the midpoint of the western edge of the site. The topography of the site has an existing slope of between 10-12 percent. Along Kehalani Muaka Parkway the slope is very steep leveling to a more consistent 10-12 percent grade approximately 15-to-20 feet west of the roadway.

Figure 1 – Wailuku Elementary School II Site

The land was formerly in sugar cane cultivation, and is now covered with various weedy species, but most particularly non-native Guinea grass (*Urochloa maxima*; see Figure 2).

Figure – 2 Wailuku Elementary School II site looking north towards Wailuku and showing typical Guinea grass habitat present on the site.

Botanical Survey Methods

The botanical survey was undertaken on November 17, 2009 utilizing a wandering transect that traversed all parts of the subject parcel. The survey was conducted early in the wet season and therefore some plants typical of this site, especially annuals, may not have been observed. However, the condition of the existing plants indicated that sufficient rainfall had occurred over the past month to encourage growth. For a few specimens not immediately recognized in the field, photographs were taken and/or material was collected for identification at the laboratory.

Botanical Survey Results

A plant checklist (Table 1) was compiled from field observations, with entries arranged alphabetically under plant family names (standard practice). Included in the list are scientific name, common name, and status (whether native or non-native) for each species observed on the property. Species status given in **bold** indicates a plant of some interest to the Hawaiian Islands

flora. In addition to identifying the plants present within the study site, qualitative estimates of plant abundance were made. These are coded in the table as explained in the Legend to Table 1 and apply to observations made during the present survey. For some species, a two-level system of abundance is used: the letter-number codes indicating species that have a limited distribution (e.g., found in only one small area of the property), but present there in numbers exceeding just a few individuals. For example, an abundance rating of "R" indicates a plant encountered only once or twice during the entire survey. An "R2" indicates a plant encountered in just one or two places, but with several to many individuals present where encountered. An "R3" would be a plant seldom encountered (i.e., rare), but locally abundant in one or more of the locations where it was encountered.

The project area supports only one basic type of vegetation: that associated with natural growth on highly disturbed land. The majority of the property has transitioned from barren field to grassland, completely dominated by Guinea grass. Some shrubs are starting to appear, such as castor bean (*Ricinus communis*), slender mimosa (*Desmanthus virgatus*), *koa haole* (*Leucaena leucocephala*), and hairy abutilon (*Abutilon grandifolium*). If left alone, the vegetation would likely shift gradually to a mixed Guinea grass/shrubland.

Smaller, more recently disturbed areas (along the roadway, small, leveled "lots" being used to store construction supplies, and temporary access roads) support the greatest variety of plants, whose growth here is a response to the disturbance of the Guinea grass. Thus a majority of the 59 species recorded are ruderal weeds with low occurrence values (Uncommon or Rare). Only one species recorded, '*uhaloa* (*Waltheria indica*) is regarded as a native plant. This species is a common indigenous plant found throughout the islands, particularly on drier sites. This gives a ratio of 1.6% of the species on the property as native.

Table 1 - Checklist of Plant Species Observed at the Proposed Wailuku Elementary School II Site

Species listed by family	***Common name***	Status	Abundance	Notes
FLOWERING PLANTS				
DICOTYLEDONES				
ACANTHACEAE				
Thunbergia fragrans Roxb.	sweet clock-vine	Nat	R	
AMARANTHACEAE				
Alternanthera pungens Kunth	khaki weed	Nat	R	
Amaranthus spinosus L.	spiny amaranth	Nat	U3	
ASTERACEAE (COMPOSITAE)				
Bidens pilosa L.	beggartick	Nat	U	
Conyza cf. *bonariensis* (L.) Cronq.	hairy horseweed	Nat	R	<1>
Emilia fosbergii Nicolson	Flora's paintbrush	Nat	C	

Table 1 continued

Species listed by family	***Common name***	Status	Abundance	Notes
Pluchea carolinensis (Jacq.) G. Don	sourbush	Nat	R	
Sonchus oleraceus L.	sow thistle	Nat	R	
Tridax procumbens L.	coat buttons	Nat	C3	
Verbesina encellioides (Cav.) Bernth. & Hook.	golden crown-beard	Nat	R	
Xanthium strumarium L.	*kīkānia*	Nat	U2	
BRASSICACEAE				
Lepidium virginicum L.	pepperwort	Nat	R	
CHENOPODIACEAE				
Chenopodium carinatum R.Br.	---	Nat	R	
Chenopodium murale L.	lamb's quarters	Nat	R1	
CONVOLVULACEAE				
Ipomoea triloba L.	little bell	Nat	R	
CUCURBITACEAE				
Coccinia grandis (L.) Voigt	scarlet-fruited gourd	Nar	R	
Cucumis dipsaceus Ehrenb. ex Spach	teasel gourd	Nat	R	
EUPHORBIACEAE				
Chamaesyce albomarginata (Torr. & A. Grey) Small	rattlesnake weed	Nat	R	
Chamaesyce hirta (L.) Millsp.	garden spurge	Nat	R	
Chamaesyce hyssopifolia (L.) Small		Nat	R	
Phylanthus debilis Klein ex Willd.	niruri	Nat	R	
Ricinus communis L.	castor bean	Nat	C	
FABACEAE				
Canavalia cf. *carthartica* Thouars	*maunaloa*	Nat	R	<1>
Chamaecrista nictitans (L.) Moench	partridge pea	Nat	C	
Crotalaria incana L.	fuzzy rattlepod	Nat	U	
Crotalaria pallida Aiton	smooth rattlepod	Nat	R	
Crotalaria cf. *retusa* L.	---	Nat	O3	
Desmanthus virgatus (L.) Willd.	slender mimosa	Nat	C	
Indigofera hendecaphylla Jacq.	prostrate indigo	Nat	R3	
Indigofera spicata Forssk.	indigo	Nat	U	
Leucaena leucocephala (Lam.) de Wit	*koa haole*	Nat	C	
Macroptilium atropurpureum (DC) Urb.	---	Nat	U3	
Neonotonia whightii (Wight & Arnott) Lackey	glycine vine	Nat	A	
Pithecellobium dulce (Roxb.) Benth.	*'opiuma*	Nat	R	
LAMIACEAE				
Leonotis nepetifolia (L.) T. Br.	lion's ear	Nat	U	
MALVACEAE				
Abutilon grandifolium (Willd.) Sweet	hairy abutilon	Nat	O	

Table 1 continued

Species listed by family	***Common name***	Status	Abundance	Notes
Malva parviflora L.	cheese weed	Nat	R	
Malvastrum coromandelianum (L.) Garcke	false mallow	Nat	C	
Sida fallax Wallp.	*'ilima*	**Ind**		
Sida rhombifolia L.	---	Nat	R	
Sida spinosa L.	prickly sida	Nat	R	
NYCTAGINACEAE				
Boerhavia coccinea Mill.	false alena	Nat	R2	
SOLANACEAE				
Solanum mauritianum Scop.	---	Nat	U	
Solanum lycopersicum var. *cerasiforme* (Dunal) Spooner	cherry tomato	Nat	R	
STERCULIACEAE				
Waltheria indica L.	*'uhaloa*	**Ind**	R	
VERBENACEAE				
Lantana montevidensis (Spreng.) Briq.	trailing lantana	Nat	R	
Verbena litoralis Kunth	*owi*	Nat	R	
MONCOTYLEDONES				
CYPERACEAE				
Cyperus rotundus	nut grass	Nat	R	
POACEAE				
Chloris barbata (L.) Sw.	swollen fingergrass	Nat	O3	
Chloris virgata Sw.	feather fingergrass	Nat	U	
Cynodon dactylon (L.) Pers.	Bermuda grass	Nat	U2	
Dactyloctenium aegyptium (L.) Willd.	beach wiregrass	Nat	R	
Digiteria ciliaris (Retz.) Koeler	Henry's crabgrass	Nat	R2	
Digiteria insularis (L.) Mez ex Ekman	sourgrass	Nat	R	
Eleusine indica (L.) Gaertn.	wiregrass	Nat	R2	
Eragrostis pectinacea (Michx.) Nees	Carolina lovegrass	Nat	R	
Setaria verticillata (L.) P. Beauv.	bristly foxtail	Nat	U3	
Tragus berteronianus Schult.	bertero goatgrass	Nat	R	
Urochloa maxima (Jacq.) Webster	Guinea grass	Nat	AA	

Legend to Table 1

STATUS = distributional status for the Hawaiian Islands:

Ind = indigenous; native to Hawaii, but not unique to the Hawaiian Islands.

Nat = naturalized, exotic, plant introduced to the Hawaiian Islands since the arrival of Cook Expedition in 1778, and well-established outside of cultivation.

Pol. = Polynesian introduction before 1778.

ABUNDANCE = occurrence ratings for plants by area:

R – Rare	seen in only one or perhaps two locations.
U - Uncommon-	seen at most in several locations
O - Occasional	seen with some regularity
C - Common	observed numerous times during the survey
A - Abundant	found in large numbers; may be locally dominant.
AA - Very abundant	abundant and dominant; defining species for vegetation type.

NOTES:

Numbers following an occurrence rating indicate clusters within the survey area. The ratings above provide an estimate of the likelihood of encountering a species within the specified survey area; numbers modify this where abundance, tends to be greater than the occurrence rating:

1 – several plants present in each location
2 - many plants present in each location
3 – locally abundant

<1> Specimen(s) encountered lacked fruit or flowers; determination uncertain.

Avian Survey Methods

Five avian count stations were sited roughly equidistant from each other within the proposed school site. Eight-minute point counts were made at each of the five count stations. Each station was counted once. Field observations were made with the aid of Leica 10 X 42 binoculars and by listening for vocalizations. Counts were concentrated during early morning hours, the peak of daily bird activity. Additionally, the zoologist walked the site in a similar fashion as the botanist, to ensure that no additional species or habitats not encountered during the time dependant avian counts were present on the site.

Avian Survey Results

A total of 91 individual birds of nine different species, representing five separate families, were recorded during station counts (Table 2). All bird species detected during the course of time spent on the project site are considered to be alien to the Hawaiian Islands. No avian species currently listed, or proposed for listing under either the federal or State of Hawai‘i endangered species statutes was detected during the course of this survey.

Avian diversity was low, though in keeping with the habitat present within the project site. One species: Zebra Dove (*Geopelia striata*) accounted for slightly less than 64 percent of the total number of birds detected. An average of 18 individual birds was recorded per station count.

Table 2 – Avian Species Detected Within the Proposed Wailuku II School Site

Common Name	*Scientific Name*	*ST*	*RA*
	GALLIFORMES		
	PHASIANIDAE - Pheasants & Partridges		
	Phasianinae - Pheasants & Allies		
Gray Francolin	*Francolinus pondicerianus*	A	0.80
	COLUMBIFORMES		
	COLUMBIDAE - Pigeons & Doves		
Spotted Dove	*Streptopelia chinensis*	A	0.60
Zebra Dove	*Geopelia striata*	A	11.60

Table 2 continued

Common Name	*Scientific Name*	*ST*	*RA*
	PASSERIFORMES		
	STURNIDAE - Starlings		
Common Myna	*Acridotheres tristis*	A	2.20
	MIMIDAE - Mockingbirds & Thrashers		
Northern Mockingbird	*Mimus polyglottos*	A	0.20
	FRINGILLIDAE - Fringilline and Carduleline Finches & Allies		
	Carduelinae - Carduline Finches		
House Finch	*Carpodacus mexicanus*	A	1.80
	ESTRILDIDAE - Estrildid Finches		
	Estrildinae - Estrildine Finches		
Nutmeg Mannikin	*Lonchura punctulata*	A	1.00
Chestnut Munia	*Lonchura atricapilla*	A	0.60
Java Sparrow	*Padda oryzivora*	A	2.00

Key to table 2

ST Status

A Alien – Introduced to the Hawaiian Islands by humans

RA Relative Abundance - Number of birds detected divided by the number of count stations (5)

Mammalian Survey Methods

With the exception of the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), or *‘ōpe‘ape‘a* as it is known locally, all terrestrial mammals currently found on the Island of Maui are alien species. Most are ubiquitous. The survey of mammals was limited to visual and auditory detection, coupled with visual observation of scat, tracks, and other animal sign. A running tally was kept of all vertebrate species observed and heard within the project area.

Mammalian Survey Results

Three mammalian species were detected during the course of this survey. None of the mammals recorded were actually seen on the site, but were all seen or heard from areas outside the site. Five humans (*Homo sapiens*) were seen walking or jogging along the Kehalani Mauka Parkway. One human was seen walking a dog (*Canis f. familiaris*), along the sidewalk fronting the subdivision located to the east of the site, and one cat (*Felis c. catus*), was also seen walking down the sidewalk. Several dogs were heard barking from houses located to the east and south of the school site.

No mammalian species currently listed, or proposed for listing under either the federal or State of Hawai‘i endangered species statutes was detected during the course of this survey.

Discussion

Botanical Resources

The vegetation present on the site is almost completely alien as demonstrated by the fact that only one native plant species was recorded during course of this survey. The lands surveyed are former sugar canes lands on which the vegetation is in the early successional stages of changing from former sugar cane fields, to fallow fields, to grassland and if not further disturbed would eventually become shrublands. From a botanical perspective there are no resources that are special or unique present on the site. No plant species currently listed, or proposed for listing under either the federal or the State of Hawai‘i endangered species programs were detected during the course of this survey.

Avian Resources

The findings of this survey are consistent with the Guinea grass habitat currently found on the site. All of the avian species detected are considered to be alien to the Hawaiian Islands. No species currently listed, or proposed for listing under either the federal or the State of Hawai‘i endangered species programs were detected during the course of this survey.

Although not detected during this survey both the endangered Hawaiian Petrel (*Pterodroma sandwichensis*), and the threatened endemic sub-species of the Newell's Shearwater (*Puffinus auricularis newelli*), may over-fly the project area between April and the end of November each year. Both species have been recorded flying to and from their nesting colonies located in the mountains to the to the west and east of the project site (DOFAW unpublished seabird data 1994-2009, Cooper and Day 2003, 2004, Day and Cooper 1999, Denis and Hamer 2007,). Both of these pelagic seabird species nest high in the mountains in burrows excavated under thick vegetation, especially *uluhe* (*Dicranopteris linearis*) fern. There is no suitable nesting habitat for either of these seabird species on, or close to the proposed school site.

The primary cause of mortality in both Hawaiian Petrels and Newell's Shearwaters is thought to be predation by alien mammalian species at the nesting colonies (USFWS 1983, Simons and Hodges 1998, Ainley et al. 2001). Collision with man-made structures is considered to be the second most significant cause of mortality of these seabird species in Hawai‘i. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. When disoriented, seabirds often collide with manmade structures, and if they are not killed outright, the dazed or injured birds are easy targets of opportunity for feral mammals (Hadley 1961, Telfer 1979, Sincock 1981, Reed et al. 1985, Telfer et al. 1987, Cooper and Day 1998, Podolsky et al. 1998, Ainley et al. 2001, Hue et al., 2001, Day et al., 2003).

Mammalian Resources

Given the near impenetrable Guinea grass currently present on the site, it is not surprising that we did not record any mammals on the site. The mammals recorded adjacent to the site are ones that one would expect to see within housing developments on Maui.

Although no rodents were detected during the course of this survey it is probable that one or more of the four established alien *muridae* known from the Island of Maui, roof rat (*Rattus r. rattus*), Norway rat (*Rattus norvegicus*), Polynesian rat (*Rattus exulans hawaiiensis*), and European house mice (*Mus musculus domesticus*), use resources within the project area on occasion.

Potential Impacts to Protected Species

The development and operation of the proposed Wialuku Elementary School II and associated facilities is not expected to result in deleterious impacts to any botanical, avian or mammalian species currently listed or proposed for listing under either the federal or state of Hawai‘i endangered species statutes.

Botanical Resources

No plants of any concern or having protective status were observed - and none is to be expected - on the Wailuku Elementary School II site.

Hawaiian Petrel and Newell's Shearwater

The principal potential impact that construction and operation of the proposed school poses to Hawaiian Petrels and Newell's Shearwaters is the increased threat that birds will be downed after becoming disoriented by lights associated with the project during the nesting season. The two main areas that outdoor lighting could pose a threat to these nocturnally flying seabirds is if, 1) during construction it is deemed expedient, or necessary to conduct nighttime construction activities, 2) following build-out the potential operation of streetlights and athletic field lighting during the seabird nesting season.

Recommendations

If nighttime construction activity or equipment maintenance is proposed during the construction phases of the project, all associated lights should be shielded, and when large flood/work lights are used they should be placed on poles that are high enough to allow the lights to be pointed directly at the ground.

If streetlights or facility lighting is installed in conjunction with the school, it is recommended that lights be shielded to reduce the potential for interactions of nocturnally flying Hawaiian Petrels and Newell's Shearwaters with external lights and man-made structures (Reed et al. 1985, Telfer et al. 1987). This minimization measure would serve the dual purpose of minimizing the threat of disorientation and downing of Hawaiian Petrels and Newell's Shearwaters, while at the same time complying with the Maui County Code § 20.35 *et seq.* that requires that exterior lights on Maui be shielded.

It is recommended that where appropriate and practicable native plant species be used in landscaping efforts. Not only is this ecologically prudent, but if the appropriate plants are used will also likely save maintenance and water costs over the long term.

Glossary

Alien – Introduced to Hawai‘i by humans
Endangered – Listed and protected under the Endangered Species Act of 1973, as amended (ESA) as an endangered species
Indigenous – Native to the Hawaiian Islands, but also found elsewhere naturally
Mauka – Upslope, towards the mountains
Muridae – Rodents, including rats, mice and voles, one of the most diverse family of mammals
Nocturnal – Night-time, after dark
‘Ōpe‘ape‘a – Hawaiian hoary bat
Pelagic – An animal that spends its life at sea – in this case seabirds that only return to land to nest and rear their young
Phylogenetic – The evolutionary order that organisms are arranged by
Sign – Biological term referring tracks, scat, rubbing, odor, marks, nests, and other signs created by animals by which their presence may be detected
Threatened – Listed and protected under the ESA as a threatened species

DLNR – Hawai‘i State Department of Land & Natural Resources
DOFAW – Division of Forestry and Wildlife
ESA – Endangered Species Act of 1973, as amended
MSL – Mean sea level
TMK – Tax Map Key
USFWS – United State Fish & Wildlife Service

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AIR QUALITY STUDY

FOR THE PROPOSED

WAILUKU II ELEMENTARY SCHOOL

WAILUKU, MAUI

Prepared for:

Group 70 International, Inc.

January 2010

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1.0 SUMMARY

The Hawaii Department of Education is proposing to develop the Wailuku II Elementary School in the Wailuku area on the island of Maui. The proposed school will accommodate up to 550 students. The project is expected to be completed and at near full capacity by 2015. This study examines the potential short- and long-term air quality impacts that could occur as a result of construction and use of the proposed facilities and suggests mitigative measures to reduce any potential air quality impacts where possible and appropriate.

Both federal and state standards have been established to maintain ambient air quality. At the present time, seven parameters are regulated including: particulate matter, sulfur dioxide, hydrogen sulfide, nitrogen dioxide, carbon monoxide, ozone and lead. Hawaii air quality standards are comparable to the national standards except those for nitrogen dioxide and carbon monoxide which are more stringent than the national standards.

Regional and local climate together with the amount and type of human activity generally dictate the air quality of a given location. The climate of the project area is very much affected by its elevation near sea level and by nearby mountains. The predominant trade winds tend to be channeled through the area by the mountains to the east and west. Temperatures in the project area are generally very consistent and warm with average daily temperatures ranging from about 68°F to 81°F. Rainfall in the project area is only moderate with an average of about 26 inches per year.

Except for periodic impacts from volcanic emissions (vog) and possibly occasional localized impacts from traffic congestion and local agricultural sources, the present air quality of the project area is believed to be relatively good. There is very little air quality monitoring data from the Department of Health for the project area, but the limited data that are available suggest that concentrations are generally well within state and national air quality standards.

If the proposed project is given the necessary approvals to proceed, it is inevitable that some short- and long-term impacts on air quality will unavoidably occur either directly or indirectly as a consequence of project construction and use. Short-term impacts from fugitive dust will likely occur during the project construction phase. To a lesser extent, exhaust emissions from stationary and mobile construction equipment and from the disruption of traffic may also affect air quality during the period of construction. State air pollution control regulations require that there be no visible fugitive dust emissions at the project boundary. Hence, an effective dust control plan should be implemented to ensure compliance with state regulations. Fugitive dust emissions can be controlled to a large extent by watering of active work areas, using wind screens, keeping adjacent paved roads clean, and by covering of open-bodied trucks. Other dust control measures could include limiting the area that can be disturbed at any given time and/or mulching or chemically stabilizing inactive areas that have been worked. Paving and landscaping of project areas early in the construction schedule will also reduce dust emissions. Excess exhaust emissions from traffic disruption can be mitigated by moving construction equipment and workers to and from the project area during off-peak traffic hours and by minimizing road closures during peak traffic periods.

After construction, motor vehicles coming to and from the proposed development will result in a long-term increase in air pollution emissions in the project area. To assess the impact of emissions from these vehicles, a computerized air quality modeling study was undertaken to estimate current ambient concentrations of carbon monoxide at roadway intersections in the project vicinity and to predict future levels both with and without the proposed project. During worst-case conditions, model results indicated that present 1-hour and 8-hour carbon monoxide concentrations are well within both the state and the national ambient air quality standards. In the year 2015 without the project, carbon monoxide concentrations were predicted to increase in the project area, but concentrations should remain well within state and federal standards. With the project in the year 2015, carbon monoxide concentrations were estimated to remain virtually unchanged, i.e., the project would have no measurable impact. Implementing mitigation measures for traffic-related air quality impacts is unnecessary and unwarranted.

2.0 INTRODUCTION

The Hawaii Department of Education (DOE) is proposing to develop a new elementary school in the Wailuku area on the island of Maui. The proposed school is on a 14-acre site within the lower portion of the Kehalani Mauka subdivision in close proximity to the main highway system (see Figure 1 for project location). The proposed school would have a capacity of 550 students. It is scheduled to open for the 2012-2013 school year, and it is anticipated to reach its full capacity by the 2015-2016 school year.

The purpose of this study was to evaluate the potential air quality impacts of the proposed project and recommend mitigative measures, if possible and appropriate, to reduce or eliminate any

project-related degradation of air quality in the area. Before examining the potential impacts of the project, a discussion of ambient air quality standards is presented and background information concerning the regional and local climatology and the present air quality of the project area is provided.

3.0 AMBIENT AIR QUALITY STANDARDS

Ambient concentrations of air pollution are regulated by both national and state ambient air quality standards (AAQS). National AAQS are specified in Section 40, Part 50 of the Code of Federal Regulations (CFR), while State of Hawaii AAQS are defined in Chapter 11-59 of the Hawaii Administrative Rules. Table 1 summarizes both the national and the state AAQS that are specified in the cited documents. As indicated in the table, national and state AAQS have been established for particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone and lead. The state has also set a standard for hydrogen sulfide. National AAQS are stated in terms of both primary and secondary standards for most of the regulated air pollutants. National primary standards are designed to protect the public health with an "adequate margin of safety". National secondary standards, on the other hand, define levels of air quality necessary to protect the public welfare from "any known or anticipated adverse effects of a pollutant". Secondary public welfare impacts may include such effects as decreased visibility, diminished comfort levels, or other potential injury to the natural or man-made environment, e.g., soiling of materials, damage to vegetation or other economic damage. In contrast to the national AAQS, Hawaii State AAQS are given in terms of a single standard that is designed "to protect public health and welfare and to prevent the significant deterioration of air quality".

Each of the regulated air pollutants has the potential to create or exacerbate some form of adverse health effect or to produce environmental degradation when present in sufficiently high concentration for prolonged periods of time. The AAQS specify a maximum allowable concentration for a given air pollutant for one or more averaging times to prevent harmful effects. Averaging times vary from one hour to one year depending on the pollutant and type of exposure necessary to cause adverse effects. In the case of the short-term (i.e., 1- to 24-hour) AAQS, both national and state standards allow a specified number of exceedances each year.

The Hawaii AAQS are in some cases considerably more stringent than the comparable national AAQS. In particular, the Hawaii 1-hour AAQS for carbon monoxide is four times more stringent than the comparable national limit. The U.S. Environmental Protection Agency (EPA) is currently working on a plan to phase out the national 1-hour ozone standard in favor of the new (and more stringent) 8-hour standard.

The Hawaii AAQS for sulfur dioxide were relaxed in 1986 to make the state standards essentially the same as the national limits. In 1993, the state also revised its particulate standards to follow those set by the federal government. During 1997, the federal government again revised its standards for particulate, but the new standards were challenged in federal court. A Supreme Court ruling was issued during February 2001, and as a result, the new standards for particulate were finally implemented during 2005. To date, the Hawaii Department of Health has not updated the state particulate standards. In September 2001, the state vacated the state 1-hour standard for ozone and an 8-hour standard was adopted.

During the latter part of 2008, EPA revised the standard for lead making the standard more stringent. So far, the Hawaii Department of Health has not revised the corresponding state standard for lead.

4.0 REGIONAL AND LOCAL CLIMATOLOGY

Regional and local climatology significantly affect the air quality of a given location. Wind, temperature, atmospheric turbulence, mixing height and rainfall all influence air quality. Although the climate of Hawaii is relatively moderate throughout most of the state, significant differences in these parameters may occur from one location to another. Most differences in regional and local climates within the state are caused by the mountainous topography.

The topography of Maui is dominated by the great volcanic masses of Haleakala (10,023 feet) and the West Maui Mountains (5,788 feet). The island consists entirely of the slopes of these mountains and of a connecting isthmus. Haleakala is still considered to be an active volcano and last erupted about 1790. The project site is located near sea level in the northern isthmus area between Haleakala and the West Maui Mountains.

Maui lies well within the belt of northeasterly trade winds generated by the semi-permanent Pacific high pressure cell to the north and east. Because the project area is located on the isthmus between Haleakala and the West Maui Mountains, the predominant trade wind flow tends to be channeled through the area. Local winds such as land/sea breezes and/or upslope/downslope winds also influence the wind pattern for the

area when the trade winds are weak or absent. During winter, occasional strong winds from the south or southwest occur in association with the passage of winter storm systems.

Air pollution emissions from motor vehicles, the formation of photochemical smog and smoke plume rise all depend in part on air temperature. Colder temperatures tend to result in higher emissions of contaminants from automobiles but lower concentrations of photochemical smog and ground-level concentrations of air pollution from elevated plumes. In Hawaii, the annual and daily variation of temperature depends to a large degree on elevation above sea level, distance inland and exposure to the trade winds. Average temperatures at locations near sea level generally are warmer than those at higher elevations. Areas exposed to the trade winds tend to have the least temperature variation, while inland and leeward areas often have the most. The project site's lower elevation and windward location results in relatively even temperatures compared with many other parts of the island. Average daily minimum and maximum temperatures at Wailuku are 68°F and 81°F, respectively [1]. Temperatures at the project site can be expected to be similar to this.

Small scale, random motions in the atmosphere (turbulence) cause air pollutants to be dispersed as a function of distance or time from the point of emission. Turbulence is caused by both mechanical and thermal forces in the atmosphere. It is often measured and described in terms of Pasquill-Gifford stability class. Stability class 1 is the most turbulent and class 6 is the least. Thus, air pollution dissipates the best during stability class 1 conditions and the worst when stability class 6 prevails. In the Pukualani area, stability classes 5 or 6 typically occur during the nighttime or early morning hours when temperature inversions form due to radiational cooling or to drainage flow from the

nearby mountains. Stability classes 1 through 4 occur during the daytime, depending mainly on the amount of cloud cover and incoming solar radiation and the onset and extent of the sea breeze.

Mixing height is defined as the height above the surface through which relatively vigorous vertical mixing occurs. Low mixing heights can result in high ground-level air pollution concentrations because contaminants emitted from or near the surface can become trapped within the mixing layer. In Hawaii, minimum mixing heights tend to be high because of mechanical mixing caused by the trade winds and because of the temperature moderating effect of the surrounding ocean. Low mixing heights may sometimes occur, however, at inland locations and even at times along coastal areas early in the morning following a clear, cool, windless night. Coastal areas also may experience low mixing levels during sea breeze conditions when cooler ocean air rushes in over warmer land. Mixing heights in Hawaii typically are above 3,000 feet (1,000 meters).

Rainfall can have a beneficial affect on the air quality of an area in that it helps to suppress fugitive dust emissions, and it also may "washout" gaseous contaminants that are water soluble. Rainfall in Hawaii is highly variable depending on elevation and on location with respect to the trade wind. The climate of the project area is moderately dry due to the low elevation. Historical records from Wailuku show that this area of Maui averages about 26 inches of precipitation per year with the summer months being the driest [1].

5.0 PRESENT AIR QUALITY

Present air quality in the project area is mostly affected by air pollutants from vehicular, industrial, natural and/or agricultural sources. Table 2 presents an air pollutant emission summary for the island of Maui for calendar year 1993. This is the most recent year for which an island-wide emission inventory is available. The emission rates shown in the table pertain to manmade emissions only, i.e., emissions from natural sources are not included. As suggested in the table, most of the manmade particulate and sulfur oxides emissions on Maui originate from point sources, such as power plants and other fuel-burning industries. Nitrogen oxides emissions are roughly equally divided between point sources and area sources (mostly motor vehicle traffic). The majority of carbon monoxide emissions occur from area sources (motor vehicle traffic and sugar cane burning), while hydrocarbons are emitted mainly from point sources. Emissions today are probably higher than those shown in the table, but the proportional relationships are likely about the same.

The largest sources of air pollution in the immediate project area are most likely agricultural operations and automobile traffic using local roadways. Emissions from these sources consist primarily of particulate, carbon monoxide and nitrogen oxides. The Kahului Power Plant is located about 2 miles to the east. This is an older facility that uses heavy oil as fuel and emits mostly sulfur dioxide, nitrogen oxides and particulate. Volcanic emissions from distant natural sources on the Big Island also affect the air quality at times during kona wind conditions. By the time the volcanic emissions reach the project area, they consist mostly of fine particulate sulfate.

The State Department of Health operates a network of air quality monitoring stations at various locations around the state, but only very limited data are available for Maui Island. The only air quality data for the island of Maui consists of particulate measurements collected at Kihei, which is about 7 miles to the south. Table 3 summarizes the data from the Kihei monitoring station. Annual second-highest 24-hour particulate concentrations (which are most relevant to the air quality standards) ranged from 63 to 119 $\mu g/m^3$ between 2002 and 2006. Average annual concentrations ranged from 19 to 25 $\mu g/m^3$. One exceedance of the state standard was recorded during 2005. This was reported to be due to agricultural tilling operations in the area. Because the Wailuku area tends to be upwind of agricultural operations in the area, the Kihei data are probably only partially representative of the project site. Particulate concentrations in the Wailuku area are probably lower.

Given the limited air pollution sources in the area, it is likely that air pollution concentrations are near natural background levels most of the time, except possibly for locations adjacent to agricultural operations or near traffic-congested intersections. Present concentrations of carbon monoxide in the project area are estimated later in this study based on computer modeling of motor vehicle emissions.

6.0 SHORT-TERM IMPACTS OF PROJECT

Short-term direct and indirect impacts on air quality could potentially occur during project construction. For a project of this nature, there are two potential types of air pollution emissions that could directly result in short-term air quality impacts during construction: (1) fugitive dust from vehicle movement and soil excavation; and (2) exhaust emissions from on-

site construction equipment. Indirectly, there also could be short-term impacts from slow-moving construction equipment traveling to and from the project site and from the disruption of traffic due to road construction.

Fugitive dust emissions may arise from the grading and dirt-moving activities associated with land clearing and preparation work. The emission rate for fugitive dust emissions from construction activities is difficult to estimate accurately because of its elusive nature of emission and because the potential for its generation varies greatly depending upon the type of soil at the construction site, the amount and type of dirt-disturbing activity taking place, the moisture content of exposed soil in work areas, and the wind speed. The EPA [2] has provided a rough estimate for uncontrolled fugitive dust emissions from construction activity of 1.2 tons per acre per month under conditions of "medium" activity, moderate soil silt content (30%), and precipitation/evaporation (P/E) index of 50. Uncontrolled fugitive dust emissions in the project area would likely be somewhere near this. In any case, State of Hawaii Air Pollution Control Regulations [3] prohibit visible emissions of fugitive dust from construction activities at the project boundary, and thus an effective dust control plan for the project construction phase is essential.

Adequate fugitive dust control can usually be accomplished by the establishment of a frequent watering program to keep bare-dirt surfaces in construction areas from becoming significant sources of dust. In dust-prone or dust-sensitive areas, other control measures such as limiting the area that can be disturbed at any given time, applying chemical soil stabilizers, mulching and/or using wind screens may be necessary. Control regulations further stipulate that open-bodied trucks be covered at all times when in motion if they are transporting materials that could be blown

away. Haul trucks tracking dirt onto paved streets from unpaved areas is oftentimes a significant source of dust in construction areas. Some means to alleviate this problem, such as road cleaning or tire washing, may be appropriate. Paving and/or establishment of landscaping as early in the construction schedule as possible can also lower the potential for fugitive dust emissions.

On-site mobile and stationary construction equipment also will emit air pollutants from engine exhausts. The largest of this equipment is usually diesel-powered. Nitrogen oxides emissions from diesel engines can be relatively high compared to gasoline-powered equipment, but the standard for nitrogen dioxide is set on an annual basis and is not likely to be violated by short-term construction equipment emissions. Carbon monoxide emissions from diesel engines, on the other hand, are low and should be relatively insignificant compared to vehicular emissions on nearby roadways.

Indirectly, slow-moving construction vehicles on roadways leading to and from the project area could obstruct the normal flow of traffic to such an extent that overall vehicular emissions are increased, but this impact can be mitigated by moving heavy construction equipment during periods of low traffic volume. Likewise, road closures during peak traffic periods should be avoided to the extent possible to minimize air pollution impacts from traffic disruption. Thus, with careful planning and attention to dust control, most potential short-term air quality impacts from project construction can be mitigated.

7.0 LONG-TERM IMPACTS OF PROJECT

After construction is completed, use of the proposed facilities will result in increased motor vehicle traffic in the project area, potentially causing long-term impacts on ambient air quality. Motor vehicles with gasoline-powered engines are significant sources of carbon monoxide. They also emit nitrogen oxides and other contaminates.

Federal air pollution control regulations require that new motor vehicles be equipped with emission control devices that reduce emissions significantly compared to a few years ago. In 1990, the President signed into law the Clean Air Act Amendments. This legislation requires further emission reductions, which have been phased in since 1994. More recently, additional restrictions were signed into law during the Clinton administration. The added restrictions on emissions from new motor vehicles will lower average emissions each year as more and more older vehicles leave the state's roadways. It is estimated that carbon monoxide emissions, for example, will go down by an average of about 30 percent per vehicle during the next 10 years due to the replacement of older vehicles with newer and cleaner models.

To evaluate the potential long-term indirect ambient air quality impact of increased roadway traffic associated with a project such as this, computerized emission and atmospheric dispersion models can be used to estimate ambient carbon monoxide concentrations along roadways leading to and from the project. Carbon monoxide is selected for modeling because it is both the most stable and the most abundant of the pollutants generated by motor vehicles. Furthermore, carbon monoxide air pollution is generally considered to be a microscale problem that can be addressed locally to some extent, whereas nitrogen oxides air pollution most often is a

regional issue that cannot be addressed by a single new development.

For this project, three scenarios were selected for the carbon monoxide modeling study: (1) year 2009 with present conditions, (2) year 2015 without the project, and (3) year 2015 with the project. To begin the modeling study of the three scenarios, critical receptor areas in the vicinity of the project were identified for analysis. Generally speaking, roadway intersections are the primary concern because of traffic congestion and because of the increase in vehicular emissions associated with traffic queuing. For this study, several of the key intersections identified in the traffic study were also selected for air quality analysis. These included the following intersections:

- Honoapiilani Highway at Kehalani Parkway
- Honapiilani Highway at Kuikahi Drive
- Honapiilani Highway at Waiko Road
- Waiale Road at Olomea Street
- Waiale Road at Kuikahi Drive

The traffic impact report for the project [4] describes the existing and projected future traffic conditions and laneage configurations of these intersections in detail. In performing the air quality impact analysis, it was assumed that all recommended traffic mitigation measures would be implemented.

The main objective of the modeling study was to estimate maximum 1-hour average carbon monoxide concentrations for each of the three scenarios studied. To evaluate the significance of the estimated concentrations, a comparison of the predicted values for each scenario can be made. Comparison of the estimated values to

the national and state AAQS was also used to provide another measure of significance.

Traffic estimates for the project indicate that traffic volumes generally are or will be higher during the afternoon peak hour than during the morning peak period. However, worst-case emission and meteorological dispersion conditions typically occur during the morning hours at most locations. Thus, both morning and afternoon peak-traffic hours were examined to ensure that worst-case concentrations were identified.

The EPA computer model MOBILE6.2 [5] was used to calculate vehicular carbon monoxide emissions for each year studied. One of the key inputs to MOBILE6.2 is vehicle mix. Unless very detailed information is available, national average values are typically assumed, which is what was used for the present study. Based on national average vehicle mix figures, the present vehicle mix in the project area was estimated to be 40.9% light-duty gasoline-powered automobiles, 46.2% light-duty gasoline-powered trucks and vans, 3.6% heavy-duty gasoline-powered vehicles, 0.2% light-duty diesel-powered vehicles, 8.5% heavy-duty diesel-powered trucks and buses, and 0.6% motorcycles. For the future scenarios studied, the vehicle mix was estimated to change slightly with fewer light-duty gasoline-powered automobiles and more light-duty gasoline-powered trucks and vans.

Ambient temperatures of 59 and 68 degrees F were used for morning and afternoon peak-hour emission computations, respectively. These are conservative assumptions since morning/afternoon ambient temperatures will generally be warmer than this, and emission estimates given by MOBILE6.2 generally have an inverse relationship to the ambient temperature.

After computing vehicular carbon monoxide emissions through the use of MOBILE6.2, these data were then input to an atmospheric dispersion model. EPA air quality modeling guidelines [6] currently recommend that the computer model CAL3QHC [7] be used to assess carbon monoxide concentrations at roadway intersections, or in areas where its use has previously been established, CALINE4 [8] may be used. Until a few years ago, CALINE4 was used extensively in Hawaii to assess air quality impacts at roadway intersections. In December 1997, the California Department of Transportation recommended that the intersection mode of CALINE4 no longer be used because it was thought the model has become outdated. Studies have shown that CALINE4 may tend to over-predict maximum concentrations in some situations. Therefore, CAL3QHC was used for the subject analysis.

CAL3QHC was developed for the U.S. EPA to simulate vehicular movement, vehicle queuing and atmospheric dispersion of vehicular emissions near roadway intersections. It is designed to predict 1-hour average pollutant concentrations near roadway intersections based on input traffic and emission data, roadway/receptor geometry and meteorological conditions.

Although CAL3QHC is intended primarily for use in assessing atmospheric dispersion near signalized roadway intersections, it can also be used to evaluate unsignalized intersections. This is accomplished by manually estimating queue lengths and then applying the same techniques used by the model for signalized intersections. Currently, only three of the five study intersections are signalized.

Input peak-hour traffic data were obtained from the traffic study cited previously. This included vehicle approach volumes, saturation capacity estimates, intersection laneage and signal timings (where applicable). All emission factors that were input to CAL3QHC for free-flow traffic on roadways were obtained from MOBILE6.2 based on assumed free-flow vehicle speeds corresponding to the posted speed limits.

Model roadways were set up to reflect roadway geometry, physical dimensions and operating characteristics. Concentrations predicted by air quality models generally are not considered valid within the roadway-mixing zone. The roadway-mixing zone is usually taken to include 3 meters on either side of the traveled portion of the roadway and the turbulent area within 10 meters of a cross street. Model receptor sites were thus located at the edges of the mixing zones near all intersections that were studied for all scenarios. This implies that pedestrian sidewalks or public walkways either already exist or are assumed to exist in the future. All receptor heights were placed at 1.8 meters above ground to simulate levels within the normal human breathing zone.

Input meteorological conditions for this study were defined to provide "worst-case" results. One of the key meteorological inputs is the atmospheric stability category. For these analyses, atmospheric stability category 6 was assumed for morning scenarios and stability category 4 was assumed for afternoon cases. These are the most conservative stability categories that are generally used for estimating pollutant dispersion at suburban locations for these time periods. For all cases, a surface roughness length of 100 cm was assumed and a mixing height of 300 meters was used. Worst-case wind conditions were defined as a wind speed of 1 meter per second with a wind direction resulting in the highest

predicted concentration. Concentration estimates were calculated at wind directions of every 5 degrees.

Existing background concentrations of carbon monoxide in the project vicinity are believed to be at relatively low levels. Hence, background contributions of carbon monoxide from sources or distant roadways not directly considered in the analysis were accounted for by adding a small background concentration of 0.5 ppm to all predicted concentrations for 2009. Although at least moderate development and increased traffic are expected to occur within the project area within the next several years, background carbon monoxide concentrations may not change significantly since individual emissions from motor vehicles are forecast to decrease with time. Hence, a background value of 0.5 ppm was assumed to persist for the future scenarios studied.

Predicted Worst-Case 1-Hour Concentrations

Table 4 summarizes the final results of the modeling study in the form of the estimated worst-case 1-hour morning and afternoon ambient carbon monoxide concentrations for 2009 and for each of the two future alternatives that were studied. The locations of these estimated worst-case 1-hour concentrations all occurred at or very near the indicated intersections.

As indicated in the table, the highest estimated worst-case 1-hour concentration for the present (2009) scenario was 3.6 mg/m^3, and this occurred during the morning at the intersection of Honoapiilani Highway and Kuikahi Drive. Worst-case values for other locations and times ranged from 1.3 to 3.2 mg/m^3. These concentrations are well within both the national AAQS of 40 mg/m^3 and the state standard of 10 mg/m^3.

In the year 2015 without the proposed project, the predicted highest worst-case 1-hour concentration occurred again during the morning at the intersection of Honoapiilani Highway and Kuikahi Drive with a value of 5.1 mg/m^3. Other concentrations for this scenario at other times and locations ranged between 2.2 and 3.9 mg/m^3. Without the project, carbon monoxide concentrations in the year 2015 were predicted to increase at all of the study locations in the project area compared to the existing case, but even with the increase, worst-case values would likely remain well within the state and federal standards for this scenario.

Similar to the existing and 2015 without-project scenarios, the highest worst-case concentration with the project in the year 2015 was predicted to occur during the morning at the intersection of Honoapiilani Highway and Kuikahi Drive with a worst-case 1-hour concentration of 5.1 mg/m^3. Worst-case concentrations at other locations and times ranged between 2.2 and 3.9 mg/m^3. There were no differences in the year 2015 with or without the project. The predicted worst-case 1-hour concentrations for the 2015 with-project alternative at all locations studied continued to remain well within both the national and state standards.

Predicted Worst-Case 8-Hour Concentrations

Worst-case 8-hour carbon monoxide concentrations were estimated by multiplying the worst-case 1-hour values by a persistence factor of 0.5. This accounts for two factors: (1) traffic volumes averaged over eight hours are lower than peak 1-hour values, and (2) meteorological conditions are more variable (and hence more favorable for dispersion) over an 8-hour period than they are for a single hour. Based on monitoring data, 1-hour to 8-hour persis-

tence factors for most locations generally vary from 0.4 to 0.8 with 0.6 being the most typical. One recent study based on modeling [9] concluded that 1-hour to 8-hour persistence factors could typically be expected to range from about 0.4 to 0.5. EPA guidelines [10] recommend using a value of 0.6 to 0.7 unless a locally derived persistence factor is available. Recent monitoring data for Honolulu reported by the Department of Health [11] suggest that this factor may range between about 0.35 and 0.55 depending on location and traffic variability. Considering the location of the project and the traffic pattern for the area, a 1-hour to 8-hour persistence factor of 0.5 will likely yield reasonable estimates of worst-case 8-hour concentrations. However, it should be noted that the 8-hour concentration estimates are generally less reliable than the 1-hour values due to the prediction methodology involved.

The resulting estimated worst-case 8-hour concentrations are indicated in Table 5. For the 2009 scenario, the estimated worst-case 8-hour carbon monoxide concentrations for the study locations ranged from 1.3 mg/m^3 to 1.8 mg/m^3, with the highest concentration occurring at the intersection of Honoapiilani Highway and Kuikahi Drive. The estimated worst-case concentrations for the existing case were well within both the national limit of 10 mg/m^3 and the state standard of 5 mg/m^3.

For the 2015 without project scenario in comparison to the existing case, worst-case concentrations increased but remained relatively low. Concentrations ranged from 1.8 mg/m^3 to 2.6 mg/m^3 with the highest concentration occurring at the intersection of Honoapiilani Highway and Kuikahi Drive. Despite the increase, all predicted 8-hour concentrations for this scenario were well within both the national and the state AAQS.

For the 2015 with-project scenario, there was no difference compared to the 2015 without-project case. All predicted 8-hour concentrations for this scenario were well within both the national and the state AAQS.

Conservativeness of Estimates

The results of this study reflect several assumptions that were made concerning both traffic movement and worst-case meteorological conditions. One such assumption concerning worst-case meteorological conditions is that a wind speed of 1 meter per second with a steady direction for 1 hour will occur. A steady wind of 1 meter per second blowing from a single direction for an hour is extremely unlikely and may occur only once a year or less. With wind speeds of 2 meters per second, for example, computed carbon monoxide concentrations would be only about half the values given above. The 8-hour estimates are also conservative in that it is unlikely that anyone would occupy the assumed receptor sites (within 3 m of the roadways) for a period of 8 hours.

8.0 CONCLUSIONS AND RECOMMENDATIONS

Existing Conditions

Although very little ambient air quality data are available to characterize existing conditions, it is likely that state and federal ambient air quality standards are currently being met in the project area, except perhaps for occasional exceedances of the stringent state carbon monoxide standards within small areas near traffic-congested locations. Locations adjacent to large-scale agricultural activities may also be occasionally affected by dust.

Short-Term Impacts and Mitigation

The major potential short-term impact of the project on air quality will occur from the emission of fugitive dust during construction. Uncontrolled fugitive dust emissions from construction activities are estimated to amount to about 1.2 tons per acre per month, depending on rainfall and other factors. To control dust, active work areas and any temporary unpaved work roads should be watered at least twice daily on days without rainfall. Use of wind screens and/or limiting the area that is disturbed at any given time will also help to contain fugitive dust emissions. Wind erosion of inactive areas of the project that have been disturbed could be controlled by mulching or chemical stabilization. Dirt-hauling trucks should be covered when traveling on roadways to prevent windage. A routine road cleaning and/or tire washing program will also help to reduce fugitive dust emissions that may occur as a result of trucks tracking dirt onto paved roadways in the project area. Establishment of landscaping early in the construction schedule will also help to control dust.

During construction phases, emissions from engine exhausts (primarily consisting of carbon monoxide and nitrogen oxides) will also occur both from on-site construction equipment and from the disruption of normal traffic flow. Increased vehicular emissions due to the disruption of traffic can be alleviated by minimizing road closures during peak traffic hours.

Long-Term Impacts and Mitigation

The air quality analysis indicates that the proposed project would have virtually no long-term impact on air quality in the project area. With or without the project in the year 2015, worst-case

carbon monoxide concentrations would likely increase in the project area compared to the existing case, but even with the increased concentrations, worst-case concentrations should remain well within the state and federal standards through the year 2015.

Options available to mitigate long-term, traffic-related air pollution are generally to further improve roadways, to reduce traffic and/or to reduce individual vehicular emissions. Aside from providing added roadway improvements, air pollution impacts from vehicular emissions could conceivably be additionally mitigated by reducing traffic volumes through the promotion of bus service and car pooling in the project area and/or by adjusting local school and business hours to begin and end during off-peak times. This mitigation measure is generally considered only partially successful. Reduction of emissions from individual vehicles would have to be achieved through the promulgation of local, state or federal air pollution control regulations. For example, Hawaii currently does not require annual inspections of motor vehicle air pollution control equipment. However, at the present time there is no indication that the state is contemplating adopting such rules. Because there would be virtually no measurable increase in carbon monoxide concentrations with the project and because of the projected compliance with state and federal standards, mitigation measures for air pollution from project-related traffic are unnecessary and unwarranted.

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Table 1

SUMMARY OF STATE OF HAWAII AND NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Units	Averaging Time	Maximum Allowable Concentration		
			National Primary	National Secondary	State of Hawaii
Particulate Matter (<10 microns)	$\mu g/m^3$	Annual 24 Hours	- 150[a]	- 150[a]	50 150[b]
Particulate Matter (<2.5 microns)	$\mu g/m^3$	Annual 24 Hours	15[c] 35[d]	15[c] 35[d]	- -
Sulfur Dioxide	$\mu g/m^3$	Annual 24 Hours 3 Hours	80 365[b] -	- - 1300[b]	80 365[b] 1300[b]
Nitrogen Dioxide	$\mu g/m^3$	Annual	100	100	70
Carbon Monoxide	mg/m^3	8 Hours 1 Hour	10[b] 40[b]	- -	5[b] 10[b]
Ozone	$\mu g/m^3$	8 Hours 1 Hour	157[e] 235[f]	157[e] 235[f]	157[e] -
Lead	$\mu g/m^3$	Calendar Quarter	0.15[g]	0.15[g]	1.5
Hydrogen Sulfide	$\mu g/m^3$	1 Hour	-	-	35[b]

[a] Not to be exceeded more than once per year on average over three years.
[B] Not to be exceeded more than once per year.
[C] Three-year average of the weighted annual arithmetic mean.
[D] 98th percentile value averaged over three years.
[E] Three-year average of fourth-highest daily 8-hour maximum.
[F] Standard is attained when the expected number of exceedances is less than or equal to 1.
[G] Rolling 3-month average.

Table 2

AIR POLLUTION EMISSIONS INVENTORY FOR ISLAND OF MAUI, 1993

Air Pollutant	Point Sources (tons/year)	Area Sources (tons/year)	Total (tons/year)
Particulate	63,275	7,030	70,305
Sulfur Oxides	6,419	nil	6,419
Nitrogen Oxides	7,312	8,618	15,930
Carbon Monoxide	4,612	20,050	24,662
Hydrocarbons	1,991	234	2,225

Source: Final Report, "Review, Revise and Update of the Hawaii Emissions Inventory Systems for the State of Hawaii", prepared for Hawaii Department of Health by J.L. Shoemaker & Associates, Inc., 1996

Table 3

ANNUAL SUMMARIES OF AIR QUALITY MEASUREMENTS FOR MONITORING STATIONS NEAREST THE PROPOSED WAILUKU II ELEMENTARY SCHOOL

Parameter / Location	2002	2003	2004	2005	2006
Particulate (PM-10) / Kihei					
24-Hour Averaging Period:					
No. of Samples	352	340	308	337	337
Highest Concentration ($\mu g/m^3$)	95	78	65	155	72
2nd Highest Concentration ($\mu g/m^3$)	80	72	63	119	66
No. of State AAQS Exceedances	0	0	0	1	0
Annual Average Concentration ($\mu g/m^3$)	20	23	19	25	22

Source: State of Hawaii Department of Health, "Annual Summaries, Hawaii Air Quality Data, 2002 - 2006"

Table 4

ESTIMATED WORST-CASE 1-HOUR CARBON MONOXIDE CONCENTRATIONS ALONG ROADWAYS NEAR THE PROPOSED WAILUKU II ELEMENTARY SCHOOL (milligrams per cubic meter)

Roadway Intersection	Year/Scenario					
	2009/Present		2015/Without Project		2015/With Project	
	AM	PM	AM	PM	AM	PM
Honoapiilani Highway at Kehalani Parkway	2.6	1.3	3.7	2.8	3.7	2.8
Honapiilani Highway at Kuikahi Drive	3.6	2.0	5.1	3.0	5.1	3.0
Honapiilani Highway at Waiko Road	3.2	2.2	3.6	2.3	3.6	2.3
Waiale Road at Olomea Street	3.2	1.8	3.8	2.2	3.8	2.2
Waiale Road at Kuikahi Drive	2.9	2.1	3.9	3.3	3.9	3.3

Hawaii State AAQS: 10
National AAQS: 40

Table 5

ESTIMATED WORST-CASE 8-HOUR CARBON MONOXIDE CONCENTRATIONS ALONG ROADWAYS NEAR THE PROPOSED WAILUKU II ELEMENTARY SCHOOL (milligrams per cubic meter)

Roadway Intersection	Year/Scenario		
	2009/Present	2015/Without Project	2015/With Project
Honoapiilani Highway at Kehalani Parkway	1.3	1.8	1.8
Honapiilani Highway at Kuikahi Drive	1.8	2.6	2.6
Honapiilani Highway at Waiko Road	1.6	1.8	1.8
Waiale Road at Olomea Street	1.6	1.9	1.9
Waiale Road at Kuikahi Drive	1.4	2.0	2.0

Hawaii State AAQS: 5
National AAQS: 10

ARCHAEOLOGICAL MONITORING PLAN FOR CONSTRUCTION-RELATED ACTIVITIES ASSOCIATED WITH THE WAILUKU SCHOOL II SITUATED AT KEHALANI MAUKA TMK: (2) 3-5-01:078, 77 and 67 pors. WAILUKU *AHUPUA'A;* WAILUKU DISTRICT ISLAND OF MAUI

FOR: Group 70

BY: Lisa J. Rotunno-Hazuka (B.A.)
and Jeffrey Pantaleo (M.A.)

DECEMBER 2009

ARCHAEOLOGICAL SERVICES HAWAII, LLC.
1930 A Vineyard Street
Wailuku, HI 96793

"Protecting, Preserving, Interpreting the Past, While Planning the Future"

INTRODUCTION

At the request of Group 70 for the proposed Wailuku II Elementary School and per recommendations by the State Historic Preservation Division-SHPD (Doc.No.410MK14), and the Archaeological Inventory Survey (Dega 2004), Archaeological Services Hawaii, LLC (ASH) of Wailuku proposes to undertake archaeological monitoring for all ground disturbing activities at Lot 16 or TMK: (2) 3-5-01: 078 and portions of 67 and 77, Wailuku *ahupua'a* and District, Island of Maui (Figures 1 and 2).

The proposed improvements consist of constructing the elementary school buildings, associated utilities and ancillary buildings. Additionally, any offsite improvements required by the county or state for this project would be covered under this plan.

PROJECT AREA DESCRIPTION

The project area is situated along the lower eastern slopes of the West Maui Mountains. It is approximately 1,000 ft. west of Honoapiilani Highway above Wailuku Town within the Kehalani Mauka subdivision. The parcel is composed of approximately 13 acres which contains fallow sugar cane fields.

And Archaeological Inventory Survey (AIS) was performed of the Kehalani Mauka Subdivision by Scientific Consultant Services (SCS) in 2005 which included the subject parcel, Lot 16 (Figure 3). Identified within this lot was Sites 50-50-04-5197 (Waihe`e Ditch), 5490 and 5493 (un-named ditches), 5489 (section of unpaved road) and 5492 (a linear basalt rock pile-Figure 4). All sites were considered significant under Criterion D and no further work was recommended for these sites. Although Hopoi Camp is noted on the 1922 USGS Wailuku Quadrangle map, no cultural materials and or structural remains definitively related to the camp were recovered during the AIS. Thus no state site number was applied to Hopoi Camp and SCS recommended minimal monitoring of Lot 16 during ground-disturbing activities. Additional historic properties noted within close proximity to the subject parcel consist of the Hopoi Reservoir (5473) and Kama Ditch (5474).

EXPECTABILITY OF SUBSURFACE SITES

Based on the aforementioned, cultural materials and or structural remains from Hopoi Camp may still be present below the agricultural till zone, thus all initial ground disturbing activities will be monitored.

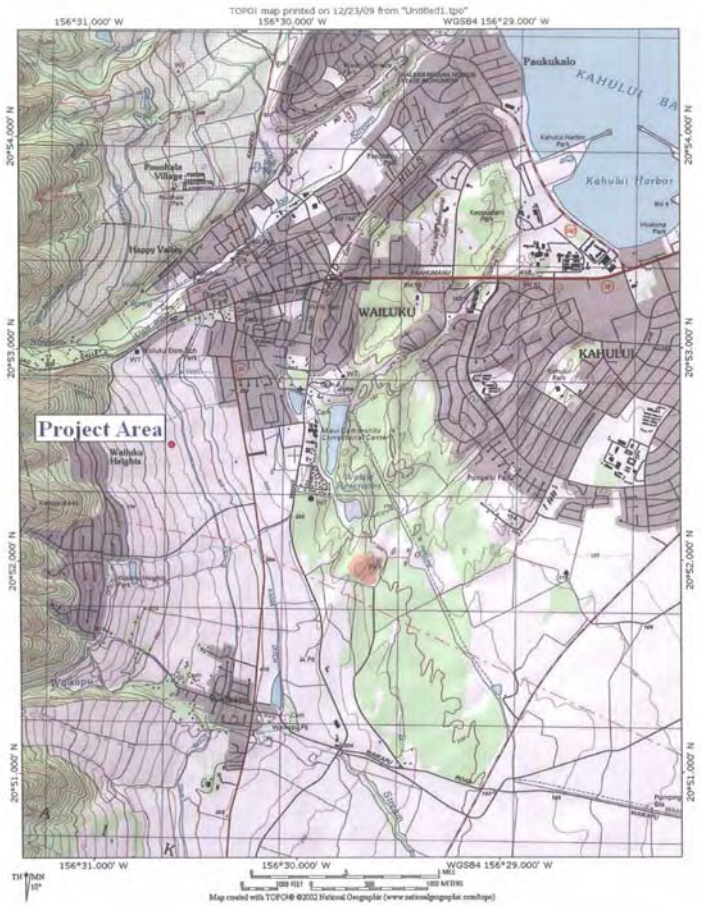

Figure 1. Location of Project Area on USGS Quadrangle

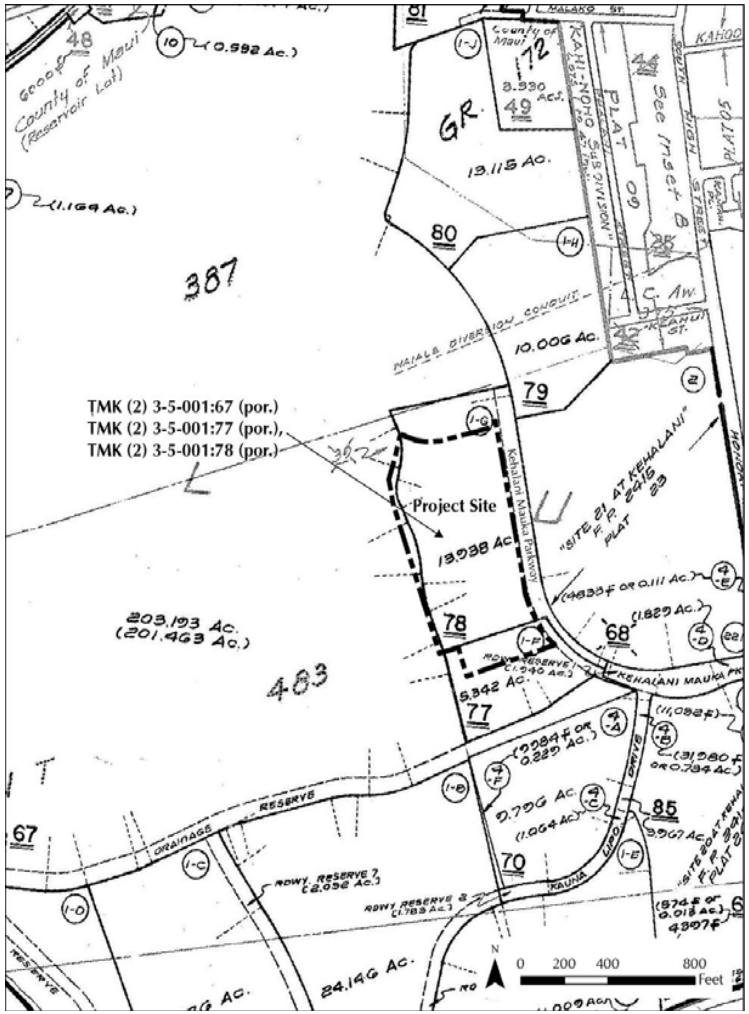

Figure 2. Location of Project Area on Tax Map Key

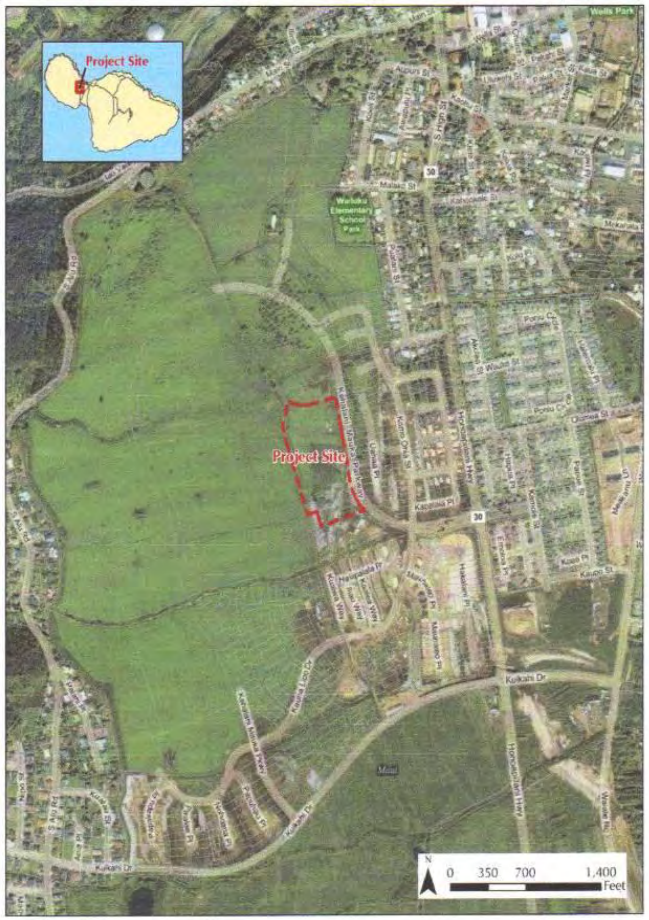

Figure 3. Aerial Photograph Showing Project Area

MONITORING PLAN

The construction plans call for excavations ranging from 1.0 to 12.0 feet in depth. Initially all ground-altering activities will be monitored full-time until the nature of the sub-surface soils can be assessed. After these initial inspections, the level of monitoring either full-time or on-call will be determined in consultation with SHPD. Additionally, in the event rock, sterile fill deposits and or the water table is encountered, monitoring procedures may need to be adjusted; however no changes may be made without consultation and approval by SHPD via telephone and or in writing. SHPD will also be notified of the onset and completion of the proposed undertaking.

One archaeological monitor per piece of ground disturbing equipment is the protocol for this monitoring project. Dependent on availability, Maui resident archaeologists will be assigned to this project. Prior to the commencement of construction, all pertinent parties including but not limited to construction and archaeological personnel will be informed of the monitoring procedures as stipulated in the monitoring plan, as well as the monitors' authority to halt work in the vicinity of a find. In the event that subsurface sites are exposed during construction, ground-disturbing activities in the immediate area will temporarily halt and project activities may shift to other areas of the project. Once the archaeologist makes an assessment, they will then consult with SHPD to determine the appropriate mitigation measures for the find. The area around the site shall be protected by erecting orange fencing or yellow caution tape. The site will be recorded utilizing all standard archaeological methods and procedures. Stratigraphic profiles will be drawn, photographs will be taken, and soil samples collected not only from the subsurface site, but from selected locations within the project area. If nighttime work is performed, the general contractor must notify the consulting archaeologist at least 3 days in advance. The archaeological monitor has sole discretion to determine if lighting is adequate to perform visual inspections of the soil.

If historic bottles are found they are to be collected by the archaeologist. No bottles may be collected or taken by any construction worker.

In the event that human remains are inadvertently exposed during this undertaking, the aforementioned procedures of halting and securing the site will be performed. After an initial assessment is made by Mr. Hinano Rodrigues of SHPD, and members of the

Maui/Lana'i Islands Burial Council-MLIBC (if the remains are believed to be Native Hawaiian), procedures for documenting the burial find shall be undertaken. These mitigation measures may include mapping and collecting displaced human skeletal remains, however no human skeletal remains will be collected without authorization from SHPD. Additional documentation will include, raking and screening of the area to collect all displaced human remains, and excavations to ascertain the context (*in situ* or displaced) and number of individuals represented by the skeletal remains.

PROCEDURES FOR DISPLACED HUMAN SKELETAL REMAINS

The procedures for exposed skeletal remains and possible burial pit outlines are presented below.

1. Upon identification of displaced human remains, a possible burial pit outline, or basalt and coral manuports all construction activities in the immediate area of the find is temporarily halted.

2. SHPD and the MLIBC shall be notified.

3. Mark the perimeter of the avoidance area with yellow caution tape, and or orange construction fencing and cover the remains to protect them from the elements

4. Extend a baseline through the center of the dispersal area.

5. After notification and concurrence with SHPD, mark all displaced remains with pin flags and produce a plan view map. Locate and identify displaced remains and only collect the displaced remains if authorized by SHPD personnel.

6. If a concentration is identified, map the concentration and leave in place for determination of disposition and controlled manual excavations, as warranted.

7. Manually rake bulldozed or other mechanically produced tailings and screen push piles to collect all displaced and fragmented remains.

8. If no concentration was identified and raking is complete, skip to blade testing on item #13.

9. Complete an osteological inventory of the collected remains to determine the components that may be left *in situ* or missing.

10. If a concentration or possible burial pit was identified, notify SHPD of the possible burial feature and ask for written authorization to test the possible burial feature. Once authorization for testing has been received by SHPD, place a 2.0 by 2.0 meter controlled test unit, centrally locating the concentration within the test unit. Clean the surface with a trowel to determine if a pit outline is present. Map pit outline.

11. If SHPD has provided written authorization to test an *in situ* burial, excavate the *in situ* portion to identify any articulation, document the articulated portion within the pit outline, and collect all clearly displaced remains. Articulated remains and those in an anatomically correct position, shall be left in place until a disposition determination can be made by SHPD in consultation with the MLIBC.

12. Fill out all test excavation and burial forms and draw a plan view map of the *in situ* remains. Then cover remains with a thin layer of sand (if SHPD and MLIBC have seen the feature) and or tarp.

13. Conduct mechanical blade testing in potential areas of further discoveries. Blade testing is conducted by removing shallow (2-6") lifts over a predetermined area.

After the above referenced procedures have been performed, a Burial Treatment Plan will be prepared in consultation with the owner, SHPD and the MLIBC (if the remains are believed to be Native Hawaiian).

Upon completion of the fieldwork, all necessary lab procedures including but not limited to processing, cataloguing and analyses of artifacts and photographs; analyses of soil samples as warranted and submitting of charcoal samples for radiocarbon dating will be performed. All analyses will be synthesized into a final monitoring report, and the report shall be submitted within 180 days of the completion of fieldwork. Copies of this report will be sent to the State Historic Preservation Division offices on Oahu and Maui for their review and comments.

All notes, photographs and artifacts will be archived at the offices of Archaeological Services Hawaii, LLC at 1930 A Vineyard Street, Wailuku, HI 96793.

REFERENCES

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2004 *An Intermediate Zone Archaeology Inventory Survey Located in Wailuku, Wailuku Ahupua`a, Wailuku (Kula) District, TMK 3-5-001: 001 pors.* Scientific Consultant Services, Inc., Honolulu.

Kāhela Iho O Kahalawai

(Sprawled beneath West Maui Mountains)

Wailuku 11 Elementary School

TMK 3-5-001:078 – 13.938 Ac.

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I. Introduction

a. Scope

The scope of this report will be to compile various historical, cultural and topographical accounts and facts of Wailuku and its adjacent *'ili*[1] and *ahupua'a*.[2] Much of Wailuku is noted for its battles of pre and post contact of Hawai'i. Therefore, the following description of the project area is derived from topographical, cultural and usage descriptions of the more general areas of Wailuku.

II. Specific Area of Research

a. Wailuku

This project site shall be identified as a portion of T.M.K. 3-5-001-078. This said lot resides within the district of Wailuku.

Wailuku is a vast area much of its surroundings and topographical features are common throughout this vast ahupua'a.

The history of this ahupua'a heavy laden with much historical facts of war, rural life, the paradigm of lifestyles and much more.

Wailuku's boundaries are large. The area of Wailuku begins near the 'ili of Waihe'e extents out to the beginning of Pā'ia and is also bordered by the beginning of Mā'alaea and Lāhaina.

This specific site of which this report is compiled for is currently located beneath 'Īao Valley hence the title of this report: "Kāhela Iho O Kahalawai."[3] It is part of a larger parcel but only takes up 13.938 Ac...

[1] 'Ili: Land division within a Land Section.
[2] Ahupua'a: Land Section. Much of the historical and cultural contexts of this area will be derived from the vast amounts of information about Wailuku in general. In the process of compiling this report, the researcher did not come across a specific name for said site.
[3] This line is derived from a chant written by Keali'i Reichel, noted Haku Mele and Kumu Hula. The term means sprawled beneath the Kahalawai mountains.

This ahupua'a is also home to "Nā Wai 'Ehā" or the four waters which will be mentioned at a later point in this compilation.

Wailuku means "destructive water." There are many *mo'olelo* as to why such a beautiful and serene place can have such a negative connotation in its name. One such reason that this area may be called Wai-luku because of the numerous

Battles that has taken place in this area, of which will be elaborated further on in this report.

Another account is said to be because of the waters that rush down from 'Īao Valley. Much of Wailuku town is built on 'Īao Valley's streambed.[4]

b. Surrounding 'ili within Wailuku:

There are many 'ili within the ahupua'a of Wailuku which stretches from the shore to the peak of the mountains. This specific site is located on the lower portion of Wailuku. Such 'ili as Waiehu, Kahului, Waihe'e and Waikapū.

Waiehu: Today a common surf spot, Waiehu is near to the ocean making this area great for farming and ocean activities at the same time. Waiehu is part of the famous "Nā Wai 'Ehā."[5] Waiehu's location made this area great for lo'i kalo or taro patches. Waiehu literally means "water spray." On a rough day in the ocean, Waiehu's atmosphere would seem a bit foggy; however, it is only the presence of the ocean's mist.

Kahului: Kahului can be likened as Maui's metropolis today. As Kahului is the basis of most of Maui's population, many in traditional time resided here as well. Kahului was the area of where Wailuku's water exited. However, the ocean has eroded the stream mouth. Much of Kahului's landscape in traditional Hawai'i was the common communal living and farming. Kahului literally means "the winning." There is no explanation for this title; furthermore there is no direct translation for this area.

Waihe'e: The term comes from the taro patches that laden the valley walls and the basin of Waihe'e valley. Waihe'e was also part of the four famous waters. This valley like the other three provided much water to produce thousands of

[4] Handy, E.S. Craighill, et al. Native Plants in Old Hawai'i. Honolulu, HI. Bishop Museum Press: 1991.
[5] Means: The four waters.

acres of taro. There really is no proper translation for Waihe'e as it was the name of a lo'i and the mana'o of someone who has long passed.

Waikapū: This area is also one of the four famous waters, this stream provided for much of the taro fields near upper Wailuku as well as Mā'alaea. The literal translation for Waikapū means, "The water of the conch." It was said that in traditional Hawai'i a conch shell resided in one of the caves and when used could be heard through out Hawai'i.[6] However, one day a "mystical" dog by the name of Puapualenalena stole this pū.

These are some of the 'ili within this ahupua'a. As seen through the description of these 'ili, the Wailuku ahupua'a used the water that it was given. Nā wai 'ehā or the four waters converged on this plain and created some of the healthiest farming environments in all of traditional Hawai'i.

III. Wailuku: The Historical and Cultural Context

a. Wailuku: Area of Wars

Wailuku is known through out all of Hawaiian history for being host to some of the most vicious territorial wars. Many lives were lost in these boundaries. H.T. Cheever wrote in his book, Life in the Sandwich Islands:

> There are in these region four streams in succession from the different gorges of the mountain, significantly named, it is thought, from the events of battles, which have transpired upon them. Waikapū – The water where the conch was blown and the engagement began. Waiehu – The water where the combatants smoked with dust and perspiration. Wailuku – The water of destruction, where the battle began to be fierce and fatal. Waihe'e – The water of total rout and defeat, where the army melted away. (Cheever, p. 59)

The largest battle ever to commence was that of Kamehameha's showmanship of his vast military fleet. He landed in the Kahului area, with miles of beach filled with the canoes of his warrior. Kalanikupule[7] put large resistance to Kamehameha's strong arm. However, in the end Kamehameha was victorious. Yet, thousands of lives were lost in this battle.

In one battle the waters of 'Īao stream were dammed by those who had lost the war. Hence the name, Ke-pani-wai or the dammed waters. This area also

[6] Handy, E.S. Craighill, et al. Native Plants in Old Hawai'i. Honolulu, HI. Bishop Museum Press: 1991.
[7] Son of Kahekili and last King to rule Maui.

has a second name; it is said that many of the warriors tried to escape defeat by climbing up the cliff walls, hence came the name, Ka-ua'u or Ka-uwa'u.

Definition of Paukukalo:
The definition Paukukalo is quite sketchy. I offer however, two justifications:

> Paukūkalo: According to a Bishop Museum record of an interview of Hattie Yoshikawa she describes the following: Pauku = chunks or sections; kalo = taro. This was called such because of the taro or possibly because of the rockiness of the land, the rocks lying like big chunks of taro.
>
> Pā'ūkūkalo: This translation may speak to Pā'ūkūkalo's fame. Pā'ū – covering; skirt ; Kū – upright ; Kalo – taro. It is said that the leaves were so large that the fields of kalo seemed as if they covered the land.

Paukukalo was also home to Pihana and Hale Ki'i Heiau.

Heiau – Temples to the Gods

There were many temples or Heiau in the Wailuku ahupua'a, some that still exist until this very, most however, are either partially or completely destroyed. Some of these Heiau are: Pihana, Kaluli, Malumaluakua, Keakuku and Olopio, Kealaka'ihonua. Other Heiau like Malaikhakoa at Paukukalo, or Papane at Kapukaulua, at Pu'unēnē or Poaiwa at Kapukaulua were destroyed to the point of no study. It must be understood, however, that many heiau(s) have been built over three to four hundred years ago and remolded through time, much information of these heiau(s) are unknown. It may be inferred that most of the heiau in this section were war temples. Much of the information that will be provided here forth in regards to heiau may just be the location or former location of the heiau(s).

Pihana:

Its location was on the West Side of the 'Īao Stream on the sand ridge about a half of a mile from the sea, about opposite the Wailuku Sugar Company's mill. In W.M. Walker's archaeology report of Maui, it states the following:

A large heiau partly eroded away be the action of the 'Īao Stream. Stokes in 1916 described it as follows: 'This heiau occupied the top and upper slopes of a high lime-sand-dune, its floor being about 70 feet above the stream bed on the Southeast. The dune is one of a series paralleling the coast line of Wailuku

bight…The only local information obtainable was that the heiau had been built by Kahekili.' (146-147)

Tradition relates. Ki'ikewa, the high chief who lived at "the time of Kaka'e; the king of west Maui, built the heiau of Pihana – every rebellious high chieftains of Maui were scarified at this heiau, but, no Ali'i whose lineage was tainted were sacrificed on this alter.

Story has it that after the battle of Hāna, Kamehameha I and soldiers stopped at Naholo-ku [Kaupō], to visit the high chiefess Kalanikauko'olua'ole, a daughter of Kamehamehanui, whom he knew to be one of the chiefesses of exclusive kapu8. While crossing the stream he saw a young woman taking her bath, and asked the way to the house – which was indicated. At the house, the kahu said she was at the stream. Kamehameha I felt he had been insulted, stamped his foot and exclaimed: Kā! 'Ike 'ia nā li'i o Maui i ka pepeiao. Tsa!9 Maui royalty was said to be of small ears. After the battle of 'Īao, he sent for the princess to be scarified at Pihana. Poloahilani went instead, on the advice of the priest, and saved the life of Kalanikauko'olua'ole.

Poloahilani sacrifice was the last at Pihana. In 1819 after Ka'ahumanu's proclamation she had ordered Pihana heiau destroyed. Kalanimakakauali'i and Kauanaulu demolished this heiau.

Kaluli:

In Walker's archaeology report he sites that Kaluli Heiau was located above Pu'uohala camp. Although now completely destroyed, it was said that it was repaired in the time of Kahekili under the priest Kaleopu'upu'u. While Kaleopu'upu'u performed his rites there he uttered a prophecy to Kahekili, "the fish have gone though the sluice gate and are caught in the fine meshed net." In 1776 Kalani'opu'u and his son Kīwala'o left Kōhala to wage war on the people of Maui. But as Kaleopu'upu'u's prophecy predicted, Kalani'opu'u was defeated at the battle of Kalaeoka'īlio in Kaupō. He returned to Kōhala to rebuild his forces.

Kealaka'ihonua:

Kealaka'ihonua was located in Waihe'e and resides in the 'ili of Kapokea. It is said to belong to Koi, a certain dark (pā'ele) native, prominent in the rank of Kahekili' chiefs, one of his generals and a priest of the Kaleopu'upu'u order.

According to W.M. Walker's archaeology report:

[8] Taboo, sacredness.
[9] Strike! I have seen the smallness of Maui from the ears. Tsa!

The heiau consists of a series of platforms and terraces extending back some 150 feet from the waters edge. The ma uka or inland end formerly contained a grass hut with a Ku'ula or stone worshiped as a Fish God in it. It was said to resemble a natural likeness too an animal's head and offerings were placed before it. The ma uka end is separated from the ma kai or seaward part by a high modern stone wall. Most of Kapoho was once a fishpond.10 (136)

Walker recounts the area of this heiau and also points out its location in Waihe'e. In Walker's notes he also recounts the heiau of Kapoho as being just north of the Waihe'e Dairy as he also concludes that nothing remains.

Ulukau Heiau:

Ulukau heiau is located on the North side of Waihe'e stream, although there are two sites with the same name on either side of the road. According to Walker's sites 28 and 29 visit both sites are completely destroyed.

Koihale Heiau:

According to Walker's notes Koihale was also adjusted on the North side of Waihe'e stream by the shore. However Thrum sees the site differently and is corrected by the late Mrs. Helekahi of the Waihe'e area: "There is Koihale on the North side of the stream and Kaealaekaho'omano, Kapokea and Kapoho on the South."

Kalaekaho'omano Heiau:

According to Walker's site 31 this heiau was at the base of a sandy point just south of Waihe'e stream. According to him this heiau's stones were used to build rock walls and pens for livestock.11

Battle of Kalai'ili'ili12/Kalae'ili'Ili:

After the death of Kamehamehanui, which happened about 1765, Ke'eaumoku took one of his widows for wife. This lady was Nāmāhana, daughter of Kekaulike and his wife Ha'alou, and consequently half sister of the

[10] The heiau sits in Kapokea, however, also resides right next to the Kapoho fishpond near the ocean.
[11] This was very common with all of the heiau in the Wailuku district. As the demand for dairy was needed in the Waihe'e area, much of the stones of surrounding heiau were used.
[12] Haole author A. Fornander accounts this area as "Kalai'ili'ili." Whereas, Kanaka author S.M. Kamakau notes the area as "Kalae'ili'ili." Because of Kamakau's authority over the language and history, this battle will remain with the name "Kalae'ili'ili."

deceased king and of his brother and successor, Kahekili. The latter was greatly displeased with the march.

At that time the large and fertile land of Waiheʻe was in the possession of Nāmāhana, and here she and her new husband took up their abode. They appear to have kept court in princely style, and together gathered many of the gay and restless spirits of the time as recalled by A. Fornander.

While Nāmāhana and Keʻeaumoku lived happily in this area in Waiheʻe, Kahekili and his court went to Pihana in Paukūkalo13.

A certain person by the name of Kahanana was neglected by Keʻeaumoku and his court. When fish was caught, Kahanana and his family were never given their share of fish. One evening Kahanana killed three men of Keʻeaumoku. An insurrection arose and Kahekili who was in the vicinity took the side of Kahanana. Keʻeaumoku and his wife were defeated and they fled to Kaʻanapali and set sail for Molokaʻi.

Battles of ʻĪao:

There were several wars in this valley during the late eighteenth century. The first battle was with Kahekili, king of Maui and Kalaniʻopuʻu of Kōhala. Through out history, Maui and Hawaiʻi island were always at odds with each other resulting in wars.

Kahekili traveled to Kaluli heiau in preparation for this battle with Kalaniʻopuʻu. This is why Kaluli heiau was remodeled in the time of Kahekili. Kahekili was so successful in his battle against Kalaniʻopuʻu that only two out of 800 remained alive. One of the two was caught; he was a Chief from Hilo. He was brought to Kahekili to be offered for sacrifice. However he perished of his wounds before he could be offered up to the gods.

It was this war which Kaleopuʻupuʻu's prophecy of the fish of Hawaiʻi Island entering a tiny meshed net. It is said that Kahekili's army was massive and well prepared.

Though specifics of this warm are seldom spoken or written about because of the immense war that took place about a quarter century later.

This war was with Kalanikupule and Kamehameha. This war is known by several names: Kepaniwai O ʻĪao (The damming of ʻĪao or the Cliff Climbers14)

[13] Meaning of name has yet to be determined.
[14] The death that occurred was so intense that those who survived tried to climb the cliffs of ʻĪao Valley.

Kaʻuwaʻupali. Kalanikupule was defeated and fled to Oʻahu where he and Kamehameha would battle again and his life would come to an end at the Nuʻuanu Pali.

Battle at Puʻunēnē:

Kamakau recants the following:

The hardest fighting even compared with that at Napili and Honokahua in Kaʻanapali took place on the day of the attack at Puʻunēnē. Peleioholani was surrounded on all sides, ma uka and ma kai, by the forces of Alapaʻi, led by Kalaniʻopuʻu and Keoua. The two ruling chiefs met there again, face to face, to end the war and became friends again, so great had been the slaughter on both sides. (74)15

This Kamakau notes in his Ruling Chiefs of Hawaiʻi.

Kaʻahumanu's Puʻuhonua:

The chief [Kamehameha] treated her as if she were a goddess. Any condemned person could be saved if Kaʻahumanu said the word. Her lands were also turned into places of refuge. Puʻumau [Puʻunau] in Lāhaina, Waipuka in Waiheʻe, Kaluaʻaha in Molokaʻi, and the rest, all became places where people could be saved from death.

b. Lifestyle

The lifestyle of Wailuku was unlike that of anywhere else in traditional Hawaiʻi. There were the farmers, the fishermen, the mākua, the kūpuna and the keiki. It was one of the most communal societies on Maui.

The topography of this area was abundant with lo'i kalo or taro patches. From Waiheʻe to

Waikapū much of the topography was fit for planting and farming large crops to feed large numbers of people.

The bays and valleys of these areas were known as Nā Hono a Pi'ikea, much like the term Nā Hono a Pi'ilani[16]. The saying meant the valleys and bays of Pi'ikea, sister of Pi'ilani. The Western portion of Maui is commonly referred to

[15] Kauhi rebels against his brother Kamehamehanui. He calls in Peleioholani from Oʻahu to aid him and Kamehameha nui gets help from Alapaʻi on Hawaiʻi.
[16] This refers to the Western portion of Maui.

as the bays and valleys of Pi'ilani. However, in the Wailuku district, Pi'ilani's sister, Pi'ikea, claimed this portion.

Today, Wailuku is a fast changing society, even much different from its scene ten years ago. The area is largely residential and commercial properties. The water that once furnished all of Wailuku seldom flows through its streams, if it has not been filled in yet. Much of the water and its sources has fallen victim to the Sugar Cane Era[17] and the Golf Course Era.[18]

Many of the culturally significant sights, such as heiau and ahu, no longer exist due to these two eras. During these periods[19] much of the land was cleared for sugarcane or golf course use as well as the abundant residential and commercial properties that exist to this day.

c. Native Vegetation and Habitat

The term "aloha 'āina," was best shown in the Wailuku ahupua'a. 'Āina means land and Aloha generally means love, however always implies a relationship of reciprocity. In simple terms aloha 'āina means that you take care of the land and the land will reciprocate the favor. Wailuku's abundance of water helped in this process for the land to take care of Wailuku's people.

Native Plant Growth:

The native vegetation that grew in the Wailuku district was filled with many common indigenous native introduced plants and endemic plants.

However, none could have been more common than the terraces of lo'i kalo. Handy et al. explicates in their book that:

> From Waihe'e to Wailuku Valley, in ancient times was the largest continuous area of wet-taro cultivation in the islands. In 1934 the northern and southern slopes and the mouth of Waihe'e Valley were well cultivated, about a third of the old patches being used as commercial plantations, some worked by Hawaiians, some by Japanese, some by Portuguese. (Handy et al., p. 496)

[17] Sugar Cane Era: Water and Land rights were uncompromisingly changed to suit the needs of the large sugar can industry. Much of the water and land were diverted to this industry with barely any consent of those who either owned or used the land or the water.
[18] During the tourism boom in the late seventies through the early eighties, the land and water suffered through yet another era of taking with no reciprocation. Much water was diverted to feed the acres of what looked liked green ocean; instead it was a field for the rich and famous to pass their days away.
[19] Sugarcane Era: Late 1800's to the present. Golf Course Era: 1970's to 1990's.

No amount of emphasis can portray the importance of kalo in the lives of Hawaiians.

One essential plant used to construct thatched homes was the Pili grass (heterogon contortus). This grass was also quite common in these areas because of the arid climate conditions in near the Kahului coastline. Pili liked to grow in arid and dusty conditions. This grass was useful to Hawaiians by bunching dried clumps of grass to create a waterproofed house.

A well-known tree that grew in the uplands of Wailuku is the sandalwood (Santalum freyecinetianum), known in Hawaiian as 'Iliahi. The wood was traditionally used to scent kappa cloth. It was sometimes used to make 'ukeke, a musical bow, the only traditional Hawaiian stringed instrument. The leaves and wood of the sandalwood trees were also medicinally used, often in combination with 'awa and other woods.

Common to the Wailuku area was 'Iliahi's bastard. The naio (myoporum sandwicense) tree was the bastard sandalwood tree. This native tree had a hard, dark yellow green wood, scented like sandalwood. The leaves are narrow-oblong, pointed, grouped at the branch ends. The flowers are small, pink and/or white. This tree bears a small, white, round fruit.

Much of the ground cover near the coastal line was Pā'ū 'O Hi'iaka (Jacquemontia Ovalifolia). This was a ground-covering vine with abundant tubular flowers that range in color from light blue, purple, to white. This plant did not need much water, which in turn made the coastal lines and its surrounding areas a perfect place of growth for this plant.

While Hawaiians of the past used Pā'ū 'O Hi'iaka for curing keiki (children) of ea (thrush, a mouth disease), this plant is better known for the mo'olelo or story that explains its name. Long ago, Pele, volcano goddess, took her youngest sister, Hi'iaka, to the ocean. As Pele was out amongst the waves fishing, or some say surfing, the sun climbed higher and hotter in the sky. Meanwhile, Hi'iaka waited patiently on the shoreline for her sister. A plant near Hi'iaka, seeing that the sun's merciless rays were burning the keiki's tender young skin, took pity upon Hi'iaka and extended its vine branches to shield her. When Pele returned and saw that she was protected by the plant. In gratitude, Pele gave the plant its name, Pā'ū (skirt) o Hi'iaka (of Hi'iaka, my baby sister).

Another blossoming plant that may have resided in this area is the 'a'ali'i (Dodonaca Viscosa) bush. This hard wood native shrub is indigenous to the islands. This plant also grows well in dryer climates. Ranging in heights of one to thirty feet, this shrub to tree is found growing in elevations up to 8,000 feet and wind swept open country. In today's day and age, 'a'ali'i is being used to reforest the island of Kaho'olawe. This island's water plate is cracked in half from missile

testing by the U.S government in the late 1960's and '70's. Kaho'olawe is not able to retain water because of the cracked water plate, yet the 'a'ali'i is doing well in growing and flourishing on the island.

Another plant that grew in the area is called Huehue (cocculus trilobus) or 'Inalua. This plant produced an extremely purple berry, which when collected and smashed would be used to dye kappa (bark cloth made from the wauke tree-broussonetia papyrifera) with colors ranging from a deep dark purple hue to a light periwinkle.

Native trees of these areas would have been the Hau (Hibiscus tiliaceus), Loulu (Pritchardia), Kukui (Aleurites moluccana – candle nut tree: as can be seen growing on the ridges of Kahalawai).

Wildlife:

Able to still be seen today is the Ae'o or the Hawaiian stilt. These birds make their homes in the more marshy areas of the Wailuku regions.

The Auku'u is still able to be seen taking flight over the Wailuku area. Likened to the kingfisher, this bird frequents streams and bay areas in the Wailuku district.

While it would be a miracle to see and 'elepaio or 'apapane in the densely populated Wailuku town, these birds may continue to reside in the higher points of Wailuku and not necessarily in the residential and commercial areas.

Proposed Vegetation for site:

It is the strong recommendation of the author of this report to use as many native plants that are compatible to the surroundings of T.M.K.: 3-5-001-078.

IV. Conclusion

Wailuku was a large communal society. As stated prior, Wailuku was also famous for the largest kalo terraces in all of Hawai'i. This was in contribution by Nā Wai 'Ehā that flowed from these four valleys.

Wailuku has also had its fare share of war and plagiary. Because of Wailuku's wealth in water supply, many Ali'i felt it was there responsibility to control, hence the amount of wars that occurred in this area.

As much as possible the author of this report has tried to find specific cases or historical reference points regarding T.M.K 3-5-001-078 to no avail, however, were there documented references.

Know this however; Wailuku of the past was much like the Wailuku of today, very community oriented. They lived in its own microcosm, where every parcel of life affected another.

Kaulana nā wai o nā wai 'ehā. Kāhela iho o Kahalawai.

"Famous are the waters, the four waters. Sprawled beneath Kahalawai."

V. Bibliography

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VI. Statement of Interviews

September 9, 2009, 157 Alea Place, Pukalani, Maui

Kahu Charles Kauluwehi Maxwell Sr.
Principal – CKM Cultural Resources L.L.C
Author - *Kāhela Iho O Kahalawai*

As the author of this report, having spiritual and cultural connections to this area and the surrounding area of Waikapū, it is important that my comments are noted in this report.

My Hawaiian genealogy originates from Waikapū and about 400 years ago, our family owned the area from Īao Valley to Mā'alaea. When western laws were imposed on land ownership, the land was "obtained" by the descendants of missionaries who planted sugar cane and raised cattle which completely destroyed the remnants of the past.

No matter who "owns" land, it shall be spiritually ours till the end of time. Land does not move and it is the same as it was for thousands of years. Knowing this, a very important fact should be noted here that no matter what was growing on the land, there is chances of ancient Kanaka Maoli burials are still present.

In Waikapū, 11 of my family members were found in the middle of The cane field above the Maui Tropical Plantation. In Lahaina and Olowalu, burials were found under former cane and pineapple fields.

I would strongly recommend an archeological study be conducted on this property, prior to any ground disturbance and a monitoring
Program conducted during construction.

October 9, 2009 3:15 pm.

Leslie James Aupuni Vida 111
Farmer – Vida Farm
564 Pio Drive, Waikapü, Maui Hi, 96793

Was interviewed at his home. He related that he has lived in Waikapü all of his life and he is 30 years old. That he had learned about two Heiau that was on the Wailuku side of Waikapü, however when the sugar cane was planted it was destroyed. That above Waikapü there are numerous Hawaiian archeological sites untouched but he is very afraid that the plans for a new development above the Maui Tropical Plantation will endanger these sites. As far as the location of the planned Elementary School 11, he only remembers the sugar cane and later cattle being raised in this area. Had nothing further to add.

October 30, 2009 – 4:50pm.

Ms... Kathy Juan
Reservation Specialist –Maui Medical Group
68 Kumula'au Ohia loop, Wailuku, Maui 96793

Interviewed at her residence. She stated that her family had move to their new home (1 block below Wailuku Elementary School 11) about 6 years ago. That the area was cleared of sugar cane and did not know of any archeological sites were present. Passing this area over the years, she remembers t hat the area was used to raise cattle. Had nothing further to add.

November 12, 2009 at 5:15pm

Ms. Yaeko Mabe Sasaki
Retired
243 S. Alu Road, Wailuku Heights, 96793

Was interviewed at her home. She related that she has lived in Wailuku Heights (which overlooks the project area) for the last 60 years. She remembers that the site area contained sugar cane and later, cattle were raised in the area. She has no knowledge of any archeological sites in the area proposed for the school. Had nothing further to add.

November 16, 2009, 4:15 pm interviewed:

Richard Komo
Retired – Judge
297 Alu St., Wailuku Heights, Maui 96793

At his home. He related that he has lived at his home for the last 50 years. The Wailuku Elementary School 11 is located right below his home. He cannot recall seeing or hearing about any archeological sites but only remembers this area with sugar cane. Had nothing further to add.

November 21, 2009 – 3:30pm. Interviewed:

Felipe Barroga
5th Grade Teacher – Wailuku Elementary School
98 S. Alu Rd, Wailuku 96793

At his home. He related that he has lived in the area of Wailuku all his life and grew up next to the proposed school site. That he remembers the area with sugar cane, pineapple and later cattle was raised in the area. He does not remember any archeological sites in the area. Also he saw the plans for the Wailuku Elementary School 11 and does not agree making allowances for portable class rooms. If they know that the population will be growing in the Wailuku area, then they should build extra class rooms now to save on the cost.

November 30, 2009 at 5:15pm., interviewed:

Susan Asato

Housewife
662 S. Alu Rd. Wailuku 96763

At her home. She related t hat she has lived in Wailuku Heights all her life. Her home overlooks the project site. She can only remember the growing of sugar cane and does not know of any Hawaiian archeological sites in the area. Had nothing further to add.

‘

December 1, 2009 4:25pm. Interviewed:

Leslie James Vida Jr.
Retired
R.R.1 Box 976, Wailuku, Maui

At his home. He related that he lived in Waikapü all his life and does not know of any archeological sites on the project area. The Waikapü valleys and slopes if full of sites towards the mountains and suspect that prior to the growing of sugar cane, the project area also had ancient sites but was destroyed by the planting of the sugar cane.

NOTE: Numerous efforts were made to contact people living next to or around the Wailuku Elementary School 11 proposed site, however it was difficult to find people with any knowledge of what existed on the site prior to the planting of sugar cane.

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IMINA I KA NA'AUAO E PAIRI IA MAKOU IMUA
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INTERVIEW SUMMARY AND CONSENT FORM

JOB NAME: WAILUKU ELEMENTARY SCHOOL

PERSON INTERVIEWED: LESLIE JAMES AUPUNI VIDA III

ADDRESS & E-MAIL, PHONE 564 PIO DR. WAILUKU
276-3002 - KAIHIOLSAEN@NETSCAPE.NET

DATE & TIME OF INTERVIEW: Oct. 9, 2009 — 2:15pm

INTERVIEWER: CKM CULTURAL RESOURCE L.L.C. - C. K. Maxwell

PURPOSE OF INTERVIEWE: CULTURAL IMPACT ASSESSMENT

I HEREBY GIVE PERMISSION TO CKM CULTURAL RESOURCES L.L.C., TO USE THE INFORMATION FROM THIS INTERVIEW IN PREPARING A CULTURAL IMPACT ASSESSESMENT REPORT FOR THE SUBJECT PROJECT. I FURTHER UNDERSTAND THAT I WILL BE GIVEN A COPY OF MY COMMENTS UPON REQUEST.

Yes ✓ No

Person Interviewed Print name: Leslie James Aupuni Vida III

Signature: Leslie J. Vida III

Kahu Charles Kauluwehi Maxwell, Sr.
157 Alea Place - Pukalani, Maui, HI 96768
Phone: (808) 572-8038 Fax: (808) 572-0602 Cell: 870-3345
Email: kale@moolelo.com - Website: www.moolelo.com

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INTERVIEW SUMMARY AND CONSENT FORM

JOB NAME: WAILUKU ELE. MENTARY

PERSON INTERVIEWED: Kathy Juan

ADDRESS & E-MAIL, PHONE 68 Kumulani ohia loop, Wailuku
juansoi@hawaiiantel.net

DATE & TIME OF INTERVIEW: OCTOBER 30, 2009 – 4:50 PM

INTERVIEWER: CKM CULTURAL RESOURCE L.L.C. - C. K. Maxwell

PURPOSE OF INTERVIEWE: CULTURAL IMPACT ASSESSMENT

I HEREBY GIVE PERMISSION TO CKM CULTURAL RESOURCES L.L.C., TO USE THE INFORMATION FROM THIS INTERVIEW IN PREPARING A CULTURAL IMPACT ASSESSEMENT REPORT FOR THE SUBJECT PROJECT. I FURTHER UNDERSTAND THAT I WILL BE GIVEN A COPY OF MY COMMENTS UPON REQUEST.

Yes ✓ No

Person Interviewed Print name: Kathy Juan

Signature: Kathy Juan

Kahu Charles Kauluwehi Maxwell, Sr.
157 Alea Place Pukalani, Maui, HI 96768
Phone: (808) 572-8038 Fax: (808) 572-0602 · Cell: 870-3345
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INTERVIEW SUMMARY AND CONSENT FORM

JOB NAME: WAILUKU ELEMENTARY

PERSON INTERVIEWED: YAEKO MABE SASAKI

ADDRESS & E-MAIL, PHONE 243 S. ALU ST. / WAILUKU 96793
244-4764

DATE & TIME OF INTERVIEW: NOVEMBER 12, 2009 5:15 pm

INTERVIEWER: CKM CULTURAL RESOURCE L.L.C. - C. K. Maxwell

PURPOSE OF INTERVIEWE: CULTURAL IMPACT ASSESSMENT

I HEREBY GIVE PERMISSION TO CKM CULTURAL RESOURCES L.L.C., TO USE THE INFORMATION FROM THIS INTERVIEW IN PREPARING A CULTURAL IMPACT ASSESSEMENT REPORT FOR THE SUBJECT PROJECT. I FURTHER UNDERSTAND THAT I WILL BE GIVEN A COPY OF MY COMMENTS UPON REQUEST.

Yes ✓ No

Person Interviewed Print name: Yaeko Yaeko Mabe Sasaki

Signature: Yaeko Mabe Sasaki

Kahu Charles Kauluwehi Maxwell, Sr.
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Phone: (808) 572-8038 · Fax: (808) 572-0602 · Cell: 870-3345
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INTERVIEW SUMMARY AND CONSENT FORM

JOB NAME: WAILUKU ELEMENTARY

PERSON INTERVIEWED: Felipe Barroga, Jr.

ADDRESS & E-MAIL, PHONE 58 S. Alu Rd., Wailuku, HI 96793
barrogif001@hawaii.rr.com

DATE & TIME OF INTERVIEW: 11/21/09 3:30 PM

INTERVIEWER: CKM CULTURAL RESOURCE L.L.C. - C. K. Maxwell

PURPOSE OF INTERVIEWE: CULTURAL IMPACT ASSESSMENT

I HEREBY GIVE PERMISSION TO CKM CULTURAL RESOURCES L.L.C., TO USE THE INFORMATION FROM THIS INTERVIEW IN PREPARING A CULTURAL IMPACT ASSESSEMENT REPORT FOR THE SUBJECT PROJECT. I FURTHER UNDERSTAND THAT I WILL BE GIVEN A COPY OF MY COMMENTS UPON REQUEST.

Yes ✓ No

Person Interviewed Print name: Felipe Barroga Jr.

Signature:

Kahu Charles Kauluwehi Maxwell, Sr.
157 Alea Place Pukalani, Maui, HI 96768
Phone: (808) 572-8038 Fax: (808) 572-0602 Cell: 870-3345
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INTERVIEW SUMMARY AND CONSENT FORM

JOB NAME: WAILUKU ELEMENTARY

PERSON INTERVIEWED: Susan Asato

ADDRESS & E-MAIL, PHONE 667 S. ALU Rd, Wailuku, HI

DATE & TIME OF INTERVIEW: NOVEMBER 30, 2009 5:15 PM

INTERVIEWER: CKM CULTURAL RESOURCE L.L.C. - C. K. Maxwell

PURPOSE OF INTERVIEWE: CULTURAL IMPACT ASSESSMENT

I HEREBY GIVE PERMISSION TO CKM CULTURAL RESOURCES L.L.C., TO USE THE INFORMATION FROM THIS INTERVIEW IN PREPARING A CULTURAL IMPACT ASSESSEMENT REPORT FOR THE SUBJECT PROJECT. I FURTHER UNDERSTAND THAT I WILL BE GIVEN A COPY OF MY COMMENTS UPON REQUEST.

Yes ✓ No

Person Interviewed Print name: SUSAN ASATO

Signature: Susan Asato

Kahu Charles Kauluwehi Maxwell, Sr.
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INTERVIEW SUMMARY AND CONSENT FORM

JOB NAME: Wailuku Elementary II

PERSON INTERVIEWED: Leslie J. Viola Jr

ADDRESS & E-MAIL, PHONE PO Box 976 Wailuku
242-9179

DATE & TIME OF INTERVIEW: DECEMBER 1, 2009 4:25 pm

INTERVIEWER: CKM CULTURAL RESOURCE L.L.C. - C. K. Maxwell

PURPOSE OF INTERVIEWE: CULTURAL IMPACT ASSESSMENT

I HEREBY GIVE PERMISSION TO CKM CULTURAL RESOURCES L.L.C., TO USE THE INFORMATION FROM THIS INTERVIEW IN PREPARING A CULTURAL IMPACT ASSESSEMENT REPORT FOR THE SUBJECT PROJECT. I FURTHER UNDERSTAND THAT I WILL BE GIVEN A COPY OF MY COMMENTS UPON REQUEST.

Yes ✓ No

Person Interviewed Print name: Leslie James Viola Jr

Signature: Leslie James Viola Jr

Kahu Charles Kauluwehi Maxwell, Sr.
157 Alea Place · Pukalani, Maui, HI 96768
Phone: (808) 572-8038 · Fax: (808) 572-0602 · Cell: 870-3345
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IMINA I KA NAUAO E PAHU IA MAKOU IMUA
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INTERVIEW SUMMARY AND CONSENT FORM

JOB NAME: WAILUKU ELEMENTARY

PERSON INTERVIEWED: RICHARD KOMO

ADDRESS & E-MAIL, PHONE 297 ALU Rd, WAILUKU

DATE & TIME OF INTERVIEW: NOVEMBER 16th, 2009 - 4:15 PM

INTERVIEWER: CKM CULTURAL RESOURCE L.L.C. - C. K. Maxwell

PURPOSE OF INTERVIEWE: CULTURAL IMPACT ASSESSMENT

I HEREBY GIVE PERMISSION TO CKM CULTURAL RESOURCES L.L.C., TO USE THE INFORMATION FROM THIS INTERVIEW IN PREPARING A CULTURAL IMPACT ASSESSEMENT REPORT FOR THE SUBJECT PROJECT. I FURTHER UNDERSTAND THAT I WILL BE GIVEN A COPY OF MY COMMENTS UPON REQUEST.

Yes ✓ No

Person Interviewed Print name: Richard Komo

Signature:

Kahu Charles Kauluwehi Maxwell, Sr.
157 Alea Place · Pukalani, Maui, HI 96768
Phone: (808) 572-8038 · Fax: (808) 572-0602 · Cell: 870-3345
Email: kale@mooleio.com · Website: www.mooleio.com

Maunaleo at Kehalani is a proposed 20-acre subdivision of 82 single-family homes located in the master-planned community of Kehalani on the island of Maui. Maunaleo is located at the corner of Honoapiilani Highway and Kuikahi Drive.

The developer reserves the right to modify plans, specifications, materials and prices without prior notice or obligation. All information and figures are approximate. Pacific Island Realty, LLC

Wailuku II

Conceptual Classroom Plan

GROUP 70 INTERNATIONAL

23 February 2007

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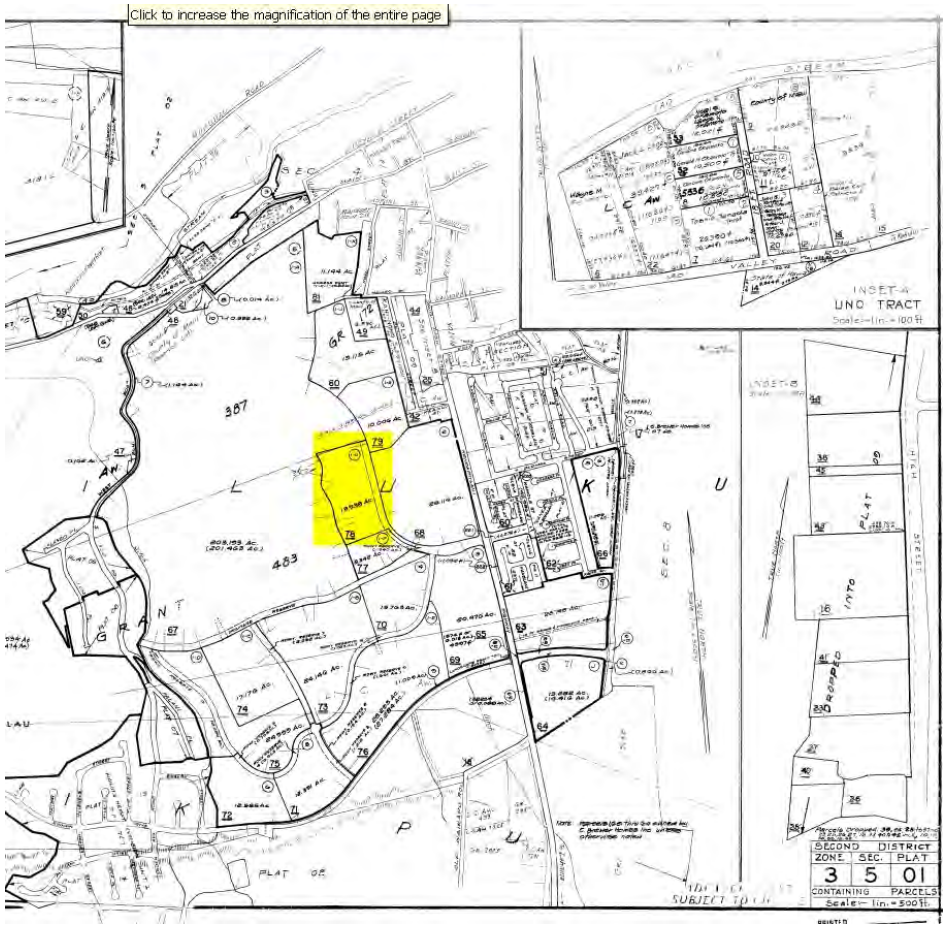

PRELIMINARY ENGINEERING AND DRAINAGE REPORT FOR WAILUKU II ELEMENTARY SCHOOL

WAILUKU, MAUI, HAWAII

March 2010

Prepared for:

Group 70 International, Inc.
925 Bethel Street, 5th Floor
Honolulu, Hawaii 96813

Prepared by:

Austin Tsutsumi & Associates, Inc.
Civil Engineers • Surveyors
1871 Wili Pa Loop, Suite A
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Telephone: (808) 244-8044
Fax: (808) 242-9163
Honolulu • Wailuku • Hilo, Hawaii

PRELIMINARY ENGINEERING AND DRAINAGE REPORT
FOR
WAILUKU II ELEMENTARY SCHOOL

WAILUKU, MAUI, HAWAII

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Honolulu • Wailuku • Hilo, Hawaii

March 2010

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PRELIMINARY ENGINEERING AND DRAINAGE REPORT FOR WAILUKU II ELEMENTARY SCHOOL

I. INTRODUCTION

The purpose of this report is to provide an overview of the preliminary civil engineering design of the Wailuku II Elementary School project. This report evaluates the existing site conditions and presents proposed site grading, drainage, water, wastewater, and roadway improvements.

II. PROPOSED PROJECT

A. LOCATION

The Wailuku II Elementary School project is located in Wailuku, Maui, Hawaii within the master planned community of Kehalani Mauka. The project site (Lot 3-A-2) is located in Wailuku-Kahului Project Distrct 3 and has a Tax Map Key of (2) 3-5-001:67 (por.), (2) 3-5-001:77 (por.), and (2) 3-5-001:78 (por.) The project site is bordered by an existing irrigation ditch (Waihee Ditch) to the west and Lot WD-2, planned multi-family residential complex and a vehicle access easement (Lot 3-A-3) to the north, Kehalani Mauka Parkway to the east, and a future community center as part of the Kehalani Mauka master planned community (Lot P-1) to the south. The project site is approximately 14 acres and is currently undeveloped with the exception of the existing irrigation ditch that runs along the western boundary. The ditch is still active and services agricultural lands to the south and is planned to be relocated offsite. The land is

owned by Kehalani Mauka, LLC, but to be dedicated to the State of Hawaii. Kehalani Mauka Parkway is an existing two-lane public road and is the main collector road for the development. Nearby residential subdivisions have already been developed. Refer to Exhibit 1 for Location and Vicinity Map.

B. PROJECT DESCRIPTION

As mentioned above, the project is part of the Kehalani Master Planned Community. The developer of the project is the State of Hawaii Department of Education (DOE). The project consists of the construction of a new elementary school consisting of 8 buildings, which includes a total of 34 classrooms, a cafeteria, playcourt, library, and administration building. The school will accommodate a maximum enrollment of 550 students and construction is planned to begin in 2011. Site work includes excavation and embankment of site, construction of retaining walls, roadways and parking areas, walkways, installation of service utilities including water, fire, sewer, underground electrical, television, cable and drainage systems. The project will also strive to obtain U.S. Green Building Council LEED Silver certification. The main access to the site will be provided through Kehalani Mauka Parkway at the north and south end of the project site. The DOE will acquire a portion of Lot P-1 to provide access at the southern end of the school and to the future community center. Refer to Exhibit 2 for Preliminary Site Plan.

III. EXISTING CONDITIONS

A. TOPOGRAPHY AND SOIL CONDITIONS

The ground surface of the site is currently covered with overgrown brush and weeds. The project site generally slopes in an easterly direction toward the existing Kehalani Mauka Parkway with an average slope of approximately 11 percent. Onsite elevations range from 461 to 389 feet mean sea level (MSL). A topographic survey of the subject parcel was conducted by Warren S. Unemori Engineering Inc. and site boring locations were provided by Hirata & Associates Inc.

The soil classification found on the project site is predominately classified as Iao Cobbly Silty Clay (IbC). The Iao series consists of well-drained soils on

valley fill and alluvial fans. These soils developed in alluvium derived from basic igneous rock. They are nearly level to moderately sloping. Elevations range from 100 to 500 feet. The mean annual soil temperature is 74°F. In particular, for Iao Cobbly Silty Clay soils, runoff is medium and the erosion hazard is moderate. Permeability is moderately slow and the hydrologic soil group is "C". This soil is used primarily for sugarcane and pasture. Soils classifications and descriptions area taken from the United States Department of Agriculture Soil Conservation Services publication entitled, Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii, dated 1972.

B. CLIMATE AND RAINFALL

The area of Wailuku is generally warm and sunny throughout the year, with temperatures varying from 70 to 80 degrees Fahrenheit. Wailuku is exposed to prevailing tradewinds with most of it coming from the northeasterly direction. These tradewinds occur mainly through the dry seasonal months of May through September. Rainy seasonal months of October through April produce strong wind conditions varying from trades from the northeast to southerly winds known as "Kona storms". Average annual rainfall for Wailuku is approximately 31 inches. The 50-year, 1-hour rainfall is 3.0 inches.

C. INFRASTRUCTURE

1. Water

The project site currently has no existing domestic water service. The County of Maui, Department of Water Supply (DWS), provides water service within the vicinity of the project. An existing 12" ductile iron distribution waterline and 16" ductile iron transmission waterline are located within Kehalani Mauka Parkway fronting the site. An existing 12" waterline stub-out connection has been installed at the northeastern corner of the project site and a future 12" waterline is planned to run along the northern boundary within the existing 25' wide utility easement "E-12" and service future mauka developments by Kehalani Mauka LLC. There are four (4) existing fire hydrants fronting the site along Kehalani Mauka Parkway.

2. Sewer

The project site currently generates no wastewater flow. An existing 12" sewerline runs along Kehalani Mauka Parkway fronting the site. There are also two existing 8" sewer stub-outs to the site. One stub-out is located at the northeastern corner of the site and a future 8" sewerline will run within existing easement "E-12" along the northern boundary of the site to service future mauka developments by adjacent land owners. The second 8" sewer stub-out is located at the southeastern corner of the site and will serve as the primary sewer connection point for the school. Sewage from the project will be treated at the Kahului Wastewater Treatment Facility.

3. Drainage

The existing onsite stormwater runoff generally flows in an easterly direction, through the project site and into the existing Kehalani Mauka Parkway drainage system. The Kehalani Mauka Parkway drainage system fronting the site consists of 24" and 36" drainpipes with 2' curb/gutter and catch basins. There are two existing drain stub-outs to the site. The first stub-out consists of a 24" drainpipe and is located at the northeast corner of the site. A future drainline will run within easement "E-12" along the northern boundary of the site and service future mauka developments by adjacent land owners. The second stub-out consists of a 30" drainpipe and is located near the southeastern corner of the site. This stub-out will serve as the primary drainline connection point for the school.

There is existing runoff generated mauka of the project site, however, a portion of this runoff is currently intercepted by Waihe'e Ditch which meanders above and within the western boundary of the project. There are plans to construct temporary diversion ditches to the west of the project site when the existing Waihee ditch within the project site is removed. Per the Kehalani Drainage Master Plan, the diversion ditches are designed to intercept a large majority of the runoff before it enters the school site. When the properties mauka of the project site are developed with their own permanent drainage system, the temporary diversion

ditches will be removed. An underground 60" drainpipe to the west of the site will be constructed to convey existing irrigation water through Waihee ditch. Construction of the temporary diversion ditches and 60" drainpipe will be constructed "by others" and are scheduled to be completed before construction of the school starts. Refer to Exhibit 2.

The Kehalani Master Plan drainage design makes provisions to intercept proposed runoff generated by developments within the Kehalani Community. The large 490 ac-ft Waikapu Retention Basin serves as the main retention area for the Kehalani Community and is designed to completely retain the increase in runoff per Maui County Standards. While no outflow is expected, an emergency overflow is provided and connects to Waikapu Stream.

Pre-development onsite runoff is estimated to be approximately 22.04 cubic feet per second (cfs), based on a 50 year – 1 hour storm recurrence interval. The existing mauka offsite runoff is estimated to be 4.77 cfs, based on a 50 year – 1 hour storm recurrence interval. Refer to Appendix A for preliminary hydrology calculations and Exhibits 3 and 6 for existing drainage information.

4. Roadway

The proposed project is bordered by Kehalani Mauka Parkway to the east. Kehalani Mauka Parkway fronting the site is a 36' wide asphalt concrete (a.c.) paved two-lane public road with a right-of-way width of 70'. The road contains an existing 12" sewerline with two 8" sewer stub-outs into the site, a 12" waterline and 16" transmission line including fire hydrants, a 24" and 36" drainline with catch basins and a 30" drainpipe stub-out, underground Maui Electric Company (MECo) electrical utilities, Hawaiian Tel (HTel) telephone lines, and cable television lines. An existing 8' a.c. walkway and 2' curb/gutter are on the mauka side of the roadway fronting the site. The current speed limit for Kehalani Mauka Parkway is a posted 30 miles per hour.

D. FLOOD ZONE

The proposed project site has a flood zone classification of Zone X. Zone X is characterized as an area of minimal flooding, specifically areas determined to be outside the 0.2% annual chance floodplain. Flood zone classification is based on the Flood Insurance Rate Map (FIRM) number 150003 0391E, effective September 25, 2009, as prepared by the Federal Emergency Management Agency. Refer to Exhibit 9 for Flood Zone Map.

IV. PROPOSED IMPROVEMENT

A. GRADING PLAN

The proposed project will require both excavation and embankment for the construction of the new roadways and relatively flat, terraced buildable areas for the proposed building structures. The majority of the project will be in a "cut" condition due to building height envelopes and roadway grade restrictions. Overall, the site will be graded to maintain the existing drainage patterns. Finish grades throughout the site will vary in elevation from 389 feet to 461 feet mean sea level (MSL). Slopes will vary between 0 to 12% after improvements with maximum 2:1 slopes along the embankments. Retaining walls will vary in height ranging from 2 to 6 feet. Retaining wall heights are determined by measuring the front face of the wall. CRM and CMU walls will be the primary choice for retaining walls within the project. Refer to Exhibit 3 – Preliminary Grading and Drainage Plan.

B. DRAINAGE PLAN

The Rational Method is used to determine stormwater runoff quantities for drainage areas less than 100 acres, based on a 50 year – 1 hour storm. The proposed onsite drainage system will be designed to manage the 50-year 1 hour storm runoff from onsite and offsite drainage areas. Post-development onsite runoff for a 50 Yr-1Hr storm is calculated at 53.69 cfs, which is an increase of 31.66 cfs over existing conditions. Refer to Appendix A. The increase in runoff has been accounted for in the Kehalani Drainage Master Plan and will be completely retained in the offsite Waikapu Retention Basin.

The proposed drainage system improvements will include grated drain inlets, area drains, catch basins, manholes, underground drain lines, and water quality treatment systems. Runoff on the school grounds will be collected by drain inlets, catch basins, area drains or swales and conveyed to the existing drainage system along Kehalani Mauka Parkway which eventually carries the flows to the Waikapu Retention Basin.

A small portion of offsite runoff, calculated to be 4.77 cfs from the west is anticipated to enter the project site. The proposed onsite drainage system will be designed to accommodate these flows.

The State of Hawaii Department of Education has also indicated interest in making the project a Leadership in Energy and Environmental Design (LEED) Silver certified project. As such, the project will be designed to meet storm water quality measures. LEED projects are designed to minimize environmental impacts and ensure that development is done in a sustainable manner.

C. STORMWATER QUALITY

In addition to reducing peak flow rates, the proposed stormwater management system will provide water quality treatment and reduce the discharge of pollutants to the maximum extent practicable. To attain LEED credits for water quality, 90% of the annual storm runoff volume must be treated. The focus is on treating the more common smaller storms rather than just the infrequent peak storm events, since the smaller storms contain most of the runoff pollutants. The project will incorporate natural and structural Best Management Practices (BMPs) to control stormwater quality. Examples of storm water quality measures include:

Grass Swales and Landscape Areas

The surface storm water runoff from road and parking areas can be directed to grass and landscaped areas where possible to provide vegetative filtration and allow percolation into the underlying soil.

Structural Filtration Systems

These underground units remove pollutants by having stormwater flow through specialized filtration media contained within cartridges. The

selected filtering device will be rated for removal of at least 80% of the total suspended solids.

An appropriate maintenance plan will be developed for each BMP which will require accumulated debris and sediments to be removed during regularly scheduled maintenance and disposed at a County approved disposal site.

LEED and the EPA accept the above methods of stormwater quality control as stormwater best management practices that reduce the pollutant loads associated with stormwater runoff. Maui County does not specifically require water quality treatment of stormwater.

D. EROSION CONTROL PLAN

Temporary erosion control measures will be incorporated during the construction to minimize soil loss and erosion hazards. Best Management Practices will include temporary sediment basins, temporary diversion berms and swales to intercept runoff, silt fences, dust fences, inlet protection, slope protection, stabilized construction entrances and truck wash-down areas. Periodic water spraying of loose soils will be implemented to minimize air-borne dirt particles from reaching adjacent properties. An application for a National Pollution Discharge Elimination System (NPDES) permit will be submitted to the State Department of Health for review and approval.

Permanent sediment control measures will be used once construction is completed. These practices are described in the previous “Stormwater Quality” section.

E. WATER SYSTEM PLAN

Onsite water system improvements will include a domestic water system, fire line system, and an irrigation system. The domestic system consists of a water meter, reduced pressure backflow preventer, and copper and ductile iron waterlines. The fire line system consists of a 10-inch double detector check assembly, fire hydrants and 12-inch ductile iron fire lines. Fire department connections will also be installed to supplement the project’s fire system as most buildings within the project will have a fire sprinkler system. The proposed domestic water, fire, and irrigation meter lateral will connect to the existing 12” distribution waterline within Kehalani Mauka Parkway at the northeast corner of

the site. Refer to Exhibit 4 for Preliminary Water System Improvements and Appendix B for Preliminary Water Demand Calculations.

Preliminary water contributions are calculated at approximately 31,958 gallons per day (gpd), which is the average daily demand for domestic use and irrigation use. Refer to Appendix B for Preliminary Water Demand Calculations. Fire hydrants are required to be installed at a maximum of 250' intervals within the site.

F. SEWER SYSTEM PLAN

An onsite sewer system will be installed to provide wastewater collection service to all proposed buildings. The collected sewage will be routed via gravity flow to the existing 8" sewer line stub-out at the southeastern portion of the site. This line connects to the 12" sewer line within Kehalani Mauka Parkway and is eventually treated at the Kahului Wastewater Treatment Facility. Preliminary wastewater contributions are calculated at approximately 9,435 gpd (average daily demand). Refer to Exhibit 5 for the Preliminary Sewer System Improvements Plan and Appendix C for Preliminary Wastewater Contribution Calculations.

G. ROADWAY

Access to the project site will connect to Kehalani Mauka Parkway. There are two proposed roadways providing access from the school to Kehalani Mauka Parkway. These two asphalt concrete paved roadways will be located along the northern and southern boundaries of the site. The two accesses will provide adequate fire access circulation and provide access to buses, service vehicles, faculty and parents dropping off or picking up children. The two main access roads will connect up along the western boundary of the site and provide a looped roadway throughout the school. Parking will be provided at both the north and south ends of the school and along the western edge of the school. The maximum slope for the proposed roadways within the project site will be 12%. The roadway intersections to Kehalani Mauka Parkway will be designed to maximize sight distance and comply with Maui County and AASHTO standards.

V. CONCLUSION

The proposed project is part of the Kehalani Mauka Master Planned Community, which contains existing water, sewer, drainage and roadway infrastructure needed to serve the project site. The proposed project is in accordance with the design assumptions for the master planned area. The proposed grading and drainage design for this project will impose no adverse effects from storm runoff to adjacent and downstream areas. Soil loss will be minimized during the construction period by implementing appropriate erosion control measures. The proposed stormwater management system will provide water quality treatment and reduce the discharge of pollutants to the maximum extent practicable with the goal of obtaining LEED credits for water quality. The offsite Waikapu Retention Basin will retain runoff generated from the project site. All drainage improvements will conform to the Maui County Standards.

The proposed improvements for this project will be designed in accordance with the applicable rules and regulations of the County of Maui. Based on the preceding information, the project is expected to have no adverse effects on existing facilities or the surrounding environment.

REFERENCES:

1. Department of Public Works & Waste Management, County of Maui, Chap.4, "Rules for the Design of Storm Drainage Facilities in the County of Maui".

2. Drainage Report "Kehalani Offsite Drainage System – Phase I", by Warren S. Unemori Engineering Inc., January 2004.

3. Drainage Report "Kehalani Mauka – Waihee Ditch from Iliahi Subdivision to Kehalani Mauka Parkway", by Warren S. Unemori Engineering Inc., June 2008.

4. "Geotechnical Investigation, Wailuku II Elementary School", by Hirata & Associates Inc., December 27, 2007.

5. County of Maui, Wastewater Reclamation Division, Wastewater Flow Standards, February 2, 2000.

6. Water System Standards, State of Hawaii, 2002.

7. Design Standards, Division of Wastewater Management, Vol. 1, February 1984.

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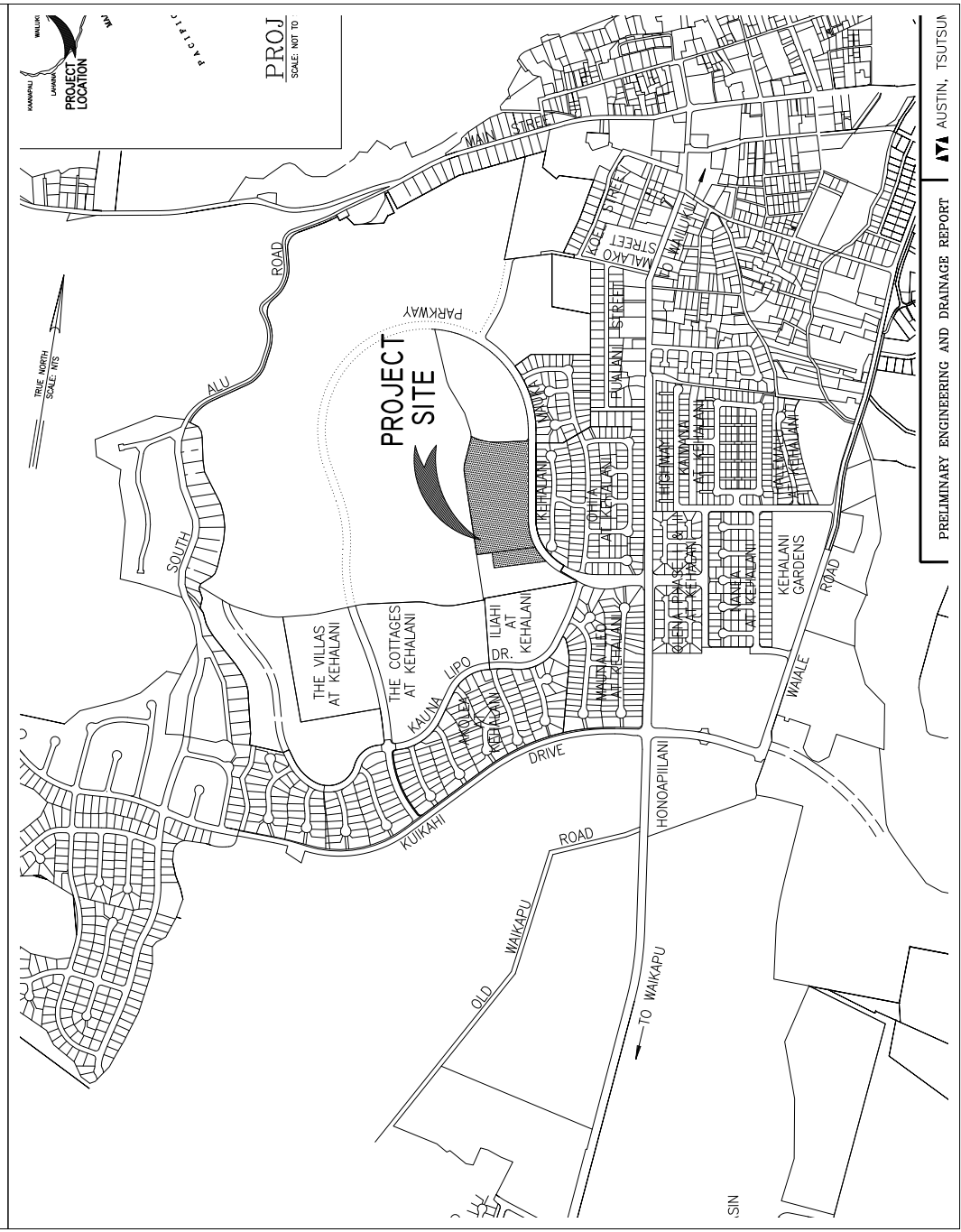
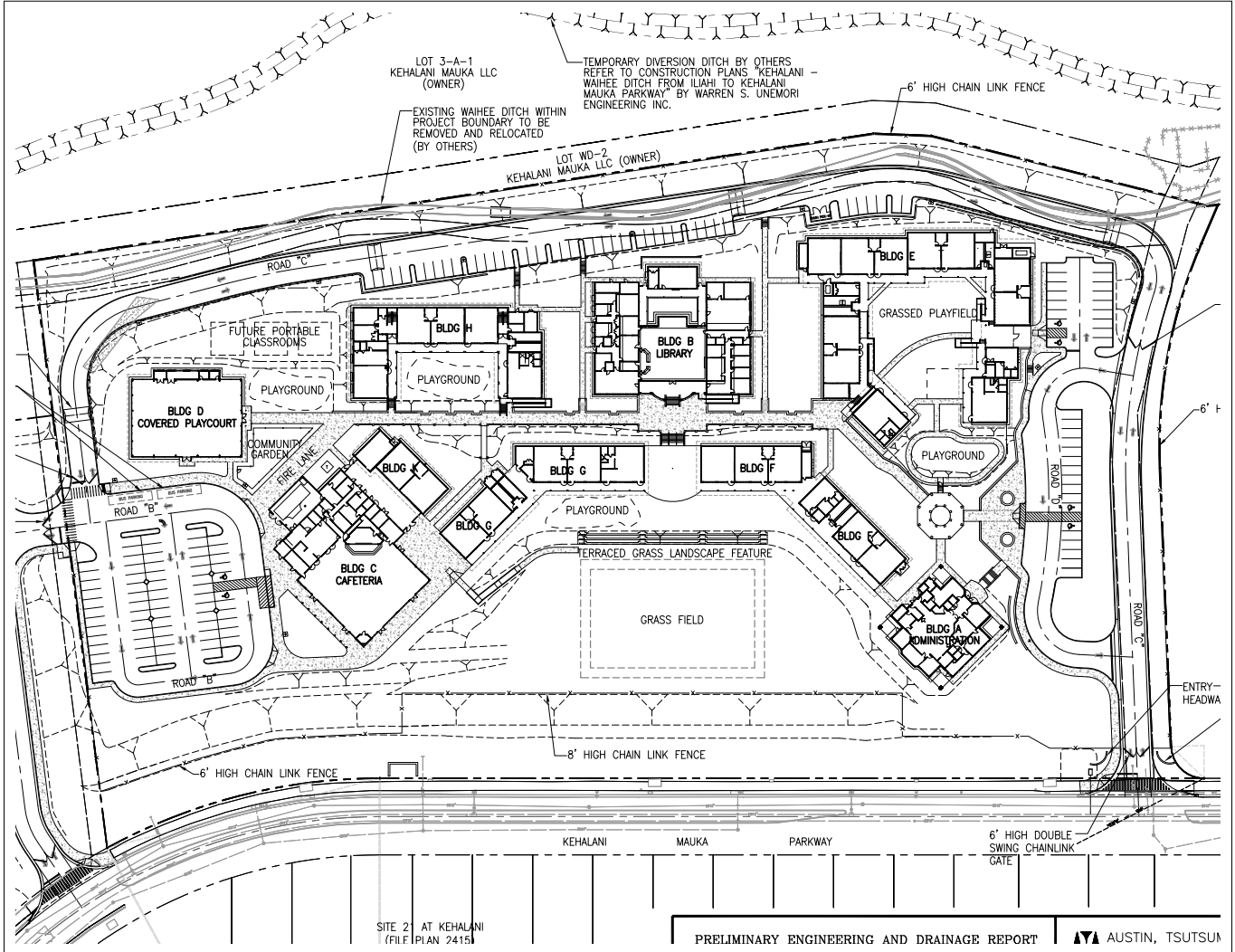
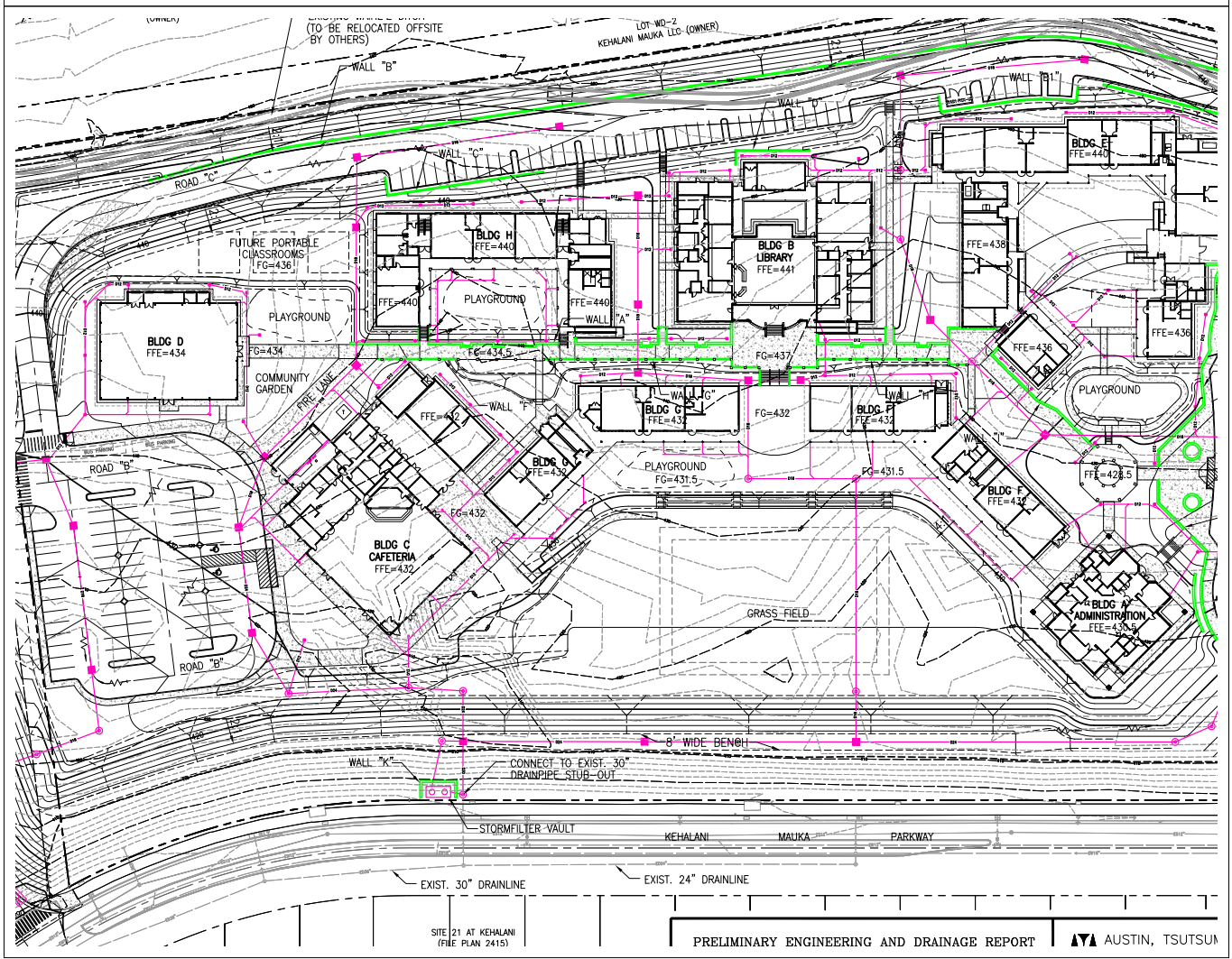
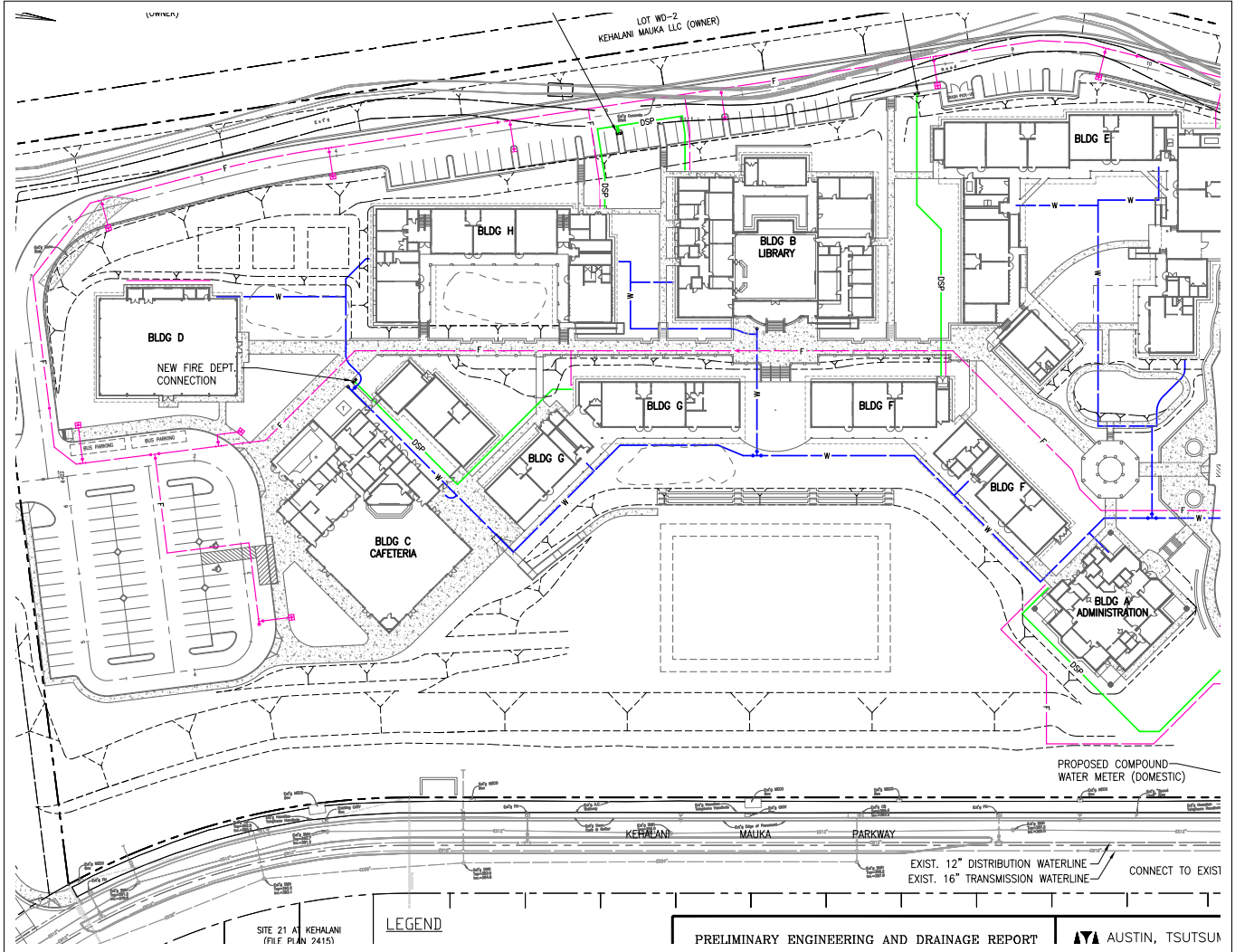
EXHIBITS

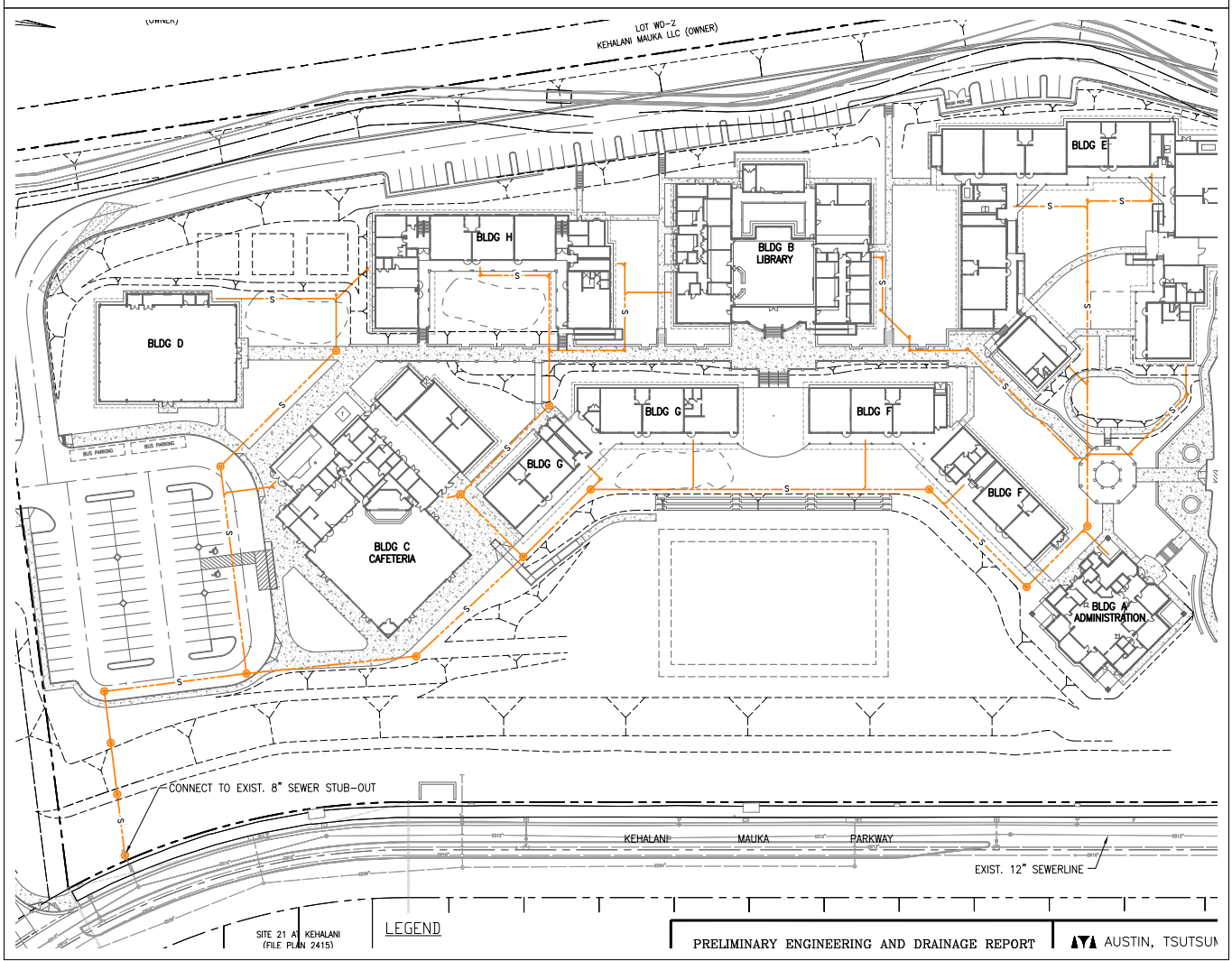


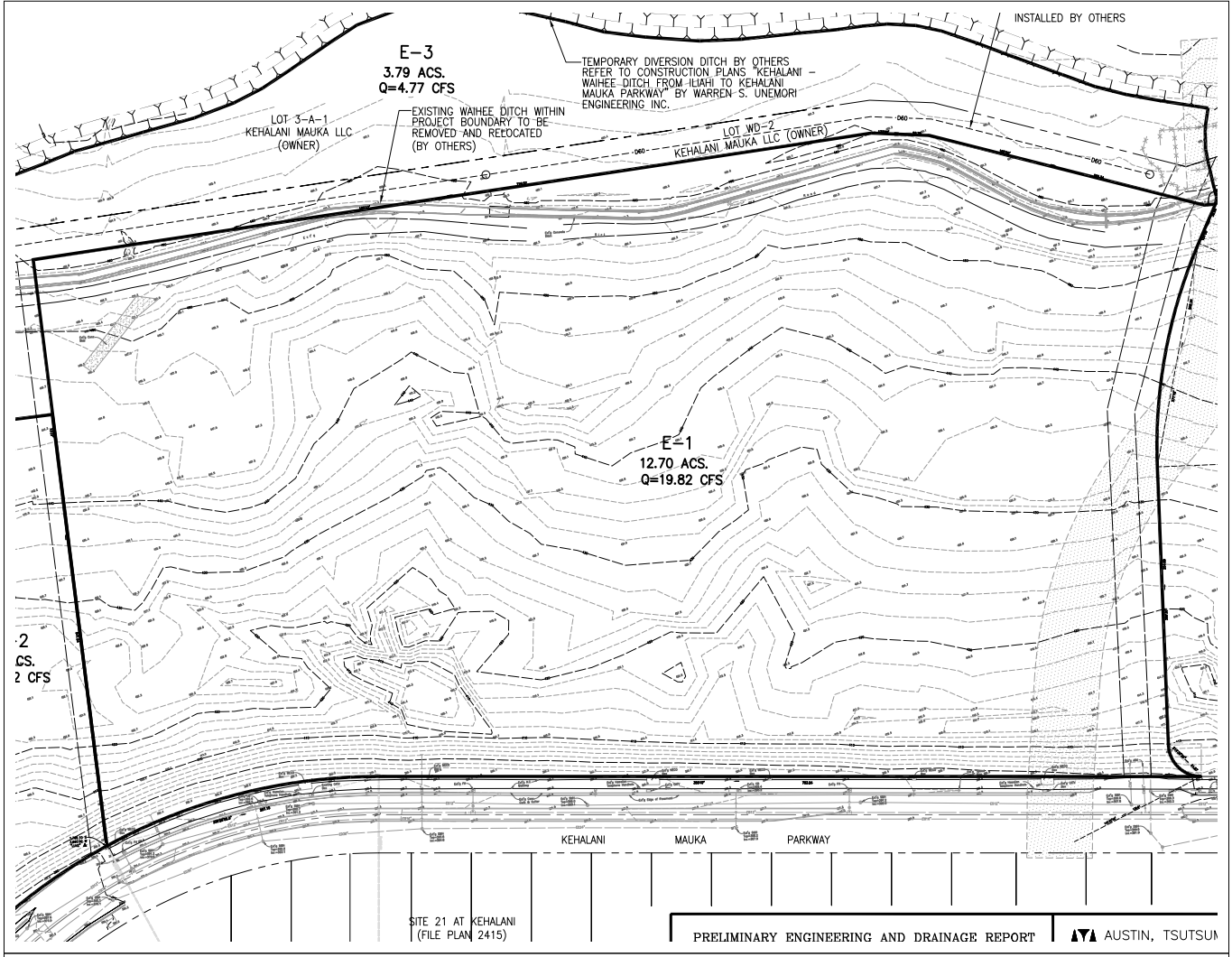
PRELIMINARY ENGINEERING AND DRAINAGE REPORT
AUSTIN, TSUTSUMI

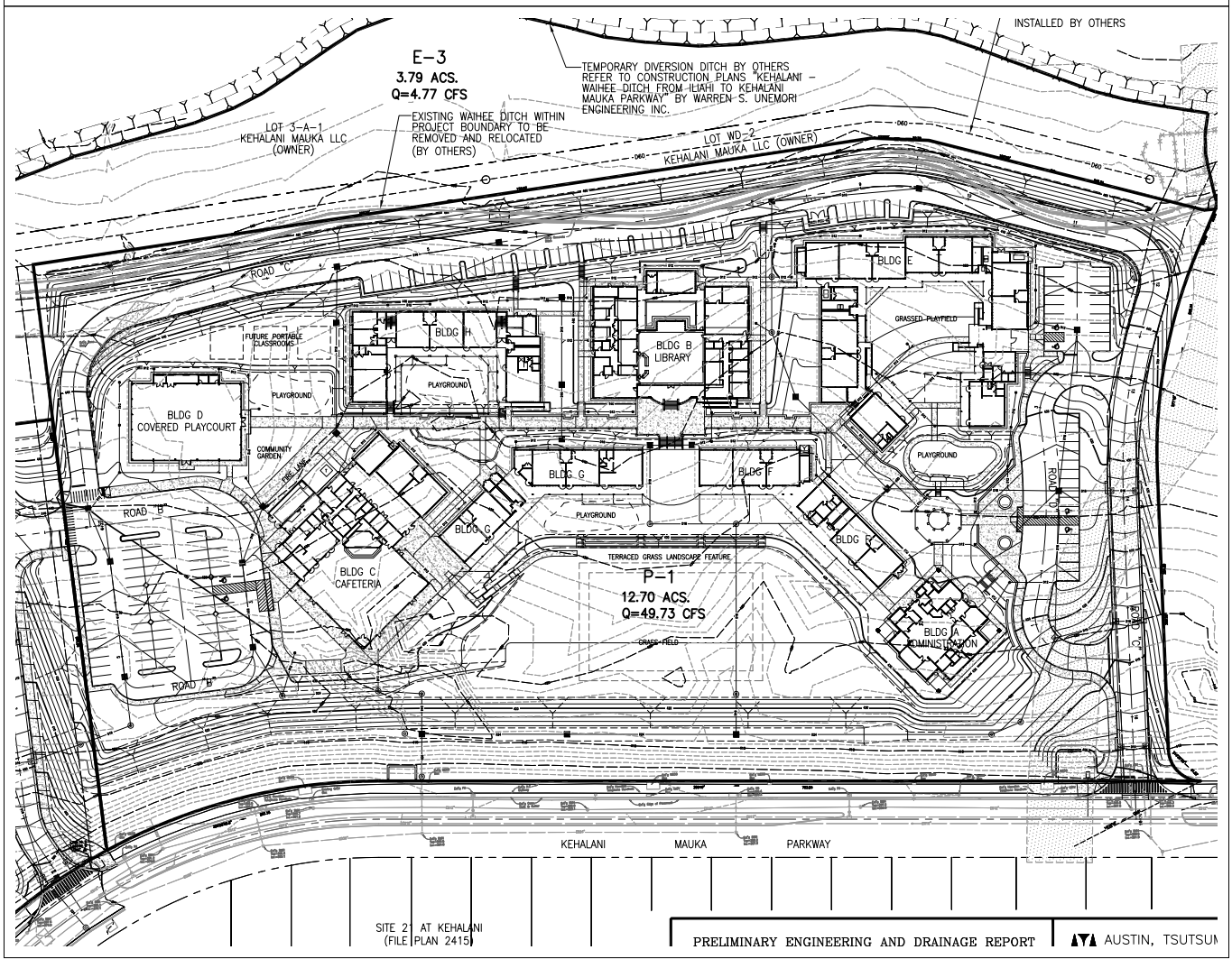

LOT 3-A-1
KEHALANI MAUKA LLC
(OWNER)
TEMPORARY DIVERSION DITCH BY OTHERS
REFER TO CONSTRUCTION PLANS "KEHALANI – WAIHEE DITCH FROM ILIAHI TO KEHALANI MAUKA PARKWAY" BY WARREN S. UNEMORI ENGINEERING INC.
6' HIGH CHAIN LINK FENCE
EXISTING WAIHEE DITCH WITHIN PROJECT BOUNDARY TO BE REMOVED AND RELOCATED (BY OTHERS)
LOT WD-2
KEHALANI MAUKA LLC (OWNER)
ROAD "C"
FUTURE PORTABLE CLASSROOMS
BLDG H
BLDG B
LIBRARY
BLDG E
GRASSED PLAYFIELD
PLAYGROUND
BLDG D
COVERED PLAYCOURT
COMMUNITY GARDEN
FIRE LANE
BLDG K
BLDG G
BLDG F
PLAYGROUND
ROAD "B"
BLDG C
CAFETERIA
TERRACED GRASS LANDSCAPE FEATURE
GRASS FIELD
BLDG A
ADMINISTRATION
ENTRY-
HEADWA
8' HIGH CHAIN LINK FENCE
6' HIGH CHAIN LINK FENCE
KEHALANI
MAUKA
PARKWAY
6' HIGH DOUBLE SWING CHAINLINK GATE
SITE 21 AT KEHALANI
(FILE PLAN 2415)
PRELIMINARY ENGINEERING AND DRAINAGE REPORT
AUSTIN, TSUTSUM

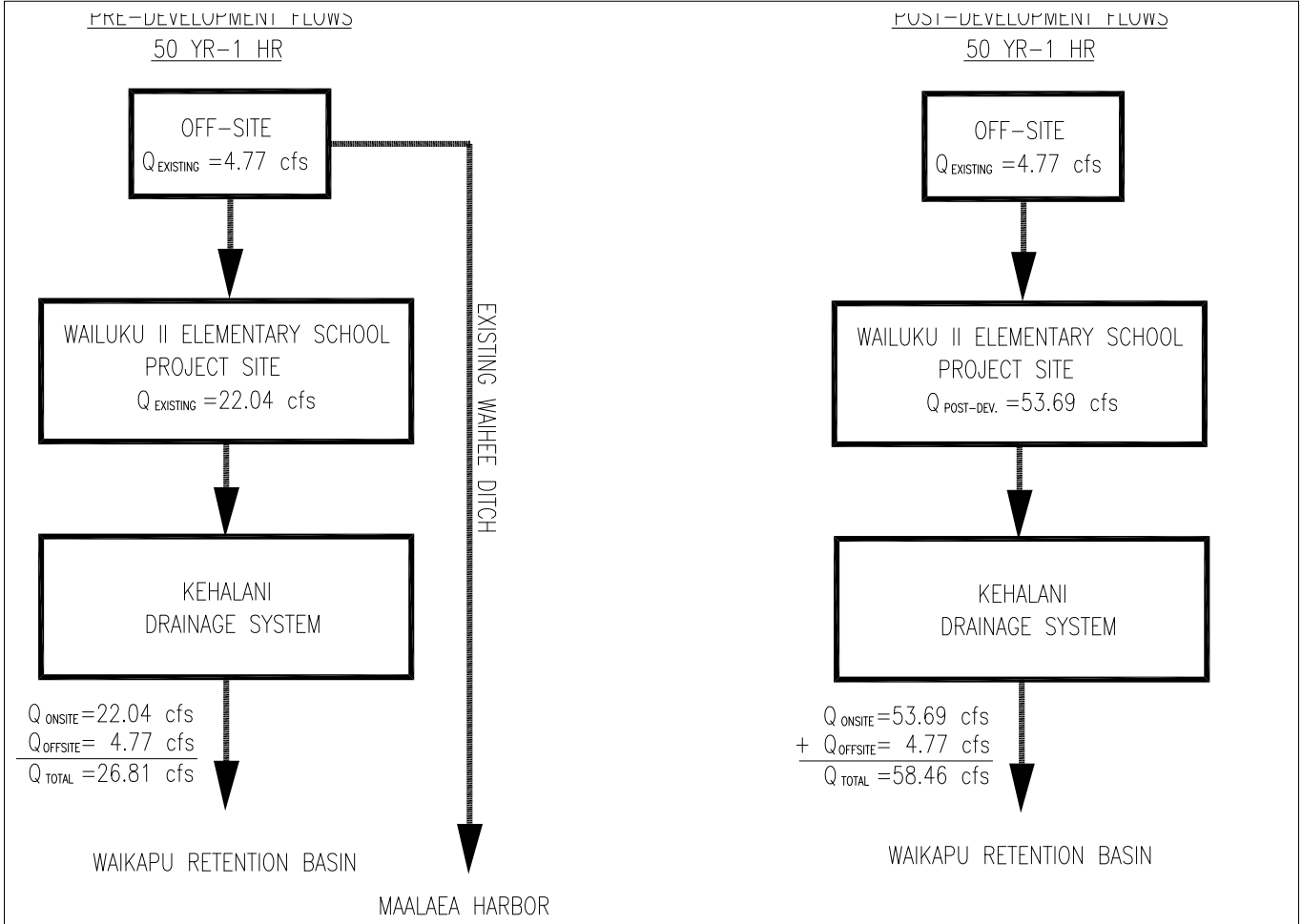

(TO BE RELOCATED OFFSITE BY OTHERS)
LOT WD-2
KEHALANI MAUKA LLC (OWNER)
WALL "B"
WALL "C"
WALL "D"
WALL "E"
ROAD "C"
BLDG E
FFE=440
FUTURE PORTABLE CLASSROOMS
FG=436
BLDG H
FFE=440
BLDG B
LIBRARY
FFE=441
FFE=438
PLAYGROUND
FFE=440
WALL "A"
BLDG D
FFE=434
FG=434
FG=434.5
FG=437
FFE=436
COMMUNITY GARDEN
FIRE LANE
WALL "F"
WALL "G"
BLDG G
FFE=432
FG=432
WALL "H"
BLDG F
FFE=432
WALL "I"
ROAD "B"
BLDG G
FFE=432
PLAYGROUND
FG=431.5
FG=431.5
FFE=428.5
BLDG C
CAFETERIA
FFE=432
GRASS FIELD
BLDG A
ADMINISTRATION
FFE=430.5
ROAD "B"
8' WIDE BENCH
WALL "K"
CONNECT TO EXIST. 30" DRAINPIPE STUB-OUT
STORMFILTER VAULT
KEHALANI
MAUKA
PARKWAY
EXIST. 30" DRAINLINE
EXIST. 24" DRAINLINE
SITE 21 AT KEHALANI
(FILE PLAN 2415)
PRELIMINARY ENGINEERING AND DRAINAGE REPORT
AUSTIN, TSUTSUM


LOT WD-2
KEHALANI MAUKA LLC (OWNER)
BLDG D
NEW FIRE DEPT. CONNECTION
BLDG H
BLDG B
LIBRARY
BLDG E
BLDG G
BLDG F
BLDG C
CAFETERIA
BLDG A
ADMINISTRATION
BUS PARKING
PROPOSED COMPOUND WATER METER (DOMESTIC)
KEHALANI
MAUKA
PARKWAY
EXIST. 12" DISTRIBUTION WATERLINE
EXIST. 16" TRANSMISSION WATERLINE
CONNECT TO EXIST
SITE 21 AT KEHALANI
(FILE PLAN 2415)
LEGEND
PRELIMINARY ENGINEERING AND DRAINAGE REPORT
AUSTIN, TSUTSUM


LOT WD-2
KEHALANI MAUKA LLC (OWNER)
BLDG D
BLDG H
BLDG B
LIBRARY
BLDG E
BLDG G
BLDG F
BLDG C
CAFETERIA
BLDG A
ADMINISTRATION
BUS PARKING
CONNECT TO EXIST. 8" SEWER STUB-OUT
KEHALANI
MAUKA
PARKWAY
EXIST. 12" SEWERLINE
SITE 21 AT KEHALANI
(FILE PLAN 2415)
LEGEND
PRELIMINARY ENGINEERING AND DRAINAGE REPORT
AUSTIN, TSUTSUM


INSTALLED BY OTHERS
E-3
3.79 ACS.
Q=4.77 CFS
TEMPORARY DIVERSION DITCH BY OTHERS
REFER TO CONSTRUCTION PLANS "KEHALANI - WAIHEE DITCH FROM ILIAHI TO KEHALANI MAUKA PARKWAY" BY WARREN S. UNEMORI ENGINEERING INC.
EXISTING WAIHEE DITCH WITHIN PROJECT BOUNDARY TO BE REMOVED AND RELOCATED (BY OTHERS)
LOT 3-A-1
KEHALANI MAUKA LLC
(OWNER)
LOT WD-2
KEHALANI MAUKA LLC (OWNER)
E-1
12.70 ACS.
Q=19.82 CFS
KEHALANI MAUKA PARKWAY
SITE 21 AT KEHALANI
(FILE PLAN 2415)
PRELIMINARY ENGINEERING AND DRAINAGE REPORT
AUSTIN, TSUTSUM


INSTALLED BY OTHERS
E-3
3.79 ACS.
Q=4.77 CFS
TEMPORARY DIVERSION DITCH BY OTHERS
REFER TO CONSTRUCTION PLANS "KEHALANI - WAIHEE DITCH FROM ILIAHI TO KEHALANI MAUKA PARKWAY" BY WARREN S. UNEMORI ENGINEERING INC.
EXISTING WAIHEE DITCH WITHIN PROJECT BOUNDARY TO BE REMOVED AND RELOCATED (BY OTHERS)
LOT 3-A-1
KEHALANI MAUKA LLC
(OWNER)
LOT WD-2
KEHALANI MAUKA LLC (OWNER)
ROAD C
FUTURE PORTABLE CLASSROOMS
BLDG H
PLAYGROUND
BLDG D
COVERED PLAYCOURT
COMMUNITY GARDEN
FIRE LANE
ROAD B
BLDG C
CAFETERIA
BLDG B
LIBRARY
BLDG E
GRASSED PLAYFIELD
BLDG G
BLDG F
BLDG A
ADMINISTRATION
TERRACED GRASS LANDSCAPE FEATURE
P-1
12.70 ACS.
Q=49.73 CFS
GRASS FIELD
KEHALANI MAUKA PARKWAY
SITE 21 AT KEHALANI
(FILE PLAN 2415)
PRELIMINARY ENGINEERING AND DRAINAGE REPORT
AUSTIN, TSUTSUM



from developed flows has been accounted for in

APPENDICIES

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APPENDIX A

DRAINAGE STUDY
PROJECT: WAILUKU II ELEMENTARY SCHOOL
PRELIMINARY HYDROLOGY CALCULATIONS

DRAINAGE STUDY

Project: WAILUKU II ELEMENTARY SCHOOL

Hydrology Calculations

Summary of Procedures

References:

1. "Rules for the Design of Storm Drainage Facilities in the County of Maui", County of Maui, Department of Public Works and Waste Management.

Pre-development and Post-development Runoff:

Definitions:

1. Drainage Area, A:

   Areas delineated by relatively identical drainage patterns based on topographic information and a common point or system.

2. Recurrence Interval, Tm:

   The frequency of the occurrence of a particular design-storm. For example, a 100-year frequency storm has a 1% chance of occurring in any given year.

   The following criteria will be used in the analysis of the drainage systems:

   a. Onsite storm runoff: 50 year – 1 hour storm interval

3. Intensity of 1-hour Rainfall value, I:

   The Rainfall Value is assumed constant over the watershed and uniformly distributed. The 10 year – 1 hour rainfall value is 2.3 inches. The 50 year – 1 hour rainfall value is 3.0 inches. (See Reference 1, Plates 4 & 7).

Methodology:

Rational Method

A. Runoff Quantity, Q:

   See Hydrology Calculations.

The equation for the Rational Method is:

$Q = c\,i\,A$ where: Q = peak flow rate (cfs)

c = runoff coefficient

i = intensity of a 1-hour rainfall

A = drainage area (acres)

B. Runoff Coefficient, C:

The percentage of rain that appears as direct runoff.

1. Unimproved and/or landscaped areas: Runoff coefficient 0.30
2. For roadways, sidewalks, future buildings: Runoff coefficient 0.95.
3. A weighted average among runoff coefficients will be used for drainage areas containing a combination of streets, sidewalks, future dwellings and landscaping.

C. Time of Concentration, Tc (min.):

Time required for water to flow from the most remote point of a drainage area to the outlet point.

1. The Time of Concentration is determined from the nomograph (See Ref. 1, Plate 1). Data for the longest length of reach, ground character and ground slope are required to use this chart appropriately.

WAILUKU II ELEMENTARY
PRELIMINARY PRE-DEVELOPMENT
HYDROLOGY CALCULATIONS

Drainage Area	Area, A, (sq ft.)	Area, A, (acres)	Runoff Coeff, C	Rainfall Intensity, I (in/hr), 10-yr-1hr	Rainfall Intensity, I (in/hr), 50-yr-1hr	Length of Reach, L, (ft)	Slope, S (ft/ft)	Time of Conc, Tc, (min)	Q10 (cfs)	Q50 (cfs)
E-1	553,323.13	12.70	0.30	4.0	5.2	625	0.11	18.0	15.24	19.82
E-2	60,812.51	1.40	0.30	4.1	5.3	465	0.15	16.5	1.72	2.22
E-3	164,964.42	3.79	0.30	3.2	4.2	840	0.03	30.0	3.64	4.77
								TOTAL:	**20.60**	**26.81**

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WAILUKU II ELEMENTARY
PRELIMINARY POST-DEVELOPMENT
HYDROLOGY CALCULATIONS

Drainage Area	Area, A, (sq ft.)	Area, A, (acres)	Runoff Coeff, C	Rainfall Intensity, I (in/hr), 10-yr-1hr	Rainfall Intensity, I (in/hr), 50-yr-1hr	Time of Conc, Tc, (min)	Q10 (cfs)	Q50 (cfs)
P-1	553,323.13	12.70	0.62	4.9	6.3	9.1	38.68	49.73
P-2	60,812.51	1.40	0.48	4.5	5.9	11.8	3.02	3.96
E-3	164,964.42	3.79	0.30	3.2	4.2	30.0	3.64	4.77
						TOTAL:	**45.34**	**58.47**
						INCREASE:	**24.74**	**31.66**

Job #: 07-510.2
1/11/2010
11:45 AM

BY: ACY

APPENDIX B

WATER SYSTEM
PROJECT: WAILUKU II ELEMENTARY SCHOOL
PRELIMINARY WATER
DEMAND CALCULATIONS

PRELIMINARY WATER DEMAND CALCULATIONS

Project Site Description

*Students – 550
*Faculty/Staff – 69
*Transient Visitors – 10

Total = 629 persons

Department of Water Supply Standard

(Table 100-18, Water System Standards)

Students **60 gallons / student

60 gallons/day x 550 students = **33,000 gallons/day** (includes domestic and landscape)

Average Daily Demand

(Table 3.3, AWWA Water Distribution Systems Handbook)

School, with cafeteria and showers ***18 gallons / person

Domestic Water Demand

550 students x (18 gallons / person / day) = 9,900 gals/day
69 faculty/staff x (18 gallons / person / day) = 1,242 gals/day
10 transient visitors x (18 gallons / person / day) = 180 gals/day

TOTAL **11,322 gals/day**

Landscape Irrigation Demand

****20,636 gallons/day**

Total Demand

11,322 + 20,636 = **31,958 gallons/day**

31,958 gallons/day < 33,000 gallons/day OK

Yearly Demand

*Assumptions: 180 school days per year for students
220 days per year for faculty/staff and transient visitors

550 students x (18 gallons / person / day) x (180 days / year) = 1,782,000 gals/year
69 faculty/staff x (18 gallons / person / day) x (220 days / year) = 273,240 gals/year
10 transient visitors x (18 gallons / person / day) x (220 days / year) = 39,600 gals/year

TOTAL **2,094,840 gals/year**

* Numbers provided by the Department of Education.
** Includes provisions for staff/faculty and landscape irrigation per Department of Water Supply.
*** 18 gallons/person derived by averaging the 16-21 gallons/person range per Water Distribution Systems Handbook and rounding down.
**** Landscape Irrigation Demand provided by Walters, Kimura, Motoda, Inc., January 14, 2010.

Austin, Tsutsumi & Associates, Inc. ● Civil Engineers ● Surveyors
1871 Wili Pa Loop ● Suite A ● Wailuku, HI 96793 ● (808) 244-8044

APPENDIX C

SEWER SYSTEM
PROJECT: WAILUKU II ELEMENTARY SCHOOL
PRELIMINARY WASTEWATER
CONTRIBUTION CALCULATIONS

PRELIMINARY WASTEWATER CONTRIBUTION CALCULATIONS

Project Site Description:

Total Project Area: 14.1 acres

550 – Students
69 – Staff/Faculty
10 – Transient Visitor

Wastewater Contribution Standards:

Students	*15 gallons / unit / day
Staff/Faculty	*15 gallons / unit / day (assumed)
Transient Visitor	*15 gallons / unit / day (assumed)

* Per County of Maui Wastewater Reclamation Division Wastewater Flow Standards

Wastewater Contribution Calculation:

Residential Units Contribution

Total number of units: 12 units

550 Students x (15 gallons/unit/day) = 8,250 gallons per day (gpd)
69 Staff/Faculty x (15 gallons/unit/day) = 1,035 gpd
10 Transient Visitor x (15 gallons/unit/day) = 150 gpd

Average Daily Wastewater Contribution: = 9,435 gpd

Maximum Wastewater Flow:

Maximum Daily Demand = Average Daily Wastewater Contribution x 5 = **47,175 gpd**

Dry Weather Infiltration/Inflow:

Dry Weather I/I = Total persons x 5 gallons/day/person = **3,145 gpd**

Design Average Flow:

Design Average Flow = Average Daily Flow + Dry Weather I/I = **12, 580 gpd**

Design Maximum Flow:

Design Maximum Flow = Maximum Wastewater Flow + Dry Weather I/I
= **50,320 gpd**

Wet Weather Infiltration/Inflow:

Wet Weather I/I = Acreage x 1,250 gallons/acre/day = **17,625 gpd**

Design Peak Flow

Design Peak Flow = Design Maximum Flow + Wet Weather I/I = **67,945 gpd**

Reference: - Wastewater Flow Standards, Wastewater Reclamation Division, County of Maui, February 2, 2006

- Design Standards, Division of Wastewater Management, Vol. 1, February 1984

Traffic Impact Analysis Report

for

Wailuku II Elementary School
Wailuku, Island of Maui, Hawai'i

Tax Map Key Number *(2) 3-5-001: 067(Por), 077(Por), 078(Por)*

DECEMBER 2009

Prepared for:

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Wailuku II Elementary School
Wailuku, Island of Maui, Hawai'i

Traffic Impact Analysis Report

TMK (2) 3-5-001: 067(Por), 077(Por), 078(Por)

December 2009

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NO. 3893-C
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Expiration Date:
April 30, 2010

This work was prepared by me or under my direct supervision.

Signature
AECOM

29 Dec 2009
Date

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TRAFFIC IMPACT ANALYSIS REPORT
for the
WAILUKU II ELEMENTARY SCHOOL

An analysis was conducted to identify the traffic impacts of the proposed Wailuku II Elementary School in Wailuku, Maui, Hawai‘i and to recommend mitigating measures. This paper summarizes the methodology, findings, and recommendations of the study.

PROJECT DESCRIPTION

An elementary school is being proposed in the Kehalani Mauka subdivision in Wailuku, Maui, to relieve the overcrowded conditions at the existing Wailuku Elementary School. The proposed project site is located in the lower portion of the subdivision in close proximity to the main highway system on a 14 acre parcel identified as TMK (2) 3-5-001: 067(Por.), 077(Por.), and 078(Por.).

The area roadway plan and the proposed school site are shown on **Figure 1**. Two roadways provide access to the Kehalani Mauka subdivision. The Kehalani Mauka Parkway provides direct access into the subdivision from Honoapi‘ilani Highway and becomes a loop collector roadway within the subdivision. Kuikahi Drive intersects Honoapi‘ilani Highway about a quarter-mile south of Kehalani Parkway and goes *mauka* (westbound) to the Wailuku Heights subdivision. The Kehalani Mauka Parkway intersects Kuikahi Drive about a half-mile *mauka* of Honoapi‘ilani Highway and provides a second access route into the subdivision.

The following intersections were selected for analysis in this study:

- Honoapi‘ilani Highway and Kehalani Parkway
- Honoapi‘ilani Highway and Kuikahi Drive
- Honoapi‘ilani Highway and Waiko Road
- Waiale Road and Olomea Street
- Waiale Road and Kuikahi Drive
- Waiale Road and Waiko Road
- Kuikahi Drive and Kehalani Mauka Parkway
- Kuikahi Drive and Alu Road

The locations of these intersections are identified on **Figure 1** in relationship to the project site.

The school is scheduled to open for the 2012-2013 school year and is anticipated to reach its full occupancy of 550 students in the 2015-2016 school year. For this reason, the year 2015 was used as the forecast year for this study. The proposed school would reduce average trip lengths for school trips by locating the school closer to its students' homes.

EXISTING CONDITIONS

A survey of the existing roadway and traffic conditions was made in November 2009.

Existing Roadways

The following roadways in the study area are identified on **Figure 1**.

Honoapi‘ilani Highway is a two-lane primary arterial highway that connects West Maui to the Central Valley area. It is identified as State Highway 30 and is under the jurisdiction of the State of Hawai‘i Department of Transportation (HDOT). The major intersections on this highway within the study area are signalized and have separate turning lanes. The roadway becomes a major collector road named High Street and provides access to the government and commercial areas of Wailuku. The posted speed limit is 35 miles per hour (mph) through the study area with a section between Kuikahi Drive and Pilikana Street posted at 45 mph. The *Maui Long Range Land Transportation Plan,* prepared by Kaku Associates, Inc., (February 1997) de-emphasizes the segment of Honoapi‘ilani Highway between the Kuihelani Highway junction and Wailuku. The four-lane Kuihelani Highway is identified as the arterial to handle regional traffic between Central and West Maui.

Waiale Road is a two-lane collector roadway that parallels Honoapi‘ilani Highway on the east side between Kaahumanu Avenue and Waiko Road. It serves existing

developments along its route and provides another access route to Wailuku Town and Lower Main Street.

Kuikahi Drive is a two-lane collector roadway aligned on an east-west orientation and intersects Waiale Road and Honoapiʻilani Highway at right angles. West of Honoapiʻilani Highway, it provides access to the Wailuku Heights subdivision and a second route to the Kehalani Mauka subdivision. It serves as a connecting link on the Honoapiʻilani Highway-Kuikahi Drive-Waiale Road route. Kuikahi Drive is being extended eastward from Waiale Road as part of a new development project.

The Kehalani Parkway serves as a collector roadway for the *makai* and *mauka* sections of the Kehalani Subdivision. The roadway section *makai* of the highway is named the Kehalani Makai Parkway and serves the completed Makai subdivision. It terminates at the north-south aligned Kamole Street. Continued access to Waiale Road is provided by Olomea Street and Kaupo Street. The *mauka* roadway section named Kehalani Mauka Parkway would be completed as the Mauka subdivision is completed. It is designed as a loop that will eventually connect with Kuikahi Drive about a half-mile *mauka* of Honoapiʻilani Highway.

Waiko Road is a two-lane collector roadway on an east-west orientation about one and a quarter-mile south of Kuikahi Drive. The *mauka* roadway serves the older Waikapu residential community while the *makai* roadway serves industrial uses on its route to Kuihelani Highway.

Alu Road is a two-lane local street through the Wailuku Heights subdivision and provides a second route into Wailuku town.

The three study intersections on Honoapiʻilani Highway are controlled by traffic signals. All three intersections have separate turning lanes on the highway approaches with protected/permitted left turn movements. The traffic signal at the Kehalani Parkway intersection operates on an eight-phase timing plan while the other two intersections have simultaneous green phases for the side streets. The remaining study intersections not on the highway are stop sign controlled. All but one has stop signs on their minor

street approaches. The Kuikahi Drive/Waiale Road intersection is currently an all-(three-)way stop and is being improved to add traffic signals and a fourth approach for the Maui Lani 100 VMX project.

The *Statewide Transportation Improvement Program (STIP) for FY 2008 thru 2013* does not list any roadway improvements in the study areas.

Traffic Volumes

Traffic turning movement counts were taken at the study intersections during the weekday morning and afternoon peak commuter periods from November 17 to 24, 2009. Traffic counts were taken on Tuesday and Thursday peak periods while the public schools were in session the full day. Traffic turning movement counts require a traffic surveyor to observe traffic flow and record the movements of each vehicle crossing the intersection as either through or by their turning movements in 15 minute intervals. The worksheets from these traffic counts are included in **Appendix A**.

The current morning and afternoon peak hour traffic volumes are shown on **Figure 2** with volumes rounded to the nearest five vehicles per hour (vph) except for volumes less than 5 vph. The peak morning direction of traffic flow on Honoapiʻilani Highway is toward Wailuku at Kehalani Parkway and toward West Maui at Waiko Road. The afternoon traffic flow is toward Wailuku. There is a strong travel pattern from Honoapiʻilani Highway to Kuikahi Drive to Waiale Road in both directions in both peak hours, creating high turning volumes at these intersections. The traffic volumes on Waiale Road are higher than those on the highway. The existing traffic operations at the study intersections are discussed in the **Level of Service Analysis** section of this report.

Traffic counts were taken at the same study intersections in May 2007 for an earlier study and are shown on **Figure 3**. Comparison of the two sets of traffic counts shows that traffic on Honoapiʻilani Highway has remained stable or decreased in the two year period for two reasons. Traffic decreases have been noted on other highways in the State during the current economic downturn. Traffic volumes have also decreased on

the highway and increased on Waiale Road as more commuters utilize Waiale Road to access Wailuku Town. Traffic volumes into and out of the Kehalani Mauka subdivision has increased on Kehalani Parkway and Kuikahi Drive with the growth of the *mauka* subdivision. Traffic volumes on Waiale Road between Kuikahi Drive and Waiko Road have also increased with the completion and occupancy of the Waikapu Gardens subdivision in the period.

The HDOT takes traffic counts at various State and County roadways throughout the state. Two of the counts were taken on Honoapiʻilani Highway in late August 2007 north of and south of Kuikahi Drive. The hourly traffic volumes in both directions at both locations are graphically shown on **Figure 4**. The graph shows higher traffic volumes south of Kuikahi Drive since many drivers cross over to Waiale Road at Kuikahi Drive to access Wailuku Town. The northbound volumes exceed the southbound volumes in both peak hours at both locations.

TRAFFIC FORECASTS

The proposed project is expected to be fully occupied by 2015. During the six year period from the traffic count date to full occupancy, ambient traffic on the area roadways can be expected to increase due to regional growth and new projects in the area. The traffic that would be generated from the proposed project was added to the ambient traffic forecast to obtain the total with project traffic forecast.

Ambient Traffic Forecast

Traffic growth in the study area will come from regional growth in other areas whose traffic passes the project site and other projects planned in the vicinity of the proposed project. Therefore, the traffic which would be generated by these future projects was added to the estimate of regional traffic growth to obtain the ambient traffic forecast.

The aforementioned *Maui Long Range Land Transportation Plan* forecasts an annual island wide growth rate of 1.6% in its 20 year forecast. Compounding this annual growth rate for a six year period (2009-2015) resulted in a 10.0% growth factor. The

current AM and PM peak hour through traffic volumes shown on **Figure 2** were increased using the 10.0% growth factor. The traffic volumes turning into and out of the Kehalani Mauka subdivision and the *mauka* Waiko development were not increased. Traffic growth for the former was calculated separately and the latter was assumed to be a mature project with little growth potential.

Several projects are planned in the Wailuku/Kahului area including:

- The residential growth in the Kehalani Mauka subdivision;
- The 180,000 sf commercial center in the Kehalani Makai subdivision;
- A church school and preschool on Waiale Road; and
- The Maui Lani 100 VMX/Affordable Housing Development.

Based on information from the developer of the Kehalani subdivision, about 748 single family and 631 multi-family residential units are expected to be completed and occupied by 2015. The developer also expects to develop an 180,000 sf commercial center at the corner of Kuikahi Drive and Waiale Road primarily to serve the residents of the subdivision. The Emmanuel Lutheran Church is proposing to move their church, school, and preschool from Kahului to a Waiale Road location. The school was assumed to have 200 students. The Maui Lani 100 VMX/Affordable Housing Development is expected to be occupied by the 2015 forecast year.

The traffic growth from the first three proposed adjoining projects were calculated using the traditional three step procedure of trip generation, distribution, and assignment to determine the future traffic patterns from them. The trip generation step forecasts the volume of vehicle trips that would be generated by the proposed project during the morning and afternoon peak periods. The Institute of Transportation Engineers' *Trip Generation* report (Seventh Edition, 2003) has trip generation equations or rates to calculate the number of morning and afternoon peak hour trips that would be generated by various land uses. The trip generation formulas and the results of these calculations for the first three land uses are summarized on **Table 1**.

Traffic forecasts from the *Traffic Impact Assessment Report Maui Lani 100 VMX/Affordable Housing Development* (July 2004) prepared by Parsons Brinckerhoff

were incorporated into the ambient traffic forecasts for this study. The Maui Lani 100 VMX project would include the various land uses shown in the table below, and would generate the number of trips shown in each peak hour:

	AM PEAK HOUR		PM PEAK HOUR	
LAND USE	**In**	**Out**	**In**	**Out**
Retail (449,171 sf)	208	133	722	783
Office (25,717 sf)	54	8	16	81
Medical Offices (64,643 sf)	126	31	51	138
Service Business (12.15 ac)	158	21	36	126
VMX Multi-Family (100 DU)	5	29	26	13
Multi-Family Residential (175 DU)	9	50	46	23
Single Family Residential (157 DU)	28	83	81	46
TOTAL	**588**	**355**	**975**	**1,210**

The actual project being developed is slightly smaller than that shown in the traffic report so that the number of trips generated would be slightly less. Based on the trip distribution factors of that study, about half the trips are forecast to utilize the Waiale Road/Kuikahi Drive intersection to enter/egress the project site. The future trips from the Maui Lani 100 VMX project are expected to have significant impacts on the Waiale Road and Honoapiʻilani Highway intersections of Kuikahi Drive. As part of this project, Kuikahi Drive would be extended to Kamehameha Avenue and form a new route from the study area to Kahului. This would divert trips from Honoapiʻilani Highway and Waiale Road and reduce traffic volumes on these roadways.

The sum of regional and adjacent projects traffic forecasts are graphically shown on **Figure 5**. The traffic operations at the study intersections with the ambient traffic forecasts are discussed in the **Level of Service Analysis** section of this report.

Project Generated Traffic

The traditional three-step process of trip generation, trip distribution, and trip assignment was used to forecast the future traffic which would be generated by the proposed project. The trip generation step forecasts the number of new trips that would be produced in each of the two study periods. The trip distribution step allocates these

new trips by direction of travel. Finally, the trip assignment step assigns the trips to the specific turning movements at the study intersections.

The trip generation step forecasts the volume of vehicle trips that would be generated by the proposed project during the morning and afternoon peak periods. The *Trip Generation* report has trip generation equations or rates to calculate the number of morning and afternoon peak hour trips that would be generated by various land uses. The trip generation equations for an elementary school (ITE Land Use 820) were utilized for the proposed project:

Morning Peak Hour	$- Ln(T) = 1.11Ln(X) – 1.73$
Afternoon Peak Hour	$- Ln(T) = 1.08Ln(X) – 1.00$

Where, T = number of hourly trips,
and, X = number of students (550).

The equation for the afternoon peak hour is applied to the hour that school lets out, which is normally before the afternoon peak hour of traffic. Since a smaller number of school trips are expected during the afternoon commuter hour, only half the calculated trips were used for the afternoon peak hour. The proposed school is forecast to generate 195 morning and 68 afternoon peak hour trips.

The *Trip Generation* report also lists the percentage of inbound and outbound trips in each peak hour. The number of generated trips was divided into inbound and outbound trips based on the information from the report, as shown on **Table 1**. The project generated trips were then distributed by direction of travel to and from the project site. The four major directions of travel and the percentage of trips in each direction are shown on the next page.

- North via Honoapiʻilani Highway – 15%
- North via Waiale Road – 20%
- East via Kuikahi Drive – 20%
- South via Honoapiʻilani Highway – 45%
- Internal (inbound)– 63% in AM, 33% in PM
- Internal (outbound)– 55% in AM, 80% in PM

The distribution factors for the four major directions of travel were adjusted after adjustment for the internal distribution factors. About half these trips are expected to be generated from within the subdivision and would not enter the study area roadway system. These project generated trips were assigned through the study area network and the resultant trip assignments are shown on **Figure 6**. The proposed project would add few trips on the roadway system, particularly during the afternoon peak hour.

Total Forecast Volumes

The project generated traffic assignment volumes from **Figure 6** were added to the ambient traffic forecasts from **Figure 5** to obtain the four totals with project traffic forecasts shown on **Figure 7**. The traffic volumes are rounded to the nearest five vph.

LEVEL OF SERVICE ANALYSIS

The concept of level of service is used to quantify the quality of traffic flow on roadway facilities. The Transportation Research Board (TRB) has developed procedures to calculate level of service value(s) by measuring traffic volumes against the capacities of different types of roadway facilities. Their *Highway Capacity Manual 2000 (HCM 2000)* describes the various procedures developed for freeways, highways, signalized and unsignalized intersections, etc. The study intersections include both signalized and unsignalized intersections.

Table 2 summarizes the signalized intersection level of service analysis while **Table 3** summarizes the unsignalized intersection level of service analysis. Each table shows the existing, ambient forecast, and total with project forecast levels of service and delay placed side by side for each of the two (AM and PM) study periods. This format facilitates a comparison of levels of service for the different forecast scenarios and can give an indication of the traffic impacts of ambient traffic growth and the proposed project. The traffic operation statistics for both signalized and unsignalized intersections were calculated with the Synchro 7 software program that simulates and optimizes traffic signal timings in a roadway network. The level of service calculation worksheets are included in **Appendix B**.

Signalized Intersection Analysis

The methodology for analyzing signalized intersections calculates the levels of service for individual movements, approaches, and the intersection as a whole based on the average stopped delay per vehicle. The results range from level of service A (best with average delays less than ten seconds) to F (worst with average delays longer than 80 seconds), described as follows:

SIGNALIZED INTERSECTION LEVEL OF SERVICE	
LEVEL OF SERVICE	**CONTROL DELAY PER VEHICLE (Seconds/Vehicle)**
A	< 10.0
B	10.1 to 20.0
C	20.1 to 35.0
D	35.1 to 55.0
E	55.1 to 80.0
F	> 80.1

Many jurisdictions consider levels of service A to D as acceptable for areas like Maui, with levels of service E and F indicating the need for mitigating measures. For signalized intersections, the major streets can be designed to have a higher level of service than the side streets or turning lanes.

The three existing signalized study intersections include:

- Honoapiʻilani Highway and Kehalani Parkway.
- Honoapiʻilani Highway and Kuikahi Drive.
- Honoapiʻilani Highway and Waiko Road.

Two other intersections are expected to be signalized by 2015 and were analyzed as such. All three study intersections on Honoapiʻilani Highway are currently operating at level of service B in both peak periods, indicating acceptable traffic operations.

The Kehalani Parkway intersection is forecast to operate at levels of service B and C in the morning and afternoon peak hours, respectively, for the ambient and total with project forecasts. The levels of service would not change from ambient to total with project forecasts. This would indicate that the proposed school project would not have an adverse traffic impact.

The Kuikahi Drive intersection will require mitigation to operate at level of service C during both peak hours. Due to the high volumes of turning movements forecast at this intersection, both Kuikahi Drive approaches would require separate left turn, through, and right turn lanes. With these changes, all but one approach would be operating at levels of service C or better, which is acceptable. The Kuikahi Drive eastbound approach is forecast to operate at level of service D in both peak hours since its green phase would be shortened by the high volumes of opposing left turns.

The two Waiko Road approaches do not have separate left turn lanes and separate left turn phases, so they are currently operating at level of service D in the morning peak hour and are forecast to remain so in forecast future. During the future afternoon peak the intersection is forecast to operate at level of service D due to the single lane on the Waiko Road westbound approach. This also causes the northbound approach of Honoapiʻilani Highway to operate at level of service E. This would indicate the future need for mitigation at this intersection even without the proposed project.

The above analysis shows no changes in level of service from the ambient to total with project forecasts at the three signalized intersections on Honoapiʻilani Highway, indicating that the proposed school project would not have an adverse traffic impact.

The Waiale Road/Olomea Street and Waiale Road/Kuikahi Drive intersections were analyzed as traffic signal controlled intersections for the future ambient and total with project forecasts since they are expected to be signalized by the study forecast year. With traffic signals, the Waiale Road/Olomea Street intersection is forecast to operate at levels of service C and B in morning and afternoon peak periods, respectively. The proposed school project would not have an adverse traffic impact at this intersection.

Maui Lani Partners is currently improving the Waiale Road/Kuikahi Drive intersection and installing traffic signals for their VMX project. With these planned traffic signals, the intersection is forecast to operate at level of service C in the morning peak and at level D in the afternoon peak. The afternoon peak hour is forecast to have higher volumes than the morning peak. The proposed school project would not have an adverse traffic impact at this intersection.

Unsignalized Intersection Analysis

The procedure used for analyzing unsignalized intersections calculates vehicle delays and levels of service based on the distribution of gaps in traffic on the major street and driver judgment in selecting gaps through which to execute turns. For two-way stop intersections where only the minor street traffic is controlled by a stop sign, levels of service are calculated for the critical turning movements including outbound movements from the stop-controlled approach and left turns from the main road to the minor road. The procedure does not calculate an overall intersection level of service.

The *HCM 2000* defines the relationship between level of service and delay (in seconds/vehicle) for unsignalized intersections as shown in the following table.

UNSIGNALIZED INTERSECTION LEVEL OF SERVICE	
LEVEL OF SERVICE	**DELAY (Seconds/Vehicle)**
A	< 10.0
B	10.1 to 15.0
C	15.1 to 25.0
D	25.1 to 35.0
E	35.1 to 50.0
F	> 50.1

Levels of service A to D are considered acceptable for unsignalized intersections. Level of service F (with average delays longer than 50 seconds) is considered undesirable for unsignalized intersections and would indicate the possible need for mitigation.

The unsignalized intersections which were analyzed include:

- Waiale Road and Olomea Street (2009 only).
- Waiale Road and Kuikahi Drive (2009 only).
- Waiale Road and Waiko Road.
- Kuikahi Drive and Kehalani Mauka Parkway.
- Kuikahi Drive and South Alu Road.

The results of the unsignalized intersection analysis shown on **Table 3** include level of service and delay.

The unsignalized intersection analysis at the Waiale Road/Olomea Street intersection shows very long current delays on the Olomea Street approach and the need for mitigation. The County of Maui engineering staff determined that this intersection meets one warrant for traffic signalization. As previously discussed, this intersection was assumed to be traffic signal controlled by the year 2015.

The Waiale Road/Kuikahi Drive intersection is currently all-way stop controlled with single lanes on all three approaches. The intersection is operating at level of service C in both peak hours. As previously discussed, intersection improvements including traffic signals are currently being installed.

The Waiale Road approach to Waiko Road is currently operating at levels of service E and D in the morning and afternoon peak hours, respectively. The levels of service are forecast to worsen by one level for the forecast future. The future connection of Kuikahi Drive with Kamehameha Avenue would create another route from the study area to Kahului. Traffic volumes on the Waiale Road approach to Waiko Road can be expected to decrease as a result, mitigating the impacts shown above.

The two *mauka* intersections of Kuikahi Drive are currently operating at levels of service A and B in both peak hours, indicating acceptable levels of service. They are forecast to remain unchanged in the future. As such, no mitigating actions are required at these two intersections.

RECOMMENDATIONS AND CONCLUSIONS

The proposed elementary school project is forecast to add a small number of trips to the roadway system outside the Kehalani Mauka subdivision and would not have an adverse impact on traffic operations. The roadway system is expected to accommodate the increase in ambient traffic and school generated traffic with adequate mitigation. Several locations were identified as needing mitigation in the future regardless of the proposed project:

- Honoapiʻilani Highway and Waiko Road - provide separate left turn lanes and traffic signal phases on Waiko Road approaches.
- Honoapiʻilani Highway and Kuikahi Drive - provide separate left turn lanes and traffic signal phases on Kuikahi Drive approaches.
- Waiale Road and Olomea Street - install traffic signals to mitigate long delays on Olomea Street.
- Kuikahi Drive and Waiale Road - roadway improvements and traffic signals being installed for a new development.

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7. Synchro Studio 7, Trafficware, Ltd.

Figures

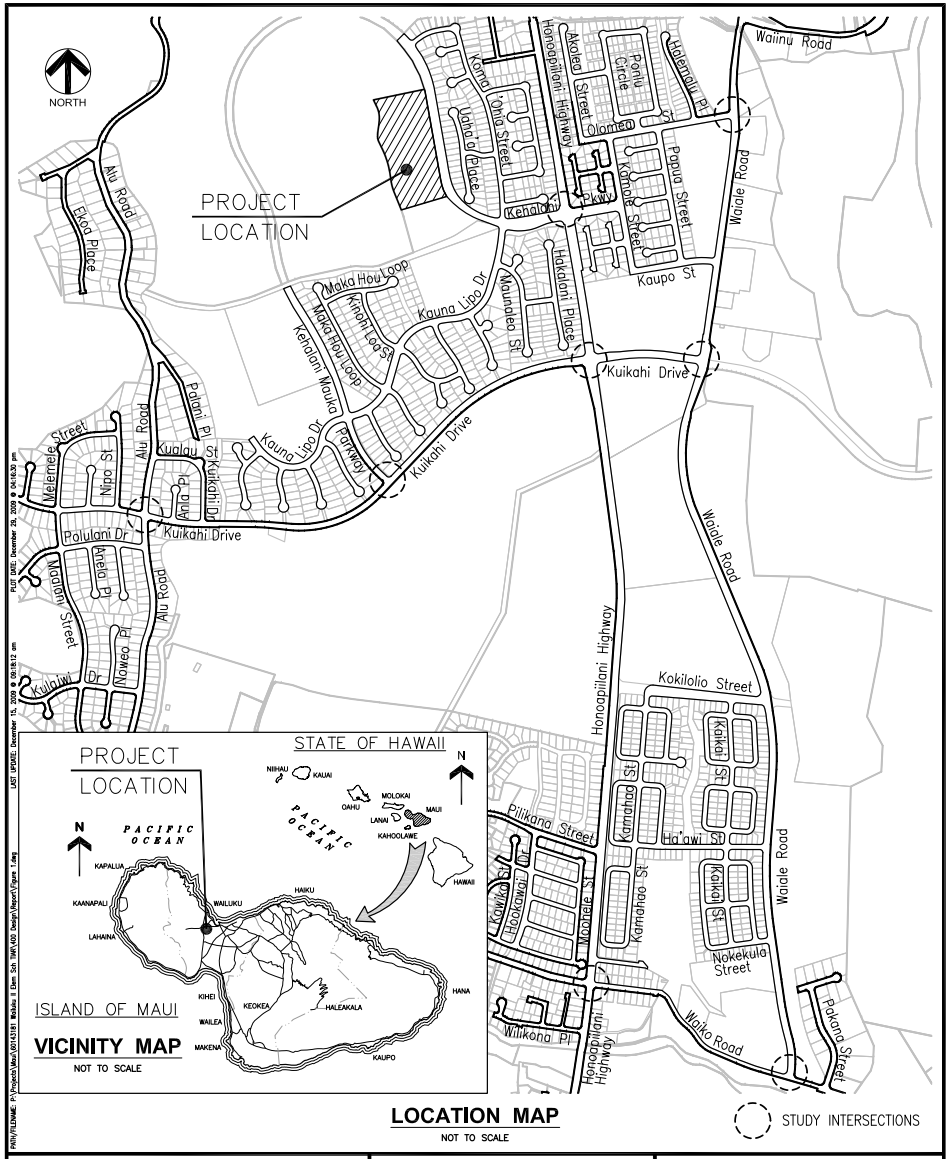

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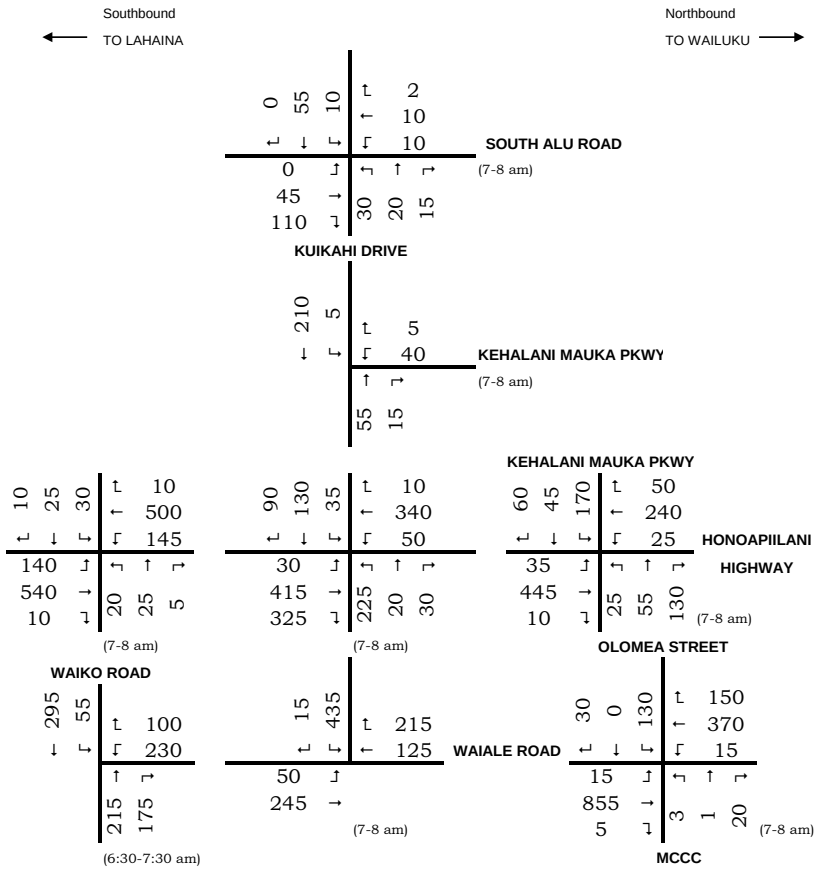
Figure 1
LOCATION MAP
TRAFFIC IMPACT ANALYSIS REPORT
WAILUKU II ELEMENTARY SCHOOL
WAILUKU, MAUI, HAWAII

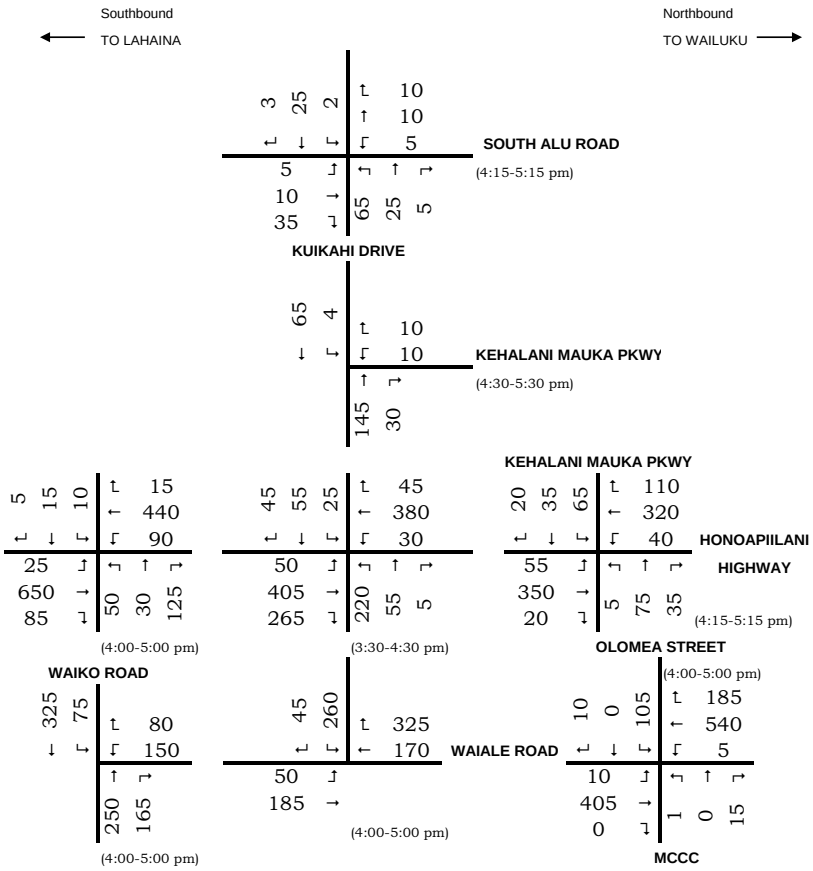
DECEMBER 2009



A. AM PEAK HOUR

2009 EXISTING TRAFFIC VOLUMES

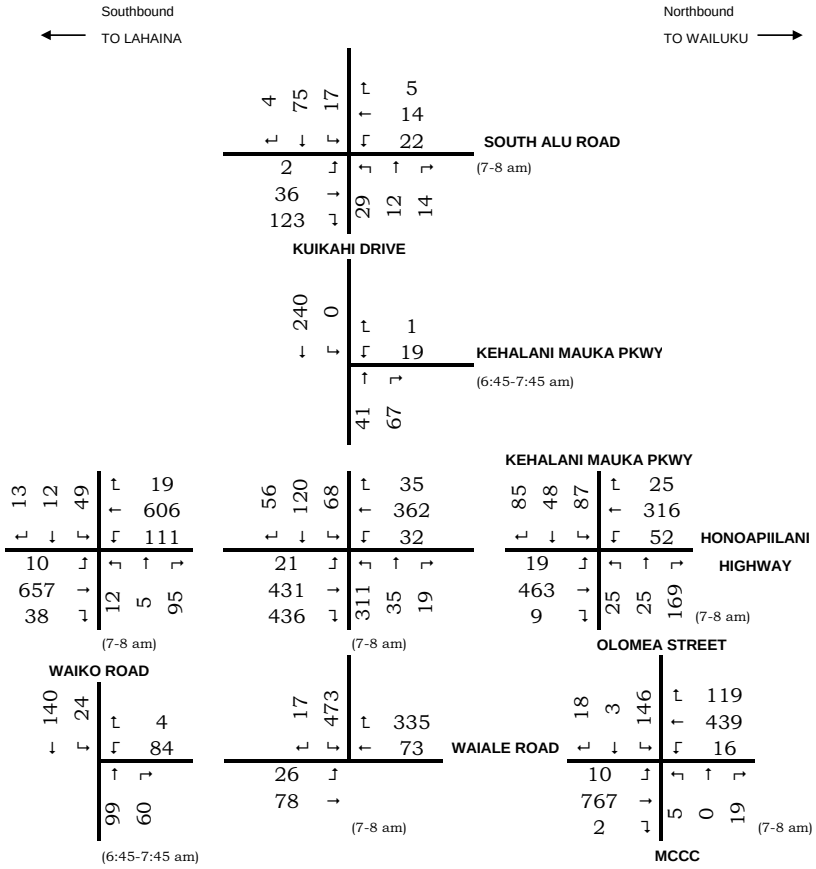
FIGURE 2



B. PM PEAK HOUR

2009 EXISTING TRAFFIC VOLUMES

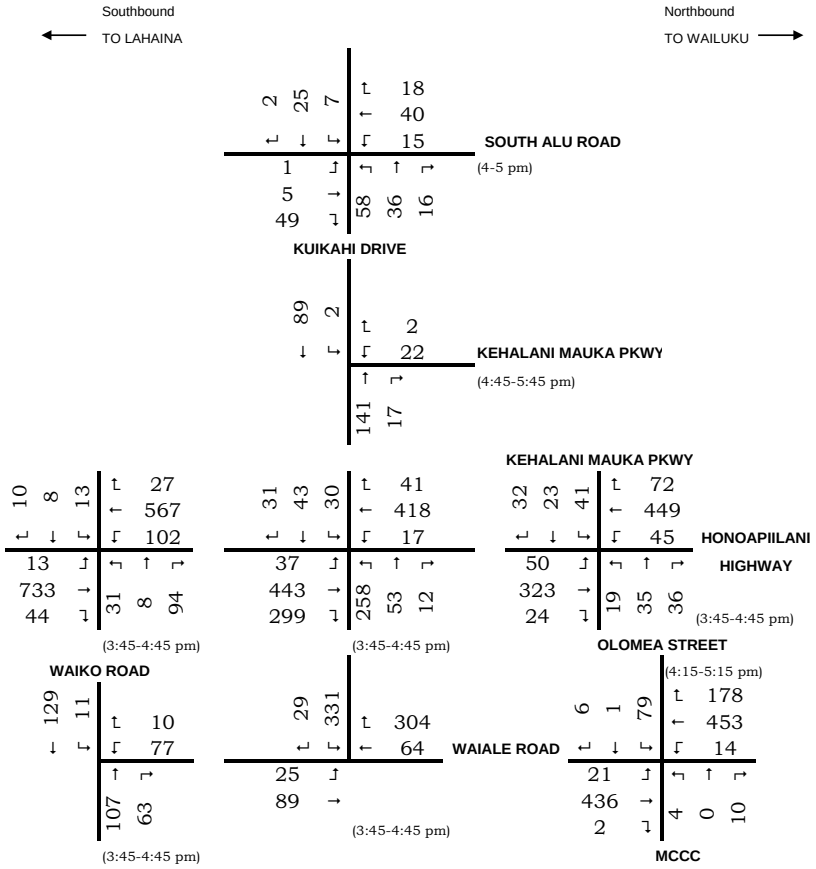
FIGURE 2



A. AM PEAK HOUR

MAY 2007 TRAFFIC VOLUMES

FIGURE 3



B. PM PEAK HOUR

MAY 2007 TRAFFIC VOLUMES

FIGURE 3

Hour Starting at	Hourly Traffic Volumes on Honoapiilani Highway: N of Kuikahi Dr To South	N of Kuikahi Dr To North	S of Kuikahi Dr To South	S of Kuikahi Dr To North
5:00 AM	189	52	275	100
6:00 AM	439	164	675	412
7:00 AM	388	475	751	907
8:00 AM	359	383	514	624
9:00 AM	278	354	465	542
10:00 AM	307	396	382	554
11:00 AM	360	336	490	540
12:00 PM	359	370	495	532
1:00 PM	348	389	500	566
2:00 PM	380	393	461	608
3:00 PM	463	452	714	702
4:00 PM	434	481	740	862
5:00 PM	402	447	568	688
6:00 PM	268	304	458	498

Source: Hawaii State Department of Transportation

Dates: N of Kuikahi Dr- August 27, 2007
S of Kuikahi Dr- August 22, 2007

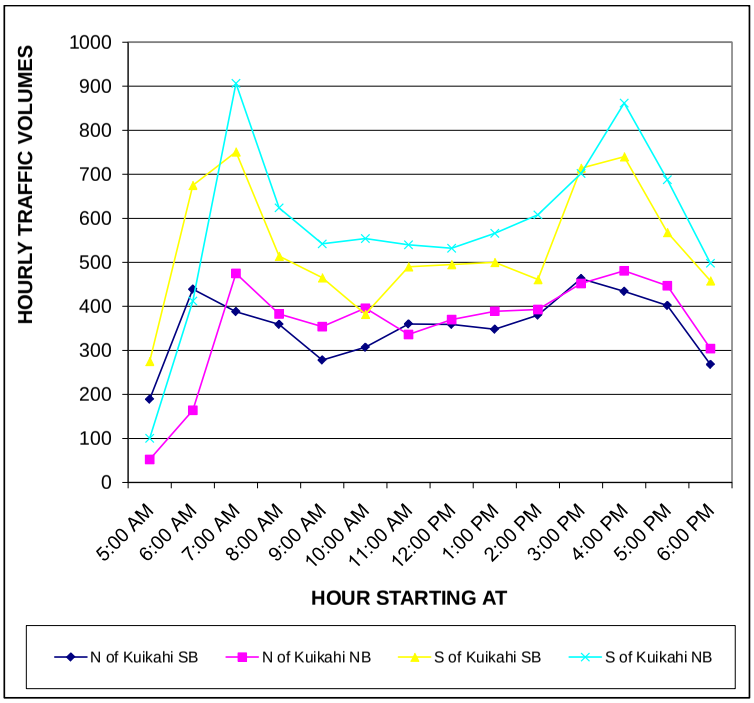
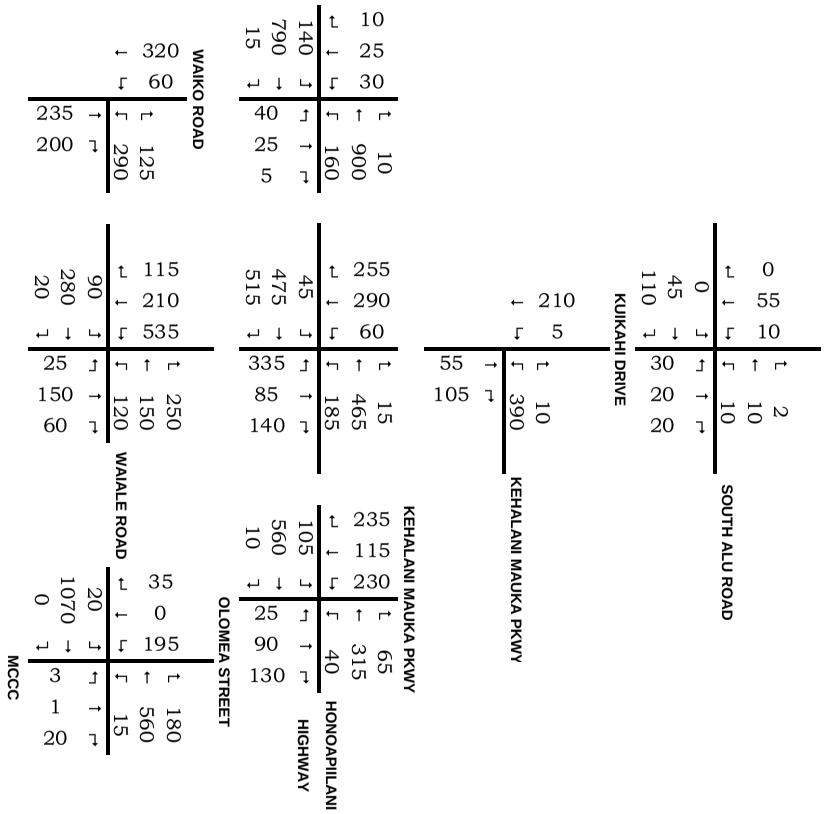


FIGURE 4

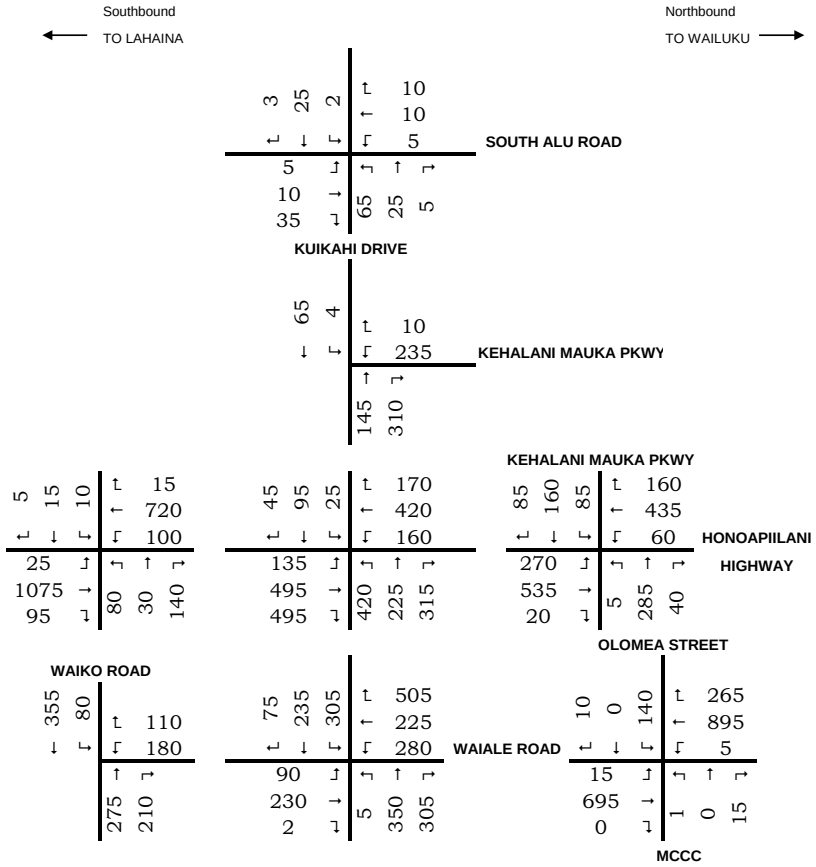
HOURLY TRAFFIC VOLUMES ON HONOAPIILANI HWY NORTH & SOUTH OF KUIKAHI DRIVE



A. AM PEAK HOUR

2015 AMBIENT TRAFFIC FORECASTS

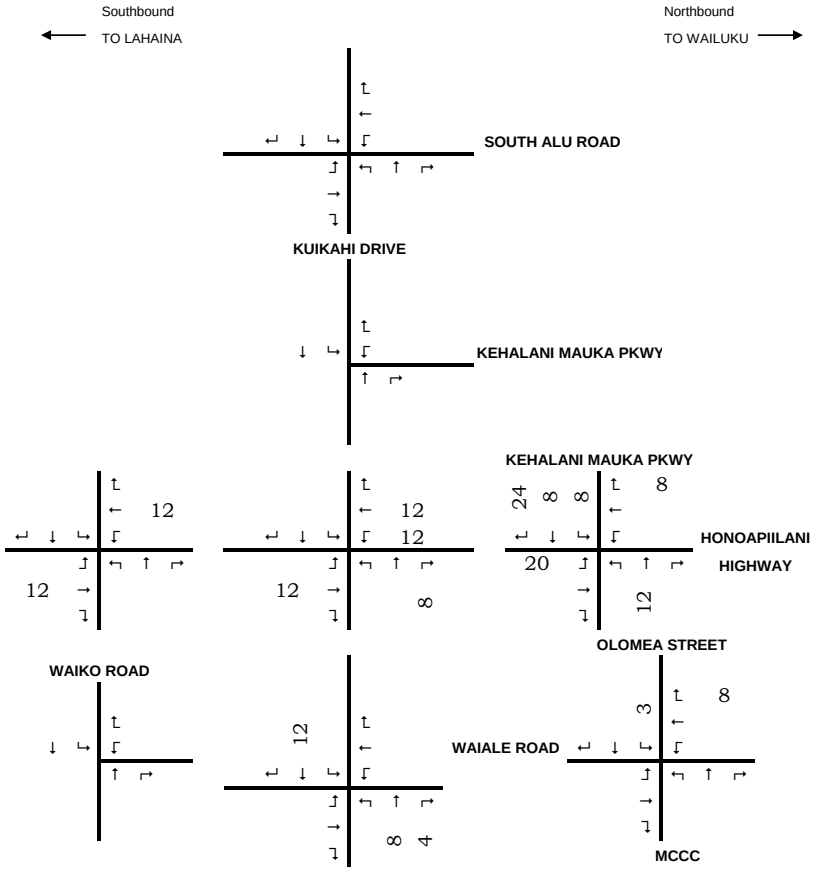
FIGURE 5



B. PM PEAK HOUR

2015 AMBIENT TRAFFIC FORECASTS

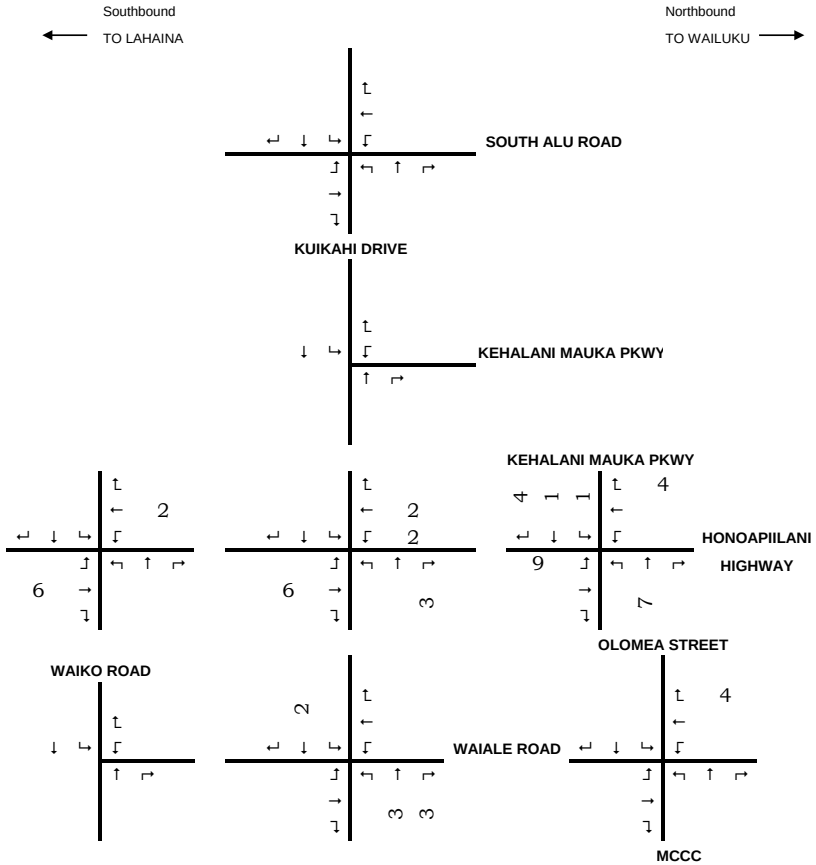
FIGURE 5



A. AM PEAK HOUR

PROJECT GENERATED TRAFFIC ASSIGNMENT

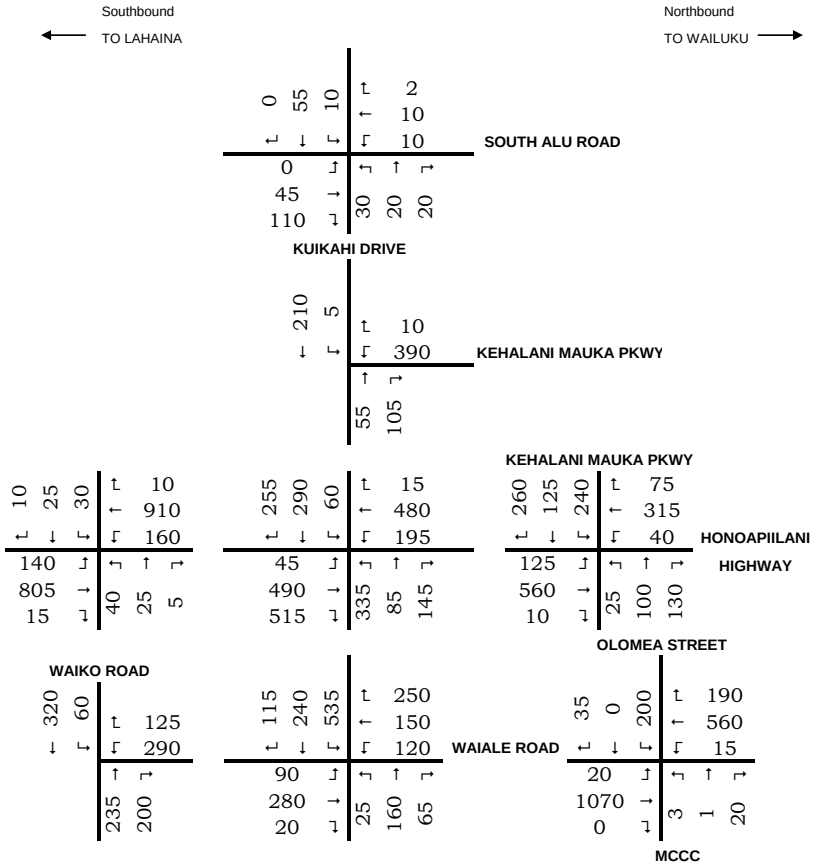
FIGURE 6



B. PM PEAK HOUR

PROJECT GENERATED TRAFFIC ASSIGNMENT

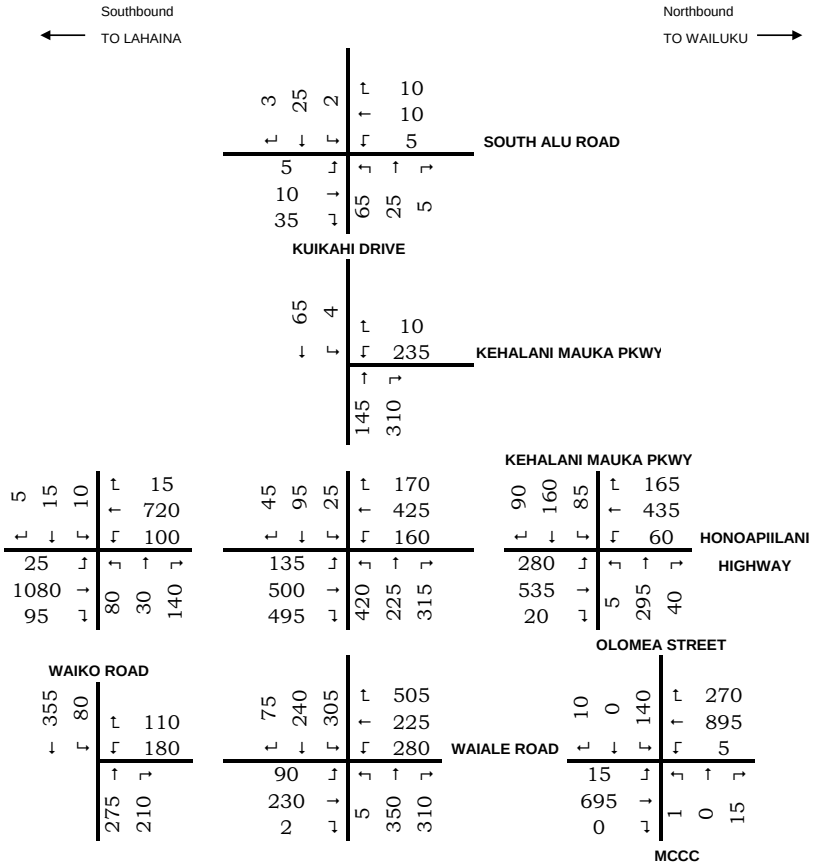
FIGURE 6



A. AM PEAK HOUR

2015 TOTAL WITH PROJECT TRAFFIC FORECASTS

FIGURE 7



B. PM PEAK HOUR

2015 TOTAL WITH PROJECT TRAFFIC FORECASTS

FIGURE 7

Tables

TABLE 1
TRIP GENERATION AND DISTRIBUTION ANALYSIS - AMBIENT & TOTAL W/ PROJECT FORECASTS

AM TRIP GENERATION

	Trips	Entering	Exiting
748 Single Family Units (LU 210, SF DU)			
T = 0.75(X)		25%	75%
T =	561	140	421
631 Multi-Family Units (LU 230, Townhouse)			
T = 0.44(X)		17%	83%
T =	278	47	230
TOTAL New Housing	839	187	651

	Trips	Entering	Exiting
180,000 sf Commercial Center (LU 820, Shopping Center)			
Ln(T) = 0.60Ln(X) + 2.29			
Ln(T) = 5.405774111		61%	39%
T =	223	136	87
Pass-by trips (34%)	92	46	46
Directly generated trips (66%)	130	90	41

AM TRIP DISTRIBUTION

Direction	Trips	North via H. Hwy	North via Waiale Rd	East via Kuikahi	South via H. Hwy	Kehalani Internal
		15.0%	20.0%	20.0%	45.0%	
Entering	187	20	26	26	59	57
Exiting	651	89	119	119	267	57

Direction	Trips	North via H. Hwy	North via Waiale Rd	East via Kuikahi	South via H. Hwy	Kehalani Internal
		15.0%	20.0%	20.0%	45.0%	
Entering	136	14	19	19	43	40
Exiting	87	7	9	9	21	40
Entering	46	7	9	9	21	
Exiting	46	7	9	9	21	
Entering	90	7	10	10	22	40
Exiting	41	0	0	0	0	40

TABLE 1
TRIP GENERATION AND DISTRIBUTION ANALYSIS - AMBIENT & TOTAL W/ PROJECT FORECASTS

AM TRIP GENERATION

	Trips	Entering	Exiting
200 Student Private School (LU534, Private School K-8)			
Ln(T) = 1.00Ln(X) - 0.13			
Ln(T) = 5.168317367		55%	45%
T =	176	97	79

	Trips	Entering	Exiting
550 Elementary School (LU520, Elementary School)			
Ln(T) = 1.11Ln(X) - 1.73			
Ln(T) = 5.274009289		55%	45%
T =	195	107	88

TOTAL AM PEAK HOUR:

AM TRIP DISTRIBUTION

Direction	Trips	North via H. Hwy	North via Waiale Rd	East via Kuikahi	South via H. Hwy	Kehalani Internal
		20.0%	20.0%	30.0%	30.0%	
Entering	97	16	16	24	24	17
Exiting	79	12	12	19	19	17

Direction	Trips	North via H. Hwy	North via Waiale Rd	East via Kuikahi	South via H. Hwy	Kehalani Internal
		20.0%	20.0%	30.0%	30.0%	
Entering	107	8	8	12	12	67
Exiting	88	8	8	12	12	48

Direction	Trips	North via H. Hwy	North via Waiale Rd	East via Kuikahi	South via H. Hwy	Kehalani Internal
Entering	527	58	69	81	138	181
Exiting	905	117	149	159	319	162

TABLE 1
TRIP GENERATION AND DISTRIBUTION ANALYSIS - AMBIENT & TOTAL W/ PROJECT FORECASTS

PM TRIP GENERATION

	Trips	Entering	Exiting
748 Single Family Units (LU 210, SF DU)			
T = 1.01(X)		63%	37%
T =	755	476	280

631 Multi-Family Units (LU 230, Townhouse)			
T = 0.52(X)		67%	33%
T =	328	220	108
TOTAL New Housing	1084	696	388

	Trips	Entering	Exiting
180,000 sf Commercial Center (LU 820, Shopping Center)			
Ln(T) = 0.66Ln(X) + 3.40			
Ln(T) = 6.827351522		48%	52%
T =	923	443	480
Pass-by trips (34%)	301	151	151
Directly generated trips (66%)	622	292	329

PM TRIP DISTRIBUTION

Direction	Trips	North via H. Hwy	North via Waiale Rd	East via Kuikahi	South via H. Hwy	Kehalani Internal
		15.0%	20.0%	20.0%	45.0%	
Entering	696	72	96	96	217	214
Exiting	388	29	38	38	86	197

Direction	Trips	North via H. Hwy	North via Waiale Rd	East via Kuikahi	South via H. Hwy	Kehalani Internal
		15.0%	20.0%	20.0%	45.0%	
Entering	443	38	51	51	114	190
Exiting	480	43	58	58	130	190
Entering	151	23	30	30	68	0
Exiting	151	23	30	30	68	0
Entering	292	15	20	20	46	190
Exiting	329	21	28	28	63	190

TABLE 1
TRIP GENERATION AND DISTRIBUTION ANALYSIS - AMBIENT & TOTAL W/ PROJECT FORECASTS

PM TRIP GENERATION

	Trips	Entering	Exiting
200 Student Private School (LU534, Private School K-8)			
T = 0.58(X) + 14.03		47%	53%
T/2 =	60	28	32

	Trips	Entering	Exiting
550 Elementary School (LU520, Elementary School)			
Ln(T) = [1.08Ln(X) - 1.9]			
Ln(T) = 4.91471174		45%	55%
T/2 =	68	31	37

TOTAL PM PEAK HOUR:

PM TRIP DISTRIBUTION

Direction	Trips	North via H. Hwy	North via Waiale Rd	East via Kuikahi	South via H. Hwy	Kehalani Internal
		20.0%	20.0%	30.0%	30.0%	
Entering	28	4	4	6	6	7
Exiting	32	2	2	2	2	24

Direction	Trips	North via H. Hwy	North via Waiale Rd	East via Kuikahi	South via H. Hwy	Kehalani Internal
		20.0%	20.0%	30.0%	30.0%	
Entering	31	4	4	6	6	10
Exiting	37	1	1	2	2	30

Direction	Trips	North via H. Hwy	North via Waiale Rd	East via Kuikahi	South via H. Hwy	Kehalani Internal
Entering	1198	119	155	160	343	421
Exiting	937	75	99	101	221	441

TABLE 2
SIGNALIZED INTERSECTION ANALYSIS

INTERSECTION APPROACH	AM PEAK HOUR						PM PEAK HOUR					
	2009 EXISTING		2015 AMBIENT		2015 TOTAL		2009 EXISTING		2015 AMBIENT		2015 TOTAL	
	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY
Honoapiilani & Kehalani	B	13.6	B	14.7	B	14.7	B	11.8	C	20.1	C	21.1
Kehalani EB	B	13.3	C	21.2	C	21.7	B	11.7	C	23.8	C	22.9
Kehalani WB	A	9.1	C	21	C	22	B	13.4	D	43.4	D	42.5
Honoapiilani NB	B	16.7	A	7.7	A	6.4	B	12	B	11.9	B	14.4
Honoapiilani SB	B	12.1	B	13.1	B	13.7	B	11.2	B	16.7	B	17.7
Honoapiilani & Kuikahi	B	15.6	C	28.4	C	29.7	B	15.8	C	20.6	C	20.6
Kuikahi EB	B	12.8	D	35.2	D	38.9	B	11.7	C	33.2	C	33.2
Kuikahi WB	C	30.7	C	30.3	C	33.9	C	30.7	C	32.2	C	33.2
Honoapiilani NB	B	11.9	C	23.5	C	22	B	10.9	B	15.2	B	15.4
Honoapiilani SB	B	13.8	C	28.4	C	30	B	15.6	B	11	A	9.6
Honoapiilani & Waiko	B	11.5	B	17.8	C	20.3	B	16.7	D	44.7	D	46.2
Waiko EB	D	47.4	D	35.9	C	32.1	C	25.8	D	40	D	40
Waiko WB	D	46.6	D	40.3	D	35.6	C	28.8	E	73.9	E	74.9
Honoapiilani NB	A	8.7	B	18.6	B	19.7	B	18.4	E	55.4	E	59.3
Honoapiilani SB	A	8.1	B	14.5	B	19.2	A	9.3	C	21	B	19
Waiale & Olomea	NA		C	21.3	C	21.5	NA		B	14.4	B	14.4
Olomea EB			C	47.4	D	48.5			C	24.2	C	24.2
Olomea WB			B	14.4	B	14.4			A	9.6	A	9.6
Waiale NB			C	24.4	C	24.6			A	10	A	10
Waiale SB			A	9.1	A	9.1			B	15.9	B	15.9
Waiale & Kuikahi	NA		C	25.2	C	24.5	NA		D	46.2	D	45.9
Kuikahi EB			C	21.7	B	19.4			D	43.8	D	40.4
Kuikahi WB			D	41.5	D	42.6			E	70.2	E	72.2
Waiale NB			C	33.9	C	33.9			D	45.2	D	45.2
Waiale SB			B	17	B	17.4			C	32.4	C	32.3

TABLE 3
UNSIGNALIZED INTERSECTION ANALYSIS

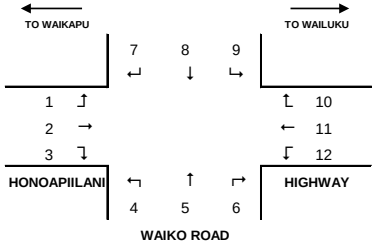
INTERSECTION APPROACH	AM PEAK HOUR						PM PEAK HOUR					
	2009 EXISTING		2015 AMBIENT		2015 TOTAL		2009 EXISTING		2015 AMBIENT		2015 TOTAL	
	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY	LOS	DELAY
Waiale & Olomea												
Olomea EB	F	>100	NA		NA		E	46.2	NA		NA	
Olomea WB	C	21.9					B	11.9				
Waiale & Kuikahi												
Kuikahi EB	C	24.1	NA		NA		C	18.5	NA		NA	
Waiale & Waiko												
Waiale SB	E	49.3	F	64	F	64	D	33.2	E	37.6	E	37.6
Kuikahi & Kehalani												
Kehalani SB	B	10.4	C	19.1	C	20.7	A	9.6	C	15.3	C	15.3
Alu & Kuikahi												
Kuikahi EB	B	10.7	B	10.7	B	10.7	A	9.6	A	9.6	A	9.6
Kuikahi WB	B	10.1	B	10.1	B	10.1	A	9.7	A	9.7	A	9.7

Appendix A

Traffic Turning Movement Counts

TRAFFIC TURNING MOVEMENT COUNT
WAILUKU ELEMENTARY II SCHOOL TIAR

LOCATION: Honoapiilani Hwy/Waiko Rd
DATE: Tuesday, November 17, 2009
TIME: 6:30a-8:30a / 3:30p-5:30p
WEATHER: Clear / Sunny
RECORDER: Jade Wallace, Don Pageisdorf

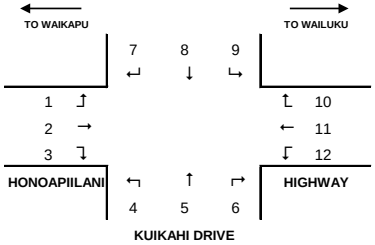


TIME PERIOD	MOVEMENT NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
6:30-6:45a	16	121	4	4	6	3	6	7	6	4	124	21	322
6:45-7:00a	19	110	3	7	3	3	3	4	7	4	113	20	296
7:00-7:15a	30	154	3	3	4	1	1	5	5	2	134	27	369
7:15-7:30a	48	116	5	4	7	3	4	7	9	4	121	57	385
7:30-7:45a	45	137	3	5	9	0	1	8	7	3	121	43	382
7:45-8:00a	17	133	1	6	3	2	2	6	8	1	122	18	319
8:00-8:15a	20	109	3	1	4	1	1	8	1	3	101	23	275
8:15-8:30a	22	109	2	1	6	0	0	7	2	1	90	24	264
6:30-8:30a	217	989	24	31	42	13	18	52	45	22	926	233	2612
7:00-8:00a	140	540	12	18	23	6	8	26	29	10	498	145	1455
PHF	0.935									0.897			

TIME PERIOD	MOVEMENT NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
3:30-3:45p	12	72	13	9	5	14	3	6	8	9	122	14	287
3:45-4:00p	5	117	14	12	5	21	1	2	0	6	104	27	314
4:00-4:15p	7	245	19	21	10	50	2	5	3	1	110	27	500
4:15-4:30p	5	115	20	7	6	14	2	2	0	5	96	15	287
4:30-4:45p	7	120	20	9	7	26	1	6	3	4	118	23	344
4:45-5:00p	5	172	26	15	7	37	0	2	2	5	114	27	412
5:00-5:15p	0	105	10	19	1	22	3	3	1	3	131	28	326
5:15-5:30p	3	102	23	9	3	17	2	5	1	9	129	20	323
3:30-5:30p	44	1048	145	101	44	201	14	31	18	42	924	181	2793
4:00-5:00p	24	652	85	52	30	127	5	15	8	15	438	92	1543
PHF	0.937			0.645						0.933			

TRAFFIC TURNING MOVEMENT COUNT
WAILUKU ELEMENTARY II SCHOOL TIAR

LOCATION: Honoapiilani Hwy/Kuikahi Dr
DATE: Tuesday, November 17, 2009
TIME: 6:30a-8:30a / 3:30p-5:30p
WEATHER:
RECORDER: Debbie Pascua, David Pascua

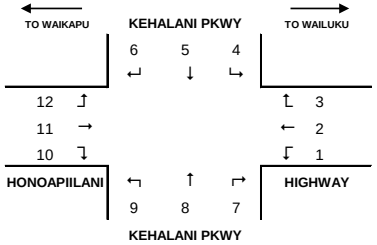


TIME PERIOD	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
	MOVEMENT NUMBER												
6:30-6:45a	3	36	58	24	5	4	8	18	11	1	81	8	257
6:45-7:00a	4	56	61	39	6	6	14	29	6	5	83	6	315
7:00-7:15a	8	87	63	59	5	5	16	29	9	3	90	3	377
7:15-7:30a	6	112	74	44	3	2	26	48	10	2	72	15	414
7:30-7:45a	8	109	99	64	3	8	27	31	13	1	87	14	464
7:45-8:00a	6	108	87	57	8	13	19	22	4	5	91	16	436
8:00-8:15a	8	85	48	49	12	4	12	14	6	2	67	7	314
8:15-8:30a	8	101	56	38	7	4	16	12	3	3	73	7	328
6:30-8:30a	51	694	546	374	49	46	138	203	62	22	644	76	2905
7:00-8:00a	28	416	323	224	19	28	88	130	36	11	340	48	1691
PHF	0.888			0.903			0.756			0.891			

TIME PERIOD	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
	MOVEMENT NUMBER												
3:30-3:45p	14	105	74	57	12	1	11	11	6	12	84	11	398
3:45-4:00p	10	102	55	67	12	2	6	14	6	9	88	9	380
4:00-4:15p	13	110	77	50	14	2	19	12	6	14	115	5	437
4:15-4:30p	12	86	59	48	15	1	7	19	6	10	93	6	362
4:30-4:45p	8	98	54	58	22	0	10	6	4	8	107	13	388
4:45-5:00p	10	91	40	52	15	2	10	14	3	5	110	8	360
5:00-5:15p	16	67	39	66	19	7	6	11	6	11	92	5	345
5:15-5:30p	9	84	49	47	12	0	4	13	3	10	82	4	317
3:30-5:30p	92	743	447	445	121	15	73	100	40	79	771	61	2987
3:30-4:30p	49	403	265	222	53	6	43	56	24	45	380	31	1577
PHF	0.896			0.867						0.851			

TRAFFIC TURNING MOVEMENT COUNT
WAILUKU ELEMENTARY II SCHOOL TIAR

LOCATION: Honoapiilani Hwy/Kehalani Pkwy
DATE: Tuesday, November 17, 2009
TIME: 6:30a-8:30a / 3:30p-5:30p
WEATHER: Partly cloudy
RECORDER: Luis Anaya, Beau Spenser

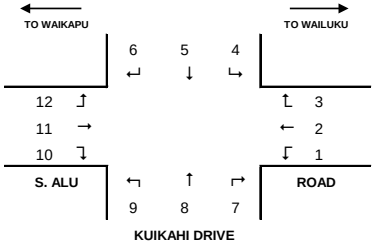


TIME PERIOD	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
	MOVEMENT NUMBER												
6:30-6:45a	3	39	5	19	8	29	1	5	2	2	30	3	146
6:45-7:00a	2	44	6	18	9	12	8	9	5	2	58	8	181
7:00-7:15a	3	38	12	19	4	11	11	7	6	2	82	7	202
7:15-7:30a	3	68	18	62	18	20	61	23	3	2	138	11	427
7:30-7:45a	8	52	6	65	11	21	38	9	4	3	108	5	330
7:45-8:00a	11	80	12	23	12	10	19	16	10	3	118	11	325
8:00-8:15a	3	41	13	6	6	8	9	13	3	1	99	4	206
8:15-8:30a	3	30	9	18	14	10	6	1	1	2	98	8	200
6:30-8:30a	36	392	81	230	82	121	153	83	34	17	731	57	2017
7:00-8:00a	25	238	48	169	45	62	129	55	23	10	446	34	1284
PHF	0.87			0.69			0.59			0.81			

TIME PERIOD	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
	MOVEMENT NUMBER												
3:30-3:45p	9	42	26	13	18	11	2	2	2	2	25	4	156
3:45-4:00p	5	40	7	9	6	3	4	11	2	1	50	7	145
4:00-4:15p	3	60	21	22	5	6	7	10	1	2	56	8	201
4:15-4:30p	6	73	22	19	16	7	10	23	4	8	98	13	299
4:30-4:45p	9	102	32	16	7	7	10	8	0	1	69	14	275
4:45-5:00p	13	74	28	24	5	3	11	27	0	5	113	13	316
5:00-5:15p	11	70	27	8	5	3	4	15	3	4	70	16	236
5:15-5:30p	15	47	34	21	9	2	3	17	3	4	70	13	238
3:30-5:30p	71	508	197	132	71	42	51	113	15	27	551	88	1866
4:15-5:15p	39	319	109	67	33	20	35	73	7	18	350	56	1126
PHF	0.82			0.71			0.78			0.81			

TRAFFIC TURNING MOVEMENT COUNT
WAILUKU ELEMENTARY II SCHOOL TIAR

LOCATION: Kuikahi Drive/S. Alu Rd
DATE: Thursday, November 19, 2009
TIME: 6:30a-8:30a / 3:30p-5:30p
WEATHER: Cloudy with sprinkles
RECORDER: Luis Anaya, Beau Spenser

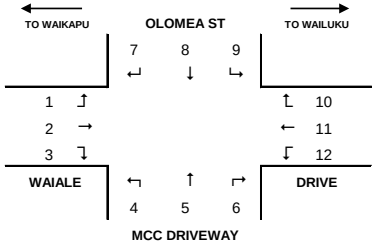


TIME PERIOD	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
	MOVEMENT NUMBER												
6:30-6:45a	6	0	2	0	5	0	0	1	4	18	6	1	43
6:45-7:00a	1	0	0	3	12	0	0	2	4	20	6	0	48
7:00-7:15a	1	1	0	6	24	0	2	4	9	31	7	0	85
7:15-7:30a	5	2	1	2	12	0	2	3	9	29	12	0	77
7:30-7:45a	2	2	0	1	13	0	5	5	7	36	17	0	88
7:45-8:00a	4	3	1	0	4	0	6	10	5	14	8	0	55
8:00-8:15a	1	1	0	0	3	0	1	2	7	18	6	0	39
8:15-8:30a	1	1	1	4	4	0	2	4	10	20	2	1	50
6:30-8:30a	21	10	5	16	77	0	18	31	55	186	64	2	485
7:00-8:00a	12	8	2	9	53	0	15	22	30	110	44	0	305
PHF										0.73			

TIME PERIOD	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
	MOVEMENT NUMBER												
3:30-3:45p	4	8	1	1	4	0	4	5	10	9	1	0	47
3:45-4:00p	1	1	3	2	3	1	4	10	22	12	6	1	66
4:00-4:15p	1	3	4	2	7	2	3	8	17	12	0	1	60
4:15-4:30p	3	3	6	1	10	1	1	6	19	11	3	2	66
4:30-4:45p	2	2	2	0	7	1	2	10	31	14	2	1	74
4:45-5:00p	2	3	0	0	3	1	2	8	10	7	2	2	40
5:00-5:15p	0	1	2	1	6	0	0	3	9	5	1	0	28
5:15-5:30p	2	3	4	2	7	0	3	8	24	10	1	0	64
3:30-5:30p	15	24	22	9	47	6	19	58	142	80	16	7	445
4:15-5:15p	7	9	10	2	26	3	5	27	69	37	8	5	208
PHF										0.74			

TRAFFIC TURNING MOVEMENT COUNT
WAILUKU ELEMENTARY II SCHOOL TIAR

LOCATION: Waiale Road/Olomea Street/MCCC Drwy
DATE: Thursday, November 19, 2009
TIME: 6:30a-8:30a / 3:30p-5:30p
WEATHER:
RECORDER: Debbie Pascua, David Pascua

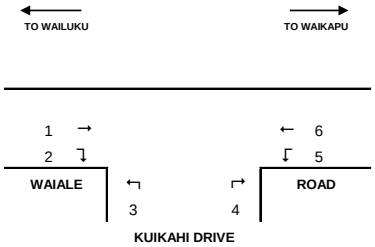


TIME PERIOD	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
	MOVEMENT NUMBER												
6:30-6:45a	2	111	5	0	0	0	5	0	28	8	44	1	204
6:45-7:00a	1	157	6	0	0	0	8	0	31	10	55	12	280
7:00-7:15a	3	126	1	3	1	9	4	0	29	31	79	3	289
7:15-7:30a	5	244	4	0	0	8	12	0	30	31	100	6	440
7:30-7:45a	5	268	1	0	0	2	7	0	37	55	95	3	473
7:45-8:00a	3	218	0	0	0	1	9	0	35	33	95	1	395
8:00-8:15a	1	119	3	0	0	1	2	0	17	14	80	3	240
8:15-8:30a	2	103	1	0	0	2	1	0	33	18	71	2	233
6:30-8:30a	22	1346	21	3	1	23	48	0	240	200	619	31	2554
7:00-8:00a	16	856	6	3	1	20	32	0	131	150	369	13	1597
PHF	0.801						0.926			0.869			

TIME PERIOD	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
	MOVEMENT NUMBER												
3:30-3:45p	6	121	0	0	0	4	4	1	20	34	115	3	308
3:45-4:00p	4	96	1	2	0	0	5	0	21	39	99	3	270
4:00-4:15p	2	112	0	0	0	8	0	0	23	45	135	2	327
4:15-4:30p	2	119	0	0	0	2	3	0	22	52	137	1	338
4:30-4:45p	4	87	0	0	0	4	2	0	28	47	148	2	322
4:45-5:00p	4	85	0	1	0	0	4	0	32	42	119	0	287
5:00-5:15p	3	103	0	0	0	1	7	0	27	39	134	0	314
5:15-5:30p	8	95	1	0	0	0	1	0	27	33	93	0	258
3:30-5:30p	33	818	2	3	0	19	26	1	200	331	980	11	2424
4:00-5:00p	12	403	0	1	0	14	9	0	105	186	539	5	1274
PHF	0.857						0.792			0.926			

TRAFFIC TURNING MOVEMENT COUNT
WAILUKU ELEMENTARY II SCHOOL TIAR

LOCATION: Waiale Rd/Kuikahi Dr
DATE: Thursday, November 19, 2009
TIME: 6:30a-8:30a / 3:30p-5:30p
WEATHER: Cloudy
RECORDER: Don Pageisdorf

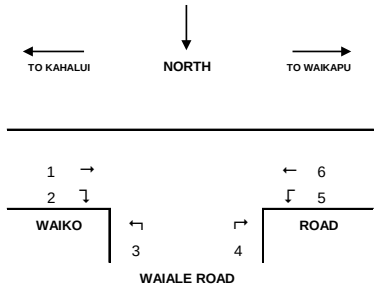


TIME PERIOD	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
	MOVEMENT NUMBER												
6:30-6:45a	26	37	67	10	7	27							174
6:45-7:00a	30	29	81	10	11	47							208
7:00-7:15a	34	52	58	4	8	33							189
7:15-7:30a	28	64	117	5	11	69							294
7:30-7:45a	30	63	148	4	13	76							334
7:45-8:00a	31	38	110	2	17	67							265
8:00-8:15a	20	52	65	11	4	25							177
8:15-8:30a	21	44	48	4	10	23							150
6:30-8:30a	220	379	694	50	81	367	0	0	0	0	0	0	1791
7:00-8:00a	123	217	433	15	49	245	0	0	0	0	0	0	1082
PHF	0.914		0.737		0.826								

TIME PERIOD	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
	MOVEMENT NUMBER												
3:30-3:45p	39	67	67	9	19	53							254
3:45-4:00p	43	70	51	11	14	42							231
4:00-4:15p	39	103	78	15	9	35							279
4:15-4:30p	50	87	65	11	10	55							278
4:30-4:45p	48	91	46	10	15	30							240
4:45-5:00p	42	67	55	9	11	36							220
5:00-5:15p	55	77	60	7	15	44							258
5:15-5:30p	47	89	51	11	15	56							269
3:30-5:30p	363	651	473	83	108	351	0	0	0	0	0	0	2029
3:30-4:30p	171	327	261	46	52	185	0	0	0	0	0	0	1042
PHF	0.877		0.825		0.912								

TRAFFIC TURNING MOVEMENT COUNT
WAILUKU ELEMENTARY II SCHOOL TIAR

LOCATION: Waiale Rd/Waiko Rd
DATE: Thursday, November 19, 2009
TIME: 6:30a-8:30a / 3:30p-5:30p
WEATHER: Cloudy / Rain / Clear
RECORDER: Jade Wallace

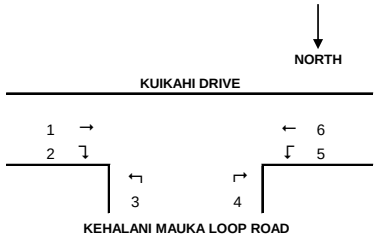


TIME PERIOD	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
	MOVEMENT NUMBER												
6:30-6:45a	50	30	40	16	21	74							231
6:45-7:00a	65	38	30	16	19	67							235
7:00-7:15a	58	43	92	43	6	94							336
7:15-7:30a	42	64	67	24	7	58							262
7:30-7:45a	37	52	50	15	10	46							210
7:45-8:00a	24	45	43	8	4	29							153
8:00-8:15a	45	48	44	12	4	26							179
8:15-8:30a	20	25	24	7	6	19							101
6:30-8:30a	341	345	390	141	77	413	0	0	0	0	0	0	1707
6:30-7:30a	215	175	229	99	53	293	0	0	0	0	0	0	1064
PHF	0.92		0.607		0.865								

TIME PERIOD	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
	MOVEMENT NUMBER												
3:30-3:45p	43	33	47	20	18	69							230
3:45-4:00p	50	35	41	15	21	78							240
4:00-4:15p	62	41	32	21	17	92							265
4:15-4:30p	58	39	28	18	18	62							223
4:30-4:45p	60	38	39	23	16	71							247
4:45-5:00p	69	48	50	16	23	98							304
5:00-5:15p	52	35	31	19	21	87							245
5:15-5:30p	48	31	20	16	25	88							228
3:30-5:30p	442	300	288	148	159	645	0	0	0	0	0	0	1982
4:00-5:00p	249	166	149	78	74	323	0	0	0	0	0	0	1039
PHF	0.887		0.86		0.82								

TRAFFIC TURNING MOVEMENT COUNT
WAILUKU ELEMENTARY II SCHOOL TIAR

LOCATION: Kuikahi Drive / Kehalani Mauka Loop Road
DATE: Tuesday, November 24, 2009
TIME: 6:30a-8:30a / 3:30p-5:30p
WEATHER: Partly Cloudy, 10-15 Knots
RECORDER: Beau Spenser



TIME PERIOD	MOVEMENT NUMBER 1	2	3	4	5	6	TOTAL
6:30-6:45a	5	4	4	0	2	27	42
6:45-7:00a	8	9	5	0	0	35	57
7:00-7:15a	12	6	9	1	1	38	67
7:15-7:30a	10	2	12	1	1	62	88
7:30-7:45a	15	2	6	2	4	69	98
7:45-8:00a	18	6	13	2	1	43	83
8:00-8:15a	9	3	5	0	2	36	55
8:15-8:30a	17	4	5	1	0	25	52
6:30-8:30a	94	36	59	7	11	335	542
7:00-8:00a	55	16	40	6	7	212	288
PHF	0.74				0.75		

TIME PERIOD	MOVEMENT NUMBER 1	2	3	4	5	6	TOTAL
3:30-3:45p	19	2	2	3	0	11	37
3:45-4:00p	19	1	5	1	2	22	50
4:00-4:15p	33	7	4	0	0	20	64
4:15-4:30p	29	9	4	0	2	22	66
4:30-4:45p	30	9	1	1	1	23	65
4:45-5:00p	25	6	4	0	0	9	44
5:00-5:15p	43	5	4	1	0	14	67
5:15-5:30p	47	8	1	7	3	21	87
3:30-5:30p	245	47	25	13	8	142	480
4:30-5:30p	145	28	10	9	4	67	263
PHF	0.79				0.74		

Appendix B

Signalized Intersection Level of Service (LOS) Calculations

Timings
14: kehalani & honoapiilani hwy

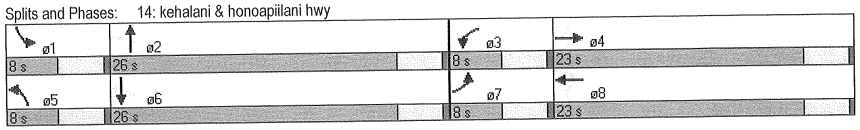
12/7/2009

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	170	45	60	25	55	130	35	445	10	25	240	50
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	10.0	10.0	4.0	12.0	12.0	4.0	13.0	13.0	4.0	13.0	13.0
Minimum Split (s)	8.0	23.0	23.0	8.0	23.0	23.0	8.0	24.0	24.0	8.0	24.0	24.0
Total Split (s)	8.0	23.0	23.0	8.0	23.0	23.0	8.0	26.0	26.0	8.0	26.0	26.0
Total Split (%)	12.3%	35.4%	35.4%	12.3%	35.4%	35.4%	12.3%	40.0%	40.0%	12.3%	40.0%	40.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	None	None	None	None	None
Act Effct Green (s)	16.1	18.2	18.2	14.5	16.0	16.0	22.1	23.1	23.1	22.1	23.1	23.1
Actuated g/C Ratio	0.35	0.39	0.39	0.31	0.35	0.35	0.48	0.50	0.50	0.48	0.50	0.50
v/c Ratio	0.39	0.07	0.10	0.06	0.09	0.22	0.07	0.52	0.01	0.07	0.28	0.07
Control Delay	15.3	15.6	6.1	11.6	17.1	5.2	9.1	17.5	7.9	9.1	13.8	5.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.3	15.6	6.1	11.6	17.1	5.2	9.1	17.5	7.9	9.1	13.8	5.1
LOS	B	B	A	B	B	A	A	B	A	A	B	A
Approach Delay		13.3			9.1			16.7			12.1	
Approach LOS		B			A			B			B	

Intersection Summary

Cycle Length: 65
Actuated Cycle Length: 46.3
Natural Cycle: 65
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.52
Intersection Signal Delay: 13.6 — Intersection LOS: B
Intersection Capacity Utilization 52.8% — ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 14: kehalani & honoapiilani hwy



Timings
14: kehalani & honoapiilani hwy

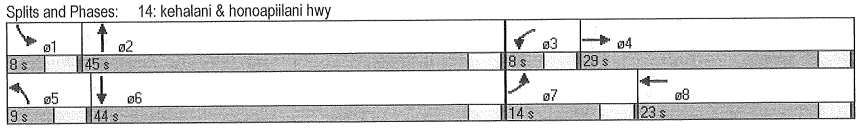
12/12/2009

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	230	115	235	25	90	130	105	560	10	40	315	65
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	10.0	10.0	4.0	12.0	12.0	4.0	13.0	13.0	4.0	13.0	13.0
Minimum Split (s)	8.0	23.0	23.0	8.0	23.0	23.0	8.0	24.0	24.0	8.0	24.0	24.0
Total Split (s)	14.0	29.0	29.0	8.0	23.0	23.0	9.0	45.0	45.0	8.0	44.0	44.0
Total Split (%)	15.6%	32.2%	32.2%	8.9%	25.6%	25.6%	10.0%	50.0%	50.0%	8.9%	48.9%	48.9%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	None	C-Max	C-Max
Act Effct Green (s)	27.4	24.2	24.2	17.4	13.4	13.4	53.1	49.2	49.2	50.3	46.3	46.3
Actuated g/C Ratio	0.30	0.27	0.27	0.19	0.15	0.15	0.59	0.55	0.55	0.56	0.51	0.51
v/c Ratio	0.64	0.25	0.42	0.10	0.35	0.40	0.21	0.60	0.01	0.12	0.36	0.08
Control Delay	33.3	28.0	6.0	22.5	37.5	9.3	3.3	8.7	0.6	8.9	15.5	3.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.3	28.0	6.0	22.5	37.5	9.3	3.3	8.7	0.6	8.9	15.5	3.9
LOS	C	C	A	C	D	A	A	A	A	A	B	A
Approach Delay		21.2			21.0			7.7			13.1	
Approach LOS		C			C			A			B	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 82 (91%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 65
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.64
Intersection Signal Delay: 14.7 — Intersection LOS: B
Intersection Capacity Utilization 62.2% — ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 14: kehalani & honoapiilani hwy



Timings
14: kehalani & honoapiilani hwy

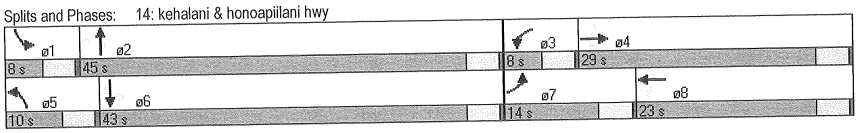
12/12/2009

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	240	125	260	25	100	130	125	560	10	40	315	75
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	10.0	10.0	4.0	12.0	12.0	4.0	13.0	13.0	4.0	13.0	13.0
Minimum Split (s)	8.0	23.0	23.0	8.0	23.0	23.0	8.0	24.0	24.0	8.0	24.0	24.0
Total Split (s)	14.0	29.0	29.0	8.0	23.0	23.0	10.0	45.0	45.0	8.0	43.0	43.0
Total Split (%)	15.6%	32.2%	32.2%	8.9%	25.6%	25.6%	11.1%	50.0%	50.0%	8.9%	47.8%	47.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	None	C-Max	C-Max
Act Effct Green (s)	27.4	24.2	24.2	17.4	13.4	13.4	53.4	49.1	49.1	48.8	43.9	43.9
Actuated g/C Ratio	0.30	0.27	0.27	0.19	0.15	0.15	0.59	0.55	0.55	0.54	0.49	0.49
v/c Ratio	0.68	0.27	0.45	0.10	0.39	0.40	0.25	0.60	0.01	0.12	0.38	0.10
Control Delay	35.2	28.3	6.0	22.4	38.3	9.3	3.6	7.1	1.0	9.0	16.6	3.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.2	28.3	6.0	22.4	38.3	9.3	3.6	7.1	1.0	9.0	16.6	3.8
LOS	D	C	A	C	D	A	A	A	A	A	B	A
Approach Delay		21.7			22.0			6.4			13.7	
Approach LOS		C			C			A			B	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 65
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.68
Intersection Signal Delay: 14.7 — Intersection LOS: B
Intersection Capacity Utilization 63.6% — ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 14: kehalani & honoapiilani hwy



Timings
14: kehalani & honoapiilani hwy

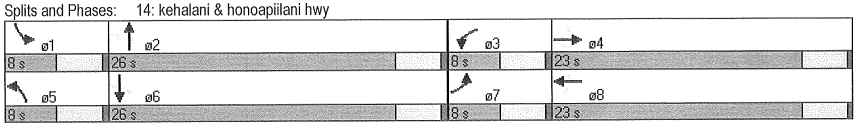
12/7/2009

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	65	35	20	5	75	35	55	350	20	40	320	110
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	10.0	10.0	4.0	12.0	12.0	4.0	13.0	13.0	4.0	13.0	13.0
Minimum Split (s)	8.0	23.0	23.0	8.0	23.0	23.0	8.0	24.0	24.0	8.0	24.0	24.0
Total Split (s)	8.0	23.0	23.0	8.0	23.0	23.0	8.0	26.0	26.0	8.0	26.0	26.0
Total Split (%)	12.3%	35.4%	35.4%	12.3%	35.4%	35.4%	12.3%	40.0%	40.0%	12.3%	40.0%	40.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	None	None	None	None	None
Act Effct Green (s)	13.8	21.0	21.0	12.7	19.5	19.5	19.7	25.3	25.3	19.0	24.0	24.0
Actuated g/C Ratio	0.34	0.52	0.52	0.32	0.49	0.49	0.49	0.63	0.63	0.48	0.60	0.60
v/c Ratio	0.14	0.04	0.03	0.01	0.09	0.05	0.11	0.32	0.02	0.08	0.31	0.12
Control Delay	11.9	13.8	7.6	11.4	16.3	7.2	8.7	12.8	6.8	8.7	13.9	4.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.9	13.8	7.6	11.4	16.3	7.2	8.7	12.8	6.8	8.7	13.9	4.0
LOS	B	B	A	B	B	A	A	B	A	A	B	A
Approach Delay		11.7			13.4			12.0			11.2	
Approach LOS		B			B			B			B	

Intersection Summary

Cycle Length: 65
Actuated Cycle Length: 40
Natural Cycle: 65
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.32
Intersection Signal Delay: 11.8 — Intersection LOS: B
Intersection Capacity Utilization 42.0% — ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 14: kehalani & honoapiilani hwy



Timings
14: kehalani & honoapiilani hwy

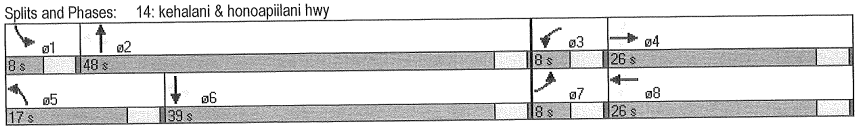
12/13/2009

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	85	160	85	5	285	40	270	535	20	60	435	160
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	10.0	10.0	4.0	12.0	12.0	4.0	13.0	13.0	4.0	13.0	13.0
Minimum Split (s)	8.0	23.0	23.0	8.0	23.0	23.0	8.0	24.0	24.0	8.0	24.0	24.0
Total Split (s)	8.0	26.0	26.0	8.0	26.0	26.0	17.0	48.0	48.0	8.0	39.0	39.0
Total Split (%)	8.9%	28.9%	28.9%	8.9%	28.9%	28.9%	18.9%	53.3%	53.3%	8.9%	43.3%	43.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	None	C-Max	C-Max
Act Effct Green (s)	24.5	23.7	23.7	22.1	18.9	18.9	56.7	49.7	49.7	46.6	41.9	41.9
Actuated g/C Ratio	0.27	0.26	0.26	0.25	0.21	0.21	0.63	0.55	0.55	0.52	0.47	0.47
v/c Ratio	0.48	0.35	0.19	0.02	0.79	0.12	0.61	0.57	0.02	0.17	0.54	0.21
Control Delay	32.0	28.5	6.9	20.6	48.5	9.5	9.9	13.3	1.6	10.0	22.4	3.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.0	28.5	6.9	20.6	48.5	9.5	9.9	13.3	1.6	10.0	22.4	3.7
LOS	C	C	A	C	D	A	A	B	A	B	C	A
Approach Delay		23.8			43.4			11.9			16.7	
Approach LOS		C			D			B			B	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 3 (3%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.79
Intersection Signal Delay: 20.1 — Intersection LOS: C
Intersection Capacity Utilization 70.9% — ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 14: kehalani & honoapiilani hwy



Timings
14: kehalani & honoapiilani hwy

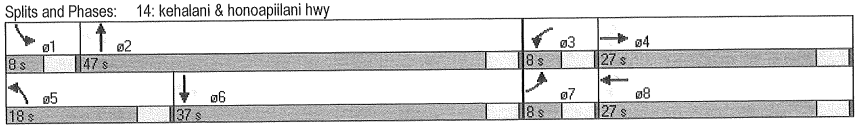
12/13/2009

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	85	160	90	5	295	40	280	535	20	60	435	165
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	10.0	10.0	4.0	12.0	12.0	4.0	13.0	13.0	4.0	13.0	13.0
Minimum Split (s)	8.0	23.0	23.0	8.0	23.0	23.0	8.0	24.0	24.0	8.0	24.0	24.0
Total Split (s)	8.0	27.0	27.0	8.0	27.0	27.0	18.0	47.0	47.0	8.0	37.0	37.0
Total Split (%)	8.9%	30.0%	30.0%	8.9%	30.0%	30.0%	20.0%	52.2%	52.2%	8.9%	41.1%	41.1%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	None	C-Max	C-Max
Act Effct Green (s)	25.2	24.4	24.4	22.8	19.6	19.6	56.0	49.0	49.0	45.3	40.6	40.6
Actuated g/C Ratio	0.28	0.27	0.27	0.25	0.22	0.22	0.62	0.54	0.54	0.50	0.45	0.45
v/c Ratio	0.48	0.34	0.20	0.02	0.79	0.11	0.64	0.57	0.03	0.18	0.56	0.22
Control Delay	31.2	27.7	6.5	19.8	47.4	9.2	11.3	16.4	2.2	10.6	23.9	3.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.2	27.7	6.5	19.8	47.4	9.2	11.3	16.4	2.2	10.6	23.9	3.9
LOS	C	C	A	B	D	A	B	B	A	B	C	A
Approach Delay		22.9			42.5			14.4			17.7	
Approach LOS		C			D			B			B	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 89 (99%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.79
Intersection Signal Delay: 21.1 — Intersection LOS: C
Intersection Capacity Utilization 72.0% — ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 14: kehalani & honoapiilani hwy



Timings
3: kuikahi & honoapiilani hwy

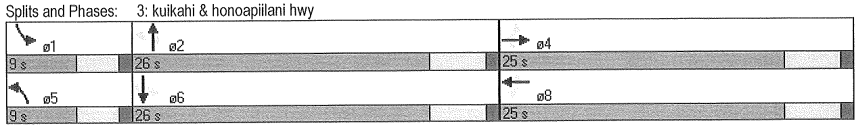
12/6/2009

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	130	90	225	20	30	30	415	325	50	340	10
Turn Type	Perm		Perm	Perm		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4	4	4	8	8	8	2		2	6		6
Detector Phase	4	4	4	8	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	20.0	20.0	5.0	20.0	20.0
Minimum Split (s)	21.0	21.0	21.0	25.0	25.0	25.0	9.0	25.0	25.0	9.0	25.0	25.0
Total Split (s)	25.0	25.0	25.0	25.0	25.0	25.0	9.0	26.0	26.0	9.0	26.0	26.0
Total Split (%)	41.7%	41.7%	41.7%	41.7%	41.7%	41.7%	15.0%	43.3%	43.3%	15.0%	43.3%	43.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	Min	Min	None	Min	Min
Act Effct Green (s)		15.7	15.7		15.7	15.7	24.9	21.3	21.3	25.6	22.9	22.9
Actuated g/C Ratio		0.30	0.30		0.30	0.30	0.48	0.41	0.41	0.49	0.44	0.44
v/c Ratio		0.36	0.18		0.77	0.07	0.06	0.59	0.41	0.12	0.45	0.02
Control Delay		17.2	4.8		33.8	6.2	7.5	18.7	3.7	7.9	14.9	7.5
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		17.2	4.8		33.8	6.2	7.5	18.7	3.7	7.9	14.9	7.5
LOS		B	A		C	A	A	B	A	A	B	A
Approach Delay		12.8			30.7			11.9			13.8	
Approach LOS		B			C			B			B	

Intersection Summary

Cycle Length: 60
Actuated Cycle Length: 52
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.77
Intersection Signal Delay: 15.6 — Intersection LOS: B
Intersection Capacity Utilization 64.1% — ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 3: kuikahi & honoapiilani hwy



Timings
3: kuikahi & honoapiilani hwy

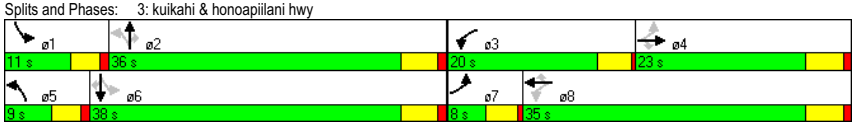
12/29/2009

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	290	255	335	85	140	45	475	515	185	465	15
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4	4	4	8	8	8	2		2	6		6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	5.0	5.0	4.0	5.0	5.0	5.0	20.0	20.0	5.0	20.0	20.0
Minimum Split (s)	8.0	21.0	21.0	8.0	25.0	25.0	9.0	25.0	25.0	9.0	25.0	25.0
Total Split (s)	8.0	23.0	23.0	20.0	35.0	35.0	9.0	36.0	36.0	11.0	38.0	38.0
Total Split (%)	8.9%	25.6%	25.6%	22.2%	38.9%	38.9%	10.0%	40.0%	40.0%	12.2%	42.2%	42.2%
Yellow Time (s)	3.5	4.0	4.0	3.5	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	0.5	1.0	1.0	0.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Min	C-Min	None	C-Min	C-Min
Act Effct Green (s)	22.6	17.3	17.3	38.1	30.7	30.7	37.8	31.8	31.8	42.7	37.5	37.5
Actuated g/C Ratio	0.25	0.19	0.19	0.42	0.34	0.34	0.42	0.35	0.35	0.47	0.42	0.42
v/c Ratio	0.19	0.88	0.54	0.90	0.14	0.24	0.17	0.78	0.65	0.77	0.65	0.02
Control Delay	18.0	61.7	9.2	45.7	15.7	2.2	18.9	36.6	11.9	35.1	26.3	8.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.0	61.7	9.2	45.7	15.7	2.2	18.9	36.6	11.9	35.1	26.3	8.3
LOS	B	E	A	D	B	A	B	D	B	D	C	A
Approach Delay		35.2			30.3			23.5			28.4	
Approach LOS		D			C			C			C	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 44 (49%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.90
Intersection Signal Delay: 28.4 — Intersection LOS: C
Intersection Capacity Utilization 84.1% — ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 3: kuikahi & honoapiilani hwy



Timings
3: kuikahi & honoapiilani hwy

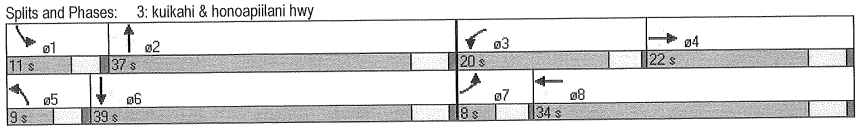
12/13/2009

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	290	255	335	85	145	45	490	515	195	480	15
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4	4	4	8	8	8	2		2	6		6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	5.0	5.0	4.0	5.0	5.0	5.0	20.0	20.0	5.0	20.0	20.0
Minimum Split (s)	8.0	21.0	21.0	8.0	25.0	25.0	9.0	25.0	25.0	9.0	25.0	25.0
Total Split (s)	8.0	22.0	22.0	20.0	34.0	34.0	9.0	37.0	37.0	11.0	39.0	39.0
Total Split (%)	8.9%	24.4%	24.4%	22.2%	37.8%	37.8%	10.0%	41.1%	41.1%	12.2%	43.3%	43.3%
Yellow Time (s)	3.5	4.0	4.0	3.5	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	0.5	1.0	1.0	0.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Min	C-Min	None	C-Min	C-Min
Act Effct Green (s)	21.9	16.6	16.6	37.6	30.2	30.2	38.2	32.2	32.2	43.2	38.0	38.0
Actuated g/C Ratio	0.24	0.18	0.18	0.42	0.34	0.34	0.42	0.36	0.36	0.48	0.42	0.42
v/c Ratio	0.19	0.91	0.55	0.91	0.15	0.25	0.17	0.80	0.65	0.82	0.66	0.02
Control Delay	18.8	68.5	9.9	50.9	18.2	3.9	13.8	37.0	8.4	41.5	26.1	7.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.8	68.5	9.9	50.9	18.2	3.9	13.8	37.0	8.4	41.5	26.1	7.2
LOS	B	E	A	D	B	A	B	D	A	D	C	A
Approach Delay		38.9			33.9			22.0			30.0	
Approach LOS		D			C			C			C	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 46 (51%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.91
Intersection Signal Delay: 29.7 — Intersection LOS: C
Intersection Capacity Utilization 85.4% — ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 3: kuikahi & honoapiilani hwy



Timings
3: kuikahi & honoapiilani hwy

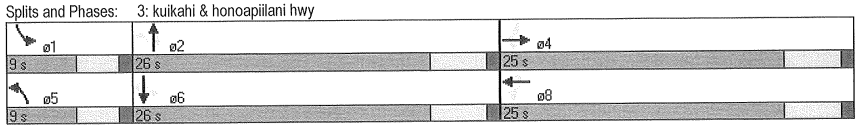
12/6/2009

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	55	45	220	55	5	50	405	265	30	380	45
Turn Type	Perm		Perm	Perm		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4	4	4	8	8	8	2		2	6		6
Detector Phase	4	4	4	8	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	20.0	20.0	5.0	20.0	20.0
Minimum Split (s)	21.0	21.0	21.0	25.0	25.0	25.0	9.0	25.0	25.0	9.0	25.0	25.0
Total Split (s)	25.0	25.0	25.0	25.0	25.0	25.0	9.0	26.0	26.0	9.0	26.0	26.0
Total Split (%)	41.7%	41.7%	41.7%	41.7%	41.7%	41.7%	15.0%	43.3%	43.3%	15.0%	43.3%	43.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	Min	Min	None	Min	Min
Act Effct Green (s)		15.4	15.4		15.4	15.4	25.6	22.8	22.8	24.8	21.2	21.2
Actuated g/C Ratio		0.30	0.30		0.30	0.30	0.50	0.44	0.44	0.48	0.41	0.41
v/c Ratio		0.18	0.10		0.76	0.01	0.12	0.54	0.34	0.07	0.54	0.07
Control Delay		15.2	5.6		31.1	9.2	7.8	16.1	3.5	7.5	17.5	5.2
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		15.2	5.6		31.1	9.2	7.8	16.1	3.5	7.5	17.5	5.2
LOS		B	A		C	A	A	B	A	A	B	A
Approach Delay		11.7			30.7			10.9			15.6	
Approach LOS		B			C			B			B	

Intersection Summary

Cycle Length: 60
Actuated Cycle Length: 51.7
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.76
Intersection Signal Delay: 15.8 — Intersection LOS: B
Intersection Capacity Utilization 58.9% — ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 3: kuikahi & honoapiilani hwy



Timings
3: kuikahi & honoapiilani hwy

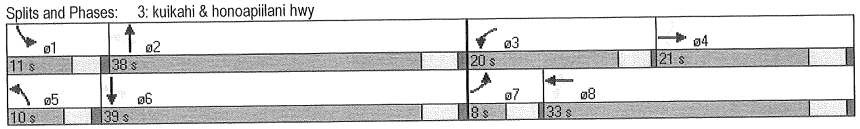
12/13/2009

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	95	45	420	225	315	135	495	495	160	420	170
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4	4	4	8	8	8	2		2	6		6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	5.0	5.0	4.0	5.0	5.0	5.0	20.0	20.0	5.0	20.0	20.0
Minimum Split (s)	8.0	21.0	21.0	8.0	25.0	25.0	9.0	25.0	25.0	9.0	25.0	25.0
Total Split (s)	8.0	21.0	21.0	20.0	33.0	33.0	10.0	38.0	38.0	11.0	39.0	39.0
Total Split (%)	8.9%	23.3%	23.3%	22.2%	36.7%	36.7%	11.1%	42.2%	42.2%	12.2%	43.3%	43.3%
Yellow Time (s)	3.5	4.0	4.0	3.5	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	0.5	1.0	1.0	0.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Min	C-Min	None	C-Min	C-Min
Act Effct Green (s)	13.7	9.8	9.8	29.4	25.2	25.2	47.8	39.3	39.3	49.4	40.1	40.1
Actuated g/C Ratio	0.15	0.11	0.11	0.33	0.28	0.28	0.53	0.44	0.44	0.55	0.45	0.45
v/c Ratio	0.13	0.51	0.23	1.00	0.47	0.50	0.34	0.66	0.54	0.48	0.55	0.23
Control Delay	21.4	45.9	13.2	56.8	23.7	5.3	12.2	27.0	4.2	11.9	14.7	1.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.4	45.9	13.2	56.8	23.7	5.3	12.2	27.0	4.2	11.9	14.7	1.2
LOS	C	D	B	E	C	A	B	C	A	B	B	A
Approach Delay		33.2			32.2			15.2			11.0	
Approach LOS		C			C			B			B	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 43 (48%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.00
Intersection Signal Delay: 20.6 — Intersection LOS: C
Intersection Capacity Utilization 76.5% — ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 3: kuikahi & honoapiilani hwy



Timings
3: kuikahi & honoapiilani hwy

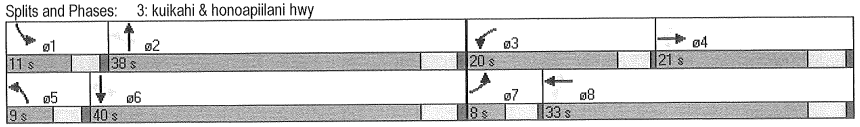
12/13/2009

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	95	45	420	225	315	135	500	495	160	425	170
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4	4	4	8	8	8	2		2	6		6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	5.0	5.0	4.0	5.0	5.0	5.0	20.0	20.0	5.0	20.0	20.0
Minimum Split (s)	8.0	21.0	21.0	8.0	25.0	25.0	9.0	25.0	25.0	9.0	25.0	25.0
Total Split (s)	8.0	21.0	21.0	20.0	33.0	33.0	9.0	38.0	38.0	11.0	40.0	40.0
Total Split (%)	8.9%	23.3%	23.3%	22.2%	36.7%	36.7%	10.0%	42.2%	42.2%	12.2%	44.4%	44.4%
Yellow Time (s)	3.5	4.0	4.0	3.5	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	0.5	1.0	1.0	0.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None	None	None	C-Min	C-Min	None	C-Min	C-Min
Act Effct Green (s)	13.7	9.8	9.8	29.4	25.2	25.2	47.6	39.3	39.3	49.7	40.3	40.3
Actuated g/C Ratio	0.15	0.11	0.11	0.33	0.28	0.28	0.53	0.44	0.44	0.55	0.45	0.45
v/c Ratio	0.13	0.51	0.23	1.00	0.47	0.50	0.35	0.67	0.54	0.48	0.55	0.23
Control Delay	21.4	45.9	13.2	58.0	26.1	5.1	12.3	27.3	4.2	12.6	12.0	0.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.4	45.9	13.2	58.0	26.1	5.1	12.3	27.3	4.2	12.6	12.0	0.7
LOS	C	D	B	E	C	A	B	C	A	B	B	A
Approach Delay		33.2			33.2			15.4			9.6	
Approach LOS		C			C			B			A	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 32 (36%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.00
Intersection Signal Delay: 20.6 — Intersection LOS: C
Intersection Capacity Utilization 76.8% — ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 3: kuikahi & honoapiilani hwy



Timings
6: waiko dr & honopiilani hwy

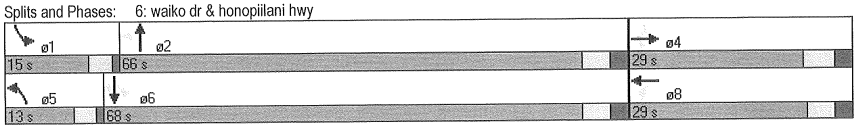
12/6/2009

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	30	25	10	20	25	140	540	145	500	10
Turn Type	Perm		Perm	Perm		pm+pt		pm+pt		Perm
Protected Phases		4			8	5	2	1	6	
Permitted Phases	4		4	8		2	2	6	6	6
Detector Phase	4	4	4	8	8	5	2	1	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	28.0	28.0	8.0	31.0	8.0	26.0	26.0
Total Split (s)	29.0	29.0	29.0	29.0	29.0	13.0	66.0	15.0	68.0	68.0
Total Split (%)	26.4%	26.4%	26.4%	26.4%	26.4%	11.8%	60.0%	13.6%	61.8%	61.8%
Yellow Time (s)	4.0	4.0	4.0	3.5	3.5	3.0	3.5	3.0	3.5	3.5
All-Red Time (s)	2.5	2.5	2.5	2.5	2.5	1.0	2.5	1.0	2.5	2.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.5	6.5	6.5	6.0	6.0	4.0	6.0	4.0	6.0	6.0
Lead/Lag						Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	None	C-Min	None	C-Min	C-Min
Act Effct Green (s)		10.5	10.5		10.8	87.2	78.6	87.3	78.7	78.7
Actuated g/C Ratio		0.10	0.10		0.10	0.79	0.71	0.79	0.72	0.72
v/c Ratio		0.40	0.07		0.35	0.23	0.45	0.25	0.41	0.01
Control Delay		52.3	20.3		46.9	3.7	10.0	3.9	9.4	4.5
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		52.3	20.3		46.9	3.7	10.0	3.9	9.4	4.5
LOS		D	C		D	A	A	A	A	A
Approach Delay		47.4			46.9		8.7		8.1	
Approach LOS		D			D		A		A	

Intersection Summary

Cycle Length: 110
Actuated Cycle Length: 110
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.45
Intersection Signal Delay: 11.5 — Intersection LOS: B
Intersection Capacity Utilization 59.8% — ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 6: waiko dr & honopiilani hwy



Timings
6: waiko dr & honopiilani hwy

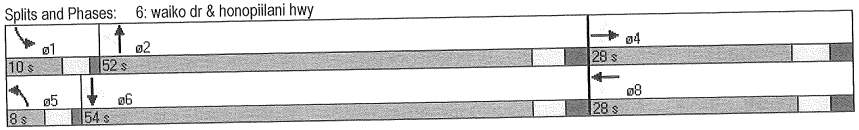
12/13/2009

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	30	25	10	40	25	140	790	160	900	10
Turn Type	Perm		Perm	Perm		pm+pt		pm+pt		Perm
Protected Phases		4			8	5	2	1	6	
Permitted Phases	4		4	8		2	2	6	6	6
Detector Phase	4	4	4	8	8	5	2	1	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	28.0	28.0	8.0	31.0	8.0	26.0	26.0
Total Split (s)	28.0	28.0	28.0	28.0	28.0	8.0	52.0	10.0	54.0	54.0
Total Split (%)	31.1%	31.1%	31.1%	31.1%	31.1%	8.9%	57.8%	11.1%	60.0%	60.0%
Yellow Time (s)	4.0	4.0	4.0	3.5	3.5	3.0	3.5	3.0	3.5	3.5
All-Red Time (s)	2.5	2.5	2.5	2.5	2.5	1.0	2.5	1.0	2.5	2.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.5	6.5	6.5	6.0	6.0	4.0	6.0	4.0	6.0	6.0
Lead/Lag						Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	None	C-Min	None	C-Min	C-Min
Act Effct Green (s)		10.1	10.1		10.5	66.8	57.2	68.4	58.0	58.0
Actuated g/C Ratio		0.11	0.11		0.12	0.74	0.64	0.76	0.64	0.64
v/c Ratio		0.34	0.06		0.43	0.50	0.74	0.45	0.81	0.01
Control Delay		39.5	16.2		40.3	13.4	19.5	7.4	15.9	2.8
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		39.5	16.2		40.3	13.4	19.5	7.4	15.9	2.8
LOS		D	B		D	B	B	A	B	A
Approach Delay		35.9			40.3		18.6		14.5	
Approach LOS		D			D		B		B	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 11 (12%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.81
Intersection Signal Delay: 17.8 — Intersection LOS: B
Intersection Capacity Utilization 79.0% — ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 6: waiko dr & honopiilani hwy



Timings
6: waiko dr & honopiilani hwy

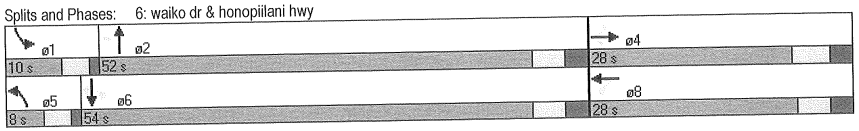
12/13/2009

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	30	25	10	40	25	140	805	160	910	10
Turn Type	Perm		Perm	Perm		pm+pt		pm+pt		Perm
Protected Phases		4			8	5	2	1	6	
Permitted Phases	4		4	8		2	2	6	6	6
Detector Phase	4	4	4	8	8	5	2	1	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	28.0	28.0	8.0	31.0	8.0	26.0	26.0
Total Split (s)	28.0	28.0	28.0	28.0	28.0	8.0	52.0	10.0	54.0	54.0
Total Split (%)	31.1%	31.1%	31.1%	31.1%	31.1%	8.9%	57.8%	11.1%	60.0%	60.0%
Yellow Time (s)	4.0	4.0	4.0	3.5	3.5	3.0	3.5	3.0	3.5	3.5
All-Red Time (s)	2.5	2.5	2.5	2.5	2.5	1.0	2.5	1.0	2.5	2.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.5	6.5	6.5	6.0	6.0	4.0	6.0	4.0	6.0	6.0
Lead/Lag						Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	None	Min	None	Min	Min
Act Effct Green (s)		9.3	9.3		9.6	53.5	47.4	57.5	49.4	49.4
Actuated g/C Ratio		0.12	0.12		0.12	0.70	0.62	0.75	0.64	0.64
v/c Ratio		0.32	0.05		0.40	0.61	0.78	0.52	0.82	0.01
Control Delay		35.1	15.5		35.6	18.3	19.9	9.7	21.1	5.0
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		35.1	15.5		35.6	18.3	19.9	9.7	21.1	5.0
LOS		D	B		D	B	B	A	C	A
Approach Delay		32.1			35.6		19.7		19.2	
Approach LOS		C			D		B		B	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 76.8
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.82
Intersection Signal Delay: 20.3 — Intersection LOS: C
Intersection Capacity Utilization 79.5% — ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 6: waiko dr & honopiilani hwy



Timings
6: waiko dr & honopiilani hwy

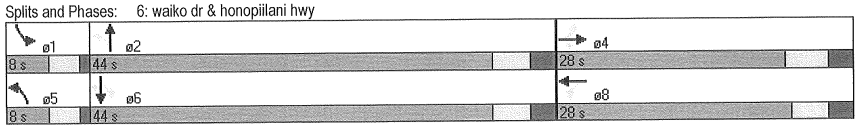
12/6/2009

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	10	15	5	50	30	25	650	90	440	15
Turn Type	Perm		Perm	Perm		pm+pt		pm+pt		Perm
Protected Phases		4			8	5	2	1	6	
Permitted Phases	4		4	8		2	2	6	6	6
Detector Phase	4	4	4	8	8	5	2	1	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	28.0	28.0	8.0	31.0	8.0	26.0	26.0
Total Split (s)	28.0	28.0	28.0	28.0	28.0	8.0	44.0	8.0	44.0	44.0
Total Split (%)	35.0%	35.0%	35.0%	35.0%	35.0%	10.0%	55.0%	10.0%	55.0%	55.0%
Yellow Time (s)	4.0	4.0	4.0	3.5	3.5	3.0	3.5	3.0	3.5	3.5
All-Red Time (s)	2.5	2.5	2.5	2.5	2.5	1.0	2.5	1.0	2.5	2.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.5	6.5	6.5	6.0	6.0	4.0	6.0	4.0	6.0	6.0
Lead/Lag						Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	None	C-Min	None	C-Min	C-Min
Act Effct Green (s)		11.6	11.6		12.1	54.1	48.4	56.5	52.4	52.4
Actuated g/C Ratio		0.14	0.14		0.15	0.68	0.60	0.71	0.66	0.66
v/c Ratio		0.14	0.02		0.70	0.04	0.72	0.27	0.39	0.02
Control Delay		27.8	15.2		28.8	5.1	18.9	6.6	10.0	5.1
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		27.8	15.2		28.8	5.1	18.9	6.6	10.0	5.1
LOS		C	B		C	A	B	A	A	A
Approach Delay		25.8			28.8		18.4		9.3	
Approach LOS		C			C		B		A	

Intersection Summary

Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.72
Intersection Signal Delay: 16.7 — Intersection LOS: B
Intersection Capacity Utilization 76.4% — ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 6: waiko dr & honopiilani hwy



Timings
6: waiko dr & honopiilani hwy

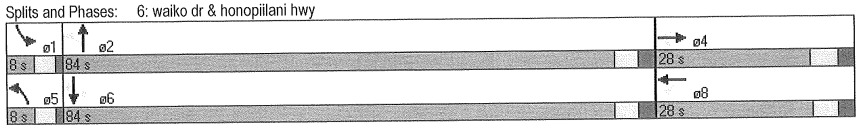
12/12/2009

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	10	15	5	80	30	25	1075	100	720	15
Turn Type	Perm		Perm	Perm		pm+pt		pm+pt		Perm
Protected Phases		4			8	5	2	1	6	
Permitted Phases	4		4	8		2	2	6	6	6
Detector Phase	4	4	4	8	8	5	2	1	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	28.0	28.0	8.0	31.0	8.0	26.0	26.0
Total Split (s)	28.0	28.0	28.0	28.0	28.0	8.0	84.0	8.0	84.0	84.0
Total Split (%)	23.3%	23.3%	23.3%	23.3%	23.3%	6.7%	70.0%	6.7%	70.0%	70.0%
Yellow Time (s)	4.0	4.0	4.0	3.5	3.5	3.0	3.5	3.0	3.5	3.5
All-Red Time (s)	2.5	2.5	2.5	2.5	2.5	1.0	2.5	1.0	2.5	2.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.5	6.5	6.5	6.0	6.0	4.0	6.0	4.0	6.0	6.0
Lead/Lag						Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	None	Min	None	Min	Min
Act Effct Green (s)		19.7	19.7		20.2	84.0	78.0	85.7	81.3	81.3
Actuated g/C Ratio		0.17	0.17		0.17	0.71	0.66	0.73	0.69	0.69
v/c Ratio		0.12	0.02		0.91	0.07	1.03	0.89	0.61	0.01
Control Delay		42.8	24.4		73.9	4.8	56.5	77.2	13.6	3.3
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		42.8	24.4		73.9	4.8	56.5	77.2	13.6	3.3
LOS		D	C		E	A	E	E	B	A
Approach Delay		40.0			73.9		55.4		21.0	
Approach LOS		D			E		E		C	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 118.2
Natural Cycle: 120
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.03
Intersection Signal Delay: 44.7 — Intersection LOS: D
Intersection Capacity Utilization 101.9% — ICU Level of Service G
Analysis Period (min) 15

Splits and Phases: 6: waiko dr & honopiilani hwy



Timings
6: waiko dr & honopiilani hwy

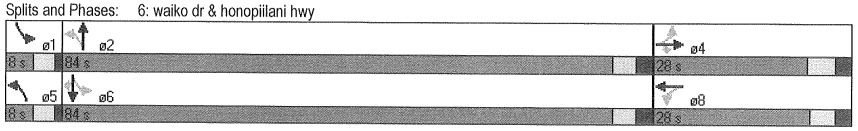
12/13/2009

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	10	15	5	80	30	25	1080	100	720	15
Turn Type	Perm		Perm	Perm		pm+pt		pm+pt		Perm
Protected Phases		4			8	5	2	1	6	
Permitted Phases	4		4	8		2	2	6	6	6
Detector Phase	4	4	4	8	8	5	2	1	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	28.0	28.0	8.0	31.0	8.0	26.0	26.0
Total Split (s)	28.0	28.0	28.0	28.0	28.0	8.0	84.0	8.0	84.0	84.0
Total Split (%)	23.3%	23.3%	23.3%	23.3%	23.3%	6.7%	70.0%	6.7%	70.0%	70.0%
Yellow Time (s)	4.0	4.0	4.0	3.5	3.5	3.0	3.5	3.0	3.5	3.5
All-Red Time (s)	2.5	2.5	2.5	2.5	2.5	1.0	2.5	1.0	2.5	2.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.5	6.5	6.5	6.0	6.0	4.0	6.0	4.0	6.0	6.0
Lead/Lag						Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	None	C-Min	None	C-Min	C-Min
Act Effct Green (s)		19.9	19.9		20.4	85.0	78.7	87.2	82.8	82.8
Actuated g/C Ratio		0.17	0.17		0.17	0.71	0.66	0.73	0.69	0.69
v/c Ratio		0.12	0.02		0.92	0.07	1.05	0.81	0.61	0.01
Control Delay		42.9	24.4		74.9	4.8	60.5	60.7	13.5	3.3
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		42.9	24.4		74.9	4.8	60.5	60.7	13.5	3.3
LOS		D	C		E	A	E	E	B	A
Approach Delay		40.0			74.9		59.3		19.0	
Approach LOS		D			E		E		B	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 140
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.05
Intersection Signal Delay: 46.2 — Intersection LOS: D
Intersection Capacity Utilization 102.1% — ICU Level of Service G
Analysis Period (min) 15

Splits and Phases: 6: waiko dr & honopiilani hwy



Timings
19: olomea st & waiale rd

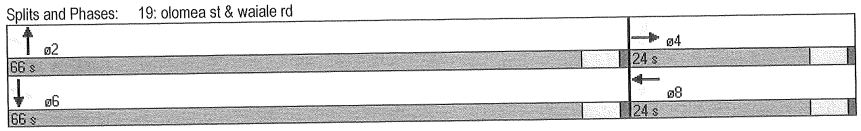
12/12/2009

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	195	0	35	3	1	20	1070	15	560	180
Turn Type	Perm		Perm	Perm		Perm		Perm		Perm
Protected Phases		4			8		2		6	
Permitted Phases	4		4	8	8	2	2	6	6	6
Detector Phase	4	4	4	8	8	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	24.0	24.0	24.0	24.0	24.0	66.0	66.0	66.0	66.0	66.0
Total Split (%)	26.7%	26.7%	26.7%	26.7%	26.7%	73.3%	73.3%	73.3%	73.3%	73.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	None	None	Min	Min	Min
Act Effct Green (s)		16.7	16.7		16.7	58.1	58.1		58.1	58.1
Actuated g/C Ratio		0.20	0.20		0.20	0.68	0.68		0.68	0.68
v/c Ratio		0.78	0.11		0.08	0.05	0.91		0.64	0.17
Control Delay		54.0	10.7		14.4	5.2	24.7		11.6	1.2
Queue Delay		0.0	0.0		0.0	0.0	0.0		0.0	0.0
Total Delay		54.0	10.7		14.4	5.2	24.7		11.6	1.2
LOS		D	B		B	A	C		B	A
Approach Delay		47.4			14.4		24.4		9.1	
Approach LOS		D			B		C		A	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 84.9
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.91
Intersection Signal Delay: 21.3 — Intersection LOS: C
Intersection Capacity Utilization 83.3% — ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 19: olomea st & waiale rd



Timings
19: olomea st & waiale rd

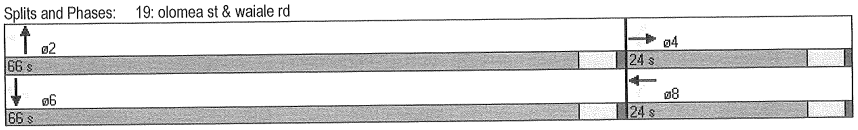
12/12/2009

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	200	0	35	3	1	20	1070	15	560	190
Turn Type	Perm		Perm	Perm		Perm		Perm		Perm
Protected Phases		4			8		2		6	
Permitted Phases	4		4	8	8	2	2	6	6	6
Detector Phase	4	4	4	8	8	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	24.0	24.0	24.0	24.0	24.0	66.0	66.0	66.0	66.0	66.0
Total Split (%)	26.7%	26.7%	26.7%	26.7%	26.7%	73.3%	73.3%	73.3%	73.3%	73.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	None	None	Min	Min	Min
Act Effct Green (s)		16.8	16.8		16.8	58.0	58.0		58.0	58.0
Actuated g/C Ratio		0.20	0.20		0.20	0.68	0.68		0.68	0.68
v/c Ratio		0.79	0.11		0.08	0.05	0.91		0.64	0.18
Control Delay		55.1	10.7		14.4	5.2	25.0		11.8	1.2
Queue Delay		0.0	0.0		0.0	0.0	0.0		0.0	0.0
Total Delay		55.1	10.7		14.4	5.2	25.0		11.8	1.2
LOS		E	B		B	A	C		B	A
Approach Delay		48.5			14.4		24.6		9.1	
Approach LOS		D			B		C		A	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 84.9
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.91
Intersection Signal Delay: 21.5 — Intersection LOS: C
Intersection Capacity Utilization 83.9% — ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 19: olomea st & waiale rd



Timings
19: olomea st & waiale rd

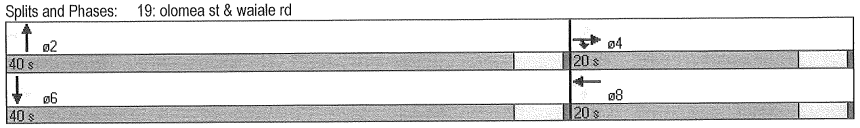
12/12/2009

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	140	0	10	1	0	15	695	5	895	265
Turn Type	Perm		Prot	Perm		Perm		Perm		custom
Protected Phases		4	4		8		2		6	
Permitted Phases	4			8		2		6		8
Detector Phase	4	4	4	8	8	2	2	6	6	8
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	20.0	40.0	40.0	40.0	40.0	20.0
Total Split (%)	33.3%	33.3%	33.3%	33.3%	33.3%	66.7%	66.7%	66.7%	66.7%	33.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	None	None	None	None	None
Act Effct Green (s)		10.9	10.9		10.9	31.1	31.1		31.1	10.9
Actuated g/C Ratio		0.22	0.22		0.22	0.62	0.62		0.62	0.22
v/c Ratio		0.50	0.03		0.05	0.11	0.66		0.85	0.52
Control Delay		25.2	9.9		9.6	6.8	10.1		18.3	7.6
Queue Delay		0.0	0.0		0.0	0.0	0.0		0.0	0.0
Total Delay		25.2	9.9		9.6	6.8	10.1		18.3	7.6
LOS		C	A		A	A	B		B	A
Approach Delay		24.2			9.6		10.0		15.9	
Approach LOS		C			A		A		B	

Intersection Summary

Cycle Length: 60
Actuated Cycle Length: 50.4
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.85
Intersection Signal Delay: 14.4 — Intersection LOS: B
Intersection Capacity Utilization 72.2% — ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 19: olomea st & waiale rd



Timings
19: olomea st & waiale rd

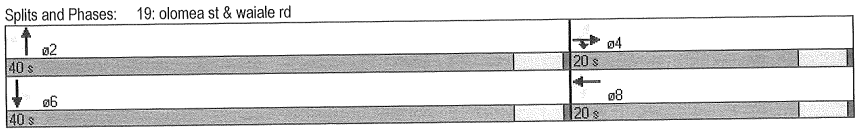
12/12/2009

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	140	0	10	1	0	15	695	5	895	270
Turn Type	Perm		Prot	Perm		Perm		Perm		custom
Protected Phases		4	4		8		2		6	
Permitted Phases	4			8		2		6		8
Detector Phase	4	4	4	8	8	2	2	6	6	8
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	20.0	20.0	20.0	20.0	20.0	40.0	40.0	40.0	40.0	20.0
Total Split (%)	33.3%	33.3%	33.3%	33.3%	33.3%	66.7%	66.7%	66.7%	66.7%	33.3%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	None	None	None	None	None
Act Effct Green (s)		10.9	10.9		10.9	31.1	31.1		31.1	10.9
Actuated g/C Ratio		0.22	0.22		0.22	0.62	0.62		0.62	0.22
v/c Ratio		0.50	0.03		0.05	0.11	0.66		0.85	0.53
Control Delay		25.2	9.9		9.6	6.8	10.1		18.3	7.6
Queue Delay		0.0	0.0		0.0	0.0	0.0		0.0	0.0
Total Delay		25.2	9.9		9.6	6.8	10.1		18.3	7.6
LOS		C	A		A	A	B		B	A
Approach Delay		24.2			9.6		10.0		15.9	
Approach LOS		C			A		A		B	

Intersection Summary

Cycle Length: 60
Actuated Cycle Length: 50.4
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.85
Intersection Signal Delay: 14.4 — Intersection LOS: B
Intersection Capacity Utilization 72.2% — ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 19: olomea st & waiale rd



Timings
17: kuikahi & waiale st

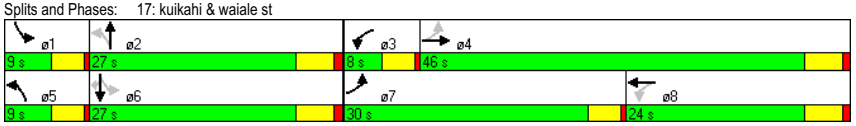
12/29/2009

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Volume (vph)	535	210	25	150	90	280	120	150	250
Turn Type	pm+pt		pm+pt		pm+pt		pm+pt		Perm
Protected Phases	7	4	3	8	5	2	1	6	
Permitted Phases	4		8		2		6		6
Detector Phase	7	4	3	8	5	2	1	6	6
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	8.0	24.0	8.0	24.0	8.0	24.0	8.0	24.0	24.0
Total Split (s)	30.0	46.0	8.0	24.0	9.0	27.0	9.0	27.0	27.0
Total Split (%)	33.3%	51.1%	8.9%	26.7%	10.0%	30.0%	10.0%	30.0%	30.0%
Yellow Time (s)	3.5	4.0	3.5	4.0	3.5	4.0	3.5	4.0	4.0
All-Red Time (s)	0.5	1.0	0.5	1.0	0.5	1.0	0.5	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.0	4.0	5.0	4.0	5.0	4.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	None	C-Max	None	C-Max	C-Max
Act Effct Green (s)	46.2	42.0	20.2	15.2	31.5	24.0	32.8	26.3	26.3
Actuated g/C Ratio	0.51	0.47	0.22	0.17	0.35	0.27	0.36	0.29	0.29
v/c Ratio	0.89	0.42	0.10	0.72	0.21	0.66	0.46	0.30	0.42
Control Delay	27.7	11.7	14.4	44.7	20.9	37.8	25.7	28.8	5.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.7	11.7	14.4	44.7	20.9	37.8	25.7	28.8	5.8
LOS	C	B	B	D	C	D	C	C	A
Approach Delay		21.7		41.5		33.9		17.0	
Approach LOS		C		D		C		B	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.89
Intersection Signal Delay: 25.2 — Intersection LOS: C
Intersection Capacity Utilization 78.8% — ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 17: kuikahi & waiale st



Timings
17: kuikahi & waiale st

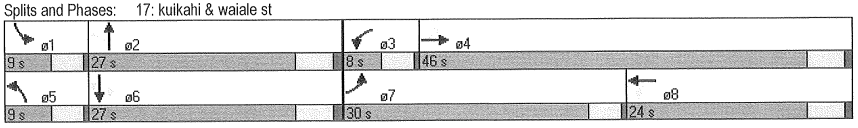
12/12/2009

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Volume (vph)	535	240	25	160	90	280	120	150	250
Turn Type	pm+pt		pm+pt		pm+pt		pm+pt		Perm
Protected Phases	7	4	3	8	5	2	1	6	
Permitted Phases	4		8		2		6		6
Detector Phase	7	4	3	8	5	2	1	6	6
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	8.0	24.0	8.0	24.0	8.0	24.0	8.0	24.0	24.0
Total Split (s)	30.0	46.0	8.0	24.0	9.0	27.0	9.0	27.0	27.0
Total Split (%)	33.3%	51.1%	8.9%	26.7%	10.0%	30.0%	10.0%	30.0%	30.0%
Yellow Time (s)	3.5	4.0	3.5	4.0	3.5	4.0	3.5	4.0	4.0
All-Red Time (s)	0.5	1.0	0.5	1.0	0.5	1.0	0.5	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.0	4.0	5.0	4.0	5.0	4.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	None	C-Max	None	C-Max	C-Max
Act Effct Green (s)	46.8	42.6	20.8	15.8	30.9	23.8	32.2	26.0	26.0
Actuated g/C Ratio	0.52	0.47	0.23	0.18	0.34	0.26	0.36	0.29	0.29
v/c Ratio	0.89	0.45	0.10	0.74	0.22	0.67	0.48	0.30	0.42
Control Delay	25.6	10.1	14.2	45.7	20.7	37.8	26.9	29.0	5.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.6	10.1	14.2	45.7	20.7	37.8	26.9	29.0	5.9
LOS	C	B	B	D	C	D	C	C	A
Approach Delay		19.4		42.6		33.9		17.4	
Approach LOS		B		D		C		B	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 10 (11%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.89
Intersection Signal Delay: 24.5 — Intersection LOS: C
Intersection Capacity Utilization 79.6% — ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 17: kuikahi & waiale st



Timings
17: kuikahi & waiale st

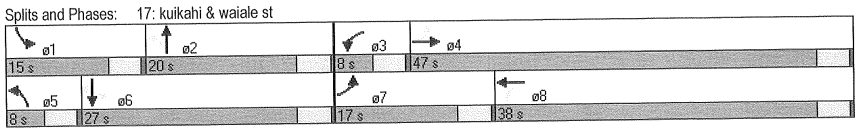
12/13/2009

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Volume (vph)	305	235	5	350	90	230	280	225	505
Turn Type	pm+pt		pm+pt		pm+pt		pm+pt		Perm
Protected Phases	7	4	3	8	5	2	1	6	
Permitted Phases	4		8		2		6		6
Detector Phase	7	4	3	8	5	2	1	6	6
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	8.0	20.0	8.0	20.0	8.0	20.0	8.0	20.0	20.0
Total Split (s)	17.0	47.0	8.0	38.0	8.0	20.0	15.0	27.0	27.0
Total Split (%)	18.9%	52.2%	8.9%	42.2%	8.9%	22.2%	16.7%	30.0%	30.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	None	C-Max	None	C-Max	C-Max
Act Effct Green (s)	51.0	49.4	38.0	34.0	20.0	16.0	31.0	24.6	24.6
Actuated g/C Ratio	0.57	0.55	0.42	0.38	0.22	0.18	0.34	0.27	0.27
v/c Ratio	1.00	0.34	0.01	1.03	0.35	0.77	0.97	0.48	0.71
Control Delay	74.9	13.2	9.6	70.6	26.7	52.3	70.3	32.0	11.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	74.9	13.2	9.6	70.6	26.7	52.3	70.3	32.0	11.5
LOS	E	B	A	E	C	D	E	C	B
Approach Delay		43.8		70.2		45.2		32.4	
Approach LOS		D		E		D		C	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 77 (86%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.03
Intersection Signal Delay: 46.2 — Intersection LOS: D
Intersection Capacity Utilization 95.2% — ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 17: kuikahi & waiale st



Timings
17: kuikahi & waiale st

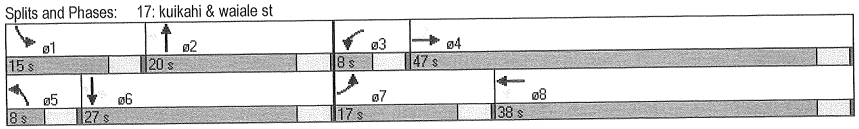
12/13/2009

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Volume (vph)	305	240	5	350	90	230	280	225	505
Turn Type	pm+pt		pm+pt		pm+pt		pm+pt		Perm
Protected Phases	7	4	3	8	5	2	1	6	
Permitted Phases	4		8		2		6		6
Detector Phase	7	4	3	8	5	2	1	6	6
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	8.0	20.0	8.0	20.0	8.0	20.0	8.0	20.0	20.0
Total Split (s)	17.0	47.0	8.0	38.0	8.0	20.0	15.0	27.0	27.0
Total Split (%)	18.9%	52.2%	8.9%	42.2%	8.9%	22.2%	16.7%	30.0%	30.0%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	None	C-Max	None	C-Max	C-Max
Act Effct Green (s)	51.0	49.4	38.0	34.0	20.0	16.0	31.0	24.6	24.6
Actuated g/C Ratio	0.57	0.55	0.42	0.38	0.22	0.18	0.34	0.27	0.27
v/c Ratio	1.00	0.34	0.01	1.04	0.35	0.77	0.97	0.48	0.71
Control Delay	71.9	9.9	9.6	72.6	26.7	52.3	70.3	32.0	11.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	71.9	9.9	9.6	72.6	26.7	52.3	70.3	32.0	11.4
LOS	E	A	A	E	C	D	E	C	B
Approach Delay		40.4		72.2		45.2		32.3	
Approach LOS		D		E		D		C	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 88 (98%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.04
Intersection Signal Delay: 45.9 — Intersection LOS: D
Intersection Capacity Utilization 95.5% — ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 17: kuikahi & waiale st



Appendix C

Unsignalized Intersection Level of Service (LOS) Calculations

HCM Unsignalized Intersection Capacity Analysis
19: olomea st & waiale rd

12/6/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	130	0	30	3	1	20	15	855	5	15	370	150
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	141	0	33	3	1	22	16	929	5	16	402	163
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1419	1402	402	1432	1562	932	565			935		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1419	1402	402	1432	1562	932	565			935		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	100	95	97	99	93	98			98		
cM capacity (veh/h)	103	135	648	103	108	323	1007			732		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	141	33	26	16	935	418	163
Volume Left	141	0	3	16	0	16	0
Volume Right	0	33	22	0	5	0	163
cSH	103	648	239	1007	1700	732	1700
Volume to Capacity	1.38	0.05	0.11	0.02	0.55	0.02	0.10
Queue Length 95th (ft)	252	4	9	1	0	2	0
Control Delay (s)	294.5	10.8	21.9	8.6	0.0	0.7	0.0
Lane LOS	F	B	C	A		A	
Approach Delay (s)	241.3		21.9	0.1		0.5	
Approach LOS	F		C				

Intersection Summary			
Average Delay	24.8		
Intersection Capacity Utilization	67.9%	ICU Level of Service	C
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
19: olomea st & waiale rd

12/6/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	105	0	10	1	0	15	10	405	0	5	540	185
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	114	0	11	1	0	16	11	440	0	5	587	201
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1076	1060	587	1071	1261	440	788			440		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1076	1060	587	1071	1261	440	788			440		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	40	100	98	99	100	97	99			100		
cM capacity (veh/h)	189	220	510	192	167	617	831			1120		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	114	11	17	11	440	592	201
Volume Left	114	0	1	11	0	5	0
Volume Right	0	11	16	0	0	0	201
cSH	189	510	542	831	1700	1120	1700
Volume to Capacity	0.60	0.02	0.03	0.01	0.26	0.00	0.12
Queue Length 95th (ft)	84	2	2	1	0	0	0
Control Delay (s)	49.4	12.2	11.9	9.4	0.0	0.1	0.0
Lane LOS	E	B	B	A		A	
Approach Delay (s)	46.2		11.9	0.2		0.1	
Approach LOS	E		B				

Intersection Summary			
Average Delay	4.4		
Intersection Capacity Utilization	51.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
17: kuikahi rd & waiale st

12/6/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	435	0	15	0	0	0	50	245	0	0	215	125
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	473	0	16	0	0	0	54	266	0	0	234	136

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	489	0	321	370
Volume Left (vph)	473	0	54	0
Volume Right (vph)	16	0	0	136
Hadj (s)	0.21	0.00	0.07	-0.19
Departure Headway (s)	6.2	7.4	6.3	6.0
Degree Utilization, x	0.84	0.00	0.56	0.62
Capacity (veh/h)	565	409	534	569
Control Delay (s)	32.9	10.4	17.3	18.3
Approach Delay (s)	32.9	0.0	17.3	18.3
Approach LOS	D	A	C	C

Intersection Summary			
Delay	24.1		
HCM Level of Service	C		
Intersection Capacity Utilization	69.6%	ICU Level of Service	C
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
17: kuikahi & waiale st

12/6/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	260	0	45	0	0	0	50	185	0	0	170	325
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	283	0	49	0	0	0	54	201	0	0	185	353

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	332	0	255	538
Volume Left (vph)	283	0	54	0
Volume Right (vph)	49	0	0	353
Hadj (s)	0.12	0.00	0.08	-0.36
Departure Headway (s)	6.1	6.9	5.9	5.1
Degree Utilization, x	0.56	0.00	0.42	0.76
Capacity (veh/h)	551	443	569	691
Control Delay (s)	16.5	9.9	13.0	22.2
Approach Delay (s)	16.5	0.0	13.0	22.2
Approach LOS	C	A	B	C

Intersection Summary			
Delay		18.5	
HCM Level of Service		C	
Intersection Capacity Utilization		68.5%	ICU Level of Service C
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
18: waiko dr & waiale st

12/6/2009

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	55	295	215	175	230	100
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	60	321	234	190	250	109
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	424				769	329
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	424				769	329
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				29	85
cM capacity (veh/h)	1135				350	713

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	380	424	359
Volume Left	60	0	250
Volume Right	0	190	109
cSH	1135	1700	414
Volume to Capacity	0.05	0.25	0.87
Queue Length 95th (ft)	4	0	216
Control Delay (s)	1.8	0.0	49.3
Lane LOS	A		E
Approach Delay (s)	1.8	0.0	49.3
Approach LOS			E

Intersection Summary			
Average Delay		15.8	
Intersection Capacity Utilization		69.4%	ICU Level of Service C
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
18: waiko dr & waiale st

12/6/2009

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	60	320	235	190	290	125
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	65	348	255	207	315	136
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	462				837	359
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	462				837	359
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	94				1	80
cM capacity (veh/h)	1099				317	686

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	413	462	315	136
Volume Left	65	0	315	0
Volume Right	0	207	0	136
cSH	1099	1700	317	686
Volume to Capacity	0.06	0.27	0.99	0.20
Queue Length 95th (ft)	5	0	269	18
Control Delay (s)	1.9	0.0	86.6	11.5
Lane LOS	A		F	B
Approach Delay (s)	1.9	0.0	64.0	
Approach LOS			F	

Intersection Summary			
Average Delay	22.3		
Intersection Capacity Utilization	70.2%	ICU Level of Service	C
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
18: waiko dr & waiale st

12/6/2009

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	60	320	235	190	290	125
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	65	348	255	207	315	136
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	462				837	359
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	462				837	359
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	94				1	80
cM capacity (veh/h)	1099				317	686

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	413	462	315	136
Volume Left	65	0	315	0
Volume Right	0	207	0	136
cSH	1099	1700	317	686
Volume to Capacity	0.06	0.27	0.99	0.20
Queue Length 95th (ft)	5	0	269	18
Control Delay (s)	1.9	0.0	86.6	11.5
Lane LOS	A		F	B
Approach Delay (s)	1.9	0.0	64.0	
Approach LOS			F	

Intersection Summary			
Average Delay	22.3		
Intersection Capacity Utilization	70.2%	ICU Level of Service	C
Analysis Period (min)	15		

WAILUKU ELEM 2015 TOTAL AM 12/6/2009 total am

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HCM Unsignalized Intersection Capacity Analysis
18: waiko dr & waiale st

12/6/2009

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	75	325	250	165	150	80
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	82	353	272	179	163	87
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	451				878	361
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	451				878	361
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	93				45	87
cM capacity (veh/h)	1109				295	683

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	435	451	250
Volume Left	82	0	163
Volume Right	0	179	87
cSH	1109	1700	368
Volume to Capacity	0.07	0.27	0.68
Queue Length 95th (ft)	6	0	120
Control Delay (s)	2.2	0.0	33.2
Lane LOS	A		D
Approach Delay (s)	2.2	0.0	33.2
Approach LOS			D

Intersection Summary			
Average Delay	8.2		
Intersection Capacity Utilization	67.7%	ICU Level of Service	C
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
18: waiko dr & waiale st

12/6/2009

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	80	355	275	210	180	110
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	87	386	299	228	196	120
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	527				973	413
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	527				973	413
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	92				24	81
cM capacity (veh/h)	1040				256	639

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	473	527	196	120
Volume Left	87	0	196	0
Volume Right	0	228	0	120
cSH	1040	1700	256	639
Volume to Capacity	0.08	0.31	0.76	0.19
Queue Length 95th (ft)	7	0	139	17
Control Delay (s)	2.4	0.0	53.3	11.9
Lane LOS	A		F	B
Approach Delay (s)	2.4	0.0	37.6	
Approach LOS			E	

Intersection Summary			
Average Delay	9.9		
Intersection Capacity Utilization	70.4%	ICU Level of Service	C
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
18: waiko dr & waiale st

12/6/2009

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	80	355	275	210	180	110
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	87	386	299	228	196	120
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	527				973	413
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	527				973	413
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	92				24	81
cM capacity (veh/h)	1040				256	639

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	473	527	196	120
Volume Left	87	0	196	0
Volume Right	0	228	0	120
cSH	1040	1700	256	639
Volume to Capacity	0.08	0.31	0.76	0.19
Queue Length 95th (ft)	7	0	139	17
Control Delay (s)	2.4	0.0	53.3	11.9
Lane LOS	A		F	B
Approach Delay (s)	2.4	0.0	37.6	
Approach LOS			E	

Intersection Summary			
Average Delay	9.9		
Intersection Capacity Utilization	70.4%	ICU Level of Service	C
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
9: kuikahi & kehalani

12/6/2009

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	5	210	55	15	40	5
Sign Control		Free	Free		Stop	
Grade		-2%	2%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	228	60	16	43	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	76				307	68
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	76				307	68
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				94	99
cM capacity (veh/h)	1523				683	995

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	5	228	76	43	5
Volume Left	5	0	0	43	0
Volume Right	0	0	16	0	5
cSH	1523	1700	1700	683	995
Volume to Capacity	0.00	0.13	0.04	0.06	0.01
Queue Length 95th (ft)	0	0	0	5	0
Control Delay (s)	7.4	0.0	0.0	10.6	8.6
Lane LOS	A			B	A
Approach Delay (s)	0.2		0.0	10.4	
Approach LOS				B	

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	21.1%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
9: kuikahi & kehalani

12/12/2009

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	5	210	55	95	370	10
Sign Control		Free	Free		Stop	
Grade		-2%	2%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	228	60	103	402	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	163				351	111
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	163				351	111
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				38	99
cM capacity (veh/h)	1416				644	942

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	5	228	163	402	11
Volume Left	5	0	0	402	0
Volume Right	0	0	103	0	11
cSH	1416	1700	1700	644	942
Volume to Capacity	0.00	0.13	0.10	0.62	0.01
Queue Length 95th (ft)	0	0	0	109	1
Control Delay (s)	7.6	0.0	0.0	19.4	8.9
Lane LOS	A			C	A
Approach Delay (s)	0.2		0.0	19.1	
Approach LOS				C	

Intersection Summary			
Average Delay	9.8		
Intersection Capacity Utilization	38.2%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
9: kuikahi & kehalani

12/12/2009

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	5	210	55	105	390	10
Sign Control		Free	Free		Stop	
Grade		-2%	2%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	228	60	114	424	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	174				356	117
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	174				356	117
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				34	99
cM capacity (veh/h)	1403				640	935

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	5	228	174	424	11
Volume Left	5	0	0	424	0
Volume Right	0	0	114	0	11
cSH	1403	1700	1700	640	935
Volume to Capacity	0.00	0.13	0.10	0.66	0.01
Queue Length 95th (ft)	0	0	0	124	1
Control Delay (s)	7.6	0.0	0.0	21.0	8.9
Lane LOS	A			C	A
Approach Delay (s)	0.2		0.0	20.7	
Approach LOS				C	

Intersection Summary			
Average Delay	10.7		
Intersection Capacity Utilization	39.3%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
9: kuikahi & kehalani

12/6/2009

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	5	65	145	30	10	10
Sign Control		Free	Free		Stop	
Grade		-2%	2%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	71	158	33	11	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	190				255	174
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	190				255	174
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	99
cM capacity (veh/h)	1384				730	870

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	5	71	190	11	11
Volume Left	5	0	0	11	0
Volume Right	0	0	33	0	11
cSH	1384	1700	1700	730	870
Volume to Capacity	0.00	0.04	0.11	0.01	0.01
Queue Length 95th (ft)	0	0	0	1	1
Control Delay (s)	7.6	0.0	0.0	10.0	9.2
Lane LOS	A			B	A
Approach Delay (s)	0.5		0.0	9.6	
Approach LOS				A	

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	19.5%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
9: kuikahi & kehalani

12/12/2009

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	5	65	145	310	235	10
Sign Control		Free	Free		Stop	
Grade		-2%	2%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	71	158	337	255	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	495				408	326
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	495				408	326
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				57	98
cM capacity (veh/h)	1069				597	715

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	5	71	495	255	11
Volume Left	5	0	0	255	0
Volume Right	0	0	337	0	11
cSH	1069	1700	1700	597	715
Volume to Capacity	0.01	0.04	0.29	0.43	0.02
Queue Length 95th (ft)	0	0	0	53	1
Control Delay (s)	8.4	0.0	0.0	15.5	10.1
Lane LOS	A			C	B
Approach Delay (s)	0.6		0.0	15.3	
Approach LOS				C	

Intersection Summary			
Average Delay	4.9		
Intersection Capacity Utilization	46.4%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
9: kuikahi & kehalani

12/12/2009

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	5	65	145	310	235	10
Sign Control		Free	Free		Stop	
Grade		-2%	2%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	71	158	337	255	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	495				408	326
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	495				408	326
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				57	98
cM capacity (veh/h)	1069				597	715

Direction, Lane #	EB 1	EB 2	WB 1	SB 1	SB 2
Volume Total	5	71	495	255	11
Volume Left	5	0	0	255	0
Volume Right	0	0	337	0	11
cSH	1069	1700	1700	597	715
Volume to Capacity	0.01	0.04	0.29	0.43	0.02
Queue Length 95th (ft)	0	0	0	53	1
Control Delay (s)	8.4	0.0	0.0	15.5	10.1
Lane LOS	A			C	B
Approach Delay (s)	0.6		0.0	15.3	
Approach LOS				C	

Intersection Summary			
Average Delay	4.9		
Intersection Capacity Utilization	46.4%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
4: kuikahi & alu

12/6/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	10	55	0	30	20	15	0	45	110	10	10	0
Sign Control		Stop			Stop			Free			Free	
Grade		-2%			2%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	60	0	33	22	16	0	49	120	11	11	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	168	201	11	171	141	109	11			168		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	168	201	11	171	141	109	11			168		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	91	100	96	97	98	100			99		
cM capacity (veh/h)	760	690	1070	735	744	945	1608			1409		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	71	71	168	22
Volume Left	11	33	0	11
Volume Right	0	16	120	0
cSH	700	778	1608	1409
Volume to Capacity	0.10	0.09	0.00	0.01
Queue Length 95th (ft)	8	7	0	1
Control Delay (s)	10.7	10.1	0.0	3.8
Lane LOS	B	B		A
Approach Delay (s)	10.7	10.1	0.0	3.8
Approach LOS	B	B		

Intersection Summary			
Average Delay	4.7		
Intersection Capacity Utilization	24.7%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
4: kuikahi & alu

12/6/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	10	55	0	30	20	20	0	45	110	10	10	0
Sign Control		Stop			Stop			Free			Free	
Grade		-2%			2%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	60	0	33	22	22	0	49	120	11	11	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	174	201	11	171	141	109	11			168		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	174	201	11	171	141	109	11			168		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	91	100	96	97	98	100			99		
cM capacity (veh/h)	749	690	1070	735	744	945	1608			1409		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	71	76	168	22
Volume Left	11	33	0	11
Volume Right	0	22	120	0
cSH	698	788	1608	1409
Volume to Capacity	0.10	0.10	0.00	0.01
Queue Length 95th (ft)	8	8	0	1
Control Delay (s)	10.7	10.1	0.0	3.8
Lane LOS	B	B		A
Approach Delay (s)	10.7	10.1	0.0	3.8
Approach LOS	B	B		

Intersection Summary			
Average Delay	4.8		
Intersection Capacity Utilization	25.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
4: kuikahi & alu

12/6/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	10	55	0	30	20	20	0	45	110	10	10	0
Sign Control		Stop			Stop			Free			Free	
Grade		-2%			2%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	60	0	33	22	22	0	49	120	11	11	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	174	201	11	171	141	109	11			168		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	174	201	11	171	141	109	11			168		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	91	100	96	97	98	100			99		
cM capacity (veh/h)	749	690	1070	735	744	945	1608			1409		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	71	76	168	22
Volume Left	11	33	0	11
Volume Right	0	22	120	0
cSH	698	788	1608	1409
Volume to Capacity	0.10	0.10	0.00	0.01
Queue Length 95th (ft)	8	8	0	1
Control Delay (s)	10.7	10.1	0.0	3.8
Lane LOS	B	B		A
Approach Delay (s)	10.7	10.1	0.0	3.8
Approach LOS	B	B		

Intersection Summary			
Average Delay	4.8		
Intersection Capacity Utilization	25.0%	ICU Level of Service	A
Analysis Period (min)	15		

WAILUKU ELEM 2015 TOTAL AM 12/6/2009 total am

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HCM Unsignalized Intersection Capacity Analysis
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12/6/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	2	25	3	65	25	5	5	10	35	5	10	10
Sign Control		Stop			Stop			Free			Free	
Grade		-2%			2%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	27	3	71	27	5	5	11	38	5	11	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	87	87	16	85	73	30	22			49		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	87	87	16	85	73	30	22			49		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	97	100	92	97	99	100			100		
cM capacity (veh/h)	867	798	1063	871	811	1045	1594			1558		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	33	103	54	27
Volume Left	2	71	5	5
Volume Right	3	5	38	11
cSH	823	862	1594	1558
Volume to Capacity	0.04	0.12	0.00	0.00
Queue Length 95th (ft)	3	10	0	0
Control Delay (s)	9.6	9.7	0.7	1.5
Lane LOS	A	A	A	A
Approach Delay (s)	9.6	9.7	0.7	1.5
Approach LOS	A	A		

Intersection Summary			
Average Delay		6.4	
Intersection Capacity Utilization		21.9%	ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
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12/6/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	2	25	3	65	25	5	5	10	35	5	10	10
Sign Control		Stop			Stop			Free			Free	
Grade		-2%			2%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	27	3	71	27	5	5	11	38	5	11	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	87	87	16	85	73	30	22			49		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	87	87	16	85	73	30	22			49		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	97	100	92	97	99	100			100		
cM capacity (veh/h)	867	798	1063	871	811	1045	1594			1558		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
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Volume to Capacity	0.04	0.12	0.00	0.00
Queue Length 95th (ft)	3	10	0	0
Control Delay (s)	9.6	9.7	0.7	1.5
Lane LOS	A	A	A	A
Approach Delay (s)	9.6	9.7	0.7	1.5
Approach LOS	A	A		

Intersection Summary			
Average Delay		6.4	
Intersection Capacity Utilization		21.9%	ICU Level of Service A
Analysis Period (min)		15	

wailuku elem 2015 ambient pm 12/6/2009 ambient pm

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HCM Unsignalized Intersection Capacity Analysis
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12/6/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	2	25	3	65	25	5	5	10	35	5	10	10
Sign Control		Stop			Stop			Free			Free	
Grade		-2%			2%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	27	3	71	27	5	5	11	38	5	11	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	87	87	16	85	73	30	22			49		
vC1, stage 1 conf vol												
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vCu, unblocked vol	87	87	16	85	73	30	22			49		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	97	100	92	97	99	100			100		
cM capacity (veh/h)	867	798	1063	871	811	1045	1594			1558		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
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Control Delay (s)	9.6	9.7	0.7	1.5
Lane LOS	A	A	A	A
Approach Delay (s)	9.6	9.7	0.7	1.5
Approach LOS	A	A		

Intersection Summary			
Average Delay	6.4		
Intersection Capacity Utilization	21.9%	ICU Level of Service	A
Analysis Period (min)	15		

ACOUSTIC STUDY FOR THE WAILUKU II ELEMENTARY SCHOOL PROJECT WAILUKU, MAUI, HAWAII

Prepared for:

GROUP 70 INTERNATIONAL

Prepared by:

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JANUARY 2010

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CHAPTER I. SUMMARY

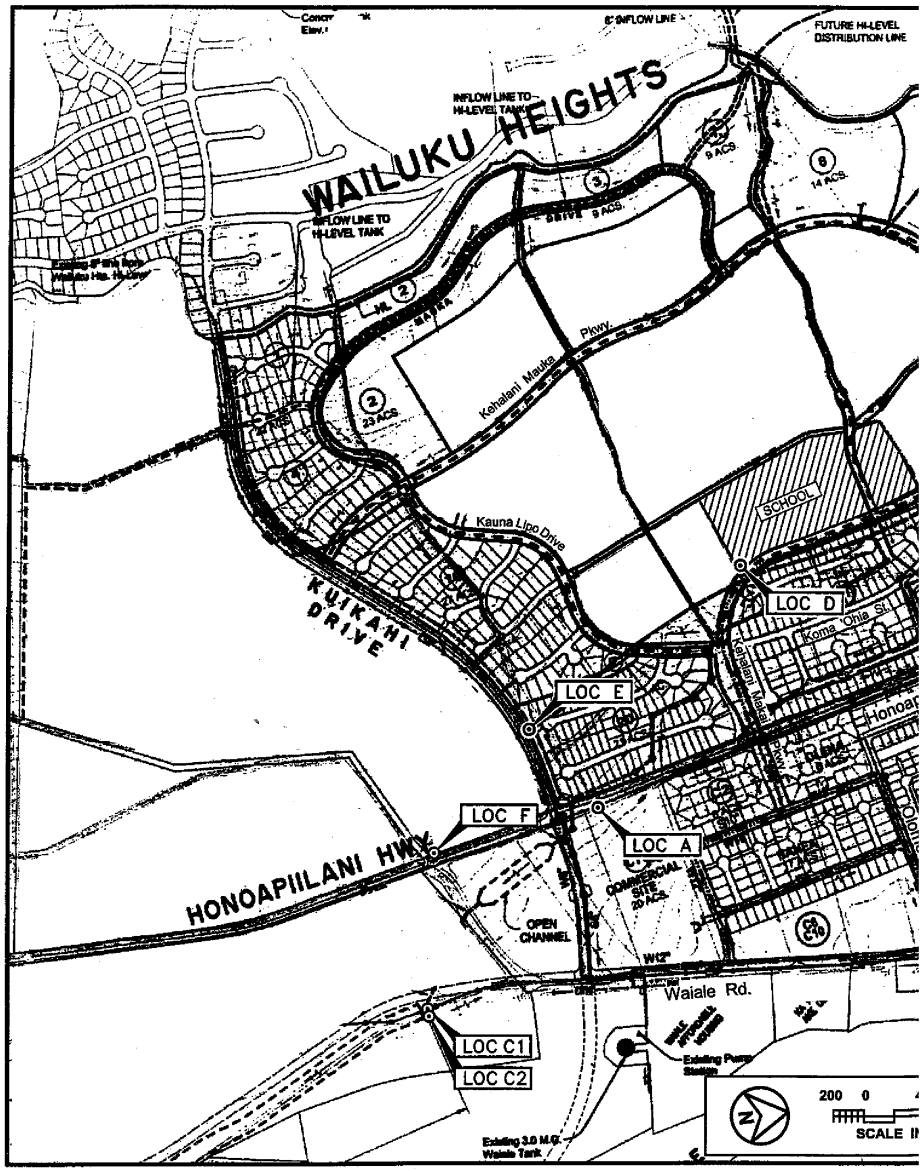
The existing and future traffic noise levels in the vicinity of the planned Wailuku II Elementary School in Wailuku, Maui were evaluated for their potential impacts and their relationship to current FHA/HUD noise standards and classroom background noise level requirements. The traffic noise level increases along the roadways servicing the project site (see FIGURE 1) were calculated. No significant increases in traffic noise are predicted to occur as a result of project traffic following project build-out by CY 2015.

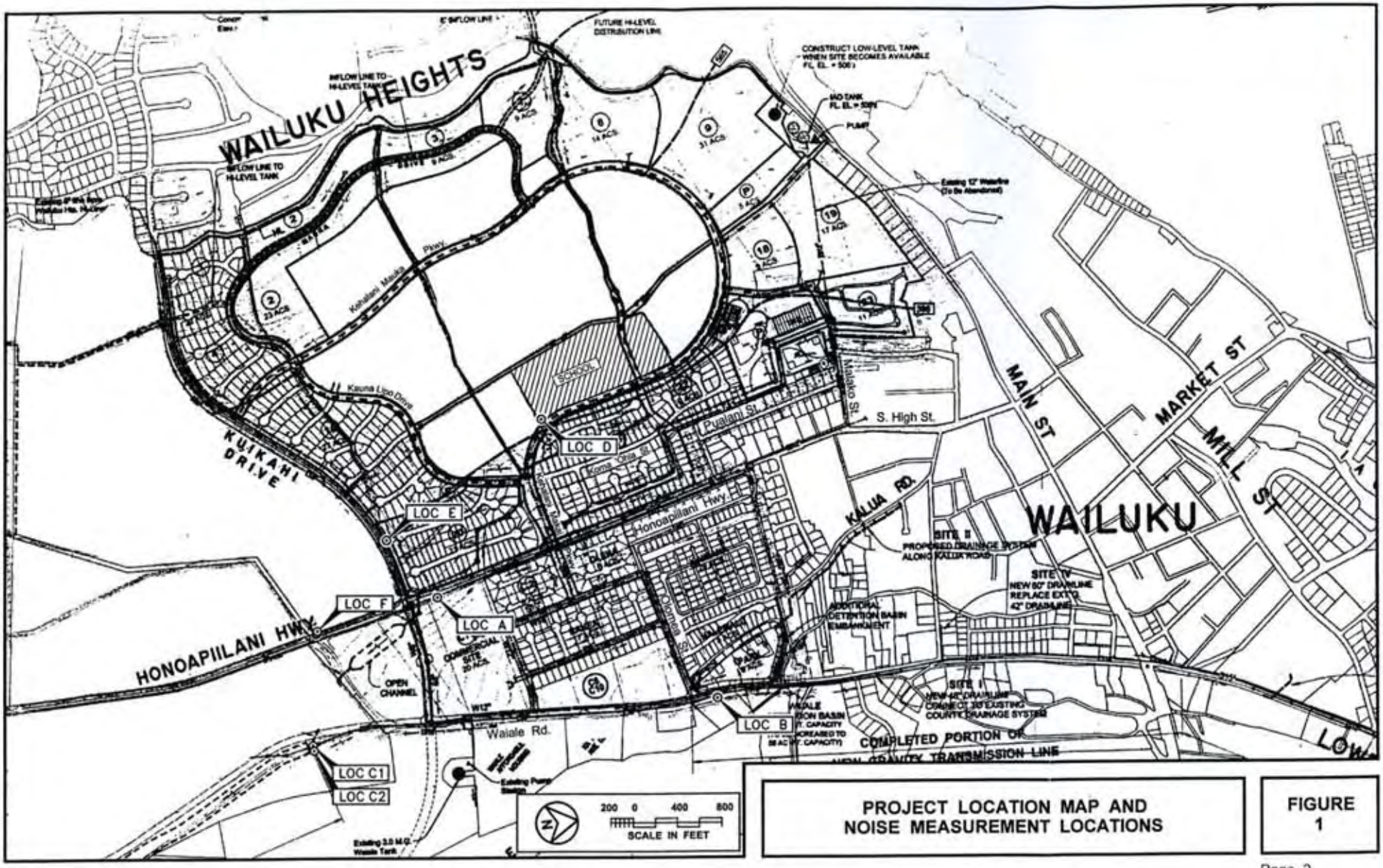
Along Kehalani Mauka Parkway fronting the school site, traffic noise levels are expected to increase from approximately 56 to 59 DNL at 50 foot distance from the centerline in CY 2015. This 3 DNL increase is relatively small due to the present use of this roadway for access to a nearby construction site. Along Honoapiilani Highway, traffic noise levels are expected to increase by 1.1 to 2.5 DNL by CY 2015 as a result of project and non-project traffic. Along Kuikahi Drive and Waiale Road, traffic noise levels are expected to increase by 1.2 to 3.8 DNL by CY 2015 as a result of project and non-project traffic. Project traffic will account for less than 0.4 DNL additional units of noise along Kehalani Mauka Parkway, Honoapiilani Highway, Kuikahi Drive, and Waiale Road in the immediate vicinity of the project. These levels of traffic noise increases resulting from project generated traffic are not considered to be significant. The predicted increases in project generated traffic noise levels are not expected to generate adverse noise impacts by CY 2015.

By CY 2015, moderately large increases in traffic noise levels are expected to occur in the project area, primarily due to the growth in non-project traffic. Increases in future traffic volumes in the order of 43 to 298 percent are anticipated, and traffic noise levels are expected to increase by 1.1 to 4.2 dB over current levels. Because of these increases, some existing residences within 100 feet of the roadway centerlines may be exposed to future traffic noise levels which exceed the 65 DNL FHA/HUD noise standard.

The noise from potential playground activities at the planned elementary school could disturb neighboring residents. Noise levels associated with school children's playground and playcourt activities tend to be high due to the shouting and screaming which normally occur during these outdoor activities and play periods. Anticipated noise levels at the closest residences to the project can be expected to exceed 54 dBA during these recess and play periods, and may intermittently exceed 74 to 84 dBA during screams. The presence of school buildings which are located between the residences and play areas will provide between 6 to 20 dBA of additional sound attenuation due to noise shielding effects

Unavoidable, but temporary, noise impacts may occur during construction of the proposed project, particularly during the excavation and earth moving activities on the





PROJECT LOCATION MAP AND NOISE MEASUREMENT LOCATIONS

FIGURE 1

project site. Because construction activities are predicted to be audible within the project site and at adjoining properties, the quality of the acoustic environment may be degraded to unacceptable levels during periods of construction. Mitigation measures to reduce construction noise to inaudible levels will not be practical in all cases, but the use of quiet equipment and compliance with State Department of Health construction noise regulations are recommended as standard mitigation measures.

CHAPTER II. PURPOSE

The primary objective of this study was to describe the existing and future traffic noise environment in the environs of the proposed Wailuku II Elementary School in Wailuku on the island of Maui. Traffic forecasts for 2015 were used. Traffic noise level increases and impacts associated with the proposed development were to be determined within the project site as well as along the public roadways which are expected to service the project traffic. A specific objective was to determine future traffic noise level increases associated with both project and non-project traffic, and the potential noise impacts associated with these increases.

Assessments of possible future noise impacts from playground activities at a planned elementary school were also included in the study. Impacts from short term construction noise at the project site were also included as noise study objectives. Recommendations for minimizing identified noise impacts were also to be provided as required.

CHAPTER III. NOISE DESCRIPTORS AND THEIR RELATIONSHIP TO LAND USE COMPATIBILITY

The noise descriptor currently used by federal agencies (such as FHA/HUD) to assess environmental noise is the Day-Night Average Sound Level (DNL). This descriptor incorporates a 24-hour average of instantaneous A-Weighted Sound Levels as read on a standard Sound Level Meter. By definition, the minimum averaging period for the DNL descriptor is 24 hours. Additionally, sound levels which occur during the nighttime hours of 10:00 PM to 7:00 AM are increased by 10 decibels (dB) prior to computing the 24-hour average by the DNL descriptor. A more complete list of noise descriptors is provided in APPENDIX B to this report.

TABLE 1, derived from Reference 1, presents current federal noise standards and acceptability criteria for residential land uses. TABLE 2, also extracted from Reference 1, presents the general effects of noise on people in residential use situations. Land use compatibility guidelines for various levels of environmental noise as measured by the DNL descriptor system are shown in FIGURE 2 (from Reference 2). As a general rule, noise levels of 55 DNL or less occur in rural areas, or in areas which are removed from high volume roadways. In urbanized areas which are shielded from high volume streets, DNL levels generally range from 55 to 65 DNL, and are usually controlled by motor vehicle traffic noise. Residences which front major roadways are generally exposed to levels of 65 DNL, and as high as 75 DNL when the roadway is a high speed freeway. In the project area, traffic noise levels associated with Honoapiilani Highway and Waialae Road are typically greater than 65 DNL along the Right-of-Way due to the large volume of traffic on those major thoroughfares.

For purposes of determining noise acceptability for funding assistance from federal agencies (FHA/HUD and VA), an exterior noise level of 65 DNL or less is considered acceptable for residences. This standard is applied nationally (Reference 3), including Hawaii. Because of our open-living conditions, the predominant use of naturally ventilated dwellings, and the relatively low exterior-to-interior sound attenuation afforded by these naturally ventilated structures, an exterior noise level of 65 DNL does not eliminate all risks of noise impacts. Because of these factors, and as recommended in Reference 4, a lower level of 55 DNL is considered as the "Unconditionally Acceptable" (or "Near-Zero Risk") level of exterior noise. However, after considering the cost and feasibility of applying the lower level of 55 DNL, government agencies such as FHA/HUD and VA have selected 65 DNL as a more appropriate regulatory standard.

For commercial, industrial, and other non-noise sensitive land uses, exterior noise levels as high as 75 DNL are generally considered acceptable. Exceptions to this occur when naturally ventilated office and other commercial establishments are exposed to exterior levels which exceed 65 DNL.

On the island of Maui, the State Department of Health (DOH) regulates noise from construction activities through the issuance of permits for allowing excessive

TABLE 1

EXTERIOR NOISE EXPOSURE CLASSIFICATION (RESIDENTIAL LAND USE)

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

Notes: (1) Federal Housing Administration, Veterans Administration, Department of Defense, and Department of Transportation.

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

TABLE 2

EFFECTS OF NOISE ON PEOPLE
(Residential Land Uses Only)

EFFECTS[1] / DAY-NIGHT AVERAGE SOUND LEVEL IN DECIBELS	Hearing Loss	Speech Interference		Annoyance[2]	Average Community Reaction[4]	General Community Attitude Towards Area
		Indoor	Outdoor			
	Qualitative Description	%Sentence Intelligibility	Distance in Meters for 95% Sentence Intelligibility	% of Population Highly Annoyed[3]		
75 and above	May Begin to Occur	98%	0.5	37%	Very Severe	Noise is likely to be the most important of all adverse aspects of the community environment.
70	Will Not Likely Occur	99%	0.9	25%	Severe	Noise is one of the most important adverse aspects of the community environment.
65	Will Not Occur	100%	1.5	15%	Significant	Noise is one of the important adverse aspects of the community environment.
60	Will Not Occur	100%	2.0	9%	Moderate to Slight	Noise may be considered an adverse aspect of the community environment.
55 and below	Will Not Occur	100%	3.5	4%		Noise considered no more important than various other environmental factors.

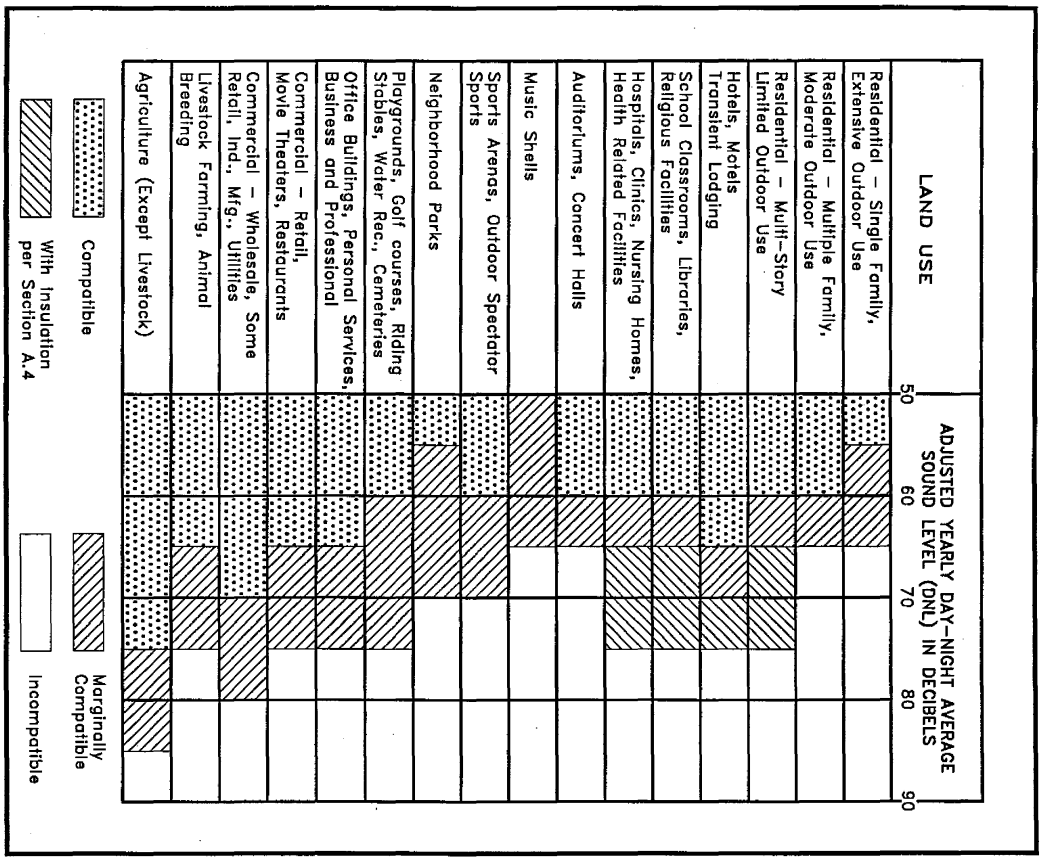
1. "Speech Interference" data are drawn from the following tables in EPA's "Levels Document": Table 3, Fig. D-1, Fig. D-2, Fig. D-3. All other data from National Academy of Science 1977 report "Guidelines for Preparing Environmental Impact Statements on Noise, Report of Working Group 69 on Evaluation of Environmental Impact of Noise."

2. Depends on attitudes and other factors.

3. The percentages of people reporting annoyance to lesser extents are higher in each case. An unknown small percentage of people will report being "highly annoyed" even in the quietest surroundings. One reason is the difficulty all people have in integrating annoyance over a very long time.

4. Attitudes or other non-acoustic factors can modify this. Noise at low levels can still be an important problem, particularly when it intrudes into a quiet environment.

NOTE: Research implicates noise as a factor producing stress-related health effects such as heart disease, high-blood pressure and stroke, ulcers and other digestive disorders. The relationships between noise and these effects, however, have not as yet been quantified.



LAND USE COMPATIBILITY WITH YEARLY AVERAGE DAY-NIGHT AVERAGE SOUND LEVEL (DNL) AT A SITE FOR BUILDINGS AS COMMONLY CONSTRUCTED.
(Source: American National Standards Institute S12.9-1998/Part 5)

FIGURE 2

noise during limited time periods. State DOH noise regulations are expressed in maximum allowable property line noise limits rather than DNL (see Reference 5). Although they are not directly comparable to noise criteria expressed in DNL, State DOH noise limits for residential, commercial, and industrial lands equate to approximately 55, 60, and 76 DNL, respectively.

CHAPTER IV. GENERAL STUDY METHODOLOGY

Existing traffic noise levels were measured at seven locations (A, B, C1, C2, D, E, and F) in the project environs to provide a basis for developing the project's traffic noise contributions along the roadways which will service the proposed development. The locations of the measurement sites are shown in FIGURE 1. Noise measurements were performed during the month of January, 2010. The results of the traffic noise measurements were compared with calculations of existing traffic noise levels to validate the computer model used. The traffic noise measurement results, and their comparisons with computer model predictions of existing traffic noise levels are summarized in TABLE 3.

Traffic noise calculations for the existing conditions as well as noise predictions for the Year 2015 were performed using the Federal Highway Administration (FHWA) Traffic Noise Model (Reference 6). Traffic data entered into the noise prediction model were: roadway and receiver locations; hourly traffic volumes, average vehicle speeds; estimates of traffic mix; and "Loose Soil" propagation loss factor. The traffic data and forecasts for the project (References 7 and 8), plus the spot traffic counts obtained during the noise measurement periods were the primary sources of data inputs to the model. APPENDIX C summarizes the AM and PM peak hour traffic volumes for CY 2009 and 2015 which were used to model existing and future traffic noise along the streets in the vicinity of the project site. For existing and future traffic along the streets in the vicinity of the project site, it was assumed that the average noise levels, or Leq(h), during the AM or PM peak traffic hour were equal to the 24-hour DNL along those roadways. This assumption was based on computations of both the hourly Leq and the 24-hour DNL of traffic noise on Honoapiilani Highway (see FIGURE 3) using State of Hawaii hourly traffic counts from Reference 9.

Traffic noise calculations for both the existing and future conditions in the project environs were developed for ground level receptors with and without the benefit of shielding from natural terrain features or man made obstructions. Traffic noise levels were also calculated for future conditions with and without the proposed project. The forecasted changes in traffic noise levels over existing levels were calculated with and without the project, and noise impact risks evaluated. The relative contributions of non-project and project traffic to the total noise levels were also calculated, and an evaluation of possible traffic noise impacts was made.

The results of the traffic noise measurements and predictions were used to determine if the elementary school buildings are in the acceptable noise zone of 65 DNL or less. In addition, the possibility of achieving the 45 dBA interior noise criteria in the naturally ventilated Cafeteria Building was evaluated.

Sound level measurements during playground activities at Waialae Elementary School on Oahu were used to predict the potential noise levels of school children during recess and/or play periods. The potential noise levels at the neighboring residences

TABLE 3

TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume AUTO	M.TRUCK	H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
A. 48 FT from the center-line of Honoapiilani Highway (1/04/10)	1555 TO 1655	45	874	4	3	66.2	66.3
A. 48 FT from the center-line of Honoapiilani Highway (1/05/10)	0700 TO 0800	45	764	5	9	66.8	66.7
B. 50 FT from the center-line of Waiale Road (1/05/10)	0815 TO 0915	45	731	21	14	67.2	66.8
C1. 50 FT from the center-line of Waiale Road (1/05/10)	0930 TO 1030	48	247	3	15	64.8	63.9
C2. 100 FT from the center-line of Waiale Road (1/05/10)	0930 TO 1030	48	247	3	15	59.3	59.4

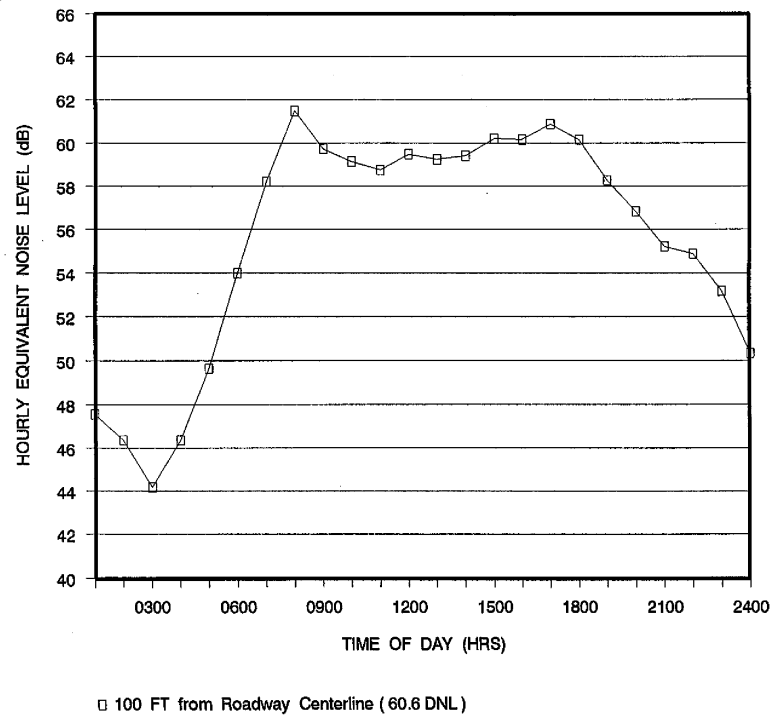
TABLE 3 (CONTINUED)

TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume AUTO	M.TRUCK	H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
D. 50 FT from the center-line of Kehalani Makai Parkway (1/05/10)	1131 TO 1231	30	33	2	8	55.8	56.5
E. 50 FT from the center-line of Kuikahi Drive (1/05/10)	1241 TO 1341	40	200	1	2	62.1	62.1
F. 50 FT from the center-line of Honoapiilani Highway (1/05/10)	1350 TO 1450	45	977	27	10	67.3	67.5
B. 50 FT from the center-line of Waiale Road (1/05/10)	1550 TO 1650	45	1,285	9	5	67.9	68.1

FIGURE 3

HOURLY VARIATIONS OF TRAFFIC NOISE AT 100 FT SETBACK DISTANCE FROM THE CENTERLINE OF HONOAPIILANI HIGHWAY AT MALAKO STREET (STA. B774003000029; APRIL 19, 2005)



due to children shouting and screaming were calculated. Calculations of average exterior and interior noise levels from construction activities were performed for typical naturally ventilated and air conditioned dwellings. Predicted noise levels were compared with existing background ambient noise levels, and the potential for noise impacts was assessed.

V. EXISTING ACOUSTICAL ENVIRONMENT

The existing background ambient noise levels within the project area are relatively low and controlled by construction activities in the project area, and distant traffic and local traffic on roadways in the project area. Traffic and background ambient noise measurements were obtained in January 2010 at seven locations (A, B, C1, C2, D, E, and F) in the project environs. These locations are shown in FIGURE 1.

The results of the traffic and background ambient noise measurements are summarized in TABLE 3, with measurement locations identified in FIGURE 1. The measurement locations were typically located at street level, except at Location D, which was on the slope of an existing berm. As shown in TABLE 3, correlation between measured and predicted traffic noise levels was good. At Location E, due to the upward slope of the roadway, measured traffic noise levels were approximately 3.5 dB greater than those predicted by the FHWA Traffic Noise Model. The Traffic Noise Model's "Loose Soil" propagation loss factor was used to obtain the good correlation.

Calculations of existing traffic noise levels during the AM or PM peak traffic hour are presented in TABLE 4. The hourly Leq (or Equivalent Sound Level) contribution from each roadway section in the project environs was calculated for comparison with forecasted traffic noise levels with and without the project. In TABLE 4, the Leq values shown also represent the DNL values for the roadways shown. The existing setback distances from the roadways' centerlines to their associated 65, 70, and 75 DNL contours were also calculated as shown in TABLE 5. The contour line setback distances do not take into account noise shielding effects or the additive contributions of traffic noise from intersecting street sections.

The existing traffic noise levels in the project environs along Honoapiilani Highway and Waiale Road are in the "Significant Exposure, Normally Unacceptable" category and greater than 65 DNL within 50 feet of the roadway's centerline. Along Kehalani Mauka Parkway (removed from Honoapiilani Highway), Olomea Street, and Kuikahi Drive, existing traffic noise levels are in the "Moderate Exposure, Acceptable" category at 50 feet or greater distance from the roadways' centerlines.

The existing residual background noise levels at the school site were estimated to be approximately 40 dBA based on measurements at Location D during the quiet periods between motor vehicle passbys. During the noise measurement period at Location D, essentially all of the motor vehicle traffic was associated with construction vehicles traveling to and from the construction site north of Location D. Because the total number of vehicle passbys was relatively small, background noise levels at Location D dropped to approximately 40 dBA during the quieter periods.

TABLE 4

EXISTING (CY 2009) TRAFFIC VOLUMES AND NOISE LEVELS ALONG ROADWAYS IN PROJECT AREA (AM OR PM PEAK HOUR)

LOCATION	SPEED (MPH)	TOTAL VPH	****** VOLUMES (VPH) ******** AUTOS	M TRUCKS	H TRUCKS	50' Leq	100' Leq	150' Leq
Honoapiilani Hwy. N. of Kehalani Mauka Prkwy.	45	1,060	1,047	5	8	67.7	62.9	60.1
Honoapiilani Hwy. S. of Kehalani Mauka Prkwy.	45	815	804	4	7	66.6	61.8	58.9
Kehalani Mauka Prkwy. W. of Honoapiilani Hwy.	40	415	409	2	4	65.8	61.0	57.9
Kehalani Mauka Prkwy. E. of Honoapiilani Hwy.	30	290	286	1	3	58.1	53.2	50.7
Kehalani Mauka Prkwy. Fronting School Site	30	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Honoapiilani Hwy. N. of Kuikahi Dr.	45	890	879	4	7	67.0	62.2	59.3
Honoapiilani Hwy. S. of Kuikahi Dr.	45	1,425	1,373	38	14	69.4	64.7	61.8
Kuikahi Dr. W. of Honoapiilani Hwy.	40	315	310	2	3	64.3	59.1	55.8
Kuikahi Dr. E. of Honoapiilani Hwy.	35	780	751	21	8	63.8	59.2	56.4
Waiale Rd. N. of Olomea St.	45	1,540	1,497	26	17	69.0	63.2	60.3
Waiale Rd. S. of Olomea St.	45	1,278	1,242	22	14	68.6	63.4	60.1
Olomea St. W. of Waiale Rd.	40	326	321	2	3	60.9	55.8	52.4
Waiale Rd. N. of Kuikahi Dr.	45	1,020	992	17	11	67.2	61.4	58.5
Waiale Rd. S. of Kuikahi Dr.	48	450	419	5	26	65.8	60.2	57.5
Kuikahi Dr. W. of Waiale Rd.	35	715	689	19	7	62.8	57.1	54.4
Kuikahi Dr. E. of Waiale Rd.	30	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TABLE 5

EXISTING AND CY 2015 DISTANCES TO 65, 70, AND 75 DNL CONTOURS

STREET SECTION	65 DNL SETBACK (FT)		70 DNL SETBACK (FT)		75 DNL SETBACK (FT)	
	EXISTING	CY 2015	EXISTING	CY 2015	EXISTING	CY 2015
Honoapiilani Hwy. N. of Kehalani Mauka Prkwy.	74	87	36	42	17	20
Honoapiilani Hwy. S. of Kehalani Mauka Prkwy.	63	85	31	41	15	20
Kehalani Mauka Prkwy. W. of Honoapiilani Hwy.	56	103	27	50	13	24
Kehalani Mauka Prkwy. E. of Honoapiilani Hwy.	19	28	9	14	5	7
Kehalani Mauka Prkwy. Fronting School Site	N/A	25	N/A	14	N/A	8
Honoapiilani Hwy. N. of Kuikahi Dr.	67	96	32	47	16	23
Honoapiilani Hwy. S. of Kuikahi Dr.	96	122	46	59	22	28
Kuikahi Dr. W. of Honoapiilani Hwy.	46	76	23	39	12	20
Kuikahi Dr. E. of Honoapiilani Hwy.	42	69	20	33	9	16
Waiale Rd. N. of Olomea St.	81	93	44	52	24	29
Waiale Rd. S. of Olomea St.	81	95	41	49	21	25
Olomea St. W. of Waiale Rd.	29	34	15	17	7	9
Waiale Rd. N. of Kuikahi Dr.	65	89	36	49	20	27
Waiale Rd. S. of Kuikahi Dr.	55	69	30	37	16	20
Kuikahi Dr. W. of Waiale Rd.	43	58	24	31	13	17
Kuikahi Dr. E. of Waiale Rd.	N/A	72	N/A	37	N/A	19

Notes:

(1) All setback distances are from the roadways' centerlines.
(2) See TABLES 4 and 6 for traffic volume, speed, and mix assumptions.
(3) Setback distances are for ground level receptors.
(4) "Loose Soil" conditions assumed along all roadways.

CHAPTER VI. FUTURE NOISE ENVIRONMENT

Predictions of future traffic noise levels were made using the traffic volume assignments of References 7 and 8 for CY 2015 with and without the proposed project. The future projections of project plus non-project traffic noise levels on the roadways which would service the project are shown in TABLE 6 for the AM or PM peak hour of traffic, under the Build Alternative. The separate non-project and project traffic noise contributions for the Build Alternative are shown in TABLE 7. Predicted increases in the setback distances to the 65, 70, and 75 DNL contours are shown in TABLE 5.

Very small changes in traffic noise levels (0.0 to 0.3 DNL) are expected in the project environs between CY 2009 and 2015 as a result of project traffic. The growth in non-project traffic by CY 2015 is predicted to result in traffic noise level increases of 1.1 to 4.0 DNL. By CY 2015, traffic noise levels in the project area are expected to increase primarily due to the anticipated growth in non-project traffic, and it will be difficult to determine the increases in future traffic noise associated with the project traffic.

The dominant traffic noise sources in the project area will continue to be traffic along Honoapiilani Highway and Waiale Road, with the increases in traffic noise levels along Kehalani Mauka Parkway and Kuikahi Drive being noticeable. All of these changes in future traffic noise levels in the immediate vicinity of the project site are the result of anticipated increases in non-project traffic as the surrounding residential area is developed.

Future traffic noise levels on the proposed school site from forecasted traffic along Kehalani Mauka Parkway are anticipated to range from 45 DNL near the future Cafeteria Building C to 52 dBA near the future Administration Building A. The future Cafeteria Building C will benefit from approximately 6 dB of the noise shielding effects which result from the terracing of the school grounds. The future Administration Building A will not benefit from noise shielding effects resulting from the terracing of the school grounds. The Administration and classroom buildings of the future Wailuku II Elementary School are expected to be air conditioned, so it should be possible to achieve acceptable interior noise levels within these spaces. Although the Student Dining Room in the Cafeteria Building will be naturally ventilated, the relatively low future noise level of 45 DNL outside the building should result in acceptable interior noise levels in the Student Dining Room.

TABLE 6

FUTURE (CY 2015) TRAFFIC VOLUMES AND NOISE LEVELS ALONG ROADWAYS IN PROJECT AREA (AM OR PM PEAK HOUR, BUILD)

LOCATION	SPEED (MPH)	TOTAL VPH	****** VOLUMES (VPH) ******** AUTOS	M TRUCKS	H TRUCKS	50' Leq	100' Leq	150' Leq
Honoapiilani Hwy. N. of Kehalani Mauka Prkwy.	45	1,360	1,342	7	11	68.8	64.0	61.2
Honoapiilani Hwy. S. of Kehalani Mauka Prkwy.	45	1,365	1,347	7	11	68.7	63.9	61.0
Kehalani Mauka Prkwy. W. of Honoapiilani Hwy.	40	1,075	1,059	5	11	70.0	65.2	62.0
Kehalani Mauka Prkwy. E. of Honoapiilani Hwy.	30	580	571	3	6	61.0	56.2	53.8
Kehalani Mauka Prkwy. Fronting School Site	40	503	495	3	5	59.2	53.4	50.3
Honoapiilani Hwy. N. of Kuikahi Dr.	45	1,595	1,574	8	13	69.5	64.7	61.9
Honoapiilani Hwy. S. of Kuikahi Dr.	45	2,120	2,042	57	21	71.1	66.4	63.5
Kuikahi Dr. W. of Honoapiilani Hwy.	40	750	738	4	8	68.1	63.0	59.6
Kuikahi Dr. E. of Honoapiilani Hwy.	35	1,710	1,647	46	17	67.2	62.5	59.8
Waiale Rd. N. of Olomea St.	45	2,055	1,997	35	23	70.3	64.4	61.5
Waiale Rd. S. of Olomea St.	45	1,688	1,640	29	19	69.8	64.6	61.3
Olomea St. W. of Waiale Rd.	40	446	440	2	4	62.2	57.1	53.7
Waiale Rd. N. of Kuikahi Dr.	45	1,855	1,803	32	20	69.9	64.0	61.1
Waiale Rd. S. of Kuikahi Dr.	48	680	634	7	39	67.6	62.0	59.2
Kuikahi Dr. W. of Waiale Rd.	35	1,565	1,507	42	16	66.2	60.6	57.8
Kuikahi Dr. E. of Waiale Rd.	30	1,187	1,169	6	12	66.7	61.5	58.5

TABLE 7

CALCULATIONS OF PROJECT AND NON-PROJECT TRAFFIC NOISE CONTRIBUTIONS (CY 2015) (AM OR PM PEAK HOUR, DNL)

STREET SECTION	NOISE LEVEL INCREASE DUE TO: NON-PROJECT TRAFFIC	PROJECT TRAFFIC
Honoapiilani Hwy. N. of Kehalani Mauka Prkwy.	1.1	0.0
Honoapiilani Hwy. S. of Kehalani Mauka Prkwy.	2.2	-0.1
Kehalani Mauka Prkwy. W. of Honoapiilani Hwy.	4.0	0.2
Kehalani Mauka Prkwy. E. of Honoapiilani Hwy.	2.9	0.0
Kehalani Mauka Prkwy. Fronting School Site	N/A	0.3
Honoapiilani Hwy. N. of Kuikahi Dr.	2.5	0.0
Honoapiilani Hwy. S. of Kuikahi Dr.	1.7	0.0
Kuikahi Dr. W. of Honoapiilani Hwy.	3.8	0.0
Kuikahi Dr. E. of Honoapiilani Hwy.	3.4	0.0
Waiale Rd. N. of Olomea St.	1.3	0.0
Waiale Rd. S. of Olomea St.	1.2	0.0
Olomea St. W. of Waiale Rd.	1.2	0.1
Waiale Rd. N. of Kuikahi Dr.	2.6	0.1
Waiale Rd. S. of Kuikahi Dr.	1.8	0.0
Kuikahi Dr. W. of Waiale Rd.	3.4	0.0
Kuikahi Dr. E. of Waiale Rd.	N/A	0.0

CHAPTER VII. DISCUSSION OF PROJECT-RELATED NOISE IMPACTS AND POSSIBLE MITIGATION MEASURES

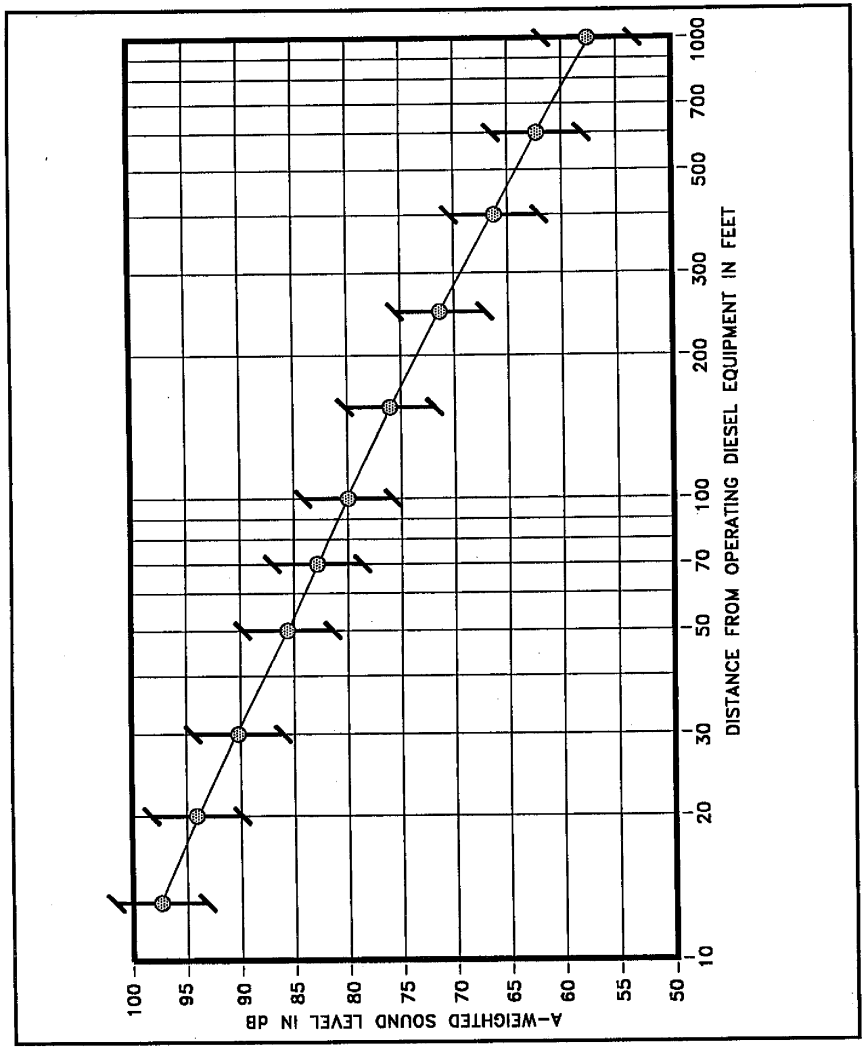
Traffic Noise. Noise impacts from project related traffic along the roadways which are expected to service the project are not expected due to the very low levels of traffic noise increases associated with project traffic. For this reason, traffic noise mitigation measures should not be required.

General Construction Noise. Audible construction noise will probably be unavoidable during the entire project construction period. The total time period for construction is unknown, but it is anticipated that the actual work will be moving from one location on the project site to another during that period. Actual length of exposure to construction noise at any receptor location will probably be less than the total construction period for the entire project. Typical levels of exterior noise from construction activity (excluding pile driving activity) at various distances from the job site are shown in FIGURE 4. The impulsive noise levels of impact pile drivers are approximately 15 dB higher than the levels shown in FIGURE 4, while the intermittent noise levels of vibratory pile drivers are at the upper end of the noise level ranges depicted in the figure.

FIGURE 4 is useful for predicting exterior noise levels at short distances (within 100 FT) from the work when visual line of sight exists between the construction equipment and the receptor. Direct line-of-sight distances from the construction equipment to existing residential buildings will range from 120 FT to 600 FT, with corresponding average noise levels of 78 to 62 dBA (plus or minus 5 dBA). Typical levels of construction noise inside naturally ventilated and air conditioned structures are approximately 10 and 20 dB less, respectively, than the levels shown in FIGURE 4.

The existing residences across Kehalani Mauka Parkway east of the school site are predicted to experience the highest noise levels during construction activities due to their closer proximity to the construction site. Adverse impacts from construction noise are not expected to be in the "public health and welfare" category due to the temporary nature of the work, and due to the administrative controls available for regulation of construction noise. Instead, these impacts will probably be limited to the temporary degradation of the quality of the acoustic environment in the immediate vicinity of the project site.

Mitigation of construction noise to inaudible levels will not be practical in all cases due to the intensity of construction noise sources (80 to 90+ dB at 50 FT distance), and due to the exterior nature of the work (pile driving, grading and earth moving, trenching, concrete pouring, hammering, etc.). The use of properly muffled construction equipment should be required on the job site.



ANTICIPATED RANGE OF CONSTRUCTION NOISE LEVELS VS. DISTANCE

FIGURE 4

Peak airborne noise levels from pile diving may be as much as 15 dBA greater than noise levels shown in FIGURE 4 for non-impulsive (steady) construction noise sources. Although the pile driving can produce more intense noise levels, each pulse is of short individual duration (less than one second). Therefore, its impact on speech communication is not as severe as that of steady source of the same noise level.

Severe noise impacts are not expected to occur inside air conditioned structures which are within 120 to 600 FT of the project construction site. Inside naturally ventilated structures, interior noise levels (with windows or doors opened) are estimated to range between 69 to 53 dBA at 120 FT to 600 FT distances from the construction site. Closure of all doors and windows facing the construction site would generally reduce interior noise levels by an additional 5 to 10 dBA.

The incorporation of State Department of Health construction noise limits and curfew times, which are applicable throughout the State of Hawaii (Reference 5), is another noise mitigation measure which is normally applied to construction activities. FIGURE 5 depicts the normally permitted hours of construction. Noisy construction activities are not allowed on Sundays and holidays, during the early morning, and during the late evening and nighttime periods under the DOH permit procedures.

Playground Noise. The new elementary school will include approximately 5 playground areas which will be dispersed within the school property boundaries. Distances between the planned playground areas and existing residences to the east across Kehalani Mauka Parkway are in exceess of 300 feet. Measured noise levels during recess and play periods at Waialae Elementary School on Oahu are shown in FIGURES 6 and 7. Distances to the children during the measurement periods ranged from 50 feet to 90 feet. As shown in the figures, noise levels during activities in the playground and playcourt areas will typically exceed 70 dBA at 50 feet, and can approach 90 dBA during shouting. Screams can exceed 100 dBA at 50 feet. At 300 feet distance, playground noise should be approximately 16 dBA lower than the levels at 50 feet distance.

Potential noise impacts from student activities within the school playground and playcourt areas are possible due to the relatively high noise levels normally associated with these types of activities. The location of playground equipment and playcourts as far as possible from existing residences is a noise mitigation measure which has been considered. In addition, most of the playground areas are located within the courtyards of classroom buildings, which should provide between 15 to 20 dBA of additional sound attenuation due to noise shielding effects from the buildings.

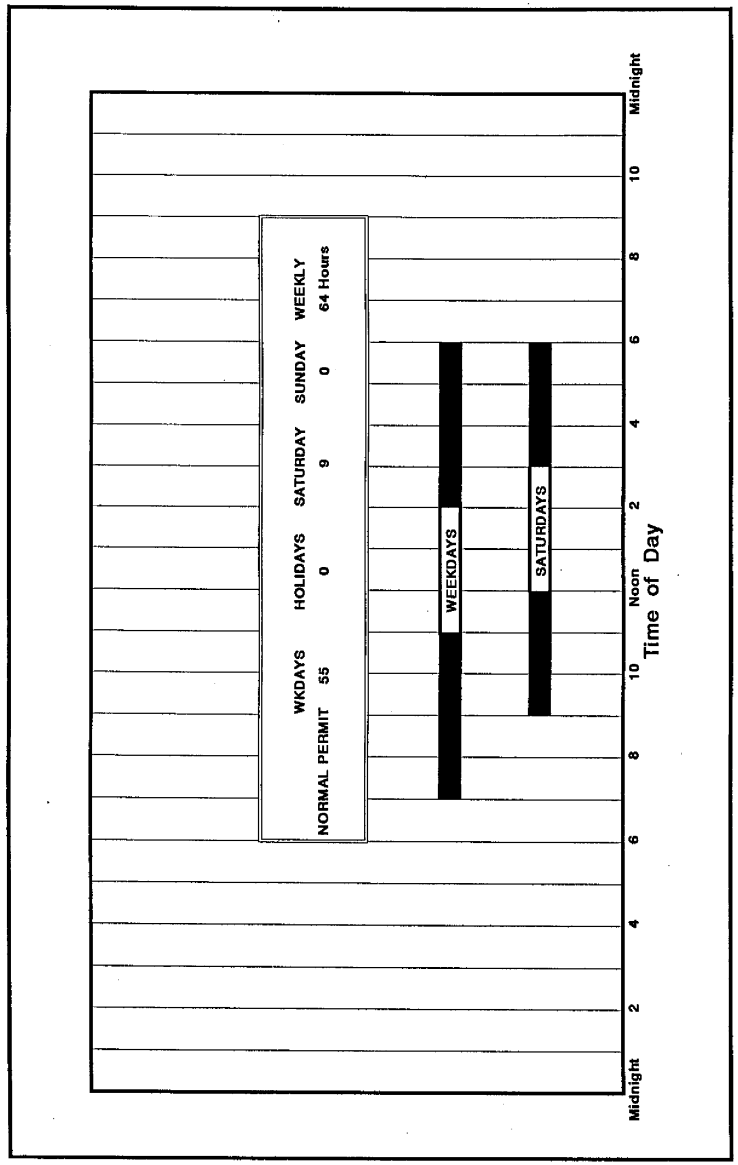
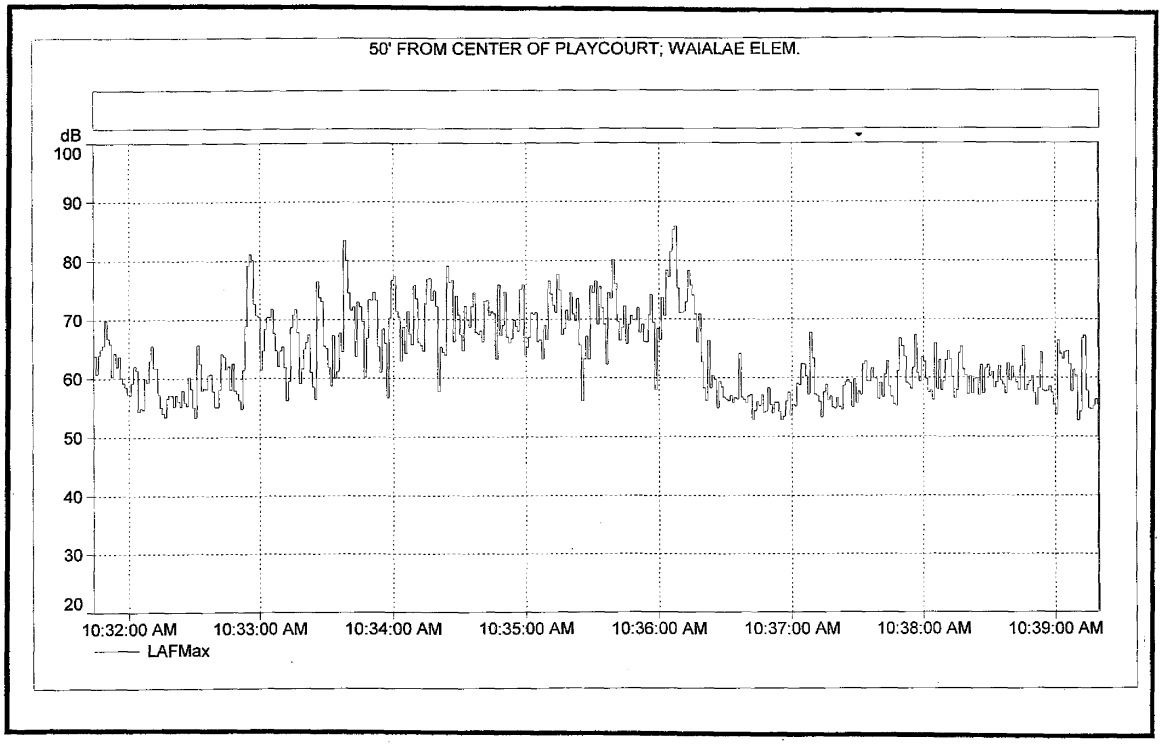


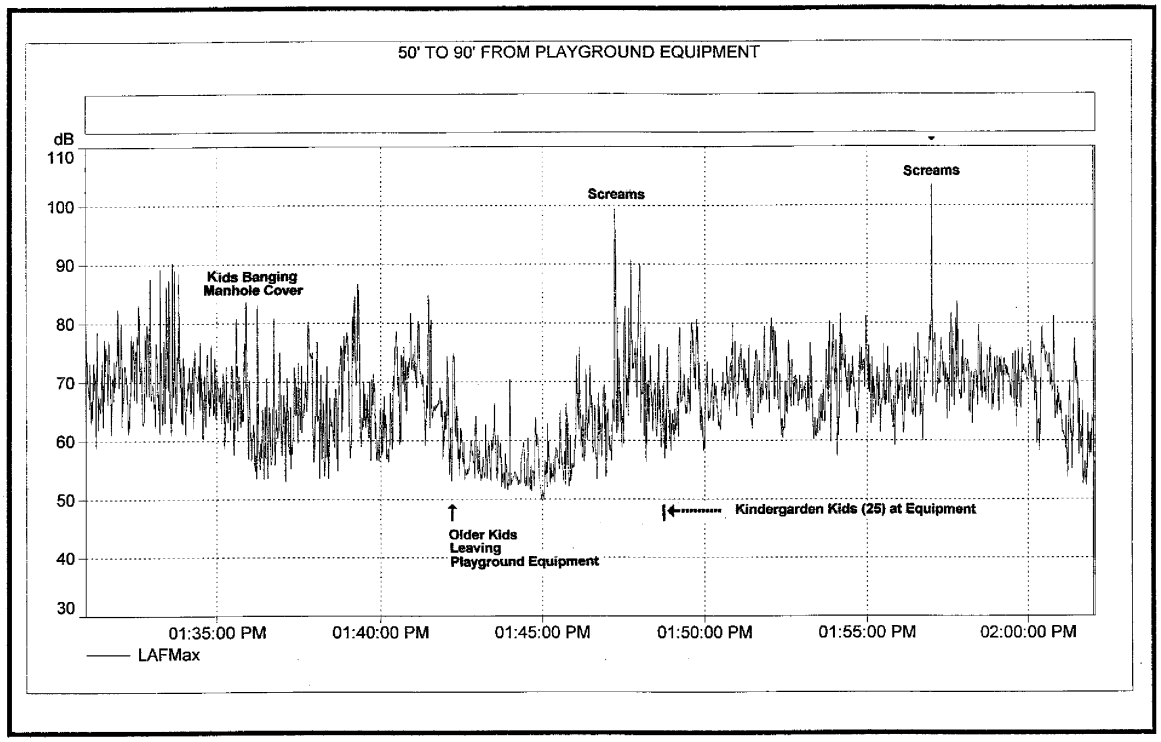
FIGURE 5

AVAILABLE WORK HOURS UNDER DOH PERMIT PROCEDURES FOR CONSTRUCTION NOISE



DBA VS. TIME HISTORY OF SOUND LEVELS DURING STUDENT PLAYCOURT ACTIVITIES

FIGURE 6



DBA VS. TIME HISTORY OF SOUND LEVELS DURING STUDENT USE OF PLAYGROUND EQUIPMENT

FIGURE 7

APPENDIX A. REFERENCES

(1) "Guidelines for Considering Noise in Land Use Planning and Control;" Federal Interagency Committee on Urban Noise; June 1980.

(2) American National Standard, "Sound Level Descriptors for Determination of Compatible Land Use," ANSI S12.9-1998/ Part 5; Acoustical Society of America.

(3) "Environmental Criteria and Standards, Noise Abatement and Control, 24 CFR, Part 51, Subpart B;" U.S. Department of Housing and Urban Development; July 12, 1979.

(4) "Information on Levels of Environmental Noise Requisite to Protect the Public Health and Welfare with an Adequate Margin of Safety;" U.S. Environmental Protection Agency; EPA 550/9-74- 004; March 1974.

(5) "Title 11, Administrative Rules, Chapter 46, Community Noise Control;" Hawaii State Department of Health; September 23, 1996.

(6) "FHWA Highway Traffic Noise Model User's Guide;" FHWA-PD-96-009, Federal Highway Administration; Washington, D.C.; January 1998 and Version 2.5 Upgrade (April 14, 2004).

(7) "Wailuku II Elementary School, Traffic Impact Analysis Report;" AECOM; December 2009.

(8) Forecast of 2015 Traffic Volumes On Kehalani Mauka Parkway Fronting Project Site; Email from Warren Yamamoto to Group 70 International; December 16, 2009.

(9) Hourly Traffic Counts At Station B74003000029, Honoapiilani Highway - Malako Street to Speed Limit 35; Hawaii State Department of Transportation; April 19, 2005.

APPENDIX B

EXCERPTS FROM EPA'S ACOUSTIC TERMINOLOGY GUIDE

Descriptor Symbol Usage

The recommended symbols for the commonly used acoustic descriptors based on A-weighting are contained in Table I. As most acoustic criteria and standards used by EPA are derived from the A-weighted sound level, almost all descriptor symbol usage guidance is contained in Table I.

Since acoustic nomenclature includes weighting networks other than "A" and measurements other than pressure, an expansion of Table I was developed (Table II). The group adopted the ANSI descriptor-symbol scheme which is structured into three stages. The first stage indicates that the descriptor is a level (i.e., based upon the logarithm of a ratio), the second stage indicates the type of quantity (power, pressure, or sound exposure), and the third stage indicates the weighting network (A, B, C, D, E.....). If no weighting network is specified, "A" weighting is understood. Exceptions are the A-weighted sound level and the A-weighted peak sound level which require that the "A" be specified. For convenience in those situations in which an A-weighted descriptor is being compared to that of another weighting, the alternative column in Table II permits the inclusion of the "A". For example, a report on blast noise might wish to contrast the LCdn with the LAdn.

Although not included in the tables, it is also recommended that "Lpn" and "LepN" be used as symbols for perceived noise levels and effective perceived noise levels, respectively.

It is recommended that in their initial use within a report, such terms be written in full, rather than abbreviated. An example of preferred usage is as follows:

The A-weighted sound level (LA) was measured before and after the installation of acoustical treatment. The measured LA values were 85 and 75 dB respectively.

Descriptor Nomenclature

With regard to energy averaging over time, the term "average" should be discouraged in favor of the term "equivalent". Hence, Leq, is designated the "equivalent sound level". For Ld, Ln, and Ldn, "equivalent" need not be stated since the concept of day, night, or day-night averaging is by definition understood. Therefore, the designations are "day sound level", "night sound level", and "day-night sound level", respectively.

The peak sound level is the logarithmic ratio of peak sound pressure to a reference pressure and not the maximum root mean square pressure. While the latter is the maximum sound pressure level, it is often incorrectly labelled peak. In that sound level meters have "peak" settings, this distinction is most important.

"Background ambient" should be used in lieu of "background", "ambient", "residual", or "indigenous" to describe the level characteristics of the general background noise due to the contribution of many unidentifiable noise sources near and far.

With regard to units, it is recommended that the unit decibel (abbreviated dB) be used without modification. Hence, DBA, PNdB, and EPNdB are not to be used. Examples of this preferred usage are: the Perceived Noise Level (Lpn was found to be 75 dB. Lpn = 75 dB). This decision was based upon the recommendation of the National Bureau of Standards, and the policies of ANSI and the Acoustical Society of America, all of which disallow any modification of bel except for prefixes indicating its multiples or submultiples (e.g., deci).

Noise Impact

In discussing noise impact, it is recommended that "Level Weighted Population" (LWP) replace "Equivalent Noise Impact" (ENI). The term "Relative Change of Impact" (RCI) shall be used for comparing the relative differences in LWP between two alternatives.

Further, when appropriate, "Noise Impact Index" (NII) and "Population Weighed Loss of Hearing" (PHL) shall be used consistent with CHABA Working Group 69 Report Guidelines for Preparing Environmental Impact Statements (1977).

APPENDIX B (CONTINUED)

TABLE I

A-WEIGHTED RECOMMENDED DESCRIPTOR LIST

TERM	SYMBOL
1. A-Weighted Sound Level	L_A
2. A-Weighted Sound Power Level	L_{WA}
3. Maximum A-Weighted Sound Level	L_{max}
4. Peak A-Weighted Sound Level	L_{Apk}
5. Level Exceeded x% of the Time	L_x
6. Equivalent Sound Level	L_{eq}
7. Equivalent Sound Level over Time (T) (1)	$L_{eq(T)}$
8. Day Sound Level	L_d
9. Night Sound Level	L_n
10. Day-Night Sound Level	L_{dn}
11. Yearly Day-Night Sound Level	$L_{dn(Y)}$
12. Sound Exposure Level	L_{SE}

(1) Unless otherwise specified, time is in hours (e.g. the hourly equivalent level is $L_{eq(1)}$). Time may be specified in non-quantitative terms (e.g., could be specified a $L_{eq(WASH)}$ to mean the washing cycle noise for a washing machine).

SOURCE: EPA ACOUSTIC TERMINOLOGY GUIDE, BNA 8-14-78,

APPENDIX B (CONTINUED)

TABLE II

RECOMMENDED DESCRIPTOR LIST

TERM	A-WEIGHTING	ALTERNATIVE(1) A-WEIGHTING	OTHER(2) WEIGHTING	UNWEIGHTED
1. Sound (Pressure)(3) Level	L_A	L_{pA}	L_B, L_{pB}	L_p
2. Sound Power Level	L_{WA}		L_{WB}	L_W
3. Max. Sound Level	L_{max}	L_{Amax}	L_{Bmax}	L_{pmax}
4. Peak Sound (Pressure) Level	L_{Apk}		L_{Bpk}	L_{pk}
5. Level Exceeded x% of the Time	L_x	L_{Ax}	L_{Bx}	L_{px}
6. Equivalent Sound Level	L_{eq}	L_{Aeq}	L_{Beq}	L_{peq}
7. Equivalent Sound Level (4) Over Time(T)	$L_{eq(T)}$	$L_{Aeq(T)}$	$L_{Beq(T)}$	$L_{peq(T)}$
8. Day Sound Level	L_d	L_{Ad}	L_{Bd}	L_{pd}
9. Night Sound Level	L_n	L_{An}	L_{Bn}	L_{pn}
10. Day-Night Sound Level	L_{dn}	L_{Adn}	L_{Bdn}	L_{pdn}
11. Yearly Day-Night Sound Level	$L_{dn(Y)}$	$L_{Adn(Y)}$	$L_{Bdn(Y)}$	$L_{pdn(Y)}$
12. Sound Exposure Level	L_S	L_{SA}	L_{SB}	L_{Sp}
13. Energy Average Value Over (Non-Time Domain) Set of Observations	$L_{eq(e)}$	$L_{Aeq(e)}$	$L_{Beq(e)}$	$L_{peq(e)}$
14. Level Exceeded x% of the Total Set of (Non-Time Domain) Observations	$L_{x(e)}$	$L_{Ax(e)}$	$L_{Bx(e)}$	$L_{px(e)}$
15. Average L_x Value	L_x	L_{Ax}	L_{Bx}	L_{px}

(1) "Alternative" symbols may be used to assure clarity or consistency.

(2) Only B-weighting shown. Applies also to C,D,E,.....weighting.

(3) The term "pressure" is used only for the unweighted level.

(4) Unless otherwise specified, time is in hours (e.g., the hourly equivalent level is Leq(1). Time may be specified in non-quantitative terms (e.g., could be specified as Leq(WASH) to mean the washing cycle noise for a washing machine.

APPENDIX C

SUMMARY OF BASE YEAR AND YEAR 2015 TRAFFIC VOLUMES

ROADWAY LANES	**** CY 2009 ***** AM VPH	PM VPH	CY 2015 (NO BUILD) AM VPH	PM VPH	CY 2015 (BUILD) AM VPH	PM VPH
Honoapiilani Hwy. N. of Kehalani Mauka Prkwy. (NB)	745	450	920	660	930	660
Honoapiilani Hwy. N. of Kehalani Mauka Prkwy. (SB)	315	470	420	655	430	660
Two-Way	1,060	920	1,340	1,315	1,360	1,320
Honoapiilani Hwy. S. of Kehalani Mauka Prkwy. (NB)	490	425	675	825	695	835
Honoapiilani Hwy. S. of Kehalani Mauka Prkwy. (SB)	325	345	575	525	600	530
Two-Way	815	770	1,250	1,350	1,295	1,365
Kehalani Mauka Prkwy. W. of Honoapiilani Hwy. (WB)	140	240	260	715	300	740
Kehalani Mauka Prkwy. W. of Honoapiilani Hwy. (EB)	275	120	580	330	625	335
Two-Way	415	360	840	1,045	925	1,075
Kehalani Mauka Prkwy. E. of Honoapiilani Hwy. (WB)	210	115	245	330	255	340
Kehalani Mauka Prkwy. E. of Honoapiilani Hwy. (EB)	80	95	165	240	175	240
Two-Way	290	210	410	570	430	580
Honoapiilani Hwy. N. of Kuikahi Dr. (NB)	480	435	675	835	695	840
Honoapiilani Hwy. N. of Kuikahi Dr. (SB)	400	455	665	750	690	755
Two-Way	880	890	1,340	1,585	1,385	1,595
Honoapiilani Hwy. S. of Kuikahi Dr. (NB)	770	720	1,035	1,125	1,050	1,130
Honoapiilani Hwy. S. of Kuikahi Dr. (SB)	655	645	1,055	885	1,070	890
Two-Way	1,425	1,365	2,090	2,010	2,120	2,020
Kuikahi Dr. W. of Honoapiilani Hwy. (WB)	60	150	145	530	145	530
Kuikahi Dr. W. of Honoapiilani Hwy. (EB)	255	125	605	165	605	165
Two-Way	315	275	750	695	750	695
Kuikahi Dr. E. of Honoapiilani Hwy. (WB)	275	280	560	960	565	960
Kuikahi Dr. E. of Honoapiilani Hwy. (EB)	505	350	990	750	1,000	750
Two-Way	780	630	1,550	1,710	1,565	1,710
Waiale Rd. N. of Olomea St. (NB)	1,005	525	1,285	850	1,290	850
Waiale Rd. N. of Olomea St. (SB)	535	730	755	1,165	765	1,170
Two-Way	1,540	1,255	2,040	2,015	2,055	2,020
Waiale Rd. S. of Olomea St. (NB)	875	415	1,090	710	1,090	710
Waiale Rd. S. of Olomea St. (SB)	403	551	598	906	598	906
Two-Way	1,278	966	1,688	1,616	1,688	1,616

APPENDIX C (CONTINUED)

SUMMARY OF BASE YEAR AND YEAR 2015 TRAFFIC VOLUMES

ROADWAY LANES	**** CY 2009 ***** AM VPH	PM VPH	CY 2015 (NO BUILD) AM VPH	PM VPH	CY 2015 (BUILD) AM VPH	PM VPH
Olomea St. W. of Waiale Rd. (WB)	166	195	201	280	211	285
Olomea St. W. of Waiale Rd. (EB)	160	115	230	150	235	150
Two-Way	326	310	431	430	446	435
Waiale Rd. N. of Kuikahi Dr. (NB)	680	445	875	840	880	845
Waiale Rd. N. of Kuikahi Dr. (SB)	340	495	520	1,010	520	1,010
Two-Way	1,020	940	1,395	1,850	1,400	1,855
Waiale Rd. S. of Kuikahi Dr. (NB)	295	235	390	322	390	322
Waiale Rd. S. of Kuikahi Dr. (SB)	140	215	290	305	290	305
Two-Way	435	450	680	627	680	627
Kuikahi Dr. W. of Waiale Rd. (WB)	265	375	490	945	500	945
Kuikahi Dr. W. of Waiale Rd. (EB)	450	305	860	615	890	620
Two-Way	715	680	1,350	1,560	1,390	1,565
Kuikahi Dr. E. of Waiale Rd. (WB)	N/A	N/A	235	660	250	665
Kuikahi Dr. E. of Waiale Rd. (EB)	N/A	N/A	350	517	380	522
Two-Way	N/A	N/A	585	1,177	630	1,187
Kehalani Mauka Pkwy. @ School (NB)	N/A	N/A	83	317	159	343
Kehalani Mauka Pkwy. @ School (SB)	N/A	N/A	250	156	279	160
Two-Way	N/A	N/A	333	473	438	503

Notes:
1. Existing AM or PM Peak Hour traffic counts not available for Kehalani Mauka Parkway fronting Wailuku II Elementary School site.
2. CY 2015 future traffic forecasts for Kehalani Mauka Parkway fronting Wailuku II Elementary School provided by separate email dated 12/16/09.

3-5-001:por 1

Final

SCS Project 396-2

AN INTERMEDIATE ZONE ARCHAEOLOGY INVENTORY SURVEY LOCATED IN WAILUKU, WAILUKU AHUPUA`A, WAILUKU (KULA) DISTRICT, MAUI ISLAND, HAWAI`I [TMK:3-5-001:portion of 001]

Michael F. Dega, Ph.D.

Revised January 2004

Prepared for:
Stanford Carr
Amfac Center, Hawaii Tower
745 Fort St., Ste. 2110
Honolulu, HI 96813

SCIENTIFIC CONSULTANT SERVICES Inc.

711 Kapiolani Blvd. Suite 975 Honolulu, Hawai`i 96813

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ABSTRACT

Archaeological Inventory Survey was conducted on 348.613 acres of arid land that composed one large land tract (Lot 1) in Wailuku near Waikapu, Wailuku Ahupua`a, Wailuku District, Maui Island, Hawai`i (TMK 3-5-001:portion of 001). The Inventory Survey included historic background research and settlement pattern analysis prior to fieldwork, a complete pedestrian survey of the project area, representative subsurface testing, and reporting. This is the second Inventory Survey report produced for the Kehalani Mauka Subdivision area.

Eight historic sites were documented during this Inventory Survey, two of which were recorded during a previous project. State Site Number 50-50-04-5473 represents Hopoi Reservoir. This reservoir predates Hopoi Camp and was present at least by 1922. Hopoi Camp was not identified during this survey. Occurring just to the east of the reservoir and running north-south to Waikapu, State Site Number 50-50-04-5474, is Kama Ditch, a water conduit coursing across the dry southern landscape. State Site Number 50-50-04-5493 has been designated for another (unnamed) north-south running ditch occurring along the western flank of the parcel. State Site Number 50-50-04-5197 represents Waihee Ditch, which was constructed between 1905 and 1907. The four other sites consist of a combination of historic-modern roadways (State Site No. 50-50-04-5489), a system of smaller historic ditches (State Site No. 50-50-04-5490), a historic artifact scatter on the surface (State Site No. 50-50-04-5491), and several clearing mounds likely created during the plantation era (State Site No. 50-50-04-5492). Extensive survey and refined testing in the area of isolated finds failed to yield many additional artifacts or cultural deposits. Representative subsurface testing (27 trenches) in the project area primarily revealed homogenous soil matrices across this open, barren intermediate area.

Eight sites, designated as State Site Number 50-50-04-5473, -5474, -5197, -5489, -5490, -5491, -5492, and -5493 were identified (or re-identified) during this research. All eight sites, representing historic period activities on the parcel, were assessed as significant under Criterion D. Based on the results of this project and depth of documentation, no additional archaeological mitigation is recommended for this project area. However, SHPD and SCS will be notified by the contractor when large-scale ground work is scheduled for Lot 16 so that SHPD and the SCS archaeologist may view the area for any remnants of Hopoi Camp.

Jan. 14. 2004 8:05AM SCIENTIFIC CONSULTAN SERVICES, Inc.

711 Kapiolani Blvd., Suite 1475 Honolulu, Hawai'i 96813

PH: 808-597-1182 FAX: 808-597-1193

FAX or TRANSMITTAL MEMORANDUM

To: Dr. Melissa Kirkendall Date: Jan 15, 04

Firm: SHPD - Maui Phone: —

Address: Wailuku, HI Fax: 243-5838

The following is being sent to you: ✓ By Fax ___ Enclosed ___ Under Separate Cover

___ SCS Report(s) ___ Contract(s) ___ Billing(s) ___ Bid ✓ Other

Enclosed: Item:

___ Replacement pages

___

___

( ) For your files
( ) For your client
( ) For review and comment
( ) For your signature and return
( ) Submitted as a "DRAFT"
( ) Submitted as a "FINAL"
(✓) For necessary action
( ) As requested
( ) As per our conversation

Comments: Hey Mk: we looked @ USGS office in Honolulu for 1922 Wailuku quad but they do not have that one (they all the rest) they are still looking :) Shb, take care out there!

Mahalo,

For SCS: M. Dye

Spear / Chaffee / Dega / McGerty / Buffum / Pestana / Tome / Calis / Baker

Robert Spear. Ph.D.
Scientific Consultant Services, Inc
711 Kapiolani Boulevard, Suite 975
Honolulu, HI 96813

LOG NO:
DOC NOC: 0401MK07

Dear Dr. Spear,

Subject: **Historic Preservation Review - 6E-42 - Archaeological Inventory Survey**
Large Lot Subdivision (Subdivision No. 3.2059) [County/DSA]
Wailuku Ahupua'a, Wailuku District, Maui
TMK (2) 3-5-001: por of 001 (Lots 2, 3, 5-14, 16-19, 20, 22, and 23)

Thank you for the opportunity to review this report which our staff received on 14 November 2003 (Dega 2003, *An Intermediate Zone Archaeology Inventory Survey Located in Wailuku, Wailuku Ahupua'a, Wailuku [Kula] District, Maui Island, Hawai'i [TMK 3-5-001: Portion of 001]*...SCS ms. We have previously commented on this action, most recently on December 16, 2003 (Log 2003.2556/Doc 0312MK13), when we approved the subdivision action pending the review of this report on the condition that no ground altering activities would occur until completion of the review.

The background section acceptably establishes the ahupua'a settlement pattern and predicts the likely site pattern in the project area. The historical information provided summarizes the history of the post-contact period land uses. The summary of previous archaeological work in the area provides a baseline for the current work.

The survey has adequately covered the project area documenting seven newly identified historic properties in the project area, and one previously recorded historic properties. Five of these represent single features; 50-50-04-5473 (Hopoi Reservoir), 50-50-04-5474 (Kama Ditch), 50-50-04-5493 (unnamed ditch), 50-50-04-5197 (previously documented Waihe'e Ditch), and 50-50-5491 (artifact scatter). Three of the sites represent aggregates of features; Site 50-50-04-5489 (historic roadways), 50-50-04-5490 (drainage ditches), and 50-50-5492 (clearing mounds).

We concur that the sites are significant under Criterion "D" and that sufficient information has been collected to document these sites. We also concur that although considerable testing was conducted on Lot 16, remnants of Hopoi Camp may be identified during construction. Therefore SCS will conduct periodic field inspections of Lot 16, the lot on which remains of the camp are anticipated. In addition, we recommend that the construction crew be made aware of the fact that remnants of the camp may yet exist, and that should indications of the camp be identified, all work will stop in the area and SHPD and SCS will be notified.

We find this report to be acceptable. The historic preservation review process is concluded. Development of the project areas will have "no effect" on significant historic sites. As always, if you disagree with our comments or have questions, please contact Dr. Melissa Kirkendall (Maui/Lana'i SHPD 243-5169) as soon as possible to resolve these concerns.

Aloha,

Holly McEldowney, Acting Administrator
State Historic Preservation Division

cc: Michael Foley, Director, Department of Planning, County of Maui, FAX 270-7634
Bert Ratte, County of Maui, Land Use and Codes, FAX 270-7972
Glen Ueno, County of Maui, Land Use and Codes, FAX 270-7972

Robert Spear. Ph.D.
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We concur that the sites are significant under Criterion "D" and that sufficient information has been collected to document these sites. We also concur that although considerable testing was conducted on Lot 16, remnants of Hopoi Camp may be identified during construction. Therefore SCS will conduct periodic field inspections of Lot 16, the lot on which remains of the camp are anticipated. In addition, we recommend that the construction crew be made aware of the fact that remnants of the camp may yet exist, and that should indications of the camp be identified, all work will stop in the area, and SHPD and SCS will be notified.

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INTRODUCTION

Scientific Consultant Services (SCS), Inc. conducted Archaeological Inventory Survey on 348.613 acres of land composing the main land parcel of the Kehalani Mauka Subdivision in the dry intermediate zone of Wailuku, Wailuku Ahupua`a, Wailuku District, Maui Island, Hawai`i [TMK:(2) 3-5-001:portion of 001] (Figures 1, 2, and 3). The large survey area lies between coastal flats to the east and more mountainous terrain to the west along the medial reaches of the Maui isthmus between Wailuku and Mā`alaea (Figure 4). Roughly equivalent to the open, dry environment of the Waikapu area, the land tract has been intensively modified through historic sugar cane and pineapple cultivation practices. Some of these modifications were the creation of a web of water conduits, drainages, and reservoirs, some built as early as 1905.

Fieldwork, primarily consisting of systematic pedestrian survey, recordation, and representative subsurface testing, was conducted between September 28, 2003 and October 10, 2003 by SCS personnel Sandy Wadsworth, B.A., Dean Tye, B.A., and Michael Dega, Ph.D. The Principle Investigator for this project was Michael Dega, Ph.D.

Archaeological Inventory Survey of the project area was conducted to determine the presence/absence of archaeological deposits in surface and subsurface contexts through complete systematic survey and representative subsurface testing. The ultimate goals were to determine if historically significant archaeological sites occurred on the parcel and to provide recommendations to the State Historic Preservation Division (SHPD) concerning site mitigation in lieu of future land use of the project area.

Based on limited archival research, settlement pattern analysis of the project area, and knowledge of previous Inventory Survey on several parcels directly surrounding this larger parcel (Dega 2003), there were restricted expectations prior to fieldwork for documenting significant traditional-period archaeological sites in the project area. Previous archaeological research in adjacent intermediate areas has not yielded many positive results, this perhaps due to historic land use, which led to the massive landscape modifications in an open area without natural perennial water sources. Artificial water resources were created, however, and these features are significant in terms of plantation-era Hawai`i.

Previous Archeological Inventory Survey of a smaller portion of the Kehalani Mauka Subdivision (Dega 2003; see Figure 3) only led to the documentation of three sites: two historic

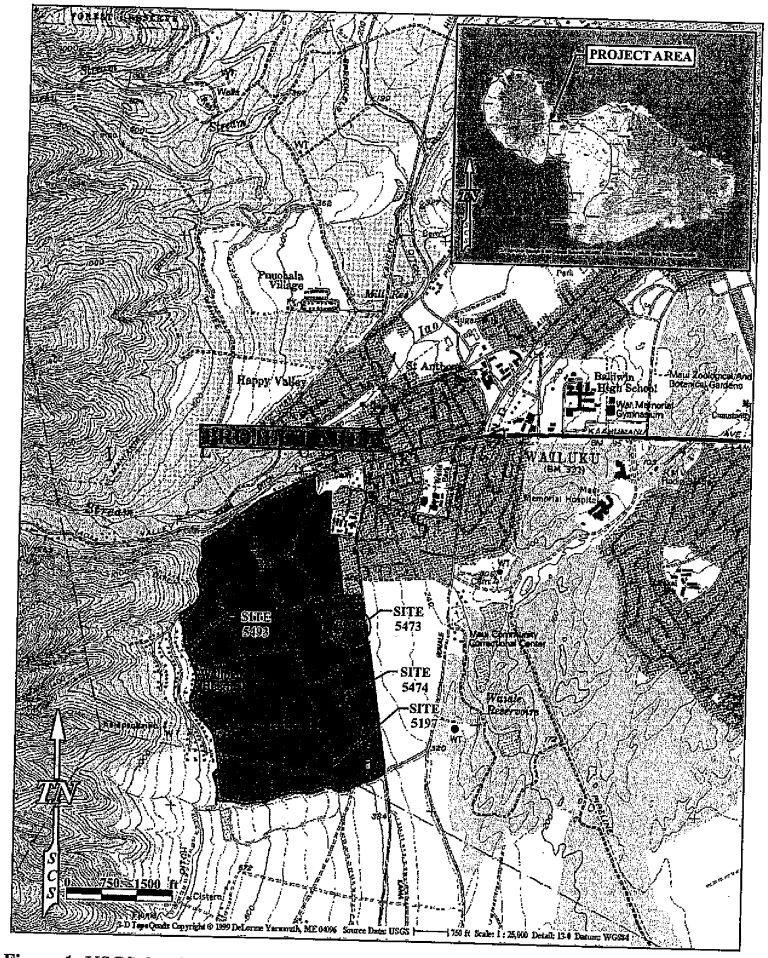

Figure 1: USGS Quadrangle Map Showing Project Area.

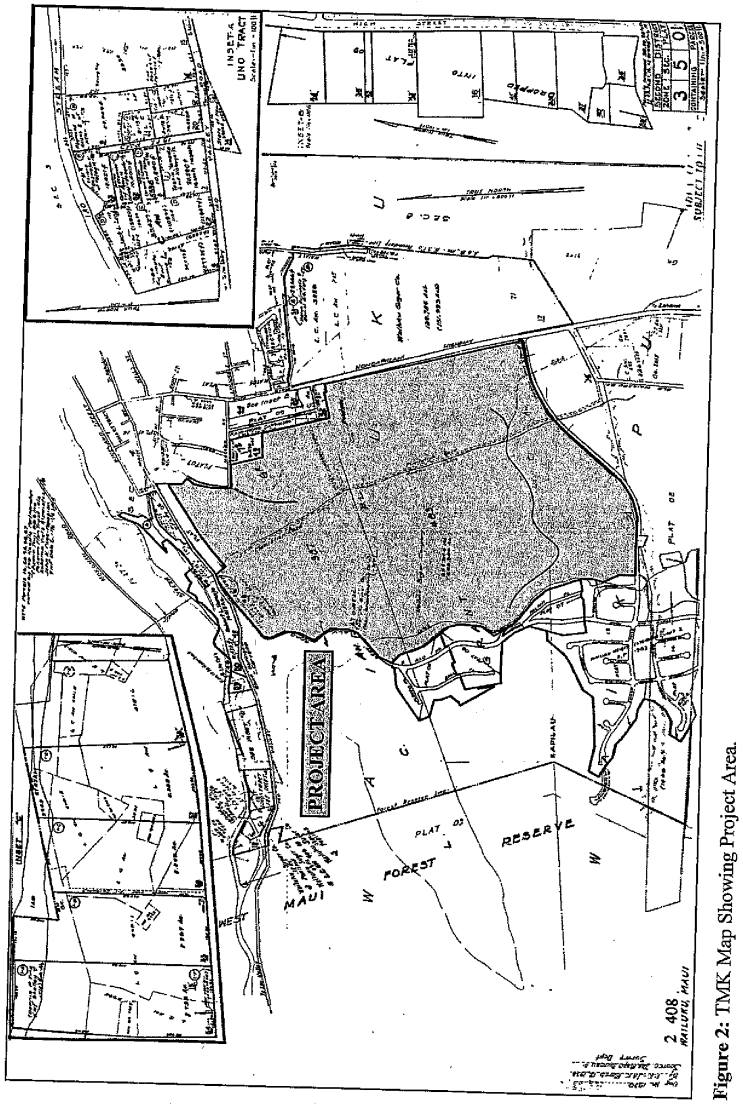

Figure 2: TMK Map Showing Project Area.

Figure 4: Photograph Showing Basic Project Overview Facing North.

features and one traditional artifact designated as State Site Number 50-50-04-5473 (Hopoi Reservoir), State Site Number 50-50-04-5474 (Kama Ditch), and Site 50-50-04-5478 (basalt adze fragment). However, there was the possibility that traditional and historic-era agricultural loci, historic deposits associated with Hopoi Camp, and sandy matrices perhaps containing cultural strata and/or burials could be identified during the present Inventory Survey.

ENVIRONMENTAL SETTING

LOCATION

The project area consists of a large land parcel totaling a recorded area of 348.613 acres (see Figure 3). This parcel is divided herein for ease of explanation (see below). The project area is located just to the south of Wailuku and a portion of the parcel abuts Honoapi`ilani Highway as it traverses from Wailuku toward Waikapu across the central Maui isthmus. Located approximately 2,000 linear feet due west of the present Maui Lani development, the project area is bound on its eastern flank by Honoapi`ilani Highway, Pualani Street residences, and Kehalani Mauka lots No. 20 and 21, the latter composing a portion of the previous Inventory Survey (see Dega 2003). The western border is defined by Wailuku Heights, an existing residential neighborhood. The northern boundary of the survey area proceeds to existing residences along West Main Street and West Road while the southern boundary is largely defined by Kuikahi Drive. The current project area is the proposed location for the remainder of the Kehalani Mauka residential developments.

PROJECT AREA LANDFORM

Both archeological field survey and a review of geotechnical reports for the parcel reveal that the slightly sloping project area lies in locations previously utilized for the cultivation of sugar cane, and for pasture land , now mostly abandoned. Some sections of the parcel remain cow grazing areas and some of the conduits/ditches still flow with water. According to Shimamoto (1995:2), "site topography slopes down gently toward the east at a gradient of less than 8 percent." Ground elevations range from approximately 115 meters (380 feet) above mean sea level (amsl) to 200 meters (660 feet) amsl. As is discussed more below, the slightly sloping project area exclusively consists of tilled zone, fill, and alluvial sediments as the parcel rises from the east and elevates to the west. To the east, near the Maui Lani development, sandy matrices were identified. Sandy matrices were not identified in the current study area nor in areas just to the east of Honoapi`ilani Highway across the road from this project area (Monahan 2003) through either archaeological or geotechnical subsurface testing.

No perennial streams run directly through the project area, and thus artificial ones had to be created. By comparison, `Iao Stream runs east-west to the north of the proposed development while Waikapu Stream runs east-west to the south of the project area. Being located near these two major streams appears to have been beneficial for cultivation on the present parcel, at least during historic times. A fair number of abandoned and still utilized irrigation ditches (*i.e.*, Waihee Ditch, Site -5197) transect the project area, while the abandoned Hopoi Reservoir (Site -5473) occurs in the eastern-central portion of the project area. The remnant irrigation ditches (Kama Ditch, Site -5474) and reservoirs not only point to massive landscape modification in the area during historic times but also strongly infer the aridness of the area, which required large-scale water importation. Soil borings conducted during geotechnical analyses failed to reveal the presence of the area's water table to at least 25 feet below the surface (Shimamoto 1995:4). Water from upland rain drainages runs *mauka-makai* through the project area. In the future, this water will be collected and transported to a retention basis to the southeast of the project area near Waikapu.

VEGETATION

Vegetation in the project area is dominated by the presence of the non-native secondary growth shrubs and various introduced grasses (see Figures 4 and 5). These grasses and secondary growth shrubs have grown in areas where agricultural activities have been abandoned. Native vegetation was not documented within the project area. However, several Land Commission Awards (LCA) for the parcel indicates that several *lauhala* trees occurred in the area, at least from the 1850s (see below). In general though, the entire surveyed parcel consists of open, grassy vegetation. Due to this lack of extreme vegetation, surface visibility was quite

good, easily allowing crew members to assess the presence/absence of architecture, artifacts, or midden on the surface of the parcel and to select testing areas with the most potential.

CLIMATE

Rainfall in this intermediate, leeward-type environment is very modest. The project area receives an average annual rainfall of only 33 to 44 centimeters (Price 1983:63), with much of this rainfall occurring during the winter months (November–April). Seasonal variation in rainfall amount follows normal orographic patterns for leeward-type areas of Maui. The project area occurs just to the south of what may be considered the leeward-windward boundary. At higher elevations within Wailuku Ahupua`a, the amount of rainfall doubles and triples that of the project area. To the north, from `Īao Stream Valley area toward Waihee Valley, rainfall is much more intensive, with combined rainfall and geographic patterns being more conducive to traditional types of agricultural cultivation (*i.e.*, *lo`i*, sweet potato). The rainfall in this gently sloping project area drains downhill to the east and provides an additional water source for traditional Hawaiian agriculture in the lowland flats to the east of the project area (see Handy and Handy 1972).

SOILS

According to Foote *et al.* (1972:46–47), soils in the project area are predominantly classified as `Īao cobbly silty clay (IbB), particularly along the eastern flank of the parcel, and `Īao clay (IcC) and `Īao cobbly silty clay (IbC) within the remainder of the parcel. These soils are derivatives of the `Īao series that consists of well-drained soils on valley fill and alluvial fans. These soils all have developed from igneous rock and are nearly level to moderately sloping. These soil series are similar yet are primarily differentiated by the texture of the surface layer and inclusions of a higher content of cobblestones, such as in `Īao cobbly silty clay. The presence of these soil types was confirmed through geotechnical studies and archaeological testing during the current project. Importantly, no sandy sediment was identified in the project area. Sandy sediment (sand dunes) and mixed coastal-terrigenous sediments occur to the east of the current parcel (*i.e.*, Maui Lani).

A geotechnical study of the project area and environs by Shimamoto (1995) of Fewell Geotechnical Engineering, Ltd., provides a cross-section of soil deposits from the surface to 7.5 meters below the surface. Shimamoto (1995:4) noted that the test borings "indicate that the site is generally underlain by relatively uniform soil conditions, consisting of very stiff to hard alluvial (water-deposited) clayey silts with weathered cobbles and boulders, which extend to the bottom of the borings at 25.0 feet below the existing ground surface." The report further states that "loosened, tilled surface soils were encountered to depths of 1.0 to 2.0 feet below the

existing ground surface" (Shimamoto 1995:4) and above natural alluvial sediments. Fill sediments were also documented during geotechnical test borings, the fill being underlain by naturally deposited, very stiff to hard alluvial silts. The general profile revealed during archaeological trenching is in agreement with the results of this geotechnical study: brown clayey silt (alluvium), brown clayey silt (agriculture disturbed), or brown clayey silt with gravel and cobbles (compacted fill) underlain by brown clayey silt (alluvium) with traces of weathered gravels (see also Shimamoto 1995:Figures 4–12). As seen through both sampling programs, there is only very slight differentiation in soil sequence and formation, the latter mostly caused by artificial landscape modifications (*i.e.*, filling, tilling for agriculture) and the presence or absence of rock content.

The fairly homogenous nature of soils in the project area does provide contrast to soil regimes occurring more to the east (coastal-terrigenous and coastal) and to the north and south (dynamic stream valleys). The current project area occurs in a medial or intermediate environmental zone, both on a north-south and east-west axis. Along a north-south axis, the property lies in a very dry, open area between two perennial streams (`Īao and Waikapu). On an east-west axis, the project parcel lies above the influence of the coastal plain and below the wetter uplands. The current parcel thus lies in a fairly non-dynamic environmental zone that is practically surrounded on all sides by contrastingly vibrant areas. That this intermediate area, occurring between more dynamic zones, required artificial controls is well-observed throughout the project area in the form of irrigation ditches and reservoirs.

TRADITIONAL AND HISTORIC SETTING

Wailuku District inhabits the eastern side of the West Maui Mountains (Mauna Kahalawai) and occupies the isthmus through thecenter of the island to coastal reaches in Kahukui and Mā`alaea. Wailuku, together with Waikapū, Waihee, and Waiehu, is one of the *Na Wai `Ehā*, or "the four waters," known for the occupancy of chiefly individuals (Kame`eleihiwa 1992; Pukui and Elbert 1992; and Creed 1993). Wailuku District and Wailuku Ahupua`a are frequently mentioned in historical texts and oral traditional accounts as being politically, ceremonially, and geographically important areas during traditional times (Cordy 1981, 1996; Kirch 1985). Wailuku was considered a "chiefly center" (Sterling 1998:90) with many of the chiefs and much of the area's population residing near or within portions of `Īao Valley and lower Wailuku. The many *heiau* constructed in the Wailuku area point to its ceremonial and religious importance during pre-Contact times. During historic times, after numerous battles in the area, the large concentration of Land Commission Awards granted in Wailuku, particularly in

lower `Īao Valley, also attest to a sizeable population base and the importance of the lands for cultivation through time. More recent land use in the area included sugar cane cultivation and use of the land for pasture.

THE TRADITIONAL SETTING OF WAILUKU

Archaeological settlement data indicates that initial colonization and occupation of the Hawaiian Islands first occurred on the windward sides of the main islands, with populations eventually settling into drier leeward areas at later periods (Kirch 1985). Archaeological dates for initial occupation of the Hawaiian Islands far pre-dates accepted ranges gleaned from palynological data. A more secure estimate for initial occupation of the islands is the A.D. 9th century (Athens 1997), if one is to lay more credibility with the pollen record than the archaeological record. In the Waihe`e and Waiehu areas of Wailuku, Kirch (1985:87) notes that "a number of coastal dune midden sites have been reported, and at least one of these contained pearl-shell fishhooks similar to those from the Bellows Site, eroding from the wave-cut midden." (The Bellows site, located on the windward coast of O`ahu, has yielded dates of occupation, albeit controversial, from A.D. 300 to 600 [Pearson *et al.* 1971], one of the earliest dated sites in the Hawaiian Islands. For the most part, these dates have now been diagnosed as very problematical and are no longer valid.) More recent research within Wailuku Ahupua`a indicates that the area was likely settled between *c.* A.D. 1100 (Kirch 1985:142) and A.D. 1200 (Fredericksen and Fredericksen 1996).

To the north of the current project area lies `Īao Valley, one of the most important locations in the area for prehistoric activity. Connolly (1974:5) states that the pre-Contact valley [`Īao] had a large population base with "most people residing in a settlement near `Īao Needle," just north of the project area. Supposedly, the subsistence base of this population consisted of fish and taro, with Kahului Harbor and the coast close by and *lo`i* systems lining `Īao Valley's stream banks. Prehistoric ditches or *`auwai* were utilized in taro cultivation (Connolly 1974:5). Sterling (1998:86) adds that two *`auwai* within the valley:

> have existed immemorially and were evidently constructed for the purpose of irrigating *kalo* on the plains which stretch away to the northward and southward of the [`Īao] river. Several minor *`auwai* have, since ancient times, tapped the river at different points lower down and spread the water through the lands in the gulch on either side of the river bed.

Handy in Sterling (1998:63) further notes that "From Waihee and Wailuku Valley, in ancient times, was the largest continuous area of wet taro cultivation in the islands." Cheever

(1851:124) writes: "the whole valley of Wailuku, cultivated terrace after terrace, gleaming with running waters and standing pools, is a spectacle of uncommon beauty to one that has a position a little above it."

Recent archaeological research (Fredericksen and Fredericksen 1996:52) has revealed that habitation sites along what is now Lower Main Street in Wailuku, "are associated with the rich taro producing lands in the Lower `Īao River flood plain, and the extensive cultivation systems present in `Īao Valley." These habitation sites have been dated to the A.D. 15th through 17th centuries. The `Īao Valley area was not only renowned for its agricultural base during prehistoric times but its ceremonial and political base as well (see also Cordy 1996; Donham 1996).

No discussion of Wailuku is complete without mentioning the important *heiau* complex above `Īao Valley near its seaward terminus. During the mid to late 18th century, the Halekii-Pihana *heiau* complex was supposedly designed by a Hawaiian named Kiha (Sterling 1998:89). These monuments, designated as State Site Number 50-50-04-522 and occurring along the northwest flank of the current project area, are described as very important *heiau* within Hawaiian history. Yent (1983:7) notes the life cycle of the *ali`i* was represented here. It was the place where Kamehameha I's wife was born, Kahekili lived, and Kekaulike died. Thrum (1909:46) reported that Kamehameha I evoked his war god at Pihana Heiau after his warriors defeated Kalanikupuli's forces during the Battle of `Īao in 1790. The two *heiau* are primarily associated with Kahekili, who is connected with the Halekii-Pihana complex between *c.* A.D. 1765 and 1790, and Kamehameha, during his conquering of Maui in 1792 (Yent 1983:18). Halekii and Pihana Heiau are the only remaining pre-Contact Hawaiian structures of religious and historical importance in the Wailuku-Kahului area that are easily accessible to the public (Estioko-Griffin and Yent 1986:3). As stated, the area within and adjacent to the current project is known not only for its religious and/or ceremonial significance, but for its political prominence as well.

The Fredericksens' (1996:52) report states that politically, Wailuku [village] was known as a central settlement for high ranking chiefs and their retinue. The Wailuku area was also witness to many battles, from the Battles of `Īao and Sand Hills to the Battles of Kepaniwai and Kakanilua. The most famous battle was that of Kepaniwai where Kamehameha I, in July 1790, finally wrested control of Maui Island. Kamehameha I and his warriors landed at the Kawela portion of Kahului Bay and proceeded up `Īao and other valleys to score a decisive victory. Wailuku, meaning water of destruction, succinctly describes the area in which many of these

major battles occurred. Of additional note is that in the Kauahea area of `Īao Valley (southeast of `Īao Stream below Pihana Heiau-supposedly within the current project area), warriors apparently dwelt and were "trained in war skills and there was a boxing site in the time of Kahekili" (Sterling 1998:89).

TRADITIONAL SETTING OF THE PROJECT AREA

Creed (1993) has written extensively on the traditional background of the Waikapu area, much of which directly applies to the open landscape of the current project area just to the north of Waikapu. Many classes of sites are found or may have existed in the Waikapu-Wailuku area during traditional times. Creed (1993:19–21) provides an extensive list, including some site types that would not apply to the current parcel due to its distance from major drainages, the coastline, and its open land classification. Traditional sites that would apply include agricultural sites (*kula* lands, *wauke* patches, *hala* trees, pigs, and potato patches), boundary walls, burials (sometimes located in habitation terraces), feather gathering areas (particularly in the mountains to the west), habitation loci, and *pohaku* (an adze stone marks the border between Wailuku and Waikapu). While populations were predominantly centered in `Īao Valley and Waikapu Valley, there was agricultural and habitation activity in the open grasslands of the current project area above the coastal flats. Much evidence for such activities has not yet been found through archaeological means, a situation that places much culpability on historic land use that may have erased or scattered this evidence. As such, there is much more evidence for historic activities occurring in the area.

HISTORICAL TIMES

Current project area lands were first assigned to the district formerly known as Kula. Taken literally, *Kula* refers to open land or plains (Pukui and Elbert 1992:70). Kula District is known for its dry, arid lands being vacant of perennial streams. Kula was always an arid region, throughout its long, low seashore, vast stony *kula* lands, and broad uplands. There are exceptions in Wailuku as one proceeds along Īao Stream Valley and further to the west/northwest past Waihee and Waiehu. However, even the vast stony kula lands were utilized during traditional and historic times. Most evidence for such land utilization has come in the from historic records.

In 1848, during the late historic period, commissioners of the Great *Māhele* instigated an extreme modification to traditional land tenure on all islands that resulted in a division of lands and a system of private ownership. The *Māhele* was based upon the principles of western law. While a complex issue, many scholars believe that in order to protect Hawaiian sovereignty from

foreign powers, Kauikeaouli (Kamehameha III) was forced to establish laws changing the traditional Hawaiian society to that of a market economy (Kuykendall Vol. I 1938:145 footnote 47 *et passim*; Daws 1968:111; Kame`eleihiwa 1992:169–170, 176). The dramatic shift from a redistributive economy to a market economy resulted in drastic changes to land tenure, among other things. Case in point, foreigners demanded private ownership of land to ensure their investments (Kuykendall Vol. I 1938: 145 *et passim*; Kame`eleihiwa 1992:178; Kelly 1998:4).

Once lands were made available and private ownership was instituted, native Hawaiians, including the *maka`āinana* (commoners), were able to claim land plots upon which they had been cultivating and living. Oftentimes, foreigners were simply just given lands by the *ali`i*. However, in the case of commoners, they would only make claims only if they had first been made aware of the foreign procedures (*kuleana* lands, land commission awards). These claims could not include any previously cultivated or currently fallow land, *okipu*, stream fisheries, or many other natural resources necessary for traditional survival (Kame`eleihiwa 1992:295; Kirch and Sahlins 1992). Awarded parcels were labeled as Land Commission Awards (LCAs). If occupation could be established through the testimony of witnesses, the petitioners were issued a Royal Patent number and could then take possession of the property. Commoners claiming houselots in Honolulu, Hilo, and Lāhainā were required to pay commutation to the government before obtaining a Royal Patent for their awards (Chinen 1961:16).

During the *Māhele*, Wailuku District was declared Crown Land and numerous Land Commission Awards, approximately 180, were awarded within Wailuku Ahupua`a while approximately 100 were awarded for Waikapu Ahupua`a (Creed 1993). A handful of foreigners (*i.e.*, Anthony Catalena, James Louzada, E. Bailey) gained control of large parcels of lands that would later be used for mass cultivation of sugar. Significantly, the majority of LCAs were awarded to Hawaiians, a gauge that can be used to measure pre-Contact settlement, since there was little overall change in traditional land use among Hawaiians prior to 1853 (Creed 1993:38).

During the *Māhele* of 1848, a total of three land claims were awarded in and near the current project area (Waihona `Aina 2003): LCA 326, 71, and 387. Three Royal Patents for the three LCAs were also issued: 1925, 4549, and 7659. The LCAs and Royal Patents are listed in their entirety in Appendix A and only summarized here. Briefly, the LCA and Royal Patent information predominantly list 'property for raising cattle' and 'pasture grounds for cattle' as one of the primary land uses in the project area. There also is some mention of stone walls, *kalo* patches, and *lauhala* trees on the landscape. Perhaps the most significant structures were built by the American Board of Commissioners for Foreign Missions (A.B.C.F.M.) which consisted of

two house lots with adobe walls. The lots occurred "near pasture land," a common theme for the area (Waihona `Aina 2003). In Waikapu, to the south, the LCAs reflect *lo`i* cultivation, *kula* lands, and house sites. These keep with the overall LCA pattern of the Waikapu-Wailuku area intimating taro cultivation in association with permanent residences. Such a pattern is historically documented from 1848, but likely extended deeper into the past. However, much or all of the evidence related to such settlement of the Waikapū area has been effaced by late historic and modern cultivation.

Land use in Wailuku and Waikapu Ahupua`a in the mid 19th and early 20th century was largely devoted to the sugar industry. During the 1860s, the sugar business was growing, with plantations and mills at Wailuku, Waihe`e, Waikapu, and Haiku. Many of the plantation camps associated with these mills were centered in the Pu`unene, Kahului, and Wailuku area (see Denham *et al.* 1992:16). Hopoi Camp supposedly occurred within or near the project area by Hopoi Reservoir but was not relocated during the present investigation. Hopoi Reservoir was constructed by at least by 1922, when references to Hopoi Camp occurred on an area map (M. Kirkendall, personal communication 10.September.2003) Historic utilization of the Waikapū-Wailuku landscape within and near the project area focused on industrial-levels of cultivating sugar cane and pineapple. Water was channeled from traditional sources (*e.g.*, Waikapū Stream, western aquifers or springs) through plantation lands. Both local and imported workers operated on these plantation lands and the area maintained fair population density. Evidence for expansive landscape modifications to accommodate the industrial-level of production is very evident across the current subject parcel in the form of the north-south oriented Kama Ditch, Hopoi Reservoir, and several excavated/bunded areas (see Results section below). The significant amount of plastic and rubber tubing found across the surface of the project area attests to even more recent utilization of the open landscape for cultivation. These former sugar cane and pineapple lands are now being reclaimed through residential developments.

PREVIOUS ARCHAEOLOGY

Of primary importance for the present study are the results from two projects recently conducted within and bordering the current 348-acre project area. First, Archaeological Inventory Survey was conducted on approximately 100 acres of land that included five separate lots and a proposed road corridor in the Kehalani Mauka Subdivision (Dega 2003). Three historic sites were documented during this Inventory Survey. State Site Number 50-50-04-5473 has been assigned to Hopoi Reservoir. This reservoir predates Hopoi Camp and was present at least by 1922 (see Dega 2003). Occurring to the immediate east of the reservoir and running

north-south to Waikapu is Kama Ditch (State Site No. 50-50-04-5474), a water conduit carrying the precious commodity to dry southern lands. A single basalt adze (Site 50-50-04-5478) was recovered from the northern flank of Lot 21 along the eastern flank of the parcel. Extensive survey and testing in the area of the isolated find failed to produce additional artifacts or cultural deposits. Representative subsurface testing (18 trenches) on the lots only revealed highly homogenous soil matrices across the open, barren intermediate area.

Archaeological Inventory Survey was also conducted on Kehalani lands just to the east of Honoapi`ilani Highway (Monahan 2003). This survey failed to produce any structures or artifact scatters. Trench excavation demonstrated a fairly consistent subsurface stratigraphy with a thick layer of dark brown silt (Layer II) inclusive of historical garbage (*i.e.*, black plastic and rubber tubing, white plastic irrigation pipes, and black plastic sheeting) over an undisturbed very dark grayish-brown silty clay subsurface (Layer III). A dark brown, silty root mat-layer (Layer I) was present in some units. No undisturbed sandy deposits were encountered, although a few trenches close to the eastern boundary of the project area did contain thin lenses of yellowish-brown sand. These sand lenses were clearly introduced as recent fill. In total, pedestrian survey and subsurface testing demonstrated that both parcels had been extensively altered through grading and other earthmoving activities associated with historic construction (of water features) and cultivation.

In terms of general projects in the Wailuku-Waikapu environs, the earliest archaeological endeavors on Maui were undertaken by Thrum (1909), Stokes (1918), Emory (1921), and Walker (1931). None of their archaeological finds directly pertain to the current project area; however, their data allows for a deeper understanding of the traditional use of the Wailuku-Waikapu area.

In an area south of the project area, within open lands similar to what is being researched herein, Thrum mentions that two *heiau* may have possibly existed within the *ahupua`a* of Waikapū, but evidence of the two sites no longer remains (1909–1918:59). A group of approximately 45 house and shelter sites (State Sites 50-50-09-1441, the McGregor Point C-shaped structures, and 50-50-09-1287, the Mā`alaea Complex) was identified by Walker (1931) to the west of Mā`alaea. Chronology for these sites has yet to be determined (Creed 1993). Walker (1931:58) also described a *koa*, or fishing shrine, and two petroglyph fields with an associated *heiau* (State Site numbers 50-50-09-1169 and -1199) at Mā`alaea. The *koa* was not assigned a State Site number, nor has it been relocated.

Recent archaeological work in nearby Waikapū Ahupua`a (Kennedy 1988, 1989; Folk and Hammatt 1989; Haun 1989; Brisbin *et al.* 1991; and Donham 1991) has revealed sites ranging in function from habitation to agriculture. The latter of the eight investigations provided dates ranging from the A.D. 1100s to modern times. Together, their collective data suggests a "general trend toward development of large, densely settled populations between A.D. 1200 and about 1800, and the expansion and intensification of dryland field systems, particularly during the latter two centuries of this period" (Creed 1993:33).

Other recent archaeological work just to the south of the current project area has been limited to two field inspections (Donham 1991, 1995) and on the eastern boundary line of the current project location, two archaeological Inventory Survey-level investigations (Kennedy 1988, 1989; Buffum and Dega 2001). The conclusions offered by these few projects conducted just to the south of the currently-investigated land area primarily indicate that any surface and/or subsurface features of cultural value that were once present within the area have most likely since been destroyed by intensive agricultural use of the land (*i.e.*, sugar cane and/or pineapple cultivation); this pattern was also confirmed by subsurface examination. As such, a broader background for Wailuku District is offered herein (see below).

WAILUKU DISTRICT OVERVIEW

The following section provides a brief overview of archaeological research in Wailuku District itself and is presented in two arbitrary sections: Upper Wailuku and Lower Wailuku District. Upper Wailuku is considered to be the lands above Kuihelani Highway while Lower Wailuku encompasses the lands below Kuihelani Highway and extends to Mā`alaea Bay in Waikapu Ahupua`a.

UPPER WAILUKU DISTRICT

The majority of archaeological work is associated with the Pu`u One region in the northern most section of Wailuku District. Prior archaeological work in the Pu` One region indicates an emerging pre-Contact settlement pattern for this region. SCS (Dunn and Spear 1995) conducted research at the intersection of Naniloa and Waiale Roads where habitation features and a cultural layer interspersed with hearth and pit features were identified during a monitoring project. These features all occurred in sandy substrate. Radiocarbon dates submitted from these features yielded dates ranging from A.D. 1434 to A.D. 1807, dates suggesting pre-Contact sites and early historic land use. SCS (Burgett and Spear 1995) conducted Archaeological Inventory Survey in the sand hills along lower Main Street. One habitation site (50-50-04-4004) located in a remnant of a once larger cultural deposit was identified.

Radiocarbon samples dated the site to A.D. 1420 and A.D. 1640, or to the early to mid-prehistoric time range. SCS (Morawski and Spear 2001) conducted Archaeological Monitoring during the installation of a water pipeline and fire hydrants on Naniloa, Helenani, Leilani, Kainani, Naniluna, and Ka`ahumanu Highway roads with the town of Wailuku. During the research, a historic refuse dump was discovered, as were the remains of previously disturbed human burials. SCS (Buffum and Spear 2001; Zachman and Spear 2002) conducted Archaeological Monitoring at the Maui Medical Center. Due to extensive landscape modifications, no archaeological or traditional materials were identified during excavation.

Pantaleo and Sinoto (1996) conducted archaeological work at the Maui Lani Development to the east of the present project area. As of the 1996 publication, only one concentration of multiple burials was discovered while the remainder were isolated individual burials at the tip of the dune (in the highest elevational locations). A more contemporary report documenting additional burial finds at Maui Lani should aid in clarifying the overall results of that project. Research conducted by Fredericksen and Fredericksen (1997) indicated that this section of dunes was primarily used during prehistoric times as an interment area, a contention easily supported by the previous year's study. Habitation sites (several with associated burials) have been found mostly in the dune area associated with the Lower Main Street/Waiale Road Corridor. Conversely, studies east of this corridor have yielded only human burials (Fredericksen and Fredericksen 1998). Fredericksen and Fredericksen (1998) lists many of the archaeological studies conducted in the Lower Main Street/Waiale Road Corridor and Central Maui area.

LOWER WAILUKU DISTRICT

A limited number of archaeological projects have been conducted in this particular land section, much of which was disturbed during the massive sugar cane cultivation. The fair amount of archaeological work conducted along Lower Main Street is summarized elsewhere (see Morawski and Dega 2003). In comparison, Sinoto and Pantaleo (1992) conducted Archaeological Inventory Survey of a proposed location for the Kihei Gateway complex, on the *makai* side of the Piilani-Mokulele Highway junction. One historic site, the remains of concrete footings from a bridge across Waiakoa stream, was identified (Site 50-50-09-31).

SCS (Burgett and Spear 1997) conducted large-scale Archaeological Inventory Survey of the Puunene Bypass/Mokulele Highway improvements stretching across the majority of Wailuku District. Although no sites were identified, this absence may account for the lack of archaeological remains: extensive disturbance associated with prior sugar cane cultivation,

highway and private construction activities, and little or no prehistoric occupation of the area. However, *lo`i* cultivation was reported to be intensively cultivated in this area (Handy and Handy 1972). The replacement of *lo`i* with sugar cane during historic times would be the most likely cause for the destruction of all traditional sites related to prehistoric cultivation in the area.

Fredericksen and Fredericksen (1998) conducted archaeological research on 232 acres northeast of Puunene Avenue stretching to Haleakala Highway. No formalized traditional or prehistoric sites were discovered. Several sites consisting of volcanic-glass surface scatters were identified in the former sugar cane fields along with a historic irrigation ditch.

SETTLEMENT PATTERN

Archaeological investigations within the currently studied portion of Wailuku-Waikapū have revealed relatively little regarding traditional settlement patterns due to the dearth of supporting empirical evidence. Archival research and analyses of the generalized settlement pattern for Wailuku District have been the foremost sources for discerning an established settlement pattern for the current project area.

Archaeological evidence suggests that early settlement in the Hawaiian Islands occurred along windward shoreline areas between the A.D. 4th and 11th centuries. Pollen evidence suggests a settlement date of the A.D. 9th century (see Athens 1997). For the most part, these populations used local resources and seldom ventured into upland valleys. Cordy (in Creed 1993) suggests, however, that upper valley areas on windward coasts were likely populated before the A.D. 1100s. Coastal settlement was still dominant, but populations began exploiting and living in more upland *kula* zones. Greater population expansion to inland areas did not occur until the *c.* A.D. 12th century but continued through the 16th century. Large scale or intensive agricultural endeavors were implemented in association with habitation. Coastal lands were used for settlement and taro was cultivated in near-coastal reaches and in the uplands. Upland areas of Maui such as the Waiohuli-Kula area contained large garden enclosures, ceremonial structures, and permanent habitation sites by *c.* A.D. 1600.

Nearer the coast in intermediate lands such as the current project area (*c.* 60–85 meters amsl), taro was cultivated along stream courses, dryland taro was grown on *kula* lands such as the project area, and populations were settled. It is possible that the *kalo* patches described in the aforementioned LCA accounts originated during the "Expansion Period" of A.D. 1400 to 1600, perpetuating through historic times (Kirch 1985). However, most of the LCAs for the area

describe almost no cultivation occurring in the area during the 1850s as pasture land and sugar cane cultivation were already dominating the use of the land (Creed 1993:74). Primary settlement and resource zones lay outside the current medial environmental zone in Wailuku proper, near perennial water sources (`Īao Valley, Waihee, Waiehu). The only substantial settlement along this medial isthmus zone between 300 and 600 feet amsl was at Waikapu, to the south of the current project area, near the base of Waikapu Stream Valley (see Creed 1993). As the current project area does not contain a perennial water source and is primarily open grassland, the area is considered to lie at the periphery of the more resource-rich zones in Wailuku.

Historic utilization of the Wailuku-Waikapu landscape was dominated by the cash cropping of sugar cane and pineapple, made possible by water channeled from traditional sources (*e.g.*, Waikapu Stream) through plantation lands. Historic features associated with this period are represented as water features in the form of reservoirs (Hopoi Reservoir) and water channels (Kama Ditch, Waihee Ditch). This area was also an important transportation corridor linking both the south and north flanks of the Maui isthmus, with Honoapi`ilani Highway having been demarcated as a Government Road on area maps by 1882 (Creed 1993:20).

PROJECT AREA EXPECTATIONS

Prior to commencing archaeological fieldwork, a review of archival resources and the results of previous archaeological work conducted in the area was undertaken to assess possible findings during fieldwork. Based on previous archaeological work in this intermediate landscape and on LCA information, site patterns prior to intensive historic land alteration activities show systematic use of the terrain as *kula* lands, habitation sites, and pastureland. Previous archaeological investigations within this portion of the Wailuku-Waikapū corridor have revealed very little data to confirm these patterns, this not surprising considering the impact that long and intensive agricultural exploitation has had on the surface of the area and subsurface strata. Traditional site components expected prior to these land-altering activities consist of dryland taro patches, associated agricultural components such as *`auwai* and/or terracing, house sites, boundary walls, and pasture walls. Expectations for identifying such data sets were low, however, due to the aforementioned historic land uses.

Evidence of traditional sites that may once have been present within the current project area were not thought to be clearly evident or unaltered in the project area. Given LCA testimony and general settlement patterns for this inland, intermediate area, land use patterns for the current project area were thought to be most obviously related to historic-period cultivation.

At present, an empirically-based chronology of this area has yet to be provided, given intensive historic land modifications and the lack of datable archaeological evidence. According to Creed (1993:77):

> ...we have no carbon dates to indicate the possible beginnings for this wetland agriculture in Waikapū Valley. Moreover, this area has been in constant use for crops and habitations at least since the time of the *Māhele*, if not long before and modern uses may have destroyed all traces of prehistoric uses. However, the LCA records and early maps document the extent of the *lo`i* agriculture in the 1850s. The stream valley in its upper reaches may have some remnants of these *Māhele* period *lo`i* or *`auwai*.

Expectations for this project area rested on several assumptions, some of which were proven valid at the end of fieldwork. First, the project area, lying in an open, intermediate zone containing hard soil composed of silty clay with cobbles was not intensively occupied during traditional times. Traditional and early historic-period populations were focused elsewhere in areas such as Waikapu, `Īao Valley, Waihee Valley, and Waiehu Valley. Thus, there were low expectations for identifying larger, intact sites or deposits; they simply were not constructed in this area. Secondly, there was the possibility that sand sediment could be present along the eastern flank of the project area. The association of sand and traditional/historic burials and cultural deposits has been well documented (see Kirch 1985). Thus, if sandy deposits did occur along the eastern flank, cultural deposits could be present. Third, the area was heavily modified for industrial cultivation. Remnants of such modifications, such as fill strata, excavated areas, reservoirs, and earth mounds were expected throughout the project area. Finally, based on the primarily negative results from other archaeological projects conducted along the intermediate Wailuku-Waikapu corridor, there were limited expectations for identifying intact traditional-period architectural structures or intact cultural deposits lying beneath the tilled surface. However, historic structures related to irrigation and water pooling were likely, considering they were previously documented near the parcel (see Dega 2003). In all, some of these expectations were met during the current study.

METHODOLOGY

FIELD METHODS

Fieldwork consisted of systematic pedestrian survey of the entire 348 acre parcel and mechanical subsurface testing across representative portions of the parcel (Figures 5 and 6). Written and photographic documentation occurred during each phase of research. First, 100 percent systematic pedestrian survey was conducted to assess the presence/absence of surface

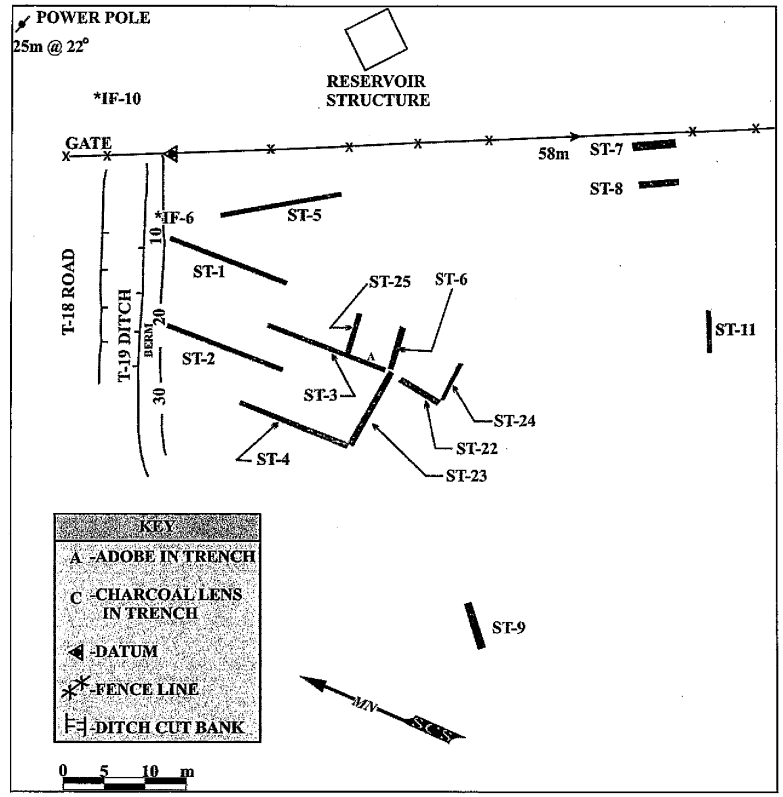

Figure 5: Drawing Showing Location of Stratigraphic Profiles Near Reservoir Structure.

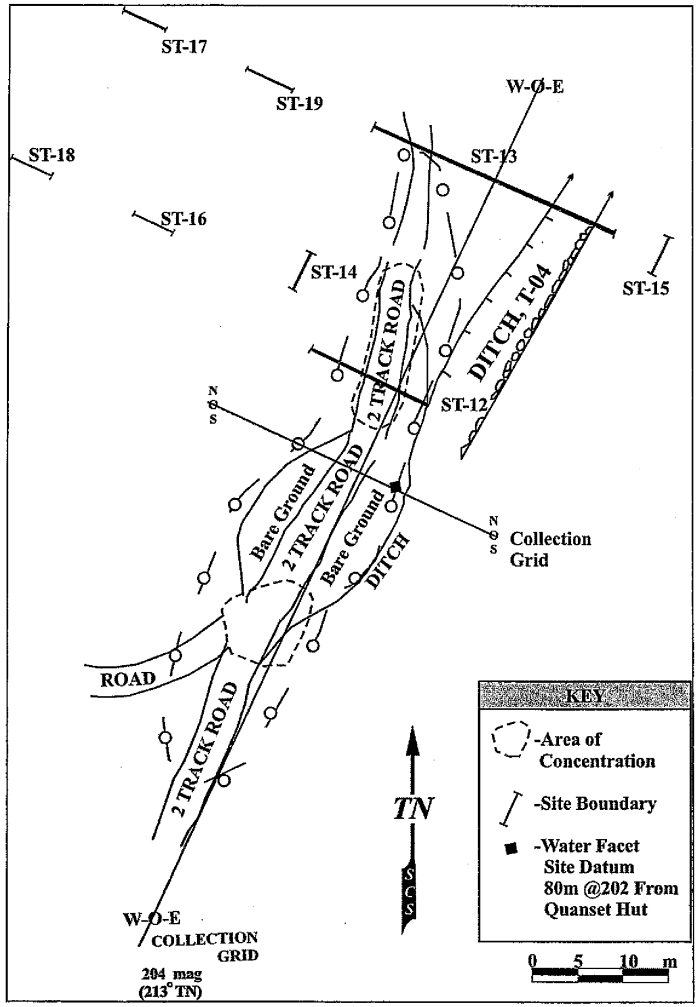

Figure 6: Drawing Showing Location of Stratigraphic Trenches Near T-04.

features and artifacts as well as to assess soil deposits amenable to testing. As visibility was high, 100 percent survey was conducted by two to three crewmembers spaced 5 meters apart, walking parallel along north-south transects. When any structures, artifacts, or intriguing topographical changes were identified, they were plotted on an overall site map and flagged. Surface artifact assemblages, surface features, or anomalies were assigned temporary site numbers (n=34) and individual surface artifacts were designated as Isolated Findspots (IF). These IFs have since been subsumed under State Site Numbers (see below) and several of the temporary site numbers will receive permanent State site numbers. Also, 5-meter grids were established with a site datum and artifacts were collected from each grid square with proper provenience to assess their surface distribution.

After survey, the crew returned to each flagged location to more fully investigate the area and assess excavation potential. Representative areas were demarcated for subsurface testing. All subsurface testing was done mechanically by backhoe. Testing was concentrated in areas with surface artifacts and near Hopoi Reservoir, the latter testing conducted in possible locations of the former Hopoi Camp. In total, 27 stratigraphic trenches (ST-1 through ST-27) were excavated and documented. The trenches averaged 5 m long (16 feet), 1.10 m wide (3.6 feet), and 1.30 m deep (4.25 feet).

Calculating the above averages, an approximate total of 135 m^2 (linear; 442 square feet) and 193 m^3 (three-dimensions; 633 cubed feet) of soil was excavated during testing. These sampling figures are primarily indicative of the limited positive results achieved for each trench; if significant cultural resources were documented during the project, it is likely that less geographic space would have been excavated as documentation and sampling of such cultural resources would have been more time consuming. In the amount of time allowed for the project, testing was geared toward obtaining the most information available to assess the presence/absence of subsurface cultural deposits and past land use across the project area. However, more areas were excavated in the supposed location of Hopoi Camp.

While very few cultural materials were collected from any trench, soil samples were taken from each trench and promptly analyzed in the field. The results revealed a fairly homogenous soil matrix. None of the excavated soil was screened, but all trench walls were thoroughly inspected. Photographs were taken first of trench locations prior to excavation, secondly of at least one profile (or multiples) of each trench, and thirdly, photographic overviews were acquired of the respective trench at the base of excavation. Only representative profiles are offered herein (but see Appendix B for all profiles) as the results of each trench were very

similar and not very interesting. Post-excavation documentation consisted of trench measurements, descriptions, photographics, stratigraphic profiles, and sectional drawings. Each trench location was demarcated on an overall site plan map (see Figure 3).

LABORATORY METHODS

As the results of survey and excavation were minimal in terms of collected artifact classes and samples, laboratory work was limited in scope. Because none of the soils analyzed in the field were deemed to be associated with past habitation surfaces, traditional agricultural levels, or cultural deposits, no samples were submitted for specialized analysis (*e.g.*, radiocarbon, pollen, phytolith analysis). Subsurface charcoal was an extremely rare commodity. A sizeable historic artifact component was recovered from the surface of the parcel. These artifacts were catalogued, analyzed, and interpreted in the laboratory. Drafting of stratigraphic profiles, mapping illustration, and section drawings, were the primary components to laboratory work. All field notes, maps, photographs, and artifacts pertaining to this project are being curated at the SCS laboratory in Honolulu.

ARCHAEOLOGICAL INVENTORY SURVEY RESULTS

SURVEY

A 100-percent pedestrian survey of the project area revealed the presence of a network of historic-period structures and one significant historic artifact scatter that are represented as eight sites. The previously documented and abandoned Hopoi Reservoir (State Site No. 50-50-04-5473) and segments of the Kama Ditch (State Site No. 50-50-04-5474) were subject to additional documentation during this survey. As has been reported previously (Dega 2003), the surface of the project area had been subject to extensive modification in recent times through bulldozing and historic land use. As such, many of the historic artifact scatters were documented on the surface in secondary context. Also, many artificially-created (mechanical) earthen mounds occurred across the project area, but some of these were not deemed significant.

SITE PROVENIENCE DATA

The following text enumerates the structures, landscape modifications, and historic artifact scatters identified and documented during this survey. Surface finds and subsurface testing (see below) will be discussed herein, the latter only in representative fashion. For ease of locating the provenience of these areas, Figure 3 shows the numbered lots across the parcel. It is from systematically discussing these lots that the provenienced finds and testing locations should be more easily located. *Mauka-makai* land use patterns may also be more discernible through this approach. This report details the cultural materials/structures beginning in the eastern

portion of the parcel and follows north-south swaths across the lots. In this arbitrary pretext, Lot 22 and Lot 23 compose the eastern grouping; Lot 10, Lot 16, Lot 17, Lot 18, and Lot 19 compose the east-central grouping; Lot 11, Lot 12, Lot 13, Lot 14, and Lot 9 compose the central grouping; and Lot 2, Lot 5, Lot 3, Lot 6, Lot 7, and Lot 8 constitute the western grouping. The east and east-central sections have been divided by Kama Ditch and the east-central to central sections have been mostly divided by Waihee Ditch. Sites that cross multiple lots will be referenced as such in the text. Please note that Lots 1, 4, 15, 20, and 21 were previously subject to Inventory Survey (Dega 2003) and will only be mentioned briefly herein. Further, subsurface testing results are presented in abbreviated form in the body of the text as the stratigraphic profiles were fairly homogenous and the results of trenching were very limited.

Additionally, while eight State Site Numbers have been assigned to the identified features, several of the site numbers pertain to more than one feature composing the site. For instance, Site –5489, composing historic-modern roadways, contains six different segments in different parts of the project area. Not all temporary sites (T-#) received permanent site numbers. Table 1 denotes State Site Numbers and their associated temporary site numbers.

Table 1: State Site Numbers and Associated Temporary Site Numbers

State Site Number and Feature 50-50-04-#	*Temporary Site Number (T-#) and Lot Number
-5473 Hopoi Reservoir	n/a; Lot 21
-5474 Kama Ditch	n/a; Lot 20 and Lot 21
-5493 Ditch	T-24; Lot 3 and Lot 7
-5197 Waihee Ditch	T-13; Lot 9, 12, 14, 12/16, and 11/15
-5489 Roadways	T-17, T-33, T-34, T-18, T-9, T-21; Various Lots
-5490 Drainage Ditches	T-15, T-16, T-19; Lot Various Lots
-5491 Artifact Scatter	T-05; Lot 19
-5492 Clearing Mounds	T-20, T-29, T-30, T-22, T-28, T-26; Various Lots

*Note: The text describes these features in terms of their temporary site number

THE EASTERN GROUP (LOTS 22 AND 23)

This grouping of lots (n=2) forms the northeastern corner of the project area. Lots 20 and 21 were previously surveyed (Dega 2003) during which Site -5474 (Kama Ditch) and Site -5478 (basalt adze fragment) were recorded.

LOT 22

One item of note was identified on Lot 22, a small earthen berm that ran north-south from the northern flank of Hopoi Reservoir for *c.* 400 m (1,300 feet) to a small Quonset hut (Site T-6; no state site number designated). The berm was only *c.* 1 m high and power poles ran next to the berm. No architectural components were identified in the berm and no artifacts eroded from the soil. The berm was presumed to be created during installation of the power poles.

LOT 23

The main observation for Lot 23 was that a segment of Kama Ditch, Site -5474, passed along its northern flank. This portion of Kama Ditch was assigned as T-04 (Figure 7) in the field. Kama Ditch itself runs roughly north-south across the parcel through Lots 23, 18, 21, and 20. In the Lot 23 portion of the drainage ditch, the sides are primarily concreted over an earthen base. However, sections of the ditch are lined with dry laid stone, preformed concrete slabs, and stone and mortar. This drainage is spatially associated with Hopoi Reservoir although it does not directly carry water into the reservoir or drain water out of the reservoir. This is an amended observation from the initial survey by Dega (2003). Of note for this section of the ditch was that the concrete drainage feature was constructed on parallel railroad rail pieces of formed concrete slabs (Figure 8). The ditch in this section is approximately 1 m deep and 3 m wide. This water conduit could date to a time contemporaneous with Hopoi Reservoir (1905-1907).

Two isolated finds (IF-1; Appendix A), a porcelain ceramic body sherd and ring foot, were recovered from the surface of Lot 23 (Figure 9). The sherds contained interior and exterior glaze with a slight bluish tint but were too small to gain more significant information. The sherds occurred in secondary context and were not given state site numbers.

THE EASTERN-CENTRAL GROUP (LOTS 10, 16, 17, 18, AND 19)

The east-central group is composed of five lots occurring between Kama Ditch and Waihee Ditch. Lot 15, also occurring along this north-south tract, was previously surveyed (Dega 2003) but yielded only negative results.

LOT 10

Located along the extreme southern boundary of the project area, Lot 10 yielded several of the more intriguing finds. T-14, representing a section of Site -5197, consisted of an earthen berm running parallel to T-15 (a portion of Site -5490), a formalized drainage conduit. T-14 measured 35 m long, 2 to 3 m wide, 1 m high, and was oriented on an east-west axis. The berm

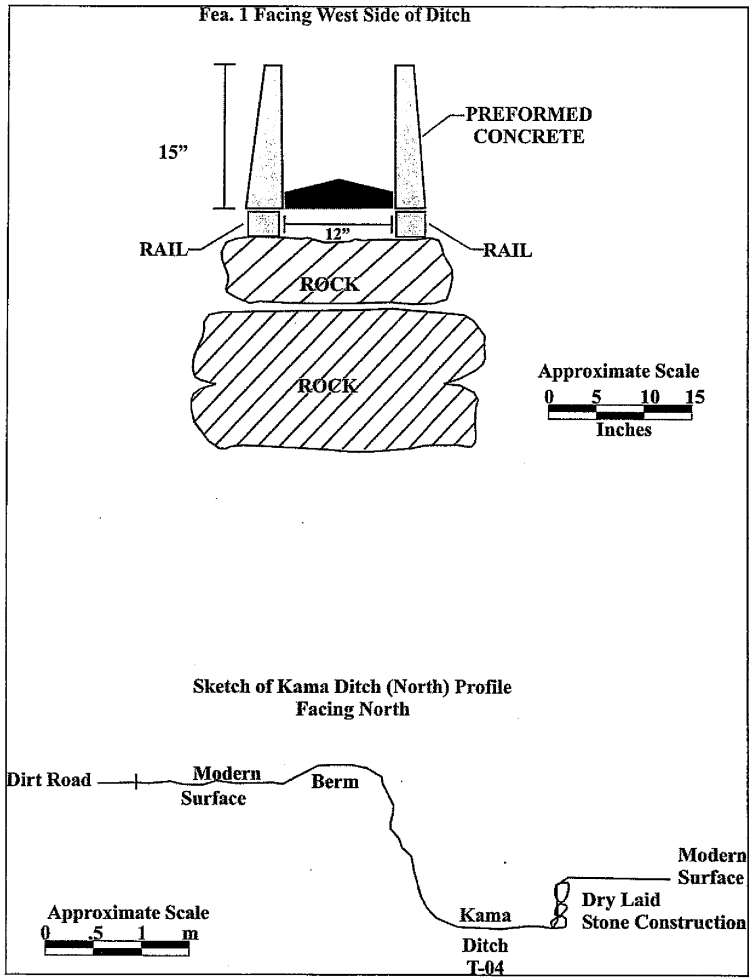

Figure 7: Sketch of Kama Ditch and Concrete Slab Feature.

was pushed against the southern flank of T-15 and was likely a modern, bulldozer-created feature (and was not assigned a State Site Number). T-15 consists of an east-west bearing irrigation ditch running for c. 3,400 feet from the western boundary of the parcel to a small drainage basin at the intersection of Honoapi`ilani Highway and Kuikahi Drive in the southeastern corner of the parcel on Lot 20. The conduit runs beneath, not into, Waihee Ditch and Kama Ditch. This occurs as the channel runs through two large metal culverts measuring 5 m deep and 15 m in diameter beneath the larger ditches. Fractured slabs of concrete occur at the base of the T-15 conduit floor, these likely having been eroded through time; a similar occurrence is seen in Kama Ditch. The conduit appears to be a naturally eroded drainage at its western section yet becomes more formalized with concrete as it reaches Waihee Ditch and proceeds past Kama Ditch. T-15 definitely articulates with the two major drainages and may date to the same time period.

T-17, T-33, and T-34, part of Site -5489, are all small, dirt road segments occurring in Lot 10. The roads average 4 m wide and have earthen berms on their sides, this created by of clearing during construction or maintenance of the roads. These may be segments of older sugar cane-era roads that course through the property.

Several isolated artifact finds were documented in Lot 10 (see Appendix A). IF-2 was located in the T-14 earthen berm and IF-8 was located on the T-17 road segment. IF-2 consisted of a cowrie shell (*Cypraea* sp.) weighing 13.2 grams. IF-8 consisted of a fragmented red brick with concrete mortar. These finds were not given state site numbers.

LOT 16

Several important sites were recorded in Lot 16, the parcel also being subject to the most intensive excavations in our quest for remnants of Hopoi Camp. The major site of this lot, and perhaps of the project area, was Site T-13, Waihee Ditch. This site has been designated as State Site Number 50-50-04-5197. Waihee Ditch, which was constructed between 1905 and 1907 (Wilcox 1996:124), runs north-south through the entire project area for *c.* 1,515 meters and varies from 2 to 5 meters feet wide. The ditch borders the east-central and central lots across the project area (see Figure 3) and runs roughly parallel to Kama Ditch along the 140 meter elevation contour. However, unlike Kama Ditch, Waihee Ditch continues far past Waikapu towards Ma`alaea. The historic Waihee Ditch is presently in use, as evidence by substantial columns of water coursing through its channel.

Figure 8: Photograph Showing Concrete Slab Over Kama Ditch.

Figure 9: Photograph of Isolated Find 1.

At the southern intersection of Waihee Ditch and T-16 (an east-west ditch, Site -5197; see below), the major drainage is 2 m wide and 3 m deep. The ditch is lined with concrete sides that are vertical and appear to be of single-slab construction. Towards the northern section of Lot 16, the Waihee Ditch runs past an existing, active corral. Here, the ditch is built with plastered side walls, rails, and metal walkways. Near the northern terminus of the project area (Lot 19), Waihee Ditch is 5 m wide and 2 m deep. In this section, concrete was poured to form the layered sides of the ditch and a concrete valve controls water output. Also in this northern section, a concrete block structure occurs on the eastern side of the ditch. The structure has a hole in its side where a pump or gauge was removed.

Intersecting with Waihee Ditch is T-16 (Site -5490), an east-west bearing ditch that also intersects with T-24 (Site 5493), a ditch located along the western flank of the project area. T-16 is a small ditch measuring a variable 1 to 2 m wide, 2 m deep, and runs for approximately 1,000 meters through the south-central portion of the project area parcel. The western, upslope portion of the ditch is wider and more deeply eroded. There is no evidence of construction (*i.e.*, concrete slabs) at the western end of the ditch. As the ditch nears Waihee Ditch, the dimensions increase to 2 to 3 m deep and 5 m wide. T-16 passes beneath Waihee Ditch through a metal conduit and thus appears to be a later construction. The eastern terminus of the unnamed ditch lies approximately 242 meters to the west of Honoapi`ilani Highway and does not empty into a basin but simply ends at a small berm.

T-19 (Site -5490) consists of an earthen ditch running west-east (upslope) across the central portion of the project area toward Hopoi Reservoir. The ditch runs for approximately 1,060 meters and is composed entirely of an earthen floor. The interior width of the ditch measures 3.5 meters and the depth is 1.5 m below the undulating ground surface. As is typical for this area, the ditch becomes deeper and narrower along its western flanks, a function of increased susceptibility to erosion more so than on the flatter, eastern flanks. The ditch runs perpendicular to the westernmost ditch (Site T-24 or a portion of Site -5493; see below) and artificially terminates several meters from the western edge of Hopoi reservoir at a small earthen berm.

Other features noted on Lot 16 include T-18 (Site -5489), T-20 (Site -5492), and T-25 (no state site number designated). T-18 is a small, unpaved road segment measuring *c.* 4 m wide and running along the northern boundary of Lot 16 and southern boundary of Lot 17. The road segment occurs to the northwest of Hopoi Reservoir and terminates at the abovementioned corral. T-20 is a linear basalt rock pile measuring 30 m on a north-south axis by 2 m high by 5 m

wide. T-20 is a clearing mound. Finally, T-25 consists of an earthen berm located along the southern flank of the T-19 ditch. This berm appeared to be a modern creation (bulldozer work).

Seven historic glass and ceramic fragments, composing IF-6, were recovered from the surface near the northwestern flank of Hopoi Reservoir. The fragments consist of glass body sherds, glass bases, and a ceramic ring foot sherd (see Appendix A). None of these pieces were readily datable. However, due to the mini-concentration of historic materials, and the ever increasing desire to locate Hopoi Camp, a multitude of trenches were excavated in the IF-6 area. The results of this trenching were mixed (see below) and Hopoi Camp, if evidence still exists in this area of the parcel, was not identified.

LOT 17

Two features were documented in Lot 17. T-08 (no state site number assigned) represents a small, modern concrete bridge that crosses the Kama Ditch in the northern section of the project area. T-09 (Site -5489) consists of a north-south bearing elevated dirt road running parallel to Kama Ditch at the eastern flank of Lot 17 and western flank of Lot 22. The road has been built up and is elevated on a raised bed some 0.8 m above the surrounding terrain. The road may have been utilized in the upkeep of Kama Ditch or to access the Hopoi Reservoir area.

LOT 18

Only one feature was identified during the survey of Lot 18. T-12 (no state site number designated) represents a field soil boring location and consists of a concrete square measuring 66 by 13 centimeters. Inscribed into the concrete are the words: *FIELD 63 TEST BORE*. Also inscribed was the following: *ELEV. 457 07, May-June 1945, Water 30.56, Salt 1.5 GR*. Soil testing was thus conducted on the parcel in the summer of 1945. The results of this testing have yet to be located.

LOT 19

This area, occurring near the northern flank of the survey area, contained several features, foremost among them the largest historic artifact scatter on the property. A significant portion of Site -5474, Kama Ditch, runs through Lot 19 along its border with Lot 23 and continues to the northeast out of the project area. In this northern section, Kama Ditch is lined with preformed concrete slabs (62 cm high, 4 cm thick) and in some sections, the eastern ditch walls are formed of four courses of basalt cobbles roughly filled with cement. The cement appears to have been used as mortar when the wall was built, the wall not appearing to pre-date the cement mortar

finish. The western side of these sections is composed only of earthen berms. Kama Ditch is broken in places along this northern link although other sections are fairly substantial.

Adjacent to Kama Ditch in this northern section is T-06 (no state site number designated), a Quonset hut situated just to the west of a ditch segment. The Quonset hut consists of a wire cage with acoustic tiles hung on the inside of the structure. Various metal machinery parts lie outside the hut. T-06 was probably constructed and utilized during sugar cane production on the parcel, as indicated by the several older valves and pipes outside the hut. However, this temporal assessment is tenuous.

T-05 (Site -5491) represents a historic trash scatter located adjacent to the northeast of the Quonset hut. The scatter was recorded for 80 m along a dirt road (portion of T-09, Site -5197) running parallel to Kama Ditch. The site consists of mostly small historic glass and ceramic fragments exposed on the surface of the dirt road, the latter being some 5 m to the west of Kama Ditch. After dividing the area into 5 m grids, systematic surface collections of each square commenced. Only a few grid squares failed to produce an historic artifact. A total of 141 historic ceramic sherds and glass shards, among other artifact classes, were collected from the site, all appearing in secondary context. Other classes of materials collected include small coral fragments (non-worked), some marine shell, and several non-diagnostic iron pieces. As catalogued in Appendix A, several diagnostics allowed for dating some of the fragments to the early 1900s. The small sizes of the pieces precluded matching each of the fragments with a specific time period. However, in the context of parcel use and the nature of the scatters' pieces, it is estimated that a majority of the scatter likely dates to the late 1880s to the early 1900s. One glass shard base piece was manufactured in 1925, for instance, as based on the bottle's manufacturer stamp. In the context of known regular historic construction events and land use on the parcel, the offered date range appears to coincide with these types of cultural materials. To investigate this large scatter further, seven trenches (ST-12, 13, 14, 16, 17, 18, and 19) were excavated on Lot 19, again with mixed results.

THE CENTRAL GROUP (LOTS 11, 12, 13, 14, AND 9)

Five large lots composing the central grouping of the parcel occur to the west of Waihee Ditch. Several previously-noted ditches occur in these lots, T-16 and T-19 among the most notable (both have been designated as part of Site -5490).

LOT 11

The northern flank of Lot 11 forms one boundary of the T-16 ditch as it proceeds from the western flank of the project area to the eastern section near Kama Ditch. Beyond the ditch, no features or surface cultural materials were located within Lot 11.

LOT 12

The southern boundary of Lot 12 is bound by the T-16 (Site -5490) ditch. Only one feature, a small rock pile, was noted on Lot 12. The rock pile failed to exhibit any structure and measured 6 m in diameter by 3 m high. The insignificant rock pile is a small, conical-shaped clearing mound with dirt and boulders composing its upper surface.

LOT 13

The northern boundary of Lot 13 is formed by the T-19 (Site -5490) ditch. Only two clearing mounds were documented on Lot 13. T-29 (Site -5492) consists of a rock mound measuring a variable 2 to 5 m high and 20 m (north-south) by 30 m (east-west). This substantial clearing mound was formed by machinery clearing the land for sugar cane cultivation. Like T-29, T-30 (Site -5492) was also a large clearing mound. T-30 measured 3 m high, 10 m wide, and 23 m long on an east-west axis. These were two of the most significant clearing mounds occurring in the project area. It is likely that others existed on the parcel, but the rocks forming them may have been dismantled to be utilized elsewhere.

LOT 14

The northern flank of the T-19 (Site -5490) ditch forms the southern boundary of Lot 14. Two fairly inconsequential features were also noted on Lot 14. T-21 consisted of a small, unpaved section of road running a short distance along T-19. The road measured 4 m wide. T-22 represents a linear push pile along the northern flank of T-19. The push pile was mostly composed of soil and small boulders hastily arranged along the ditch. It is possible that this push pile is associated with clearing the small road (T-21; Site -5489) as the road segment is cleared between two small sections of the push pile. There was very little structure to the push pile.

LOT 9

Occurring in the northwestern portion of the project area, Lot 9 failed to yield any significant finds. Only a modern two-track road was evident along the western flank of the lot.

THE WESTERN GROUP (LOTS 2, 5, 3, 6, 7, AND 8)

The western group stretches to the boundary with Wailuku Heights, an existing residential neighborhood. From south to north, six lots were present in this grouping. Lot 1 and Lot 4 to the south were previously subject to Inventory Survey (see Dega 2003) but did not yield any significant sites.

LOT 2

One feature was recorded in Lot 2 in the southwestern portion of the project area. T-15 (Site -5490) consists of an earthen ditch that runs from Wailuku Heights to the east through the current project area and terminates at Honoapi'ilani Highway. The ditch is slightly smaller in width than either Kama Ditch or Waihee Ditch, and measures a variable 0.5 to 3.0 m deep and some 3.0 m wide. T-15 does not contain any formal construction elements in its formation. The drainage ditch runs beneath Kama Ditch in the southeastern portion of the project area and represents another one of the west-east (upslope) drainages occurring on the property.

LOT 3

The southern boundary of Lot 3 formed the northern boundary of the T-16 (Site -5490) ditch. No cultural materials or structures of note were identified in Lot 3.

LOT 5

Located directly to the north of Lot 2, Lot 5 yielded little in the way of features or surface finds. Only one isolated find was notable, IF-9, which consists of an unidentified iron stabilization device (see Appendix A). Cement adhered to the surface of the iron and it may have been a displaced construction element, its purpose unknown.

LOT 6

Located just to the east of Lot 3, the southern border of Lot 6 formed the northern border of the T-16 ditch (Site -5490). Only two clearing mounds/push piles were documented in Lot 6. T-28 and T-29 (both composing a portion of Site -5492) represent dirt and rock-composed mounds measuring an average 30 m long, 10 m wide, and 3 to 5 m high. Boulders, displaced soil, concrete fragments, and PVC pipe were found on both the mounds.

LOT 7

Two features were identified in Lot 7, a clearing mound and a ditch. T-26 (Site -5492) consists of a large mound composed of rock and displaced soil measuring 2 m high, 60 m long, and 12 m wide. Small boulders, concrete pieces, and irrigation pipes were strewn about the

clearing mound. The more significant feature initially documented on Lot 7 was T-24, an irrigation ditch.

Site T-24 (Site -5493) is a concrete-lined, north-south oriented ditch that parallels the western boundary of the subject property. Water runs to the south and drains into an unnamed reservoir just to the south of Kuikahi Drive outside of the project area. The ditch runs for approximately 1,273 meters through the project area and directly borders the former sugar cane lands. The interior channel of the ditch is 1.5 m wide and 0.9 m deep. The ditch is primarily composed of concrete, however, angular gravels form the base of the structure. Some southern sections of the ditch are crossed by white PVC pipes.

LOT 8

The only claim to fame for Lot 8 is that the southern border of the lot parallels the northern flank of T-19 (Site -5490), an east-west running ditch.

HOPOI RESERVOIR DOCUMENTATION

This site was first documented during Inventory Survey of eastern parcels (Dega 2003). As documented in that report, Hopoi Reservoir, State Site Number 50-50-04-5473 occurs along the western flank of Lot 21 (see Figure 1) and to the east of Lot 16 and Lot 17. This reservoir is the largest in the intermediate zone and occurs just to the north of Kama Trench (Site -5474). The present study allowed for more descriptive information on the reservoir.

Hopoi Reservoir measures approximately 825 feet (251 m) long on a north-axis by 225 feet (69 m) at its widest section. Shaped like a fancy hotel swimming pool (irregular, amoeba-shaped), the reservoir is well-constructed from basalt and some concrete additive. The floor of the tank lies some 15 feet below the top of its enclosing wall; the top of the reservoir wall averages 2 m across. At the northeast corner of the reservoir, the outer margin of the reservoir is constructed of dry laid basalt boulders measuring some 20 to 80 meters across. The wall slopes inward from its base and larger boulders form the bottom core of the construction. Interstices are cobble-filled (this practice is often referred to as 'chinking' or placing very small rocks in spaces created by fitted larger rocks in a wall). The stone construction of the site is present in the lower 5 to 6 feet while upper construction (1–2 feet) is solely soil-based. In some instances, stone construction has been reinforced by concrete. Hopoi Reservoir is a well-constructed feature that is now void of water and has been abandoned.

On the northeast corner of the reservoir wall is a metal tank. The tank measures 74 inches in circumference and a 2-inch metal pipe extends to the outside of the reservoir. This feature likely acted as a drain should the reservoir reach near capacity.

At the northwestern flank of the reservoir, on the upper rim, is a corrugated metal structure resting on a stone foundation. The structure measures 4.90 m (east-west) wide by 6.15 m (north-south) long and is an estimated 3.00 m high. A screened ventilation area occurs below the roof and locking casement windows occur on the east and west sides of the structure. The north and south sides of the building have double doors. The interior is a work room containing a generator, desk, chair, meter boxes, and electric lights. Kama Ditch, Site -5474, lies to the east of the reservoir and contrary to our initial opinion, does not directly empty into or drain into Hopoi Reservoir.

SUBSURFACE TESTING: THE HIGHLIGHTS

Twenty-seven trenches were mechanically excavated by backhoe to test for the presence/absence of subsurface cultural deposits in a variety of project area locations. Of these, only a few merit serious considerations. Several trenches were excavated to sample surface artifact scatters and many trenches were placed through historic ditches to assess construction techniques. Appendix A details the few artifacts found in specific trenches (mostly backfilled sediment; secondary context) and Appendix B for stratigraphic profiles of each trench excavated during this project. The following provides trenching results from the more informative trenches.

STRATIGRAPHIC TRENCH 1 (ST-1)

The trench results of ST-1 (Figures 10 and 11) are described herein as it represents a common stratigraphic profile encountered during trenching across the parcel. ST-1 measured 15 m long (north-south axis), 1.10 m wide, and was excavated to a maximum depth of 1.40 meters below surface (mbs). Four discrete stratigraphic layers were documented in ST-1. Layer I (0–0.28 mbs) was composed of very dark grayish brown (10YR 3/2) coarse sandy silt with rounded gravels. Layer II (0.28–0.78) consisted of very dark grayish brown (10YR 3/2) silt overlying unsorted pebbles and cobbles. Layer III (0.78–1.24 mbs) was composed of very dark brown (10YR 2/2) massive silt peds with few sub-angular pebbles. Layer IV (1.24–1.40 mbs) consisted of dark brown (10YR 3/3) to dark, yellowish-brown (10YR 3/4) granular, graded, course silty sand with few small waterworn pebbles. All four layers were culturally sterile.

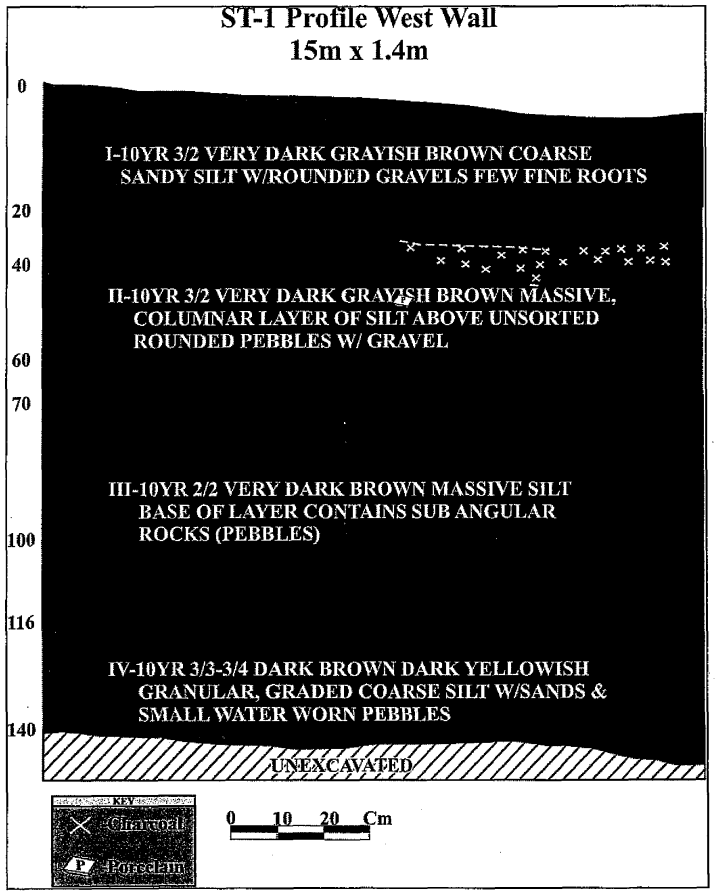

Figure 10: Stratigraphic Profile of ST-1, Profile to the West.

Figure 11: Photograph Showing ST-1.

Representative Stratigraphic Trench Soils

Variations of this stratigraphic profile did occur in portions of the project area but the effects were inconsequential in terms of the presence/absence of cultural materials. Compact silty loam, silty clays, compacted silt, and sandy silts were the most common classes of soil recognized in the other trenches. The reader is referred to the first Inventory Survey of the property for additional data on project area soil regimes (see Dega 2003).

STRATIGRAPHIC TRENCH 13 (ST-13)

This trench (Figures 12 and 13) was one of the more interesting as it was placed to bisect a northern section of the Kama Ditch. In profile, both construction elements and three stratigraphic layers were documented. First, basalt cobbles were fitted into the eastern face of the ditch. From the surface, the construction extended to 1.10 m below the ground surface. The western, upslope side of the ditch was primarily earthen. This construction method whereby the downslope flank was buffered by fitted rocks was presumably due to the propensity for gravitational erosion to more heavily erode a downslope bank rather than an upslope bank. Secondly, three soil layers were present in the floor of the ditch (Note: profile depths for each layer are variable outside the ditch floor). The ditch floor and primary sidewalls were composed of Layer I (0–0.24 mbs), a dark brown (7.5YR 3/3) silt-silty clay. Layer II (0.24–0.34 mbs) was composed of very dark brown (7.5YR 2.5/2) compacted silt. Basalt wall cobbles were constructed on this layer. Layer III (0.34–0.40 mbs) was composed of dark brown (7.5YR 3/2) fine laminar silt. Based on the fairly shallow ditch floor profile, it surprisingly appears as though some maintenance of this feature occurred fairly recently, particularly considering the relative ease of silty sediment build-up in a water-based environment such as an active ditch.

STRATIGRAPHIC TRENCHES AND CULTURAL MATERIAL

Fourteen out of twenty-seven or roughly half of the excavated trenches yielded cultural material. Of the total fourteen trenches, all but two were excavated around T-05 (Site -5491) and just to the west of Hopoi reservoir, two locations which contained surface artifacts. A total of 99 pieces of glass, ceramic, bone, coral, shell, and ambiguous iron fragments were recovered during trenching. All the significant artifacts were historic; none were traditional-period artifacts. A majority of these cultural materials were identified in the backfill of the excavated trench, an indication that 1) the materials were small in size; and 2) no concentrated cultural deposits were identified *in situ* below the surface. Overall artifact counts were dominated by glass body shards, a not so surprising conclusion considering the fractioned nature of glass. All the finds and their proveniences are listed in Appendix A.

Temporal identification of the recovered cultural material was arduous due to the small, rather non-diagnostic appearance of the glass, ceramic sherds, or other artifact types. Several diagnostic pieces were amenable to dating however. In total, the manufacturing dates for glass shards ranged from 1919 to post-1950. Ceramic fragments such as body sherds indicative of a style known as 'Dutch gaudy wear,' while still made in various forms today, were popular in the islands from the late 1800s through early 1900s (Dr. Bertell D. Davis, personal communication). The artifact assemblage, although mostly non-diagnostic, does fall in line with late 1800s to the early 1900s use of the landscape. The fact that most of these artifacts were recovered in secondary context does not hinder this interpretation because solid evidence supports feature construction and industrial use of this landscape from the late 1800s through early 1900s and beyond. Perhaps the most glaring omission in the archaeological record of Kehalani Mauka is traditional period activity.

DISCUSSION AND CONCLUSIONS

Archaeological Inventory Survey investigations were conducted on a 348.613 acre parcel of land located in an open, intermediate zone of southern Wailuku Ahupua`a, Wailuku District, Maui Island, Hawai`i (TMK:3-5-001:001). Inventory Survey included archival research, systematic pedestrian survey of the project area, and representative subsurface testing. While the landscape did not yield traditional-period archaeological sites, it did reveal a complex network of ditches, roads, and reservoirs intimating large-scale activity in this dry intermediate zone during the late 1800s to the early 1900s and beyond.

MONUMENTAL HISTORIC FEATURES

Several noteworthy features were identified in the project area. Large-scale, historic features such as Waihee Ditch (Site -5197) and Kama Ditch (Site -5474) traverse the landscape in monumental proportions. Hopoi Reservoir (Site -5473), one of the few named features in the area, constitutes a rather important water catchment in an otherwise inhospitable environment.

WAIHEE DITCH

In terms of site information, the most available for the area pertains to Waihee Ditch. According to Wilcox (1996:124), the Waihee "Canal" was started in June 1905 and was completed in May 1907. The entire canal cost $160,000 to construct, a fee less than half the price of a single house that will be placed on this parcel in the near future. The Waihee Canal was built under the leadership of an engineer named James T. Taylor. The canal, or ditch as it is now known, represents a monumental effort to carry water to dry areas of Maui and it is well worth quoting Wilcox's (1996:124) research at length to show this effort:

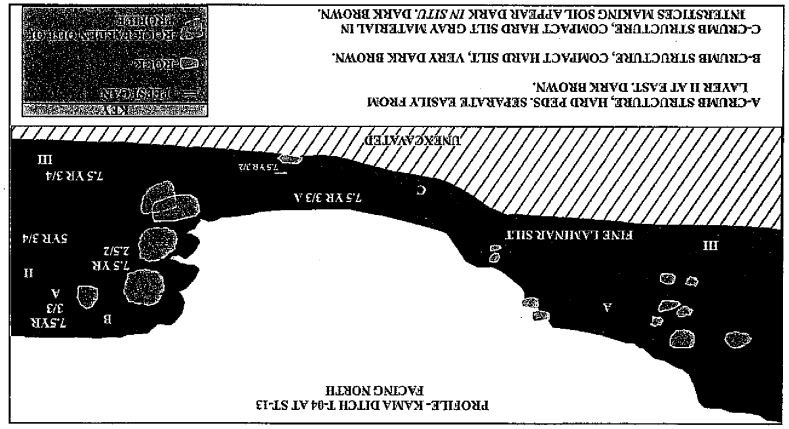

Figure 12: Stratigraphic Profile of ST-13. View to North.

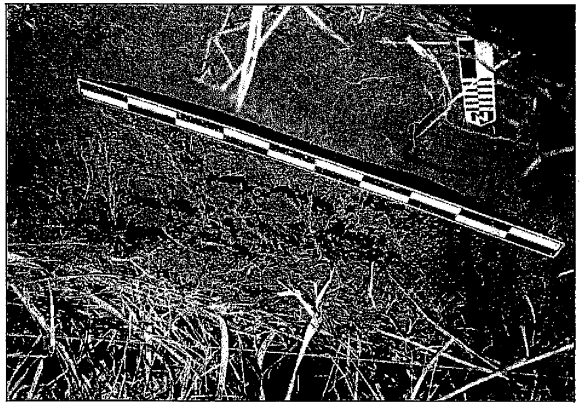

Figure 13: Photograph of ST-13.

> this 50-mgd-capacity ditch tapped the Waihee stream at the 650 foot elevation, just below the Aliele falls. . .Its 10.62 miles included twenty-two tunnels totaling 16,539 feet; thirty-nine flumes totaling 2764 feet; *35,549 feet of open, cement-lined ditch* [italics mine]; and a 1253-foot-long, 3-foot-diameter siphon to cross Iao Valley. Ditch grade averaged 2/5 feet per 1000. The longest tunnel (2246 feet) was especially challenging, as much of it went through hard close-grained rock and it required compressed air and percussion drills. This tunnel took eighteen months to cut. The contract price for the labor ranged from 85 cents to $5 per foot, depending on the material cut, the location, and the length of the tunnel.

The Waihee ditch (or canal) represents one of the oldest securely dated features on the Kehalani Mauka landscape. However, several other significant ditches run parallel to Waihee Ditch and are of similar construction. It possible that these ditches were contemporaneous with Waihee Ditch. Kama Ditch and Hopoi Reservoir, two significant features on the landscape, were constructed around the same time period, both pre-dating 1922, as they both appear on a 1923 TMK map book for this section of Maui. Consequently, it is also believed that a vast majority of the artifacts recovered during this project date to the same time period. The one missing link to the cultural history of this landscape are data that may possibly be derived from Hopoi Camp.

WATER CIRCUITRY

Several intriguing patterns emerge as one focuses upon the empirical, historic-period evidence at hand. One of these patterns is the direction in which the historic ditches have been constructed and utilized across the parcel. Case in point: three main ditches or canals run north-south, or parallel to the slope, across the project area and beyond. Waihee Ditch, Kama Ditch, and the westernmost ditch of Site T-24 (Site -5493) are the most well-constructed on the parcel. These ditches were water conduits across these dry zones. Typically they could be used to water areas along their course or would simply empty into large retention basins (reservoirs) at selected points.

However, there is also a network of ditches, mostly earthen berms and small channels, that run perpendicular to the slope on a west (upslope)-east (downslope) axis. These ditches are commonly non-formalized like the north-south ditches and tend to be more localized. Site T-16 (Site -5490), built on an east-west axis for instance, runs a total of 1,000 meters while the north-south Waihee Ditch runs for more than 16 kilometers. The important point is that there is a functional difference between the north-south oriented ditches and the east-west coursing ditches. The more formalized [and costly] north-south ditches are actually water conduits

wherein water may be carried long distances to irrigate such water-poor locales as the present project area. The less conventional ditches situated on an east-west axis are simply drainages and do not fulfill an irrigation role on these dry parcels. These smaller ditches appear to be more naturally formed by erosion and were simply modified to accommodate excess water and sediment flow so as not to interfere with the main purpose of cultivation. This pattern appears valid for the present project area but requires additional information from other locales to be proven, negated, or amended.

Thus, we propose two hypotheses that remain to be examined:

1. All north-south canals or ditches along central Maui that run parallel to the slope are water conduits and inherently contain an irrigation function.

2. All east-west bearing canals or ditches along Central Maui that run perpendicular to the slope are only drainages that do not disseminate water for irrigation purposes but function to remove overflow so as not to curtail cultivation potential.

DISCUSSION POINTS

The root causes for such negative pre-Contact findings, particularly from traditional-period use of the landscape, may be multi-fold. First, and most obviously for this location, historic impacts have dramatically altered the landscape so much as to erase larger archaeological traces of traditional-period activities. Sugar cane cultivation is fairly destructive from the surface into subsurface contexts, although there are exceptions. Soil borings show disturbances that extend over two feet below the surface. Second, the lack of traditional-period evidence suggests that these open lands were simply not intensively utilized during prehistoric times. The current project area may have not been selected as a habitation zone as it is an open area without perennial water resources and more preferable lands were readily available.

During traditional times, primary areas selected for settlement such as Wailuku, Lahaina, and Hana, for instance, contained abundant natural resources such as water and adequate soils on which to plant, live, and maintain chiefly seats. Population pressure was likely never a factor in Maui settlement patterns; rather, political dictates and prime lands at different elevations available for cultivation were the likely motivators in settlement distribution. The present intermediate landscape was not likely one of those prime areas for extended or intensive activity use during traditional times. The limited information gleaned from project area LCAs and Royal Patents support this assertion. Third, the types of traditional activities conducted within and near the project area may not have left archaeological signatures. For example, feather and botanical

collecting areas would only reveal limited, if any, evidence in the soil. Small taro patches without walls or terraces may be buried beneath deep strata or have been tilled during plantation times. Thus, while not exhaustive, this list provides a sample of activities that may have been conducted in the project area although evidence for such has not survived in the archaeological record. Finally, as is the case for all archaeological projects, sampling may have determined the presence/absence of subsurface cultural materials. This is unlikely but always a prevision that 100 percent of any parcel is not ever fully tested.

As described above, historic-period plantation activities were well represented in the project area. Large-scale features such as Waihee Ditch, Kama Ditch, and Hopoi Reservoir, among the largest of a broad network of water-related features, attest to the imperative need of water in order to cultivate the land. Soil testings have shown extensive disturbance even to subsurface contexts where plow zone/tilling or historic ditch construction is common across the project area. .

While initially occupied with the prospect of identifying Hopoi Camp near the reservoir of the same name (Figure 14), the search has again eluded this archaeological team, for the time being. The small cache of historic artifacts near the reservoir appeared promising but led nowhere. Future archival and archaeological work may eventually lead to the discovery and documentation of Hopoi Camp, and link together the rich plantation history of the area that is now mainly seen through monumental structures on the landscape, and not the daily lives of the persons who constructed the features.

SIGNIFICANCE ASSESSMENT AND RECOMMENDATIONS

Eight archaeological sites were documented in the project area: Kama Ditch (Site -5474), the abandoned Hopoi Reservoir (Site -5473), a north-south ditch (Site -5493), Waihee Ditch (Site -5197), road segments (Site -5489), east-west bearing drainages (Site -5490), a histric artifact scatter (Site -5491), and several clearing mounds/push piles (Site -5492). All eight of these historic sites have been assessed as significant under Criterion D.

Based upon the results of this Inventory Survey, a previous Inventory Survey on the parcel, and the results of archaeological work on adjacent parcels that have also produced primarily negative results (see Buffum and Dega 2001), it appears as though additional archaeological research on this land parcel would not contribute a significant volume of additional data to the interpretation of the area or region or to Hawaiian prehistory/history. Overall archaeological Monitoring is not recommended during construction in the project area.

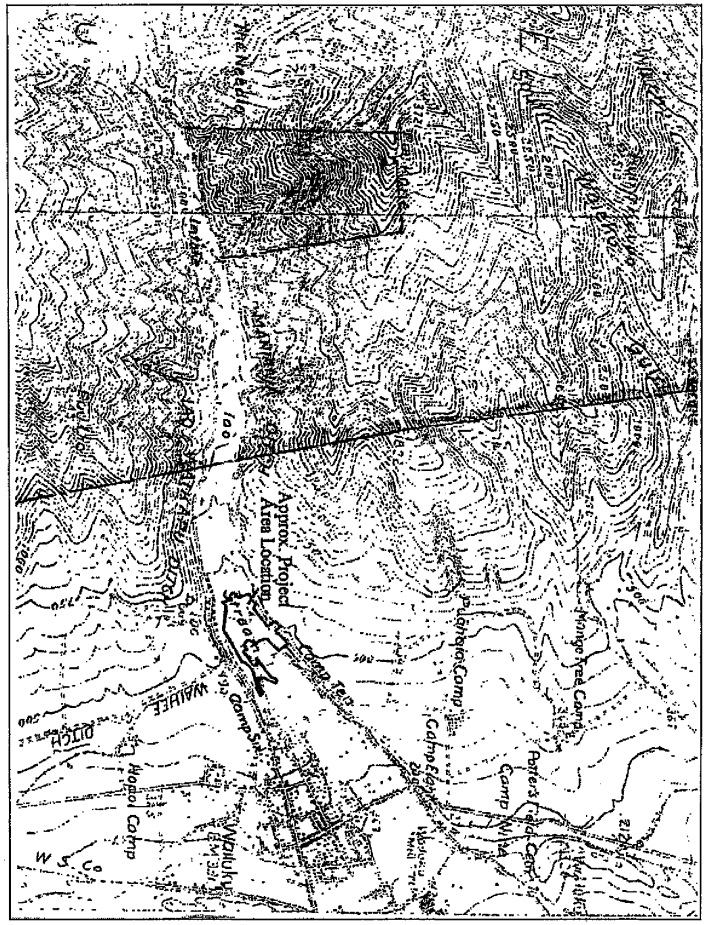

Figure 14: Map Showing Hopoi Camp Near Reservoir. Portion of 1922 Wailuku Quadrangle.

No additional archaeological work beyond spot-checking Lot 16 is needed. Both SHPD and SCS will be notified by the contractor when large-scale ground work is scheduled for Lot 16 so that SHPD and the SCS archaeologist may view the area for any remnants of Hopoi Camp.

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APPENDIX A: ARTIFACT TABLES

SCS PROJECT 396 CULTURAL and MANUPORT MATERIALS INVENTORY

BAG	SITE	UNIT	IN SITU LOCATION	CULTURAL and MANUPORT MATERIALS	LOT COUNT	REMARKS
1	IF-1	-	Surface	Ceramic Body Sherd	1	Interior and exterior glazed with slight bluish tint
1	IF-1	-	Surface	Ceramic Ring Foot Sherd	1	Interior and exterior glazed with slight bluish tint, exterior decorated with blue line circumnavigating the body/ ring foot transition
2	IF-2	-	Surface	Marine Invertebrate	1	*Cypraea* sp. - 13.2 g
3	IF-6	-	Surface	Glass Body Sherds	3	Light green color
3	IF-6	-	Surface	Flat Glass Sherds	2	Clear
3	IF-6	-	Surface	"Milk" Glass Base Sherd	1	Milk color
3	IF-6	-	Surface	Ceramic Ring Foot Sherd	1	Interior and exterior glazed white, exterior decorated with blue lines circumnavigating body/ ring foot transition, interior decorated with red/ white floral pattern surrounded by cobalt blue
4	IF-8	-	Surface	Red Brick	1	Fragmented; cement (fine sand and gravel) mortar attached; laterite, calcareous sand and coarse basalt rock observed as temper. Existing dimensions: height-6.8 cm, length-10.0 cm, width-14.0 cm, weight-1587.6 g
5	IF-9	-	Surface	Unidentified Iron Stabilization Device	1	Device may have been for structure construction; cement adhered to device. Existing artifact dimensions: length-20.0 cm, width-12.5 cm, thickness-1.6 cm, weight-257.9 g
6	5491	-	Surface	Ceramic Body Sherds	5	*A* - Interior and exterior glazed (possible salt glaze), interior brownish-tan colored, exterior brownish-tan and off-white colored. *B* - Interior and exterior glazed off-white, glaze crackled, exterior decorated gold with "eye" pattern. *C* - Interior and exterior glazed white, glazed crackled, exterior decorated with undistinguishable blue pattern. *D*, *E* - "Dutch gaudy ware" interior and exterior glazed white, glaze crackled, green leaf and red flower patterns decorated on exterior.
6	5491	-	Surface	Ceramic Base Sherds	2	*A* - Interior and exterior glazed white with bluish tint. *B* - Interior and exterior glazed white with bluish tint, blue floral pattern decoration on interior.
6	5491	-	Surface	Glass Base Sherd	1	Twist mold, flat base, base embossed with raised 3.
7	5491	-	Surface	Flat Glass Sherd	1	Clear

IF = Isolated Find; ST = Stratigraphic Trench

SCS PROJECT 396 CULTURAL and MANUPORT MATERIALS INVENTORY

BAG	SITE	UNIT	IN SITU LOCATION	CULTURAL and MANUPORT MATERIALS	LOT COUNT	REMARKS
7	5491	-	Surface	Ceramic Body Sherd	1	Interior and exterior glazed white, crackled
8	5491	-	20N/10E	Flat Glass Sherd	1	Clear
8	5491	-	20N/10E	Coral	2	Not worked
9	5491	-	35N/0W	Glass Body Sherds	3	*A* - Lime green color. *B*, *C* - Clear.
9	5491	-	35N/0W	Coral	1	Not worked
10	5491	-	30N/0W	Glass Body Sherds	4	*A*, *B*, *C* - Lime green colored. *D* - Clear.
10	5491	-	30N/0W	Flat Glass Sherd	1	Clear
10	5491	-	30N/0W	Ceramic Base Sherd	1	Interior and exterior glazed white, glaze crackled, interior decorated blue
10	5491	-	30N/0W	Marine Invertebrate	1	Non-diagnostic - 0.3 g
11	5491	-	25N/0W	Glass Body Sherds	3	*A*, *B* - Clear. *C* - Amber color.
11	5491	-	25N/0W	Ceramic Body Sherds	4	Interior and exterior glazed white, crackled
11	5491	-	25N/0W	Ceramic Base Sherds	2	*A* - Interior and exterior glazed white, crackled. *B* - Interior and exterior glazed white, crackled, blue vegetation pattern on exterior.
11	5491	-	25N/0W	Ceramic Rim Sherd	1	Interior and exterior glazed white, crackled
11	5491	-	25N/0W	Non-Diagnostic Iron	1	-
12	5491	-	20N/5E	Glass Body Sherd	1	Clear
12	5491	-	20N/5E	Flat Glass Sherd	1	Clear
12	5491	-	20N/5E	Ceramic Body Sherd	1	Interior and exterior glazed white
12	5491	-	20N/5E	Marine Invertebrate	1	*Periglypta reticulata* - 0.5 g
13	5491	-	20N/0W	Ceramic Body Sherds	4	*A*, *B* - Interior and exterior glazed white, crackled. *C* - Interior and exterior glazed white, non-crackled. *D* - Interior decorated pink/ red, exterior glazed white, non-crackled
13	5491	-	20N/0W	Glass Body Sherds	5	*A*, *B* - Amber color. *C*, *D* - Clear. *E* - Olive-green color.
13	5491	-	20N/0W	Flat Glass Sherd	1	Clear
13	5491	-	20N/0W	Coral	1	Not worked
14	5491	-	15N/5E	Glass Body Sherds	4	*A*, *B*, *C* - Clear. *D* - Olive-green color.
14	5491	-	15N/5E	Ceramic Body Sherd	1	Interior and exterior glazed white

IF = Isolated Find; ST = Stratigraphic Trench

SCS PROJECT 396 CULTURAL and MANUPORT MATERIALS INVENTORY

BAG	SITE	UNIT	IN SITU LOCATION	CULTURAL and MANUPORT MATERIALS	LOT COUNT	REMARKS
14	5491	-	15N/5E	Ceramic Rim Sherd	1	Interior and exterior glazed white
15	5491	-	15N/0W	Glass Body Sherds	4	*A* - Light blue color. *B* - Clear. *C* - Cobalt blue color. *D* - Olive-green color.
15	5491	-	15N/0W	Ceramic Rim Sherd	1	Interior and exterior glazed white, crackled
15	5491	-	15N/0W	Ceramic Body Sherd	1	Interior and exterior glazed black
16	5491	-	10N/5E	Glass Body Sherds	3	*A* - Amber color. *B* - clear. *C* - Olive-green color.
16	5491	-	10N/5E	Glass Sherd	1	Clear, non-vessel sherd
16	5491	-	10N/5E	Ceramic Body Sherds	2	Interior and exterior glazed white, crackled
16	5491	-	10N/5E	Coral	7	Not worked
16	5491	-	10N/5E	Marine Invertebrate	1	*Conus* sp. - 3.3 g
17	5491	-	10N/0W	Glass Body Sherds	7	*A*, *B*, *C*, *D* - Olive-green color. *E*, *F* - Clear bottle glass. *G* - Thin, possible lantern glass
17	5491	-	10N/0W	Ceramic Body Sherd	1	Interior and exterior glazed white, crackled
18	5491	-	5N/0W	Glass Body Sherd	1	Clear
18	5491	-	5N/0W	Ceramic Body Sherd	1	Interior and exterior glazed white, crackled, exterior decorated with gold/ brown indistinguishable pattern
19	5491	-	0N/5E	Glass Body Sherds	3	*A* - Olive-green color. *B* - Aqua-marine color. *C* - Purple color.
19	5491	-	0N/5E	Ceramic Body Sherd	1	Interior glazed off-white and displays informal incising, exterior glazed tan
20	5491	-	0N/0W	Ceramic Body Sherds	2	Pieces fitted, interior and exterior glazed brown, crackled
20	5491	-	0N/0W	Coral	2	Not worked
21	5491	-	5S/5E	Glass Sherd	1	Light green color
21	5491	-	5S/5E	Ceramic Body Sherds	2	Interior and exterior glazed white, crackled
21	5491	-	5S/5E	Ceramic Base Sherd	1	Interior and exterior glazed white, crackled, exterior decorated with manufacturer's stamp (black lettering) lst line: **PAT.**, 2nd line: **NSTON**, 3rd line: **JONE**.
21	5491	-	5S/5E	Non-Diagnostic Iron	1	-

IF = Isolated Find; ST = Stratigraphic Trench

SCS PROJECT 396 CULTURAL and MANUPORT MATERIALS INVENTORY

BAG	SITE	UNIT	IN SITU LOCATION	CULTURAL and MANUPORT MATERIALS	LOT COUNT	REMARKS
21	5491	-	5S/5E	Coral	2	Not worked
22	5491	-	5S/0W	Glass Body Sherd	1	Amber color
22	5491	-	5S/0W	Glass Base Sherd	1	Amber color, base embossed with a raised encircled **B**. Manufacturer: Brockway Machine Bottle Company of Brockway, PA. Manufacture date: post 1925.
22	5491	-	5S/0W	Ceramic Body Sherd	1	Interior and exterior glazed white
22	5491	-	5S/0W	Ceramic Rim Sherd	1	Interior and exterior glazed white
23	5491	-	10S/5E	Flat Glass Sherd	1	Clear
23	5491	-	10S/5E	Ceramic Body Sherds	4	*A*, *B*, *C* - Interior glazed brown, exterior glazed black. *D* - Interior and exterior glazed off-white.
23	5491	-	10S/5E	Ceramic Rim Sherd	1	Interior and exterior glazed tan, crackled
24	5491	-	10S/0W	Glass Neck Sherd	1	Amber colored, raised horizontal line
24	5491	-	10S/0W	Flat Glass Sherds	4	Clear
24	5491	-	10S/0W	Glass Body Sherds	3	*A*, *B* - Clear. *C* - Lime green color.
25	5491	-	20S/5E	Coral	2	Not worked
25	5491	-	20S/5E	Marine Invertebrate	1	Non-diagnostic
26	5491	-	15S/0W	Glass Body Sherd	1	Lime green color
26	5491	-	15S/0W	Ceramic Rim Sherd	1	Interior and exterior glazed white, crackled
26	5491	-	15S/0W	Non-Diagnostic Iron	2	-
27	5491	-	20S/0W	Glass Body Sherds	5	*A*, *B*, *C*, *D* - Clear. *E* - Amber color.
28	5491	-	25S/5E	Glass Body Sherd	1	Amber color
28	5491	-	25S/5E	Ceramic Rim Sherd	1	Interior and exterior glazed white, crackled
28	5491	-	25S/5E	Coral	1	Not worked
29	5491	-	25S/0W	Marine Invertebrate	1	Non-diagnostic - 0.7 g
30	5491	-	30S/5E	Glass Body Sherd	1	Amber color
31	5491	-	40S/0W	Glass Body Sherd	1	Olive-green color
31	5491	-	40S/0W	Marine Invertebrate	1	*Drupa morum* - 0.4 g
32	5491	ST-1	Backfill	Glass Body Sherds	2	*A* - Amber color. *B* - Clear.
32	5491	ST-1	42 cmbs	Ceramic Body Sherd	1	Interior and exterior glazed white

IF = Isolated Find; ST = Stratigraphic Trench

SCS PROJECT 396 CULTURAL and MANUPORT MATERIALS INVENTORY

BAG	SITE	UNIT	IN SITU LOCATION	CULTURAL and MANUPORT MATERIALS	LOT COUNT	REMARKS
33	IF-6	-	-	Glass Base Sherd	1	Amber color, portion of body present, body embossed **DA** near base
34	-	ST-3	Backfill	Glass Body Sherds	2	*A* - Olive-green color. *B* - Aqua-marine color, Coke bottle sherd, embossed with manufacturer's stamp and year. Manufacturer: Owens Illinois Glass Company of Toledo, Ohio. Manufacture date (based on manufacturer's stamp): 1945.
34	-	ST-3	Backfill	Ceramic Ring Foot Sherd	1	Interior and exterior glazed white
34	-	ST-3	Backfill	Non-Diagnostic Iron	1	-
35	-	ST-7	Backfill	Glass Body Sherds	7	*A*, *B*, *C*, *D*, *E* - Clear. *F* - Clear, corrugated. *G* - Light blue.
35	-	ST-7	Backfill	Flat Glass Sherds	2	Clear
35	-	ST-7	West Wall 24 cmbs	Glass Base Sherd	1	Cobalt blue color
35	-	ST-7	Backfill	Ceramic Rim Sherd	1	Interior and exterior glazed white, green and blue floral pattern decoration on exterior
35	-	ST-7	West Wall 35 cmbs	Sawn Mammal Bone	1	-
35	-	ST-7	Backfill	Coral	1	Not worked
36	-	ST-8	Backfill	Glass Body Sherds	2	Clear
36	-	ST-8	Backfill	Flat Glass Sherd	1	Clear
36	-	ST-8	Backfill	Glass Finish Sherd	2	Fitted, screw top design (post 1919 production)
37	-	ST-11	Surface	Glass Body Sherd	1	Amber color
37	-	ST-11	Surface	Glass Rim Sherd	1	Clear
37	-	ST-11	Surface	"Milk" Glass Body Sherd	1	-
37	-	ST-11	Surface	Ceramic Body Sherds	4	Fitted, interior and exterior glazed white
37	-	ST-11	Surface	Ceramic Rim Sherd	1	Interior and exterior glazed white
38	-	ST-11	Backfill	Glass Sherd	1	Amber color
38	-	ST-11	Backfill	Flat Glass Sherd	1	Clear
38	-	ST-11	Backfill	Glass Body Sherd	1	Clear
39	IF-10	-	Surface	Glass Body Sherds	6	*A*, *B*, *C*, *D*, *E* - Clear. *F* - Light blue/ green color.
39	IF-10	-	Surface	Ceramic Body Sherd	1	Interior and exterior glazed white
39	IF-10	-	Surface	"Milk" Glass Base Sherd	1	-

IF = Isolated Find; ST = Stratigraphic Trench

SCS PROJECT 396 CULTURAL and MANUPORT MATERIALS INVENTORY

BAG	SITE	UNIT	IN SITU LOCATION	CULTURAL and MANUPORT MATERIALS	LOT COUNT	REMARKS
40	5491	-	5N/5E	Ceramic Base Sherd	1	Interior and exterior glazed white
41	-	ST-12	Backfill	Ceramic Body Sherds	3	*A* , *B* - Interior and exterior glazed white. *C* - Interior and exterior glazed tan.
41	-	ST-12	Backfill	Ceramic Rim Sherd	1	Interior and exterior glazed white, interior rim decorated with red/ pink stripe, exterior rim decorated with red/ pink stripe and red floral pattern.
41	-	ST-12	Backfill	Ceramic Ring Foot Sherds	2	Interior and exterior glazed white
41	-	ST-12	Backfill	Glass Body Sherds	2	Clear
41	-	ST-12	Backfill	Ceramic Handle Sherd	1	Glazed white
41	-	ST-12	Backfill	Coral	2	Not worked
42	-	ST-13	South Wall 58 cmbs	Medium Mammal Bone	2	-
42	-	ST-13	65 cmbs	Glass Sherd	1	Clear, thick, non-vessel sherd
42	-	ST-13	Backfill	Glass Body Sherd	1	Clear
42	-	ST-13	Backfill	Glass Base Sherd	1	Clear
42	-	ST-13	Backfill	Ceramic Ring Foot Sherd	1	Interior and exterior glazed white
42	-	ST-13	Backfill	Ceramic Body Sherds	2	*A* - Interior and exterior glazed white, exterior decorated with unidentified green color pattern. *B* - Interior and exterior glazed white, exterior decorated with unidentified red/ pink pattern
42	-	ST-13	Backfill	PVC Pipe	1	White plastic
42	-	ST-13	Backfill	Ceramic Base Sherd	1	Interior and exterior glazed tan
43	T-04	ST-13	Backfill	Steel Soda Beverage	3	Fragments
43	T-04	ST-13	Backfill	Ceramic Rim Sherd	1	Interior and exterior glazed white, exterior decorated with red/pink horizontal stripes and red and green floral patterns
44	-	ST-14	Backfill	Glass Body Sherds	3	*A* , *B* - Olive-green color. *C* - Cobalt blue color.
44	-	ST-14	Backfill	Ceramic Body Sherd	1	Interior and exterior glazed white
45	-	ST-15	Backfill	Coral	1	Not worked
46	-	ST-22	Backfill	Flat Glass Sherd	1	Clear
46	-	ST-22	Backfill	Ceramic Ring Foot Sherd	1	Interior and exterior glazed white, exterior decorated with blue bamboo patterns. Sherd is a portion of a tea cup.
47	-	ST-23	Upper Fill	Glass Body Sherds	3	Clear. Artifacts found at west 5 m.

IF = Isolated Find; ST = Stratigraphic Trench

SCS PROJECT 396 CULTURAL and MANUPORT MATERIALS INVENTORY

BAG	SITE	UNIT	IN SITU LOCATION	CULTURAL and MANUPORT MATERIALS	LOT COUNT	REMARKS
47	-	ST-23	Upper Fill	Flat Glass Sherd	1	Clear. Artifact found at west 5 m.
47	-	ST-23	Upper Fill	Sawn Mammal Bone	1	Artifact found at east 5 m.
48	-	ST-24	Backfill	Glass Body Sherd	1	Clear
48	-	ST-24	Backfill	Glass Neck Sherd with Finish	1	Amber color, twist mold, cork top finish with skirted collar, post 1919 production
48	-	ST-24	Backfill	Ceramic Rim Sherds	2	Interior and exterior glazed white
48	-	ST-24	Backfill	Ceramic Ring Foot Sherd	1	Interior and exterior glazed white, interior decorated with what appears to be a part of an oriental language character. Sherd may be from a tea cup due to its size and shape.
49	-	ST-25	Backfill	Glass Body Sherd	1	Light green color
49	-	ST-25	Backfill	Glass Sherd	1	Clear, non-vessel sherd
49	-	ST-25	Backfill	Sawn Mammal Bone	1	-
50	-	ST-26	Backfill	Glass Body Sherds	2	Amber color
51	-	ST-3/ ST-6	Backfill	Glass Rim Sherd	1	Clear, twist top finish, post 1919 production
51	-	ST-3/ ST-6	Backfill	Glass Body Sherds	3	*A* - Clear. *B* - Clear glass with corrugation. *C* - Light green "Coke" bottle glass sherd, embossment: 1st line: **Co**, 2nd line: **TRADE**, 3rd line: **BOTTLE**.
51	-	ST-3/ ST-6	Backfill	Glass Neck Sherd	1	Clear
51	-	ST-3/ ST-6	Backfill	Flat Glass Sherd	1	Clear
51	-	ST-3/ ST-6	Backfill	Glass Base Sherd	1	Amber color, at least two piece mold, embossed **NW 7**. Manufacturer: Northwestern Glass Company of Seattle, Washington. Manufacture date (based on manufacturer using amber glass): post 1950.
51	-	ST-3/ ST-6	Backfill	Ceramic Body Sherd	1	Interior and exterior glazed white

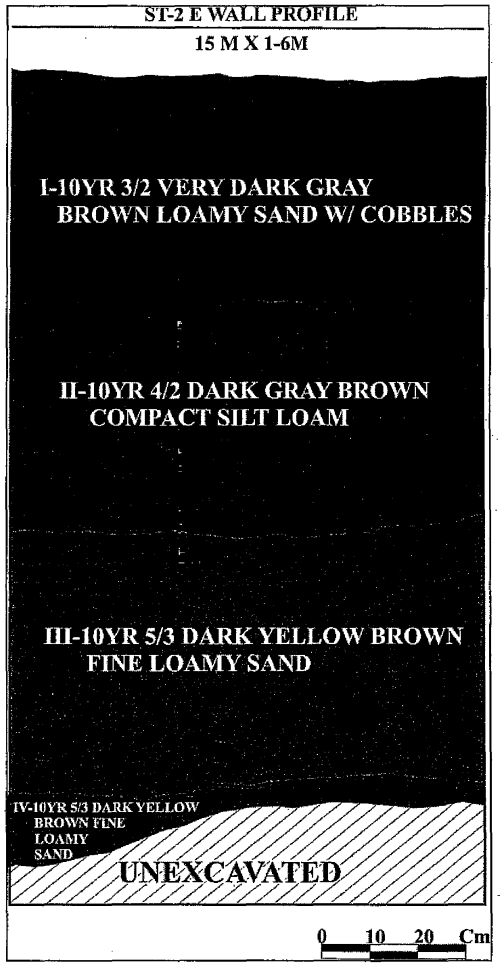
IF = Isolated Find; ST = Stratigraphic Trench

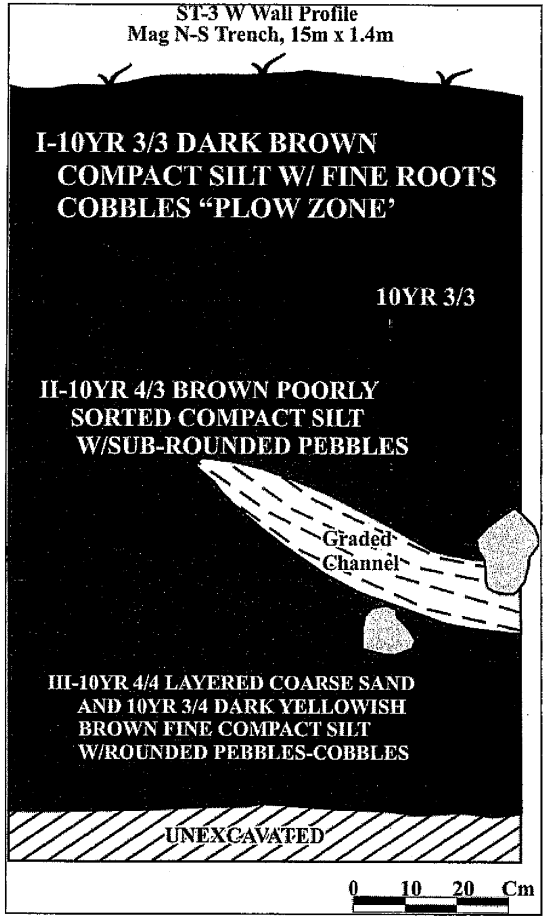
SCS PROJECT 396 CULTURAL and MANUPORT MATERIALS INVENTORY

BAG	SITE	UNIT	IN SITU LOCATION	CULTURAL and MANUPORT MATERIALS	LOT COUNT	REMARKS
51	-	ST-3/ ST-6	Backfill	Glass Bottle	1	Intact, amber color, screw top finish, collared neck, slightly sloped shoulders, multi-faceted body (4-sides), embossed base, 4-piece mold, automatic machine made. Base embossment: manufacturer's stamp with the number * below it. Multiple circles encompass the manufacturer's stamp (fish scale pattern). Bottle dimensions: height-5.1 cm, base dimensions-2.2 X 2.2 cm, body height-3.0 cm, inner mouth diameter-1.2 cm, weight-23.4 g. Manufacturer: Owens Illinois Glass Co. of Toledo, OH. Manufacture date (based on manufacturer's stamp): 1929-1954.
51	-	ST-3/ ST-6	Backfill	Possible Adobe	1	Red in color, attached to soil

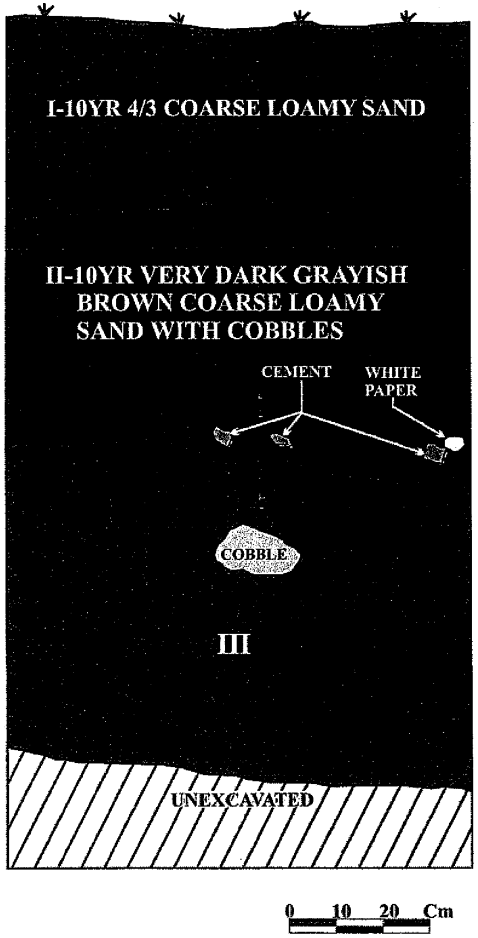
IF = Isolated Find; ST = Stratigraphic Trench

APPENDIX B: STRATIGRAPHIC PROFILES

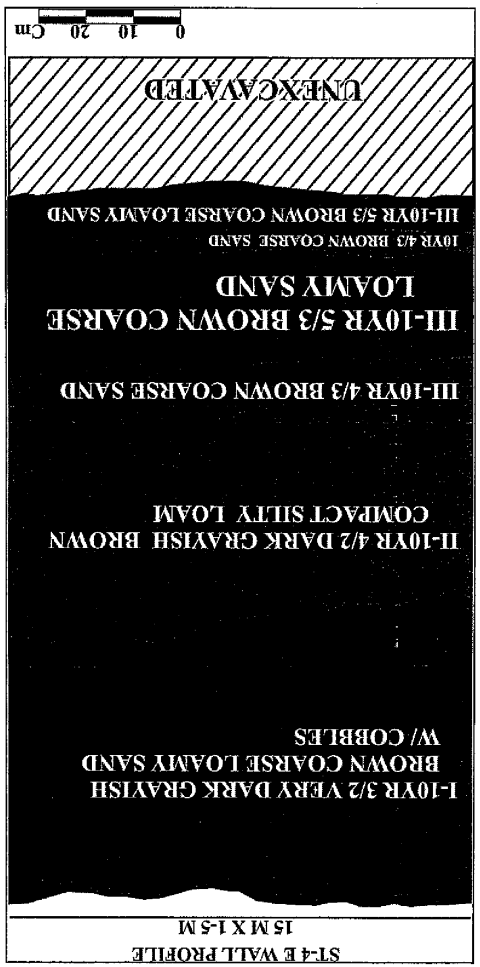

ST-2 E WALL PROFILE
15 M X 1-6M
I-10YR 3/2 VERY DARK GRAY BROWN LOAMY SAND W/ COBBLES
II-10YR 4/2 DARK GRAY BROWN COMPACT SILT LOAM
III-10YR 5/3 DARK YELLOW BROWN FINE LOAMY SAND
IV-10YR 5/3 DARK YELLOW BROWN FINE LOAMY SAND
UNEXCAVATED
0 10 20 Cm

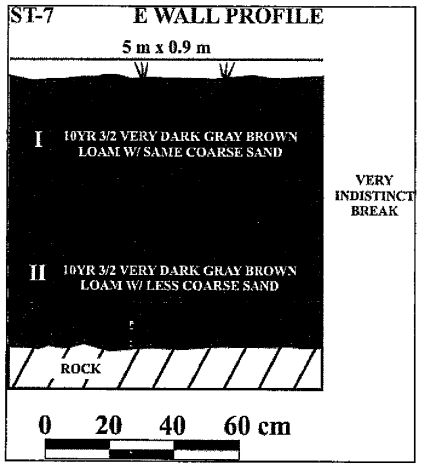

ST-3 W Wall Profile
Mag N-S Trench, 15m x 1.4m
I-10YR 3/3 DARK BROWN COMPACT SILT W/ FINE ROOTS COBBLES "PLOW ZONE'
10YR 3/3
II-10YR 4/3 BROWN POORLY SORTED COMPACT SILT W/SUB-ROUNDED PEBBLES
Graded Channel
III-10YR 4/4 LAYERED COARSE SAND AND 10YR 3/4 DARK YELLOWISH BROWN FINE COMPACT SILT W/ROUNDED PEBBLES-COBBLES
UNEXCAVATED
0 10 20 Cm

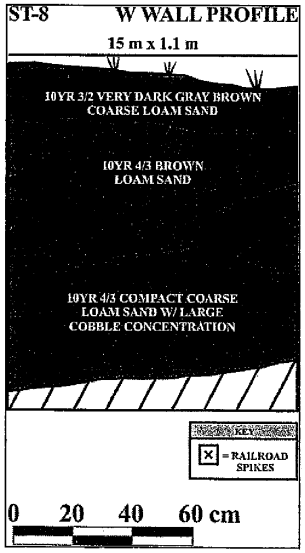
ST-5 E Wall Profile
15m X 1.6m



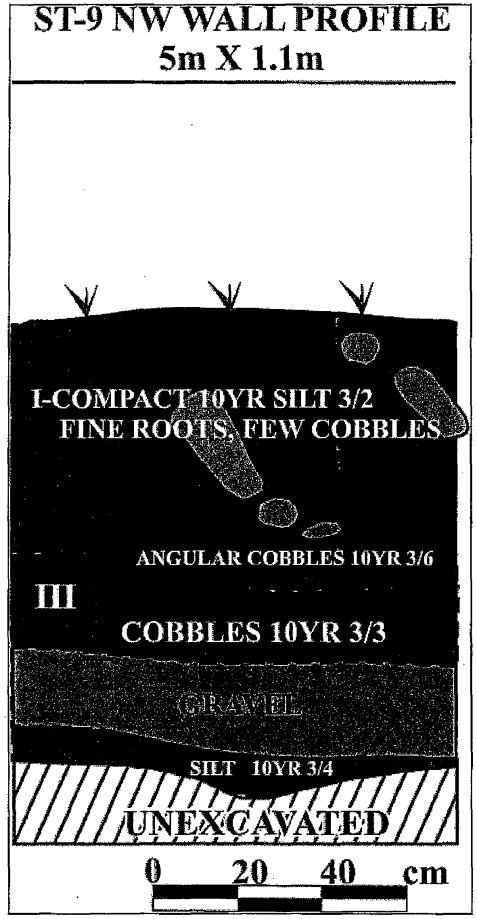
ST-4 E WALL PROFILE
15 M X 1-5 M

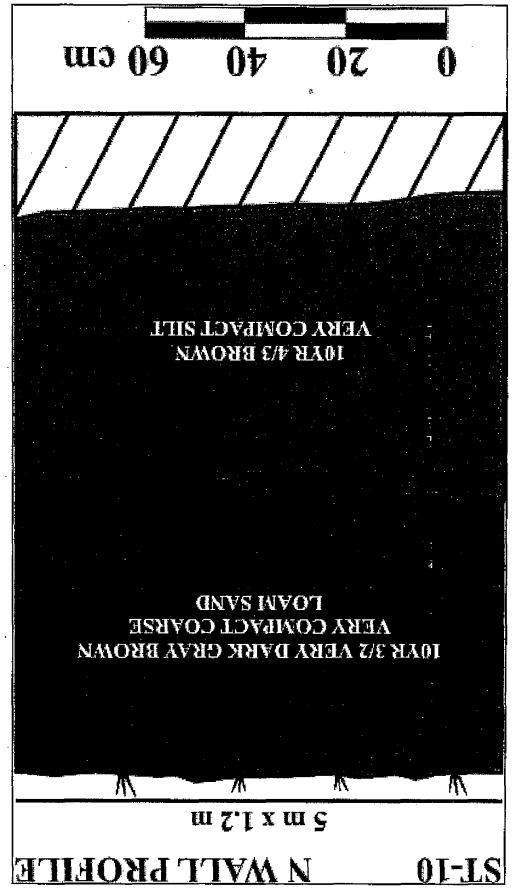


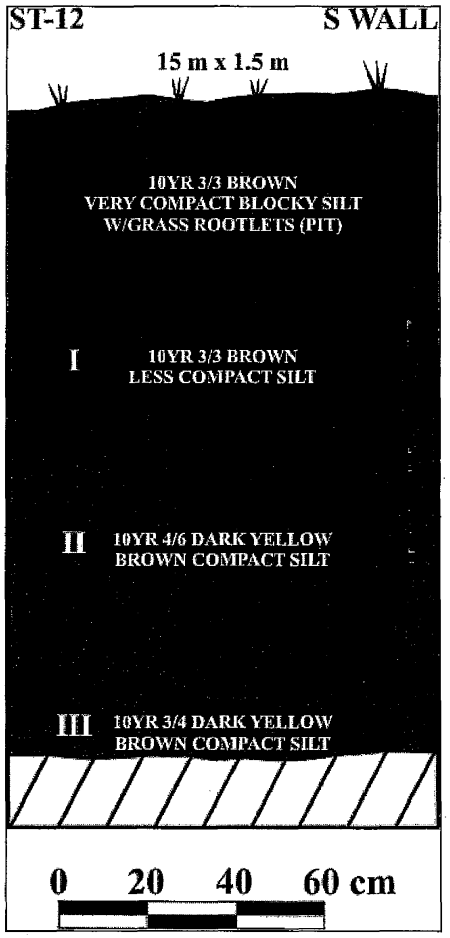

ST-7
E WALL PROFILE
5 m x 0.9 m
I
10YR 3/2 VERY DARK GRAY BROWN
LOAM W/ SAME COARSE SAND
VERY
INDISTINCT
BREAK
II
10YR 3/2 VERY DARK GRAY BROWN
LOAM W/ LESS COARSE SAND
ROCK
0 20 40 60 cm


ST-8
W WALL PROFILE
15 m x 1.1 m
10YR 3/2 VERY DARK GRAY BROWN
COARSE LOAM SAND
10YR 4/3 BROWN
LOAM SAND
10YR 4/3 COMPACT COARSE
LOAM SAND W/ LARGE
COBBLE CONCENTRATION
KEY
= RAILROAD
SPIKES
0 20 40 60 cm

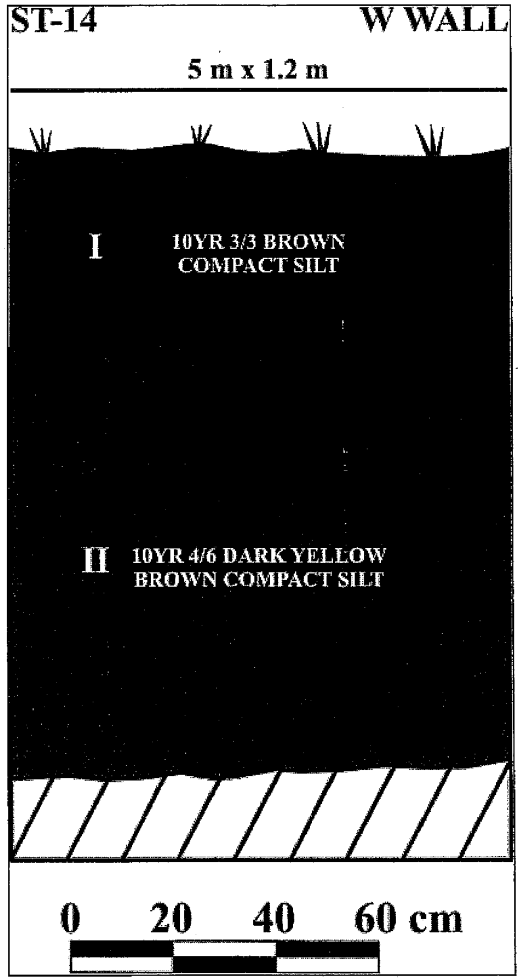
ST-6 N WALL PROFILE
5m X 1.3m
I- COMPACT SILT
10YR 3/2 W/MANY
FINE ROOTS
FEW COBBLES
II-10YR 3/4 MIXED
POORLY SORTED SILT
W/COARSE SAND
SUB-ANGULAR PEBBLES
III-GRADED PEDS FINE
SILT/COARSE SAND/
SUB ROUNDED PEBBLES
10YR 3/3
UNEXCAVATED
0 20 40 cm

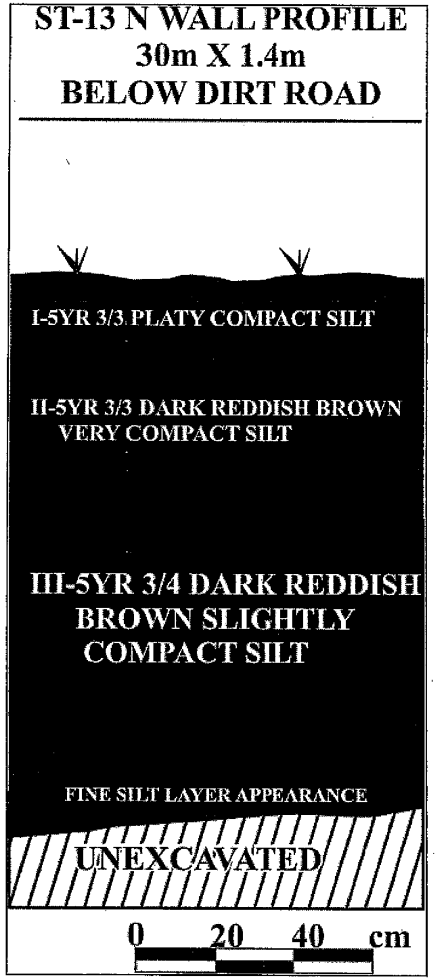

ST-9 NW WALL PROFILE
5m X 1.1m
I-COMPACT 10YR SILT 3/2
FINE ROOTS, FEW COBBLES
ANGULAR COBBLES 10YR 3/6
III
COBBLES 10YR 3/3
GRAVEL
SILT 10YR 3/4
UNEXCAVATED
0 20 40 cm

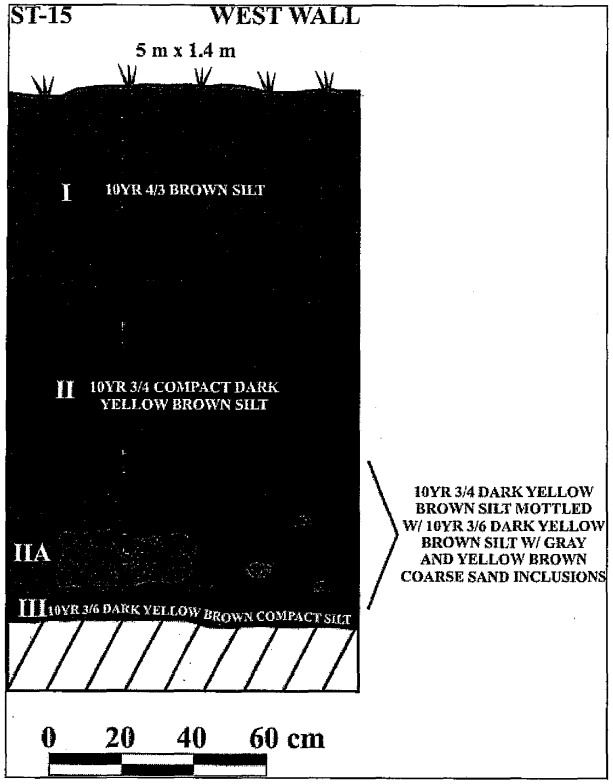

ST-10 N WALL PROFILE
5 m x 1.2 m
10YR 3/2 VERY DARK GRAY BROWN
VERY COMPACT COARSE
LOAM SAND
10YR 4/3 BROWN
VERY COMPACT SILT
0 20 40 60 cm

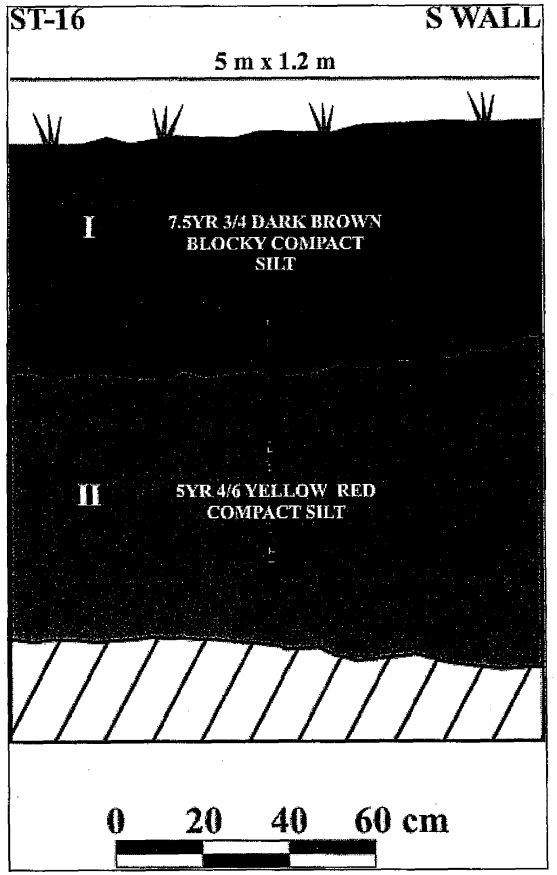

ST-12
S WALL
15 m x 1.5 m
10YR 3/3 BROWN
VERY COMPACT BLOCKY SILT
W/GRASS ROOTLETS (PIT)
I
10YR 3/3 BROWN
LESS COMPACT SILT
II
10YR 4/6 DARK YELLOW
BROWN COMPACT SILT
III
10YR 3/4 DARK YELLOW
BROWN COMPACT SILT
0 20 40 60 cm

ST-11 N WALL PROFILE
5m X 1.2m
I-COMPACT 10YR 3/2
SILT, FINE ROOTS
II-MIXED COMPACT SILT
SMALL PEBBLES 10YR 2/2
COBBLES
UNEXCAVATED
0 20 40 cm

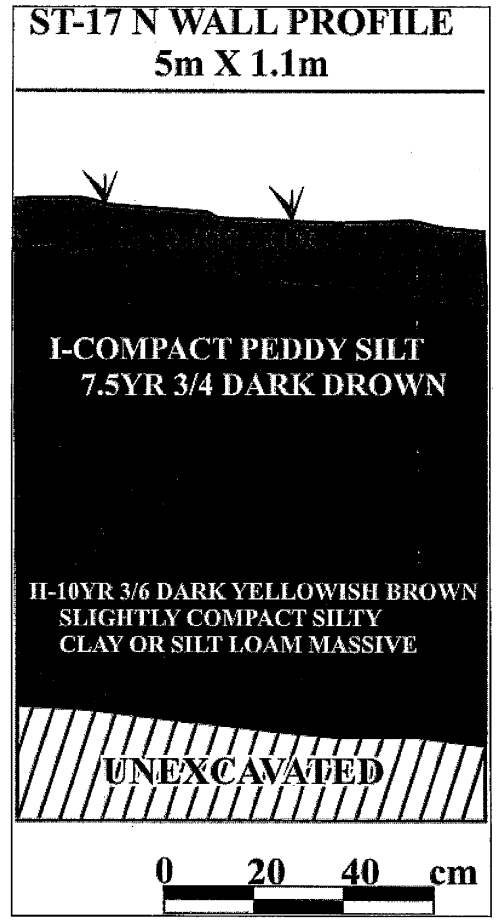

ST-14
W WALL
5 m x 1.2 m
I
10YR 3/3 BROWN
COMPACT SILT
II
10YR 4/6 DARK YELLOW
BROWN COMPACT SILT
0 20 40 60 cm

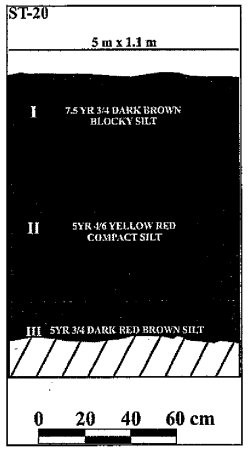

ST-13 N WALL PROFILE
30m X 1.4m
BELOW DIRT ROAD
I-5YR 3/3 PLATY COMPACT SILT
II-5YR 3/3 DARK REDDISH BROWN
VERY COMPACT SILT
III-5YR 3/4 DARK REDDISH
BROWN SLIGHTLY
COMPACT SILT
FINE SILT LAYER APPEARANCE
UNEXCAVATED
0 20 40 cm

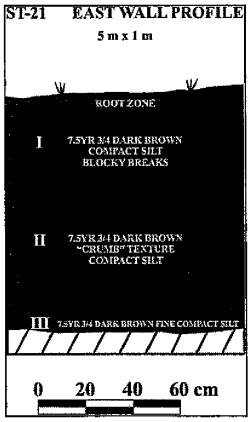

ST-15
WEST WALL
5 m x 1.4 m
I
10YR 4/3 BROWN SILT
II
10YR 3/4 COMPACT DARK YELLOW BROWN SILT
IIA
10YR 3/4 DARK YELLOW BROWN SILT MOTTLED W/ 10YR 3/6 DARK YELLOW BROWN SILT W/ GRAY AND YELLOW BROWN COARSE SAND INCLUSIONS
III
10YR 3/6 DARK YELLOW BROWN COMPACT SILT
0 20 40 60 cm

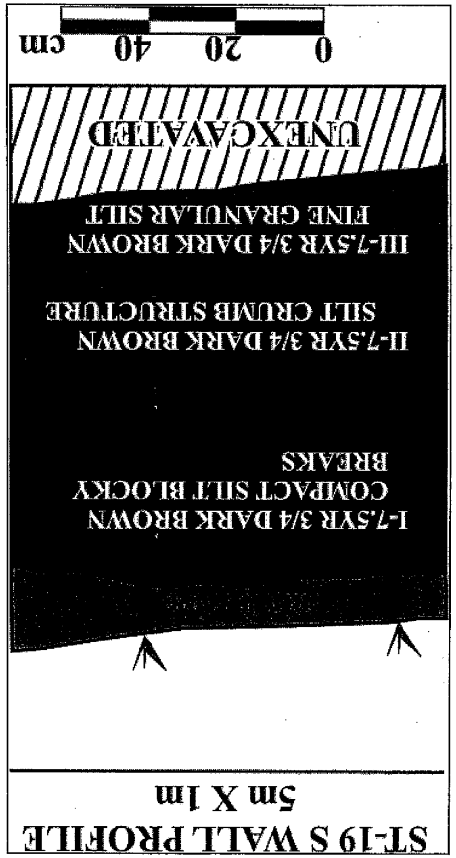

ST-16
S WALL
5 m x 1.2 m
I
7.5YR 3/4 DARK BROWN BLOCKY COMPACT SILT
II
5YR 4/6 YELLOW RED COMPACT SILT
0 20 40 60 cm

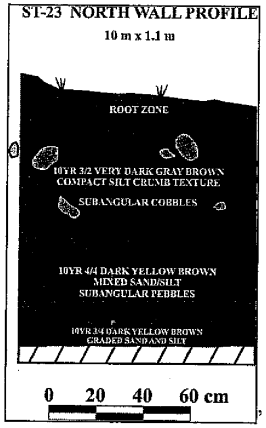
ST-18
N WALL
5 m x 1 m
I
7.5 YR 3/4 DARK BROWN
BLOCKY COMPACT SILT
II
5YR 4/6 YELLOW RED
COMPACT SILT
0 20 40 60 cm

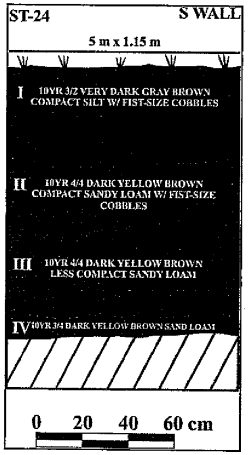

ST-17 N WALL PROFILE
5m X 1.1m
I-COMPACT PEDDY SILT
7.5YR 3/4 DARK DROWN
II-10YR 3/6 DARK YELLOWISH BROWN
SLIGHTLY COMPACT SILTY
CLAY OR SILT LOAM MASSIVE
UNEXCAVATED
0 20 40 cm

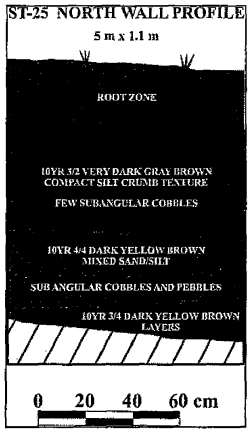

ST-20
5 m x 1.1 m
I
7.5 YR 3/4 DARK BROWN
BLOCKY SILT
II
5YR 4/6 YELLOW RED
COMPACT SILT
III
5YR 3/4 DARK RED BROWN SILT
0 20 40 60 cm

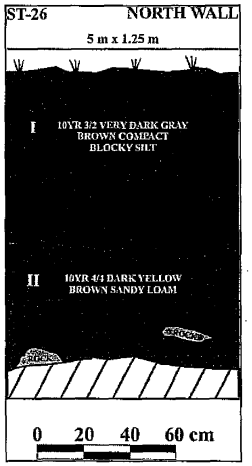

ST-21 EAST WALL PROFILE
5 m x 1 m
ROOT ZONE
I
7.5YR 3/4 DARK BROWN
COMPACT SILT
BLOCKY BREAKS
II
7.5YR 3/4 DARK BROWN
"CRUMB" TEXTURE
COMPACT SILT
III
7.5YR 3/4 DARK BROWN FINE COMPACT SILT
0 20 40 60 cm


ST-19 S WALL PROFILE
5m X 1m
I-7.5YR 3/4 DARK BROWN
COMPACT SILT BLOCKY
BREAKS
II-7.5YR 3/4 DARK BROWN
SILT CRUMB STRUCTURE
III-7.5YR 3/4 DARK BROWN
FINE GRANULAR SILT
UNEXCAVATED
0 20 40 cm


ST-23 NORTH WALL PROFILE
10 m x 1.1 m
ROOT ZONE
10YR 3/2 VERY DARK GRAY BROWN
COMPACT SILT CRUMB TEXTURE
SUBANGULAR COBBLES
10YR 4/4 DARK YELLOW BROWN
MIXED SAND/SILT
SUBANGULAR PEBBLES
10YR 3/4 DARK YELLOW BROWN
GRADED SAND AND SILT
0 20 40 60 cm

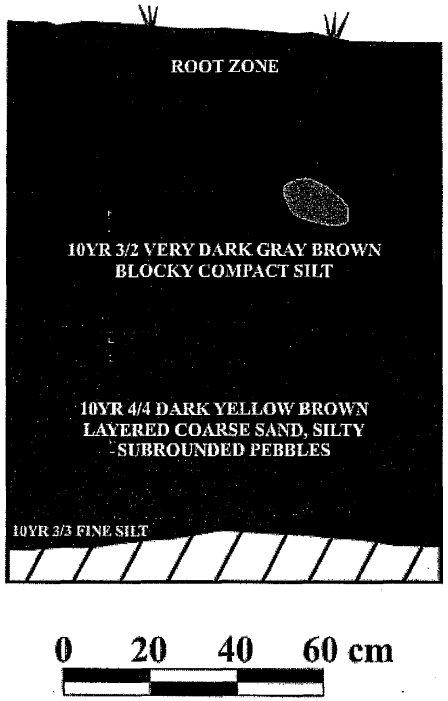

ST-24
S WALL
5 m x 1.15 m
I 10YR 3/2 VERY DARK GRAY BROWN
COMPACT SILT W/ FIST-SIZE COBBLES
II 10YR 4/4 DARK YELLOW BROWN
COMPACT SANDY LOAM W/ FIST-SIZE
COBBLES
III 10YR 4/4 DARK YELLOW BROWN
LESS COMPACT SANDY LOAM
IV 10YR 3/4 DARK YELLOW BROWN SAND LOAM
0 20 40 60 cm


ST-25 NORTH WALL PROFILE
5 m x 1.1 m
ROOT ZONE
10YR 3/2 VERY DARK GRAY BROWN
COMPACT SILT CRUMB TEXTURE
FEW SUBANGULAR COBBLES
10YR 4/4 DARK YELLOW BROWN
MIXED SAND/SILT
SUB ANGULAR COBBLES AND PEBBLES
10YR 3/4 DARK YELLOW BROWN
LAYERS
0 20 40 60 cm


ST-26
NORTH WALL
5 m x 1.25 m
I 10YR 3/2 VERY DARK GRAY
BROWN COMPACT
BLOCKY SILT
II 10YR 4/3 DARK YELLOW
BROWN SANDY LOAM
0 20 40 60 cm

ST-27 NORTH WALL PROFILE

5 m x 1.3 m



NOTARIZED LETTER OF LAND OWNERSHIP AND PERMISSION

We, Kehalani Mauka, LLC the legal owner of the subject Lot 3-A-2, Lot P-1, and Lot R-6 located on Tax Map Key (2) 3-5-001:67 (por.), (2) 3-5-001:77 (por.), and (2) 3-5-001:78 (por.)

do hereby grant full permission for the State of Hawai'i Department of Education, Facilities Development Branch to obtain necessary permits and to construct Wailuku II Elementary School on the subject Lot 3-A-2, Lot P-1 (portion), and Lot R-6 (portion) which consist of approximately 14 acres.

SIGNATURE OF LEGAL LANDOWNER'S AGENT: _____ DATE: 1/28/10

Address: 1100 Alakea Street, 27th Floor, Honolulu, HI 96813

Phone Number: (808) 537-5220

NOTARY PUBLIC SIGNATURE:

Subscribed and Sworn to before me this 28th day of January 20 10

_____
NOTARY'S SIGNATURE **Lynnette R. Tachi**

LS

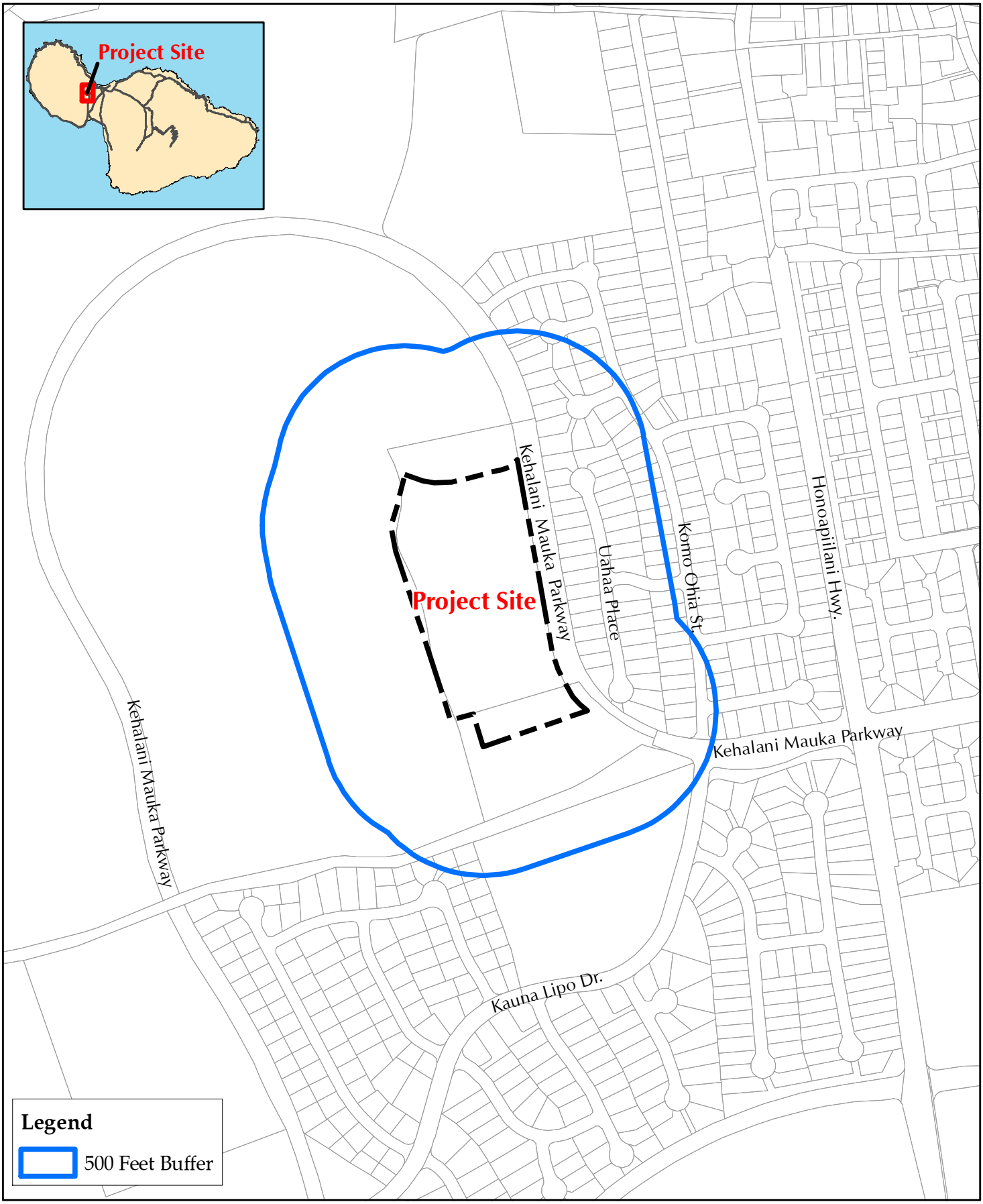
Notary Public In and For the County Of: Honolulu And the State of: Hawaii

NOTARY PUBLIC CERTIFICATION
Lynnette R. Tachi First Circuit
Doc. Description: Notarized Letter of Land Ownership and Permission

No. of Pages: 1 Date of Doc. 1/28/10

_____ 1/28/10
Notary Signature Date

LS



TMK within 500 Feet Buffer of the Project Site

N

0 250 500 1,000 Feet

List of Landowners and Recorded Lessees of Real Property within 500 Feet of the Project Site

TMK	OWNER NAME	MAILING ADDRESS
235001078	Kehalani	1100 Alakea Street, 27th Floor, Honolulu, HI 96813
235001067	Kehalani	1100 Alakea Street, 27th Floor, Honolulu, HI 96813
235023106	Resipico,James Ramel B	41 Papuhau Pl, Wailuku, HI 96793
235023001	Estabillo,Catherine Cahiga	10 Kapalaia Pl, Wailuku, HI 96793
235023105	Kanohokula, John A M Sr	682 Komo`ohia St, Wailuku, HI 96793
235023107	Castroman, Andrea Lynn	12 Uahaa Pl, Wailuku, HI 96793
235023141	C/O Hawaiiana Management Co. Ltd.	140 Hoohana Street, Suite 210, Kahului, HI 96732
235023108	Chou, Thomas Shikun	291 Hookahi Street, Suite 209, Wailuku, HI 96793
235023104	Yokoyama, Lance Kazuaki	678 Komo Ohia Street, Wailuku, HI 96793
235023068	McDonald, Kerri Michele	PO Box 10933, Lahaina, HI 96761
235023145	Kehalani	1100 Alakea Street, 27th Floor, Honolulu, HI 96813
235023103	Nishida, Yasuo	672 Komo`ohia Street, Wailuku, HI 96793
235023109	Binas, Jaime Romero	PO Box 1979, Kihei, HI 96753
235023069	Bagay, Rogelio Tuliao Jr.	673 Komo`ohia Street, Wailuku, HI 96793
235023140	Pearson, Jeffrey Theodore	19 Uaha'a Place, Wailuku, HI 96793
235023102	Bach, Jimmy Vi-Cuong	668 Komo Ohia Street, Wailuku, HI 96793
235023070	Pascual, Glen Ramos	671 Komo`ohia Street, Lahaina, HI 96761
235026041	Wailuku Water Company, LLC	15 Ohia Leo Pl, Wailuku, HI 96793
235035102	Kehalani	1100 Alakea Street, 27th Floor, Honolulu, HI 96813
235035101	Kehalani	1100 Alakea Street, 27th Floor, Honolulu, HI 96813
235035098	Kehalani	1100 Alakea Street, 27th Floor, Honolulu, HI 96813
235035099	Kehalani	1100 Alakea Street, 27th Floor, Honolulu, HI 96813
235035100	Kehalani	1100 Alakea Street, 27th Floor, Honolulu, HI 96813
235001070	Iliahi at Kehalani Condominium	220 S. King St. Suite 2170, Honolulu HI 96813
	Friel, Ramona Ruth	21 Kamauhalii Way # 1-A, Wailuku, HI 96793
	Friel, William George	21 Kamauhalii Way #1-A, Wailuku, HI 96793
	Dellaria, Alexander	21 Kamauhalii Way #1-B, Wailuku, HI 96793
	Dellaria, Sabine A.	21 Kamauhalii Way #1-B, Wailuku, HI 96793
	Foell, Gelene Lapaz	21 Kamauhalii Way, #1-C, Wailuku, HI 96793
	Foell, Steven A.	21 Kamauhalii Way, #1-C, Wailuku, HI 96793
	Christopher, Dianne Fecility	21 Kamauhalii Way, #1-D, Wailuku, HI 96793
	Bantilan, Melissa Maria M.	11 Kamauhalii Way, #2-A, Wailuku, HI 96793
	Bowler, Carol F.	777 S Kihei Rd Apt 228 Kihei HI 96753
	Bowler, William F.	777 S Kihei Rd Apt 228 Kihei HI 96753
	Ochi, Dennis Rikio Trust	11 Kamauhalii Way, #2-C, Wailuku, HI 96793

List of Landowners and Recorded Lessees of Real Property within 500 Feet of the Project Site

TMK	OWNER NAME	MAILING ADDRESS
	Frazier, Bruce Allen	11 Kamauhalii Way, #2-D, Wailuku, HI 96793
	McGaughey, Ellie	5 Kamauhalii Way #3-A, Wailuku, HI 96793
	McGaughey, Stephen A.	5 Kamauhalii Way #3-A, Wailuku, HI 96793
	Yamagushi, Sukiko	5 Kamauhalii Way #3-B, Wailuku, HI 96793
	Yamagishi, Toshiyuki	5 Kamauhalii Way #3-B, Wailuku, HI 96793
	Gannon, Casey Anne K.	5 Kamauhalii Way #3-C, Wailuku, HI 96793
	Hepner, Debra Kazue	2515 W Conley Ave, Tampa, FL 33611
	Hepner, Peter Mitchell	2515 W Conley Ave, Tampa, FL 33611
	Compian Frank Thomas	378 Makahou Lp, Wailuku, HI 96793
	Goodfellow Chad Stephen	PO Box 220, Kihei, HI 96753
	O'Neill-Goodness Sally Anne	PO Box, 1447 Kihei, HI 96753
	Commercial Plumbing Properties	1820 Colburn St, Honolulu, HI 96819
	Breitbach, Brad Jospeh	31 Kalo Aloa Way #5-A, Wailuku, HI 96793
	Breitbach, Kim Kimi	31 Kalo Aloa Way #5-A, Wailuku, HI 96793
	Singh, Surendar Kaur	31 Kalo Aloa Way #5-B, Wailuku, HI 96793
	Koyama, Darran Ronald	31 Kalo Aloa Way #5-C, Wailuku, HI 96793
	Koyama, Rocephine Ganutisi	31 Kalo Aloa Way #5-C, Wailuku, HI 96793
	Rausch Sandra Maros	31 Kalo Aloa Way #5-D, Wailuku, HI 96793
	Tomita, Lisa Ann	23 Kalo Aloa Way #6-A, Wailuku, HI 96793
	Carlson, Matthew Allen	PO Box 1325, Kihei, HI 96753
	Fonseca, David Joseph	PO Box 1325, Kihei, HI 96753
	Skog, Ellerey Unemori	23 Kalo Aloa Way #6-C, Wailuku, HI 96793
	Skog, Michiko Erin Yamada	23 Kalo Aloa Way #6-C, Wailuku, HI 96793
	Hughes, Kevn Michael	23 Kalo Aloa Way #6-D, Wailuku, HI 96793
	Drummond Leinaala Teruya	15 Kalo Aloa Way #7-A, Wailuku, HI 96793
	Taddei, Lee Ann	15 Kalo Aloa Way #7-B, Wailuku, HI 96793
	Taddei, Paul Francis	15 Kalo Aloa Way #7-B, Wailuku, HI 96793
	Zangari, Carolyn	15 Kalo Aloa Way #7-C, Wailuku, HI 96793
	Freeman, Sandra Jean	15 Kalo Aloa Way #7-D, Wailuku, HI 96793
	Shimada, Dean Kazuo	452 Palani Pl, Wailuku, HI 96793
	Shimada, Derek Noaki	452 Palani Pl, Wailuku, HI 96793
	Guico, Elvira Jimenez	PO Box 330753, Kahului, HI 96733
	Kelly Family Revocable Trust	PO Box 2411, Wailuku, HI 96793-7411
	Blette, Kent and Annetta, TTEES	84 Kinohi Loa Lp, Wailuku, HI 96793
	Ovens, Brigette B. Revocable Trust	PO Box 1829, Wailuku, HI 96793

List of Landowners and Recorded Lessees of Real Property within 500 Feet of the Project Site

TMK	OWNER NAME	MAILING ADDRESS
	Andersen, Athena Denise	39 Kaalea Way #9-B, Wailuku, HI 96793
	Andersen, John Magnus, Jr.	39 Kaalea Way #9-B, Wailuku, HI 96793
	Jackson, Jennifer Anne	39 Kaalea Way #9-C, Wailuku, HI 96793
	Thoemke, Michael Dale	39 Kaalea Way #9-C, Wailuku, HI 96793
	Shiotani, Brooke M.	PO Box 1628, Miles City, MT 59301-1628
	Shiotani Glenn Masamichi	PO Box 1628, Miles City, MT 59301-1628
	Shiotani, Uta Gerhild Simms	PO Box 1628, Miles City, MT 59301-1628
	Higuchi, Kelly L. H.	33 Kaalea Way #10-A, Wailuku, HI 96793
	Bibat, Angie Siapno	PO Box 330667, Kahului, HI 96733
	Bibat, Roman Gulla	PO Box 330667, Kahului, HI 96733
	Balinbin, Bryan Conrad	33 Kaalea Way #10-C, Wailuku, HI 96793
	Magla, Charles Dougas	PO Box 3010, Kahului, HI 96733
	Black, Kris	3111 Breen Cir NW Calgary, AB T2L 1S6
	Black, Reba Ann & Paul	3111 Breen Cir NW Calgary, AB T2L 1S6
	Amaral, Deborah L. TR	25 Kaalea Way #11-B, Wailuku, HI 96793
	Amaral, Jeffrey D. TR	25 Kaalea Way #11-B, Wailuku, HI 96793
	Shishido, Craig Kazuyoshi	25 Kaalea Way #11-C, Wailuku, HI 96793
	Felix, Janeth Guico	PO Box 6402, Kahului, HI 96733
	Felix, Paul Richard Jr.	PO Box 6402, Kahului, HI 96733
	Balderas, Reginald	P O Box 522, Kihei, HI 96753
	Kamai, Elena Marie	19 Kaalea Way #12-B, Wailuku, HI 96793
	Kamai, Kevin Keaupuni	19 Kaalea Way #12-B, Wailuku, HI 96793
	O'Kief, Kelly Michael	19 Kaalea Way #12-C, Wailuku, HI 96793
	Rodrigues, Rio Del	PO Box 105, Kihei, HI 96753
	Matsuoka, Bessie Setsuko	PO Box 2893, Wailuku, HI 96793
	Matsuoka, Gunishi	PO Box 2893, Wailuku, HI 96793
	Troy, Anne Wong	7199 Lake Cove Dr, Alexandria, VA 22315
	Smith, Lora Ann Seno	11 Kaalea Way #13-C, Wailuku, HI 96793
	Black, Clifton	8595 Larkspur Lane, Gilroy, CA 95020
	Black, Deborah A.	8595 Larkspur Lane, Gilroy, CA 95020
	Black, Karl Nathan	8595 Larkspur Lane, Gilroy, CA 95020
	Black, Suenna Lynn	8595 Larkspur Lane, Gilroy, CA 95020
	D'Eliseo, Barbara Ann	1955 Walden Ln, Napa, CA 94558
	Enriques, George Peter	41 Iliau Way, #14-B, Wailuku, HI 96793
	Woolley, Antoinette Lee	41 Iliau Way, #14-B, Wailuku, HI 96793

List of Landowners and Recorded Lessees of Real Property within 500 Feet of the Project Site

TMK	OWNER NAME	MAILING ADDRESS
	Chaves, Diane P. Trust	41 Iliau Way, #14-C, Wailuku, HI 96793
	Persinger, Lisa Ellene	41 Iliau Way, #14-D, Wailuku, HI 96793
	Shigeta, Roscoe Keahi	PO Box 1375, Wailuku, HI 96793
	Ikeda, Minhkhangoc	35 Iliau Way, #15-B, Wailuku, HI 96793
	Le, Kent Hoang	35 Iliau Way, #15-B, Wailuku, HI 96793
	Callaghan, Luke Aaron	C/O Arnold Den Abe, PO Box 1787, Wailuku, HI 96793
	Wilczynski, Joanna	C/O Arnold Den Abe, PO Box 1787, Wailuku, HI 96793
	Wolter, Claire Antone	35 Iliau Way, #15-D, Wailuku, HI 96793
	Wolter, Olga Wailani	35 Iliau Way, #15-D, Wailuku, HI 96793
	Lebowitz, Wonsuk	27 Iliau Way, #16-A, Wailuku, HI 96793
	Matsui, Brent Tokio	27 Iliau Way, #16-B, Wailuku, HI 96793
	Chun, Young Hwa Jahja	27 Iliau Way, #16-C, Wailuku, HI 96793
	Jahja, Luke	27 Iliau Way, #16-C, Wailuku, HI 96793
	Bibat, Angie Siapno	PO Box 330667 Kahului, HI 96733
	Bibat, Roman Gulla	PO Box 330667 Kahului, HI 96733
	Commercial Plumbing Properties LLC	1820 Colburn St Honolulu, HI 96819
	Dupont, Petra K. Rev Living Trust	529 Honoapiilani Hwy, Wailuku, HI 96793
	Marino, Thomas A.	529 Honoapiilani Hwy, Wailuku, HI 96793
	Bukewihge, Dorothy Jean	1014 Polaris Dr., Newport Beach, CA 92660
	Bukewihge, Dustin James	1014 Polaris Dr., Newport Beach, CA 92660
	Primeaux, Rachelle	17 Iliau Way, #17-D, Wailuku, HI 96793
	Walker, Marimichael Moran	360 W Ocean Blvd, Apt E, Long Beach CA 90802
	Fried, David Gene	PO Box 12166, Lahaina, HI 96761
	Garcia, Bernadette	1109 Altic St., Houston, TX 77023
	Prestage, Peter James	1109 Altic St., Houston, TX 77023
	Gibson, Lisa Hoebreckx	2435 Burbank St., Honolulu, HI 96817
	Dann, Jonathan Edward	45 Kuaiwa Way, #19-A, Wailuku, HI 96793
	Foust, Anna Marie	45 Kuaiwa Way, #19-A, Wailuku, HI 96793
	Shirota-Zionkowski Trust	45 Kuaiwa Way, #19-B, Wailuku, HI 96793
	Funes, Dominique Angel	PO Box 681 Waimea HI 96796
	Philllips, Holly Marie	6 Loili PL, Kahului, HI 96732
	Phillips, John J III	6 Loili PL, Kahului, HI 96732
	Phillips, Margaret Mary	6 Loili PL, Kahului, HI 96732
	Guico, Christopher J.	37 Kuaiwa Way, #20-A, Wailuku, HI 96793
	Guico, Kama C.	37 Kuaiwa Way, #20-A, Wailuku, HI 96793

List of Landowners and Recorded Lessees of Real Property within 500 Feet of the Project Site

TMK	OWNER NAME	MAILING ADDRESS
	Perreira, Jacqueline N.	PO Box 330563, Kahului, HI 96733
	McMillen, Georgia K.	PO Box 1512, Wailuku, HI 96793
	Fuqua, Raymond Eugene	37 Kuaiwa Way, #20-D, Wailuku, HI 96793
	Applegate, Haku Jonathan	29 Kuaiwa Way, #21-A, Wailuku, HI 96793
	Wash, James Joseph	29 Kuaiwa Way, #21-B, Wailuku, HI 96793
	Wash, Lori Patrice	29 Kuaiwa Way, #21-B, Wailuku, HI 96793
	Jennings, Janet	PO Box 1028, Puunene, HI 96784
	Jennings, Robert Russell	PO Box 1028, Puunene, HI 96784
	Tokishi, Dean Yasuki	29 Kuaiwa Way, #21-D, Wailuku, HI 96793
	Toshiki, Nichole Haaleo L.	29 Kuaiwa Way, #21-D, Wailuku, HI 96793
	Ortega, Elizabeth	23 Kuaiwa Way, #22-A, Wailuku, HI 96793
	Greene, Wayne Ronald	23 Kuaiwa Way, #22-B, Wailuku, HI 96793
	Cohan, Alison C.	23 Kuaiwa Way, #22-C, Wailuku, HI 96793
	Cohan, Casey S.	23 Kuaiwa Way, #22-C, Wailuku, HI 96793
	Smith, Nancy Jean	23 Kuaiwa Way, #22-D, Wailuku, HI 96793
	Chu, Barry Darwin	19 Kuaiwa Way, #23-A, Wailuku, HI 96793
	Fabozzi, Donald Joseph II	191 Moleholehu Lp, Kahului, HI 96732
	Fabozzi, Mary Ann	191 Moleholehu Lp, Kahului, HI 96732
	Greiner-Marcotte, Gail M.	38 Crane Ct, Alameda, CA 94502
	Greiner-Marcotte, Michael	38 Crane Ct, Alameda, CA 94502
	Toshiki, Ione Eiko	19 Kuaiwa Way, #23-D, Wailuku, HI 96793
	Toshiki, Walter Hideo	19 Kuaiwa Way, #23-D, Wailuku, HI 96793
235001077	Kehalani	1100 Alakea Street, 27th Floor, Honolulu, HI 96813
235001067	Kehalani	1100 Alakea Street, 27th Floor, Honolulu, HI 96813
235001078	Kehalani	1100 Alakea Street, 27th Floor, Honolulu, HI 96813
235026040	Pascual, Donald Gorospe	19 Ohia Leo Place, Wailuku, HI 96793
235026039	Garcia Servio P.	25 Ohia Leo Place, Wailuku, HI 96793
235026042	Travis, Jennifer L Trust	PO Box 1090, Puunene, HI 96784-1090
235026044	Acidera, Henry Pascua	558 Komo Ohia Street, Wailuku, HI 96793
235026043	Panos, Tammy L.	552 Komo Ohia Street, Wailuku, HI 96793
235026038	Egnatchik, Daniel Anthony	412 Olive Street, Apt. 258, Huntington Beach, CA 92648
235026037	McNabb, William and Myla	20 Ohia Leo Place, Wailuku, HI 96793
235026034	Tabbay, Efren Taasin	PO Box 173, Kahului, HI 96733
235026036	Hoekstra, Peggy-An	PO Box 517, Puunene, HI 96784-0517
235026035	Wellerstein, Susan Kate	12 Ohia Leo Place, Wailuku, HI 96793

List of Landowners and Recorded Lessees of Real Property within 500 Feet of the Project Site

TMK	OWNER NAME	MAILING ADDRESS
235026035	Wellerstein, Raphael Frederic	32 Hakoi Hema Place, Kihei, HI 96753
235026033	Suzuki Ryan Kazuo	538 Komo Ohia Street, Wailuku, HI 96793-2169
235026029	Tsukano, Byron Mino	C/O Byron Tsukano, DDS, 1371 Lower Main Street, Suite 5, Wailuku, HI 96793
235026032	Aquino, Marcelino Mendoza	PO Box 5028, Kahului, HI 96733
235026028	C. Brewer	26-238 Hawaii Belt Road, Hilo, HI 96720
235026030	Cremer, Brian Allen	15 Ohia Laka Place, Wailuku, HI 96793
235026046	C/O Towne Realty of Hawaii, Inc.	PO Box 430, Wailuku, HI 96793
235026031	Martin, William Robert	526 Komo Ohia Street, Wailuku, HI 96793-2169
235026027	Bernardo, Benjamin Bocobo	PO Box 77, Wailuku, HI 96793
235026045	other	1100 Alakea Street, 27th Floor, Honolulu, HI 96813
235001067	Kehalani	1100 Alakea Street, 27th Floor, Honolulu, HI 96813
235023110	Honda, Mel R. Trust	22 Uahaa Place, Wailuku, HI 96793
235023139	Riley, Wendy Jo	23 Uahaa Place, Wailuku, HI 96793
235023101	Yamada, Daryl Tadashi	11 Hanale Way, Kula, HI 96790
235023071	Dahilig, Teodorico Pagdilao	665 Komo`ohia Street, Wailuku, HI 96793
235023111	Lewin, Barry David	PO Box 9022872, San Juan PR 00902
235023138	Bibb, Pok Yo	PO Box 2387, Wailuku, HI 96793-7387
235023100	Kanekoa, Kawika Benedict	410 Kalua Drive, Wailuku, HI 96793
235023112	Enomoto, Clement John	30 Uahaa Place, Wailuku, HI 96793
235023137	Patel, Nilesh Hariharbhai	33 Uaha`a Place, Wailuku, HI 96793
235023099	Beltran, Ramon Rodrigues	597 Pohai Street, Kahului, HI 96732
235023113	Sokalski, John Roger Jr.	32 Uaha`a Place, Kihei, HI 96753
235023136	Santiago, Eric John	37 Uaha`a Place, Wailuku, HI 96793
235023098	Kuia, Gordon Buddy Hanalei	PO Box 245, Wailuku, HI 96793
235023114	Rebold, Rhett Alan	2867 Spring Chapel Ct., Herndon, VA 20171
235023135	Rickard, Troy/Brandy Trust	41 Uahaa Place, Wailuku, HI 96793
235023097	Licht, Lorenzo Ernesto	640 Komo Ohia Street, Wailuku, HI 96793
235023115	Johnsen, Samuel E.W.	40 Uaha`a Place, Wailuku, HI 96793
235023134	Crooks, Debra Jean	45 Uaha`a Place, Wailuku, HI 96793
235023133	Glanzer,Charles E. Jr.	1318 W. Huron Street, Chicago, IL 60622
235023096	Nemoto, Casey Hajime	626 Komo`ohia Street, Wailuku, HI 96793
235023116	Ideda, Minhkhangoc	50 Uaha`a Place, Wailuku, HI 96793
235023132	Dumalanta, Wayne	C/O Bustillos, Jeseph Jr/Lacey, 51 Uahaa Place, Wailuku, HI 96793
235023095	Domingo, Vilma Cudal	620 Komo`ohia Street, Wailuku, HI 96793
235023117	Okamura, John A.K.	PO Box 1058, Puunene, HI 96784

List of Landowners and Recorded Lessees of Real Property within 500 Feet of the Project Site

TMK	OWNER NAME	MAILING ADDRESS
235023131	Carpenter,Vincent Dam	57 Uahaa Place, Wailuku, HI 96793
235023094	Arbogast, Eric Victor	616 Komo`ohia Street, Wailuku, HI 96793
235023118	Apana, Richard Alika	PO Box 33093, Kahului, HI 96733
235023130	Deangelo, Raymond Joseph III	61 Uahaa Place, Wailuku, HI 96793
235023093	Campos, Elizabeth C. Trust	PO Box 6106, Kahului, HI 96733
235023119	Ong, Eric Chun Trust	62 Uaha`a Place, Wailuku, HI 96793
235023129	Loewen, Gregory Wayne	PO Box 165, Kihei, HI 96753
235023092	Bautista, Michael Daniel	604 Komo Ohia Street, Wailuku, HI 96793
235023128	Shammah Limited Partnership	669 South Alu Road, Wailuku, HI 96793
235023120	Macaheleg, Wendy G. Trust	36 Hoolalei Way, Kihei, HI 96753
235023091	Behnke, Thomas L. Trust	PO Box 883, Haiku, HI 96708
235023127	Ebana, Benjamin Kipe	71 Uaha`a Place, Wailuku, HI 96793
235023121	Thoma, Judith Living Trust	68 Uaha`a Place, Wailuku, HI 96793
235023090	Chun, Lourdes Trust	594 Komo Ohia Street, Wailuku, HI 96793
235023122	Edwards, Barbara C. Tr.	72 Uaha`a Place, Wailuku, HI 96793
235023126	Leffler, David M.	75 Uahaa Place, Wailuku, HI 96793
235023089	Reny, Richard Charles Sr.	590 Komo Ohia Street, Wailuku, HI 967931
235023123	Trenholm, Loren Wallace	76 Uaha`a Place, Wailuku, HI 96793
235023125	Whitworth, Dominic James M.	79 Uahaa Place, Wailuku, HI 96793
235023088	Vickers, Mark Matthew Kaleinani	580 Komo`ohia Street, Wailuku, HI 96793
235023124	Taylor, Richard Randolph	PO Box 2870, Wailuku, HI 96793
235023087	Piano, Rolly O. Revoc Trust	574 Komo Ohia Street, Wailuku, HI 96793
235023086	Polak, Simone Charlotte	564 Komo`ohia Street, Wailuku, HI 96793
235001085	Kehalani	1100 Alakea Street, 27th Floor, Honolulu, HI 96813

350010670000

HONOAPIILANI HWY

General Parcel Information

TMK	350010670000
Site Address	HONOAPIILANI HWY
Apartment No.	
Total Parcel Area	146.5 acres/ sqft

Ownership

1 of 3

Owner	KEHALANI MAUKA LLC - UND INT
Address	1100 ALAKEA ST 2700
	HONOLULU HI 96813
City	
State	
Country	
Zip Code	
Owner Type	Fee Owner

350010770000

HONOAPIILANI HWY

General Parcel Information

TMK	350010770000
Site Address	HONOAPIILANI HWY
Apartment No.	
Total Parcel Area	6.043 acres/ sqft

Ownership

Owner	KEHALANI MAUKA LLC
Address	1100 ALAKEA ST 27TH FLR HONOLULU HI 96813
City	
State	
Country	
Zip Code	
Owner Type	Fee Owner

350010780000

HONOAPIILANI HWY

General Parcel Information

TMK	350010780000
Site Address	HONOAPIILANI HWY
Apartment No.	
Total Parcel Area	12.702 acres/ sqft

Ownership

Owner	KEHALANI MAUKA LLC
Address	1100 ALAKEA ST 27TH FLR HONOLULU HI 96813
City	
State	
Country	
Zip Code	
Owner Type	Fee Owner

Components to be Addressed in an Elementary School Educational Plan ***January 2007***

- With Notes from 1/17/2007 WAILUKU II Elementary School ED PLAN Meeting
- Notes from 1/30/2007 meeting
- And Notes from 2/2/2007 meeting

A. Guiding Principles

1. Vision & Mission

Every student is important, celebrate all students,
Givens are good academics, good social skills, inclusion (differentiated instruction throughout)
The school should be a safe haven that promotes tolerance and the self esteem and self worth of all students. Students should be given opportunities to be leaders, given tasks to reach high expectations, encouraged to take risks within a safe environment

2. Desired Characteristics/Personality of the new school

Major Themes from 1/26/2007 visioning charette:

1. Gathering Places – multiple types and sizes of places
2. Center of Community – integral to the community
    a. Integrating school and adjacent community center
    b. Before & After school activity place
    c. A safe place / longer school day / a place where students want to be
    d. A place full of life and activity
3. Child friendly, Welcoming
    a. Warm feeling where the community is welcome

- School should have a friendly appearance; use of landscaping to soften edges
- Welcoming, colorful, bright, cheery, a safe haven, calming colors, Not all concrete!
- Recognition of students/student art work could be incorporated as part of building design

3. General Learner Outcomes:

- **<u>Self-directed Learner</u> (The ability to be responsible for one's own learning)**
- **<u>Community Contributor</u> (The understanding that it is essential for human beings to work together)**
- **<u>Complex Thinker</u> (The ability to demonstrate critical thinking and problem solving)**
- **<u>Quality Producer</u> (The ability to recognize and produce quality performance and quality products)**
- **<u>Effective Communicator</u> (The ability to communicate effectively)**
- **<u>Effective and Ethical User of Technology</u> (The ability to use a variety of technologies effectively and ethically)**

4. How does the "Vision of a High School Graduate" relate at the elementary school level?

Our vision of a Hawaii high school graduate is that all public school graduates will:

- **Realize their individual goals and aspirations;**
- **Possess the attitudes, knowledge and skills necessary to contribute positively and compete in a global society;**
- **Exercise the rights and responsibilities of citizenship; and**

- **Pursue post-secondary education and/or careers without need for remediation.**

B. Characteristics of Elementary School Students

1. **Describe the typical elementary school student**
2. **Create a list of characteristics of elementary school students**

Growing rapidly, curious, energetic, developing coordination, need movement & "change of state" often, brain development, motor development, more tech oriented than past generations, need to be motivated and engaged, the younger ones are learning how to be at school (i.e. wayfinding, orientation are important), going from being dependent to independence, language is still developing, many are bilingual, active play, react strongly to change, need space to move, safe places,

C. Student Organization

1. **Discuss Instructional Approaches – How will instruction be delivered…. by individual class, teaming per grade level or multi-grade level, by CORE approach, project based instruction, etc.**

Elementary classes need differentiated instruction, integrated learning opportunities
Much of the learning is hands-on, unit based instruction

- Teacher /student ratio (ideally 1:20 in lower el but tends to go up)

2. **How will students be organized? Grade level, core, teams, family/pods, small learning communities? Is looping desirable? Describe the amount of separation/interaction desired between various grade levels.**

Grade levels will include Jr. K/K through 5, upper elementary should have their own space, but still be connected to lower el for certain grouping activities.
Hard to set a specific # of classes per grade because of fluctuations in student population, but typically grade levels are grouped together

Important to intersperse SPED rooms among the general classrooms for maximum inclusion opportunities.

- <u>WES Student Organization</u>
  Once a quarter the upper grade meets the lower grades (Ohana Buddies – K/3rd grade, 1st/4th grade, 2nd/5th grade) to eat lunch, tutor and participate in special activities.
- Organized by a whole or half a grade level to team teach (language, art, math, etc.)
- "Ohana Buddies" current program matching upper el students with lower el students.

If clustering multiple grade level classrooms is implemented, need to address the different noise levels generated by each grade that may occur during different times of the day.

3. **Describe the general instructional environment/setting - i.e. general classrooms For flexibility, consider use of operable walls at selected locations and incorporation of breakout rooms.**

- With Notes from 1/17/2007 WAILUKU II Elementary School ED PLAN Meeting

And Notes from 1/30/2007 meeting

- Think outside the box for learning opportunities

Characteristics of an ideal learning environment

  Flexibility to allow teachers to get away from "all desks in a row"
  Need space for small groups, quiet spaces, large group
  Easily arrange-able
  Need areas for lab / messy work – easily cleanable with sinks

- Learning environments need to be "thermally comfortable" i.e. air conditioning AND natural ventilation capability?
- Lighting – natural lighting is highly desirable - fluorescent lighting isn't as desirable
- Acoustics in classroom settings is important – sound can be a big distraction
- Factors that inhibit learning – things to avoid:
  Minimize distractions for student learning (heat, noise, echoing/poor acoustics, not enough or too much bright light)
- Storage space within classrooms:
  Teacher needs – 10 different content areas, helps to have enclosed storage (dust concerns)
  Consider size of students for ease of access to supplies
  Student needs – cubbies seem to work well for elementary students
- Electrical outlets should be located to provide maximum flexibility for teachers to rearrange furniture and learning settings within a classroom (i.e. cluster groups, U-shaped desk arrangements, pairing of desks, multiple activity centers, etc..)
- Carpets – possibly okay for lower elementary reading/story telling area
- Bathrooms need to be easily accessible for elementary age students
- Differentiation and inclusion: different settings are needed within a classroom (i.e. large group and individual areas too)
- Maximize display areas – multi-use of walls/storage doors for student work/exemplars
- Garden areas with indigenous plants for science / learning environments
- Classrooms should have microscopes/science equipment/sinks
- Within classrooms lots of hands-on learning takes place; need water/electricity
- Upper el can get involved with vocational type activities (Ex. cooking relating to math)
- Operable walls between classrooms – use often or selectively (between General &/or Specialty Classrooms)
- Consider 'break-out rooms' connected to classrooms for small groups, tutoring, individual study opportunities, (supports differentiated learning opportunities) with visual control from classroom.

Important to integrate specialty learning spaces among the general classes, - less wasted time lining up to go "across campus." Also for flexibility if specialty spaces need to become general classrooms due to shifts in population.

Break-out rooms could be used to pull-out students.

4. Identify curriculum and other focus areas to support the school's guiding principles.

- Elementary teaching is done in "units" which combine a variety of sensory experiences (i.e. Hawaiian Studies, multi-cultural education, social studies curriculum, interdisciplinary curriculums)

- With Notes from 1/17/2007 WAILUKU II Elementary School ED PLAN Meeting

And Notes from 1/30/2007 meeting

- Various programs offered at Wailuku ES – Enrichment, remediation in math, english and
- ELL (English language learner) services are push-in or pull-out. The ELL use computer programs and involve small groups of 8-10 students max.
- Consider multi-sensory spaces for students: art, movement, dance…

a. Identify special areas/spaces needed for specialty curriculums such as: art, creative movement, PE, music, science, cultural focus, media production. Consider how these can be taught in flexible classrooms/spaces.

Typically IRAs (Resource teachers) come into the general classrooms for art, etc…
Consider a 'celebration room' used for formal and informal presentations, always available (i.e. beyond classroom count), multi-use by all classes.
Possibly 3 supplemental classrooms could have flexibility to be used as 3 distinct classrooms or be joined together to accommodate bigger groups or opened up to create larger spaces for creative movement, dance, etc…
One possibility would be to locate these classrooms near the café to support performances, maybe even connected to stage for a larger presentation area, or more audience space.

- WES Program:
  Kupuna – needs office/base, teaches Hawaiian language and culture in the existing classrooms (push-in). One per school must be provided per the law. Wailuku ES has 3 kupunas. They service every grade level (K-5). Lower grades are taught twice a week and upper grades are taught once a week for 45 minutes. A garden could be used to grow Hawaiian plants (kappa making-mulberry, taro loi, kukui).
- In existing school the resource teacher for creative movement holds classes in the café or on lanai areas. Music resource teacher typically goes to classrooms.
- Spaces needed for student performance, both formal and informal
- Possible unique spaces:
  "Exploratorium" for interdisciplinary learning opportunities
  Performance space
  Hands-on instruction
  Technology centers
- Consider a multi-purpose space to handle many size groups (30, 60, 90 or 120)
- Flexibility in instructional spaces (ease in dividing space) is important for enrollment fluctuations and to accommodate a variety of group sizes.

If a music room is provided, acoustic considerations need to be addressed to contain the sound.

b. Consider the desired location of specialty classrooms in relation to core/general classrooms.

Important to keep any specialty classrooms near general classrooms for ease of access, flexibility of use

- Consider connecting faculty center to a supplemental classroom with operable partition to provide opportunity for "kitchenette" area to be used by classroom, also ease of access to other equipment

5. **Integration of Technology: All classrooms will have space to support technology (i.e. each general classroom will accommodate 7 computers: 6 for students, 1 for teacher); and there will be at least one Computer Resource Center per school. Suggest desired location / relationship of computer resource center to other spaces.**

- All classrooms should have media/technology capabilities tv/screen/computers...
- Internet access and technology should be available throughout the campus (voice/video/data)
- Consider 'mobile labs' for ease of access to technology (cart with rechargeable laptops)

6. **Consider ways to support teachers in their efforts to promote learning, and allow for interaction and sharing of ideas among staff (faculty centers, teacher planning centers).**

- Support the Professional Learning Communities (PLC), PLCs encourage teacher communication per grade level as well as articulation across grade levels.
- Teacher office/work space should be close to classrooms for convenience
- Common storage needed near classrooms
- Teacher workspaces need to be available after hours without needing to access entire building (alarms could be zoned)
- Items that will support teachers: conference rooms for grade level articulation, easy access to supplies and workroom; encourage interaction among teachers by having workrooms convenient to classrooms; provide spaces to meet with parents, areas for teacher group planning, small group teacher meetings
- Teachers need securable/lockable areas within classrooms
- Teachers need:
  More time (may not be a facilities issue but a design that can support teachers is important)
  Access to prep materials, Accountability issues,
  Computer access (online report cards, ISPED, …)
- Portable/movable equipment for shared use throughout the school would support project/problem-based learning
- Teacher Workroom (copy machine, computers, printers, open storage) close to classrooms
- Storage needs may change with multi-disciplinary curriculum
- Staff parking close to classrooms would help teachers to transport their teaching materials.

D. Special Education (SPED)

- Wailuku ES has many severe SPED students (deaf, etc.). Maui Waena IS has some severe SPED students that are tube fed.
- See "Characteristics of an ideal learning environment" type comments under C.
- Differentiation and inclusion: different settings are needed within a classroom (i.e. large group and individual areas too)
- Carpets – maybe none in special ed rooms due to clean up issues
- Internet access and technology should be available throughout the campus (voice/video/data)

- With Notes from 1/17/2007 WAILUKU II Elementary School ED PLAN Meeting

And Notes from 1/30/2007 meeting

- SPED classrooms should be interspersed through-out the campus.
- Consider locating one/some Sped classrooms close to the health room.

1. **Type of Instructional Delivery to be used - Inclusion, mainstreamed, resource services, self-contained, other?**

Need to support mainstreaming as much as possible, good for SPED students and builds tolerance among all students.

- A variety of delivery methods is typical with the goal to maximize use of the least restrictive environment. SPED population may vary, need to accommodate all types; will district designate this school to receive specific types (medically fragile, deaf, blind,…)?

2. **Types of instructional spaces to support program needs:**
   - **Self-contained (SC) classroom**

     FSC rooms need to be interspersed with general classrooms. One should be near accessible drop-off, one near Health Room (to more easily accommodate specific students who may have severe medical emergencies)

     - SPED – Instead of one large instructional surface, disperse whiteboard and tackboards throughout the room. It will allow a variety of teaching opportunities.
     - Fully Self Contained classrooms have kitchen / daily living curriculum
     - SPED FSC prefers mats rather than carpet for PT areas. Mats are light and can be rearranged for flexibility.
     - Changing stations need to large enough and area needs privacy (privacy curtains) and storage for personal clothes, diapers, and wipes.
     - The "Mild population" always wants to go to the bathroom. Restrooms and drinking fountain should be in the FSC to reduce wandering.
     - Typical facilities in an FSC Classroom include: Laundry facility, Restrooms, Shower
     - Speech Therapists and PT's like being in the classroom (where the kids are)
     - In addition to teacher workstation, FSC Room needs area for EAs: storage for EA manipulatives, personal items, secured records, and area for OT.

   - **Additional SC classroom/s for various ability students / per grade level?**

   - **Resource Services Classrooms**

     Resource classrooms should be counted as general classrooms because most "mild" SPED students will be mainstreamed. However it is important to have smaller, "pull-out" tutoring areas used not only for SPED students but also serve as differentiated learning spaces for gifted or other small group instruction.
     Also, all SPED teachers do need a "home base" even if most of their day is spent in general classrooms with "push in" students.

The resource rooms (currently listed at 980 sf) could be reduced to create the additional meeting spaces.

   - **Preschool SC Classroom(s)**

- With Notes from 1/17/2007 WAILUKU II Elementary School ED PLAN Meeting

And Notes from 1/30/2007 meeting

- Wailuku ES Preschool has their own classrooms and play area.

Separate play areas are important for preschool and kindergarteners too.

Preschool SPED classrooms should accommodate a maximum of 8 kids.

Wailuku ES currently has 20 SPED preschoolers.

1 SPED preschool classroom is already provided in the FADS. A portable classroom could be used to accommodate more SPED preschool students if needed.

3. **SPED offices for teachers are needed if classrooms are traded away due to inclusion/mainstreaming.**

4. **Itinerant Room – Determine location, what/who it should be near. This room is used to house support personnel, such as occupational & physical therapists. Room is also used for IEPs & conferencing, etc.**

Could be located with Student Center or as counseling support room closer to the classrooms

5. **Any other types of spaces to be considered for SPED**

6. **Restrooms, showers, kitchen, laundry areas, outdoor areas, passenger - loading areas, secured play areas (elementary)**

Consider security concerns of kindergarten and preschool, and Sped "runners" (students who aren't yet comfortable with school.)

- FADS information on SPED rooms

1 – Itinerant Rm. (incl storage/teacher space)	330 sf
4 – FSC	1,550 sf

Integrated throughout areas with general classrooms (1 for preschool?)

2 – Resource Classroom	980 sf

Consider using as general classrooms

1 – Smaller FSC	1,200 sf

Consider breaking up into smaller resource rooms with "home bases" for SPED teachers. Adults need to be where the kids are.

- Wailuku ES SPED staffing/rooms

1 – Severely Handicapped
2 – Pre-K (preschool classrooms)
1 – Deaf Ed (1 teacher, 2 aides for 3 or 4 students)
9 or 10 more SPED teachers in other classrooms (push-in/pull-out, mainstream)
Lower elementary has more aides

E. Comprehensive Student Support Services (CSSS)

Consider use of a Student Center close to admin as a base, but majority of spaces should be near the classrooms – the adults need to be where the students are. Secure, private files need to centrally located.

- Not enough available conference space
- Secure storage is very important because of all the testing, needs to be "under lock & key" and privacy concerns with student records.
- PSAP
  Services Regular and SPED kids (K-1). Lower Elementary counselor (for students who aren't comfortable w/ school)
  The space should be welcoming/kid friendly. Not typical office furniture to accommodate PSAP aides (1 or 2) and students. (larger than typical office size). Security/privacy is important for confidentiality (test, etc…). Use of manipulatives. Pull-in and push-out.

1. **Type of services to be offered or particular agencies to be based on campus**

   - Elementary schools have more speech services (small group) than middle schools. Wailuku WES has 2 full time staff.
   - Therapists and outside service providers need office and conference space. Example: OT/PT providers sometimes need storage space and space to set up equipment

2. **Type of areas desired? Typically DOE has provided 2,000 sf to include:**
   - **two conference rooms (350 sf each),**
   - **three offices (@170 sf each),**
   - **one reception/work production/storage area (490 sf),**
   - **two restrooms (1 adult, 1 child @ 60 sf each)**
   - **circulation space (180 sf)**

3. **Role groups to be serviced - Students, parents, others?**

   Elementary students need to have ease of access to services

4. **Hours of operation; volume of people to be serviced per hour/day/week, etc; parking requirements**

5. **What are the functional relationships/ties with other personnel, services on campus (students, counselors, administration, parents/family coming on campus, etc…)**

6. **Location on campus – Where should this component be located to best serve the school?**

   A 'student center' is desirable as a home base for student support functions, located close to administration; easy to find by visitors; easy to get to from classroom areas, but counselors and some conference/support spaces should be even closer to classroom areas.

F. Student Services Coordinator/Educational Assistant (SSC/EA) Office

1. **What are the functional relationships/ties with other personnel, services on campus (students, counselors, administration, visitors, etc.)?**

2. **Privacy concerns?**

3. **Should the SBBH (School Based Behavioral Health) be separate or a part of this component?**

4 Offices to be closer to students/classrooms:
SBBH, Upper & Lower El Counselors, PSAP (lower el)

PSAP (typically 1 position) works w/ K-2nd grade kids and requires a counseling space.

- It should be close to the SSC, other counselors and SPED.

4. Location on campus – Where should this component be located to best serve the school?

- SBBH is for students needing special help, near counseling and SPED. SBBH office is for meetings (170 sf) and 1-on-1 tutoring. One position per school, privacy is a concern.

SBBH (typically 1 position) works w/ K-5th grade kids and requires a counseling space.

G. Student Activities

1. Discuss type of activities to be provided / fostered. How would student activities be provided? Integrated within curriculum, extra-curricular, combination, other.

- Elementary schools tend to discourage use of money on campus so "school store" space could be "traded" and utilized as storage. This activity could occur in a classroom.

The student activities "sale window" could be used to support incentive programs. Tokens could be used in place of money, which is typically discouraged at an elementary.
If the student activities coordinator is also a teacher, she might opt to use her classroom to accommodate her student activities.

2. Student Activities Coordinator Office is provided. Are there other related facilities needed to support student activities? Student store, classroom spaces, conference/meeting areas?

SAC at elementary is often a teacher, so location of SAC Office and meeting area should be located with other student support functions so they could serve multiple uses.

3. Student areas - Describe type and location of areas for students during non-instructional time. These areas will provide the variety of spaces to meet the daily activities of the students. They would provide areas for passive and active interaction with others. Safety and security (the ability to visually monitor students) would be desired criteria.

Elementary age students need areas for jumping, active play; areas for small groups to socialize or study together outside in the shade; all areas need to be easily supervised.

4. Assembly needs - Describe type of assemblies anticipated, number of students involved, frequency of the events. How multi-purpose facilities could be used.

Whole school assemblies would support idea of celebrating students, also by grade level.
Parent/student event area also needed.
May Day program and outdoor events

- With Notes from 1/17/2007 WAILUKU II Elementary School ED PLAN Meeting

And Notes from 1/30/2007 meeting

- Spaces needed for student performance, both formal and informal

H. School/Community Connections

1. How do you see the community interacting with the school? (parents/businesses, other resources)

- It takes a village to educate a child
  Everyone has a role and should be involved in the design
  Students, educators, parents, community members,…

2. Facilities/components on campus for this interaction? (frequency & timing may determine location on site - perimeter or front of the campus to allow easy access if during school hours/after school easier access?)

- Provide lots of parking.

3. School's anticipated impact on the community. Use of facilities by the community, traffic, & parking within the community.

- School - Community Connections – Currently through the PCNC, community volunteers come in to tutor during and after school.
- Parent night focuses on relationships/content areas/special occasions/activities.
- "Wildcat recognition dinner" recognizes outstanding students and workshops are for parents and students or Baldwin HS students provide childcare activities.
- Summer outreach for tutoring,
- Active PTA, community has supervised use of the library and/or cafeteria.

I. Administration
Review organization chart / positions for the school and how they will interact.

- Administration areas should have easy access, be the front door of the school, welcoming
- Having enough parking supports the "welcoming" feeling of the school (for parents, teachers, staff)

1. Location of the administration - principal and vice-principal offices in relationship to the overall campus design. Centralized or decentralized per various grade levels

The Vice Principal typically deals with students and parents. The VP should be located close to the Principal. The VP office should be large enough to accommodate small group meetings.

2. Location of the counselors

Counselors need to be located close to classrooms, where students feel comfortable going to see them, where the counselors can interact daily with the students and teachers.

3. Location of PCNC

- PCNC space should have the ability to open after hours, w/ access to restrooms and visible signage from administration entry.

- With Notes from 1/17/2007 WAILUKU II Elementary School ED PLAN Meeting

And Notes from 1/30/2007 meeting

- Need to provide a lot of storage, accessibility to workroom, and easily visible from the visitor's parking.
- Close proximity to Administration would facilitate communication.

The PCNC should be located close to the Principal's office. They need to check-in at the administration office before they go to the PCNC room.

4. Location of conference rooms

- Not enough available conference space on WES, and most, campuses.

5. Location of Health Services

J. Library / Information Resource Center / Media Center

- Library/Media Center – name should reflect that it's not just a library anymore. Should be easily accessible (for teachable moments) easy access to materials

1. How should staff be involved in the educational process?

The Library/Media Center staff can support the students by having materials readily available, being welcoming to all, being student focused.

2. Who uses this facility (individual students/classes/larger size groups/community)?

Students use library/media center more than any other group; mostly classes, small groups and individuals.

5th graders in groups of 2 or 3 children visit the library for individual research.

Surveillance of elementary students is critical in a library.

At an elementary level, carrels are not used very often in the library.

All deliveries need to first be checked in at the administration office.
Square footage is provided for a receiving area in the administration to accommodate deliveries that need to be processed. The receiving area would be convenient for processing library book deliveries.

Portable broadcast equipment would allow you the flexibility to broadcast from anywhere on campus.

A video production space is needed. Wailuku ES has a video production program.

3. What should the relationship of this facility be to the other components of the school?

Needs to be easily accessible by classes, not as important to be at the front of the campus. Use by community outside groups won't be often, and with permission.

The computer resource lab should be co-located with the library/media center.

The Library is the heart of the school. It should be in close proximity to all the classrooms.

- Internet access and technology should be available throughout the campus (voice/video/data)

K. Student Dining Area/s

1. How would daily dining needs be met? (allowable Student Dining area seats a little over half of the design enrollment at one time)

Typical day-to-day dining will be supervised in cafeteria. Informal seating areas could be provided outside in shaded areas for special class lunches, or small group get-togethers.

- Supervision is important. Wailuku ES accommodates 3 cafeteria shifts.

Food Service Information: The cafeteria will have a serving kitchen. The food will be prepared at Iao ES.

Okay with providing a specialty classroom at the cafeteria.

2. Main dining area supplemented with satellite areas? By grade level, divisions of school, family-style?

3. Stages - Portable vs. Permanent?

A permanent stage is desirable to support recognition and celebration of students.

- Spaces needed for student performance, both formal and informal
- In existing school the resource teacher for creative movement holds classes in the café or on lanai areas. Music resource teacher typically goes to classrooms.

Dressing rooms in the cafeteria should be designed for dual use to maximize the use of the space. (i.e. Designing the boys and girls next to each other with an operable partition between the two space. The space could be used as a conference room by opening up the operable partition.

4. Outdoor areas for dining?

If satellite areas are provided they need to be well supervised and may not be used on a regular basis. (Supervision and maintenance concerns).
Informal shaded seating areas with tables for studying/eating would support students who aren't always going to be out on the playfield at recess.
Readily accessible restrooms and drinking fountains should be provided.

5. Accommodation of vending machines?

Not a priority at elementary schools

L. Outdoor Areas

- With Notes from 1/17/2007 WAILUKU II Elementary School ED PLAN Meeting

And Notes from 1/30/2007 meeting

See notes above under outdoor areas for dining. Shaded seating areas near playfields (for supervision) would be desirable.

Provide easily accessible location for minor first-aid supplies and sports equipment storage.

- Handicap accessibility throughout the campus is important (including playgrounds).
- Garden areas with indigenous plants for science / learning environments
- Project based learning/problem based learning - Provide shared outdoor areas for informal teaching areas.
- Covered walkways are desirable
- Good playground structures are needed, safe and accessible
- Play equipment should be included for students with special needs.
- Play ground equipment should be accessible (good surface). Haiku park has a good accessible playground.
- Kindergarten playground should be separate from the 1st graders (PSAP suggestion)
- Wailuku ES is experiencing an overuse of their playfield (grass is dying). Used by students for 4 recesses, Kama 'aina Kids, baseball, May day activities, etc.

1. **Location of the play court (ideally this would be covered, but it's a budget item)**

   - Covered Areas for rainy days, covered walkways. Covered playcourt with presentation area could serve dual use
   - Provide 'whole school' storage (PE equipment, furniture, specialty items)

2. **Outdoor stages/presentation areas - typically adjacent to the cafeteria**

   May Day presentation and other performances need to be accommodated, with shade.

   - Spaces needed for student performance, both formal and informal

3. **Bicycle storage areas**

   Given the inclusion of bikeways in the surrounding neighborhoods, there will be more bikes on this campus than at Wailuku ES. Security and safety should be considered.

4. **Who will use various play fields? (Accommodations for community groups such as Little League, soccer leagues, Summer Fun programs).**

   Because other park by Wailuku ES is heavily used it is envisioned that these play fields will also be used by community groups. (Developer has not finalized plans for neighboring community center, which may impact type of after hours use desired on school campus.)

M. Safety & Security Issues

The school should be a safe haven for students.

- Alarm systems - should be easy to use, teacher-friendly.
- Teacher workspaces need to be available after hours without needing to access entire building (alarms could be zoned)
- Security Office should possibly have access from exterior, or also be separately alarmed.
- Displays of student work should be protected from vandalism/weather

- With Notes from 1/17/2007 WAILUKU II Elementary School ED PLAN Meeting

And Notes from 1/30/2007 meeting

1. **Discuss ways and means of providing a safe and secure environment for students, staff, and community. (perimeter control, building openings, arrangement/layout of facilities)**

- To help with security: provide good lighting; provide phones in all rooms; situate buildings so neighbors can help "watch" campus
- Consider security concerns of kindergarten and preschool, and Sped "runners" (students who aren't yet comfortable with school.)
- Bathrooms need to be easily accessible for elementary age students

2. **Determine desired entry into the site by pedestrians, private car, buses, and service vehicles. Ideally, these should be separated for the safety of students and staff. (Suggest location and functional relationship desired for the passenger drop-off areas, Bus loading/unloading, SPED van areas, staff & visitor parking)**

3. **How can the building orientation and play areas enhance the safety of students?**

- Big safety concern – minimize areas for students to hide in; consider ease of campus supervision throughout the design

N. Sustainability Goals

Inclusion of sustainability goals is a given.

1. **How important is sustainability/energy efficiency in the design of the school?**

- Learning environments need to be "thermally comfortable" i.e. air conditioning AND natural ventilation capability?

2. **Should the campus facilities be considered as learning tools for sustainability?**

Educating the next generation to be aware of human impact on environment is important.

3. **How should recycling be integrated with the school? Access to Recycle Bins?**

Although Maui doesn't have a lot of recycling opportunities, there should be designated areas that make it easy for students and staff to recycle.
Need to ask the Kehalani developer how recycling will be handled in the neighborhoods.

O. Other Considerations

1. **Consider the use of multi-level facilities to gain additional open space.**

Wailuku ES has 2 story facilities, and given the sloping site and need for grading, 2 story buildings are not considered a negative. Stairways should be open (supervisable), airy and safe.

2. **How can maintenance be made more efficient?**

Sufficient storage areas need to be provided in easily accessible locations throughout the school.

- With Notes from 1/17/2007 WAILUKU II Elementary School ED PLAN Meeting

And Notes from 1/30/2007 meeting

- Custodial Service Center – Custodial staff may need to frequently clean-up severe SPED classrooms. Close proximity should be considered.
- Provide 'whole school' storage (PE equipment, furniture, specialty items)
- Maintenance – easy to clean (red dirt location). Look at alternate flooring products instead of carpet.

~~**3. Access to Public Telephones**~~

4. Access to Trash Bins

There should be designated areas throughout the school for trash bins, readily accessible for students and staff. Possibly provide built-in containers (with trash bins hidden) in corridors.

5. Covered Walkways / Drop Off.

School does not qualify for covered walkways, but a covered waiting area for both buses and parent pick-up is important. Buses should be separated from other traffic.

- Would like covered walkways.

PHONE (808) 594-1888

FAX (808) 594-1865

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

HRD09/4771

RECEIVED
JAN 20 2010
GROUP 70 INT'L

January 5, 2010

Jeff Overton
Group 70 International, Inc.
925 Bethel Street, 5th Floor
Honolulu, HI 96813

RE: Request for preliminary comments on the draft environmental assessment (DEA) for Wailuku II Elementary School, Wailuku, Maui, TMK: 3-5-001:067.

Aloha e Jeff Overton,

The Office of Hawaiian Affairs (OHA) is in receipt of the above-mentioned letter dated December 1, 2009. OHA has reviewed the project and offers the following comments.

We do have the following general recommendations to help form a better finished project. OHA would like to point out that Hawai'i is re-inventing its energy portfolio. As such, the applicant should consider that by 2020, 20% of Hawai'i's electricity is to be from renewable sources. Further, on January 28, 2008, Assistant Secretary of the Department of Energy and Governor Linda Lingle signed a groundbreaking Memorandum of Understanding (MOU) between the state government and the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy. The MOU estimates that Hawai'i can potentially meet between 60 and 70 percent of its future energy needs from clean, renewable energy sources.

As such, the legislature has recommended applicants consider the Leadership in Energy and Environmental Design (LEED) Green Building Rating System, which is the nationally accepted benchmark for the design, construction, and operation of high performance green buildings. OHA is happy to see that this proposal strives to achieve LEED Silver certification.

Further, OHA asks if the applicant has considered compliance with Act 96 enacted by the Legislature of the State of Hawai'i (2006). The purpose of this Act is to provide one segment of a larger comprehensive approach to achieving energy self-sufficiency for the state by

incorporating green building practices and installing renewable energy resources while using environmentally preferable products.

Additionally, as this is a state facility, OHA sees that Hawaii Revised Statutes §196-9 *Energy efficiency and environmental standards for state facilities, motor vehicles, and transportation fuel* should apply. OHA notes that the applicant should implement, to the extent possible, the goals of §196-9 during planning and budget preparation and program implementation of this facility.

We also ask that the project area be landscaped with drought tolerant native or indigenous species that are common to the area. Any invasive species should also be removed. Doing so would not only serve as practical water-saving landscaping practices, but also serve to further the traditional Hawaiian concept of mālama 'āina and create a more Hawaiian sense of place. This would also help to reduce the amount of impervious surfaces in the project area, thereby reducing runoff as well. Tree and landscape planting to shade paved parking areas and provide shade and cooling to building elements and outdoor use areas should also be considered.

OHA also asks that, in accordance with Section 6E-46.6, Hawaii Revised Statutes and Chapter 13-300, Hawaii Administrative Rules, if the project moves forward, and if any significant cultural deposits or human skeletal remains are encountered, work shall stop in the immediate vicinity and the State Historic Preservation Division shall be contacted

Thank you for the opportunity to comment. If you have further questions, please contact Grant Arnold by phone at (808) 594-0263 or e-mail him at granta@oha.org.

'O wau iho nō me ka 'oia'i'o,

Clyde W. Nāmu'o
Chief Executive Officer

C: OHA Maui CRC

GROUP 70
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February 2, 2010

Clyde W. Nāmuʻo, Chief Executive Officer
State of Hawaii Department of Hawaiian Affairs
711 Kapiolani Blvd., Suite 500
Honolulu, HI 96813

Subject: **Pre-Consultation for Draft Environmental Assessment**
Wailuku II Elementary School
Wailuku, Maui, Hawaiʻi
(2) 3-5-001:67, 77, 78 (pors.)

Dear Mr. Nāmuʻo:

Thank you for your Pre-Consultation comment letter dated December 29, 2009 concerning the Draft EA for the Wailuku II Elementary School.

In response to your comments the proposed project will incorporate solar water heater at the cafeteria and integrate energy and water conservation devices and design throughout the project. Hawaiʻi Revised Statues §196-9 will be implemented to the extent possible. Appropriate native Hawaiian and Polynesian-introduced plants that do not raise safety and maintenance concerns will be used where practicable. The project will also comply with Section 6E-46.6, Hawaiʻi Revise Statues and Chapter 13-300, Hawaiʻi Administrative Rules.

We will provide a copy of the Draft EA for your review. We appreciate your input and participation in the pre-consultation process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP, LEED AP
Principal Planner

Group 70 International • 925 Bethel Street, 5th Floor • Honolulu, HI 96813-4307 • tel. 808.523.5866 • fax. 808.523.5874 • www.group70int.com

LINDA LINGLE
GOVERNOR

RUSS K. SAITO
COMPTROLLER

SANDRA L. YAHIRO
DEPUTY COMPTROLLER

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P.O. BOX 119, HONOLULU, HAWAII 96810-0119

(P)1325.9

DEC 11 2009

RECEIVED
DEC 14 2009

Mr. Jeff Overton
Group 70 International, Inc.
925 Bethel Street, 5th Floor
Honolulu, Hawaii 96813-4307

Dear Mr. Overton:

Subject: Pre-Consultation for Draft Environmental Assessment
Wailuku II Elementary School, Wailuku, Maui, Hawaii

Thank you for the opportunity to provide comments on the Wailuku II Elementary School, Wailuku, Maui, Pre-Consultation for Draft Environmental Assessment. The project does not impact any of the Department of Accounting and General Services' projects or existing facilities, and we have no comments to offer at this time.

If you have any questions, please have your staff call Mr. Clarence Kubo of the Planning Branch at 586-0488.

Sincerely,

ERNEST Y.W. LAU
Public Works Administrator

CKK:vca

DEPARTMENT OF
HOUSING AND HUMAN CONCERNS
HOUSING DIVISION
COUNTY OF MAUI

CHARMAINE TAVARES
Mayor
LORI TSUHAKO
Director
JO-ANN T. RIDAO
Deputy Director

35 LUNALILO STREET, SUITE 102 • WAILUKU, HAWAII 96793 • PHONE (808) 270-7351 • FAX (808) 270-6284

December 11, 2009

Mr. Jeff Overton
Principal Planner
Group 70 International, Inc.
925 Bethel Street, 5th Floor,
Honolulu, Hawaii 96813

Dear Mr. Jeff Overton

Subject: Pre-Consultation for Draft Environmental Assessment Wailuku II Elementary School (Wailuku, Maui, Hawaii)

The Department has reviewed the Pre-Consultation for Draft Environmental Assessment for the above subject project. Based on our review, we have determined that the subject project is not subject to Chapter 2.96, Maui County Code. At the present time, the Department has no additional comments to offer.

Please call Ms. Cara Bohne of our Housing Division at 270-5748 if you have any questions.

Sincerely,

Wayde T. Oshiro

WAYDE T. OSHIRO
Housing Administrator

cc: Director of Housing and Human Concerns

LINDA LINGLE
GOVERNOR OF HAWAII

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

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

In reply, please refer to
EMD / CWB

12052PJF.09

December 14, 2009

Mr. Jeff Overton
Principal planner
Group 70 International, Inc.
925 Bethel Street, 5th Floor
Honolulu, Hawaii 96813-4307

Dear Mr. Overton:

SUBJECT: Pre-Consultation for Draft Environmental Assessment
Wailuku II Elementary School
TMK Nos. (2) 3-5-001:067, 077 and 078 (Por.)
Wailuku, Island of Maui, Hawaii

The Department of Health, Clean Water Branch (CWB), has reviewed the subject document and offers these comments on your project.

Please note that our review is based solely on the information provided in the subject document and its compliance with the Hawaii Administrative Rules (HAR), Chapters 11-54 and 11-55. You may be responsible for fulfilling additional requirements related to our program. We recommend that you also read our standard comments on our website at: http://www.hawaii.gov/health/environmental/env-planning/landuse/CWB-standardcomment.pdf.

1. Any project and its potential impacts to State waters must meet the following criteria:

   a. Antidegradation policy (HAR, Section 11-54-1.1), which requires that the existing uses and the level of water quality necessary to protect the existing uses of the receiving State water be maintained and protected.

   b. Designated uses (HAR, Section 11-54-3), as determined by the classification of the receiving State waters.

   c. Water quality criteria (HAR, Sections 11-54-4 through 11-54-8).

2. You are required to obtain a National Pollutant Discharge Elimination System (NPDES) permit for discharges of wastewater, including storm water runoff, into State surface waters (HAR, Chapter 11-55). For the following types of discharges into Class A or Class 2 State waters, you may apply for an NPDES general permit coverage by submitting a Notice of Intent (NOI) form:

   a. Storm water associated with construction activities, including clearing, grading, and excavation, that result in the disturbance of equal to or greater than one (1) acre of total land area. The total land area includes a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under a larger common plan of development or sale. An NPDES permit is required before the start of the construction activities.

   b. Hydrotesting water.

   c. Construction dewatering effluent.

   You must submit a separate NOI form for each type of discharge at least 30 calendar days prior to the start of the discharge activity, except when applying for coverage for discharges of storm water associated with construction activity. For this type of discharge, the NOI must be submitted 30 calendar days before to the start of construction activities. The NOI forms may be picked up at our office or downloaded from our website at: http://www.hawaii.gov/health/environmental/water/cleanwater/forms/genl-index.html.

3. For types of wastewater not listed in Item No. 2 above or wastewater discharging into Class 1 or Class AA waters, you may need an NPDES individual permit. An application for an NPDES individual permit must be submitted at least 180 calendar days before the commencement of the discharge. The NPDES application forms may be picked up at our office or downloaded from our website at: http://www.hawaii.gov/health/environmental/water/cleanwater/forms/indiv-index.html.

4. Please note that all discharges related to the project construction or operation activities, whether or not NPDES permit coverage is required, must comply with the State's Water Quality Standards. Noncompliance with water quality requirements contained in HAR, Chapter 11-54, and/or permitting requirements, specified in HAR, Chapter 11-55, may be subject to penalties of $25,000 per day per violation.

If you have any questions, please visit our website at: http://www.hawaii.gov/health/environmental/water/cleanwater/index.html, or contact the Engineering Section, CWB, at (808) 586-4309.

Sincerely,

ALEC WONG, P.E., CHIEF
Clean Water Branch

JF:ml

GROUP 70
INTERNATIONAL

February 2, 2010

Alec Wong, Clean Water Branch
State of Hawaii Department of Health
P.O. Box 3378
Honolulu, HI 96801

Subject: **Pre-Consultation for Draft Environmental Assessment**
Wailuku II Elementary School
Wailuku, Maui, Hawai'i
(2) 3-5-001:67, 77, 78 (pors.)

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Tom Young
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Dear Mr. Wong:

Thank you for your Pre-Consultation comment letter dated December 14, 2009 concerning the Draft EA for the Wailuku II Elementary School.

In response to your comments the proposed project will comply with the Hawai'i Administrative Rules (HAR) Chapters 11-54 and 11-55. An application for a National Pollution Discharge Elimination System (NPDES) permit will be submitted to the State Department of Health for review and approval.

We will provide your office with a copy of the Draft EA for your review. We appreciate your input and participation in the pre-consultation process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP, LEED AP
Principal Planner

POLICE DEPARTMENT
COUNTY OF MAUI

CHARMAINE TAVARES
MAYOR

OUR REFERENCE

YOUR REFERENCE

55 MAHALANI STREET
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(808) 244-6400
FAX (808) 244-6411

GARY A. YABUTA
CHIEF OF POLICE

CLAYTON N.Y.W. TOM
DEPUTY CHIEF OF POLICE

December 14, 2009

Mr. Jeff Overton
Principal Planner
Group 70 International, Inc.
925 Bethel Street, 5th Floor
Honolulu, HI 96813-4307

Dear Mr. Overton:

SUBJECT: Pre-Consultation for Draft Environmental Assessment
Wailuku II Elementary School

This is in response to your letter dated December 1, 2009, requesting comments on the above subject.

We have reviewed the information provided and have enclosed our concerns regarding this project. Thank you for giving us the opportunity to provide our comments.

Very truly yours,

Assistant Chief Danny J. Matsuura
for: Gary A. Yabuta
Chief of Police

Enclosure

c: Jeffrey Hunt, Planning Department

COPY

TO : GARY YABUTA, CHIEF OF POLICE, COUNTY OF MAUI

VIA : CHANNELS

Concur
AC D. Matsuura
12/14/09

FROM : STEPHEN ORIKASA, ADMINISTRATIVE SERGEANT, WAILUKU PATROL DIVISION

SUBJECT : RESPONSE TO A REQUEST FOR PRE-CONSULTATION COMMENTS FOR DRAFT ENVIRONMENTAL ASSESSMENT, WAILUKU II ELEMENTARY SCHOOL

This communication is submitted as a response to a request for pre-consultation comments by Group 70 International, Inc., Principal Planner, Jeff Overton regarding the following;

SUBJECT : Pre-Consultation for Draft Environmental Assessment Wailuku II Elementary School (Wailuku, Maui, Hawaii)

RESPONSE:

In review of the submitted documents, concerns from the police perspective are upon the safety of pedestrian and vehicular movement.

The commencement of this project is to fulfill a need by the growing Wailuku district of the County of Maui. Completed roadways and adjacent pedestrian walkways should have already met with minimal standards set forth by county codes and state laws, and should continue without deviation throughout the project.

The master plan for this area indicates Kehalani Mauka Parkway to be a main roadway within the project area with ingress and egress points at Honoapiilani Highway (30) and Kuikahi Drive. This will likely lessen vehicular congestion within the Kehalani Mauka area as the intersections of Honoapiilani Highway at Kehalani Mauka Parkway and at Kuikahi Drive, are signalized.

A traffic impact study would be the only means to assess the levels of service in current and future conditions.

Respectfully submitted for your review and approval.

Stephen T. Orikasa E#716
Administrative Sergeant/Wailuku Patrol Division
12/14/09 @ 0930 Hours

Concur with Sgt. Orikasa. traffic impact needed for this project
Capt. J. Emfa SHT
12/14/09 1325 hrs.

GROUP 70 INTERNATIONAL

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M. Arch., AIA, LEED AP

Katherine M. MacNeil
AIA, LEED AP

Tom Young
AIA

February 2, 2010

Sgt. Stephen T. Orikasa, Administrative Sergeant/Wailuku Patrol Division
County of Maui Police Department
55 Mahalani Street
Wailuku, HI 96793

Subject: Pre-Consultation for Draft Environmental Assessment
Wailuku II Elementary School
Wailuku, Maui, Hawai'i
(2) 3-5-001:67, 77, 78 (pors.)

Dear Mr. Orikasa:

Thank you for your Pre-Consultation comment letter dated December 14, 2009 concerning the Draft EA for the Wailuku II Elementary School.

In response to your comments a traffic impact analysis was completed by AECOM, Inc in November 2009 as part of this project. The report concludes that the proposed elementary school project is forecast to add a small number of trips to the roadway system outside the Kehalani Mauka subdivision and would not have an adverse impact on traffic operations. The roadway system is expected to accommodate the increase in ambient traffic and school generated traffic with adequate mitigation.

According to the study, the projected Levels of Service (LOS) at the three signalized intersections (Honoapiilani Highway and Kehalani Parkway, Honoapiilani Highway and Kuikahi Drive, and Honoapiilani Highway and Waiko Drive) will not change. The Kuikahi Drive intersection will require mitigation to operate at LOS "C" during both peak hours. The Kuikahi Drive eastbound approach is forecast to operate at LOS "D" in both peak hours since its green phase would be shortened by the high volumes of opposing left turns. The two Waiko Drive approaches are currently operating at LOS "D" in the morning peak hour, and are forecast to remain at this level. During the future afternoon peak the intersection is forecast to operate at LOS "D" due to the single lane on the Waiko Drive westbound approach. This also causes the northbound approach of Honoapiilani Highway to operate at LOS "E". Several locations were identified as needing mitigation in the future regardless of the proposed project. The recommended mitigation measures are summarized in the Traffic Impact Assessment Report (TIAR).

We will provide your office with a copy of the Draft EA for your review. We appreciate your input and participation in the pre-consultation process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP, LEED AP
Principal Planner

CHARMAINE TAVARES
Mayor

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

MICHAEL M. MIYAMOTO
Deputy Director

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

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

CARY YAMASHITA, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS
200 SOUTH HIGH STREET, ROOM NO. 434
WAILUKU, MAUI, HAWAII 96793

December 16, 2009

Mr. Jeff Overton
GROUP 70 INTERNATIONAL, INC.
925 Bethel Street, 5th Floor
Honolulu, Hawaii 96813-4307

Dear Mr. Overton:

SUBJECT: **PRE-CONSULTATION FOR DRAFT ENVIRONMENTAL ASSESSMENT FOR WAILUKU ELEMENTARY SCHOOL II TMK: (2) 3-5-001:067 (POR.), 077 (POR.), 078 (POR.)**

We reviewed your pre-consultation request and have no comments to offer at this time.

Please call Michael Miyamoto at (808) 270-7845 if you have any questions regarding this letter.

Sincerely,

MILTON M. ARAKAWA, A.I.C.P.
Director of Public Works

MMA:MMM:ls
xc: Highways Division
Engineering Division
S:\LUCA\CZM\wailuku_el_sch_II_pre_35001067_077_078_pors_ls.wpd

LINDA LINGLE
GOVERNOR

DARWIN L.D. CHING
DIRECTOR

COLLEEN Y. LaCLAIR
DEPUTY DIRECTOR

STATE OF HAWAII
DEPARTMENT OF LABOR AND INDUSTRIAL RELATIONS
830 PUNCHBOWL STREET, ROOM 321
HONOLULU, HAWAII 96813
www.hawaii.gov/labor
Phone: (808) 586-8842 / Fax: (808) 586-9099
Email: dlir.director@hawaii.gov

December 29, 2009

RECEIVED
DEC 31 2010
GROUP 70 INT'L

Mr. Jeff Overton
Principal Planner
Group 70 International
925 Bethel Street, 5th Floor
Honolulu, Hawaii 96813

Dear Mr. Overton:

In accordance with your request dated December 1, 2009, the Department of Labor and Industrial Relations does not have any comments regarding the "Pre-Consultation for the Draft Environmental Assessment for the Wailuku II Elementary School".

Should you or your staff have questions, please contact me 586-8844, or Mr. Patrick Fukuki, our Business Management Officer, at 586-8888.

Sincerely,

DARWIN L.D. CHING

CHARMAINE TAVARES
Mayor

JEFFREY K. ENG
Director

ERIC H. YAMASHIGE, P.E., L.S.
Deputy Director

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793-2155
www.mauiwater.org

RECEIVED
JAN 11 2010
ENVIRONMENT'L

December 30, 2009

Mr. Jeff Overton
Group 70 International, Inc.
925 Bethel Street, 5th fl
Honolulu, HI 96813-4307

Re: Pre-Consultation for Draft Environmental Assessment Wailuku II Elementary School
TMK:3-5-001:067 (por), 3-5-001:077 (por) and 3-5-001:078 (por)

Dear Mr. Overton:

Thank you for consulting with the Department of Water Supply (DWS) in preparation of this Environmental Assessment (EA).

Source Availability and Consumption
The EA should identify expected potable and non-potable demand. Based on system per-acre standards, daily demand for the school would be 23,800 gallons. There is currently no additional source available to accommodate new customers according to system standards on the Central Maui System. New source to meet demand for the proposed school project as well as continued build-out of the Kehalani Mauka master planned area should be identified. The Department may delay issuance of meters until new sources are on line. The Department will not issue temporary construction meters for Central Maui projects.

System Infrastructure
A 12-inch waterline, a 16-inch waterline and six fire hydrants are installed along Kehalani Mauka Parkway east of the project area. System improvements and storage requirements will be determined in the building permit process.

Pollution Prevention
The entire project site is within the 2 year time of travel wellhead protection area (WHPA) of DWS sources overlying the Iao aquifer. The property borders the Waihee ditch to the West. We recommend that the following Best Management Practices (BMPs) designed to minimize infiltration and runoff be incorporated in the EA and implemented during construction:

The Department of Water Supply is an Equal Opportunity provider and employer. To file a complaint of discrimination, write: USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 14th and Independence Avenue, SW, Washington DC 20250-9410. Or call (202) 720-5964 (voice and TDD)

Printed on recycled paper

1. There shall be a designated person on site during operating hours who is responsible supervising the use, storage, and handling of hazardous material and who shall take appropriate mitigating actions necessary in the event of a fire or spill.
2. Hazardous materials left on site when the site is unsupervised must be inaccessible to the public. Locked storage sheds, locked fencing, locked fuel tanks on construction vehicles, or other techniques may be used if they will preclude access.
3. Construction vehicles and stationary equipment that are found to be leaking fuel, hydraulic fluid, and/or other hazardous materials shall be removed from the site and from Wellhead Protection Area. The vehicle or equipment may be repaired in place, provided the leakage is completely contained.
4. Storage and dispensing of flammable and combustible liquids from tanks, containers, and tank vehicles into the fuel and fluid reservoirs of construction vehicles or stationary equipment on the construction site shall be in accordance with these standards and County Fire Code Chapter 16.04A.
5. Hazardous materials and other deleterious substances shall not be allowed to enter stormwater systems.

Conservation
The EA should identify conservation measures to be implemented in project design and construction. The following conservation measures should be considered:
Use Non-potable Water: Use brackish or reclaimed water for irrigation and dust control during construction where available.
Use Climate-adapted Plants: The project is located in the "Maui County Planting Plan" - Plant Zone 4. Native plants adapted to the area conserve water and protect the watershed from degradation due to invasive alien species. Use native plants for all landscaping purposes.
Prevent Over-Watering By Automated Systems: Provide rain-sensors on all automated irrigation controllers in common areas. Check and reset controllers at least once a month to reflect the monthly changes in evapo-transpiration rates at the site. As an alternative, provide the more automated, soil-moisture sensors on controllers.
Eliminate Single-Pass Cooling: Single-pass, water-cooled systems should be eliminated per Maui County Code Subsection 14.21.20. Although prohibited by code, single-pass water cooling is still manufactured into some models of air conditioners, freezers, and commercial refrigerators.
Utilize Low-Flow Fixtures and Devices: Maui County Code Subsection 16.20A.680 requires the use of low-flow water fixtures and devices in faucets, showerheads, urinals, water closets, and hose bibs. Water conserving washing machines, ice-makers and other units are also available.
Maintain Fixtures to Prevent Leaks: A simple, regular program of repair and maintenance can prevent the loss of hundreds or even thousands of gallons a day.

Should you have any questions regarding system improvements for this project, please contact our engineering division at (808) 270-7835. For questions on water resources, please contact our Water Resources and Planning Division at (808) 244-8550.

Sincerely,

Jeffrey K. Eng, Director
emb

c: engineering division

attachments:
A Checklist of Water Conservation Ideas for Schools and Public Buildings
Plant Brochure: "Saving Water in the Yard"

C:\EA EIS SLUD\Wailuku Elementary School II pre_EA.wpd

Water Conservation for Schools and Public Buildings

General Suggestions

- Increase employee, faculty and student awareness of water conservation. Brochures explaining how to conserve water at home are available from the Department of water Supply.
- Read water meter daily to monitor the success of water conservation efforts.
- Conduct contests for employees, students and faculty (e.g.,posters, slogans or conservation ideas); locate suggestion boxes in prominent areas.
- Install signs that encourage water conservation in restrooms - leaflets suitable for display or distribution are available from the Department of Water Supply.
- When cleaning with water is necessary, use budgeted amounts.

Physical Plant - Building Maintenance

- Minimize the water used in cooling equipment, such as air compressors, in accordance with the manufacturer's recommendations.
- Reduce the load in air conditioning units by shutting air conditioning off when and where it is not needed.
- Maintain insulation on hot water pipes.
- Check water supply system for leaks, and turn off any unnecessary flows.
- Repair dripping faucets, showers, and continuously running toilets.
- Avoid excessive boiler and air conditioner blowdown. Monitor total dissolved solid levels and blowdown only when needed.
- Reduce the water used in toilet flushing by either adjusting the vacuum flush mechanism or installing toilet tank displacement devices (dams, bottles, or bags).
- Instruct clean-up crews to use less water for mopping.
- Change window cleaning schedule from periodic to on-call, as required basis.
- Install flow reducers and faucet aerators in all plumbing fixtures.
- As appliances and fixtures wear out, replace with water saving models.

Cafeteria and Food Service

- Turn off the continuous flow used to clean the drain trays of the coffee/milk/soda beverage island; clean the trays only as needed.
- Turn dishwashers off when dishes are not being processed. Wash full loads only. Replace tray heads to reduce water flow.
- Recycle rinse water from the dishwasher or recirculate it to the garbage disposer.
- Presoak utensils and dishes in panded water instead of using a running water rinse.
- Avoid thawing foods under running water by using other available alternatives, including microwave ovens.
- Minimize use of ice machines and adjust them to dispense less ice.
- Wash vegetables in panded water, do not let water run in prep sink.
- Use water from the steam table in place of fresh water to wash down the cook's area.

Pool

- Lower pool water to reduce the amount of water splashed out.
- Reduce amount of water used to backflush pool filters.
- Use a pool cover to reduce evaporation when pool is not being used.

Laundry

- Water conservation ideas for Laundries can be obtained from the Department of Water Supply.

Exterior Areas

- Wash autos, buses and trucks less often.
- Discontinue using water to clean sidewalks, driveways, loading docks, and parking lots. Consider using brooms or motorized sweeper.
- Avoid landscape fertilizing and pruning that stimulate excessive growth.
- Remove unhealthy plants so that remaining plants can benefit from the water saved.
- In many cases, older, established plants require only infrequent irrigation. Look for indications of water need such as wilt, change of color, or dry soils.
- Limit landscaping additions and alterations. In the future, design landscapes which require less water. Incorporate xeriscape (water management) techniques into the design.
- Install soil moisture overrides or timers on sprinkler systems. Time waterings, when possible, to occur in the morning when wind and evaporation are lowest. Irrigation equipment should apply water uniformity.
- Investigate the advantages of installing drip irrigation systems.
- Mulch around plants to reduce evaporation and discourage weeds.
- Remove thatch and aerate turf to encourage the movement of water to the root zone.
- Begin a flexible watering schedule, watering only when needed and not on windy or rainy days.
- Avoid runoff, and make sure sprinklers cover just the lawn or garden, not sidewalks, driveways or gutters.

GROUP 70
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Tom Young
AIA

February 2, 2010

Jeffrey K. Eng, Director
County of Maui Department of Water Supply
200 South High Street
Wailuku, Maui, HI 96793

Subject: **Pre-Consultation for Draft Environmental Assessment**
Wailuku II Elementary School
Wailuku, Maui, Hawai'i
(2) 3-5-001:67, 77, 78 (pors.)

Dear Mr. Eng:

Thank you for your Pre-Consultation comment letter dated January 11, 2010 concerning the Draft EA for the Wailuku II Elementary School.

In response to your comments a Preliminary Engineering Report (PER) was completed by Austin Tsutsumi & Associates, Inc. in January 2010 as part of this project. The projected average daily water demand for this project is approximately 31,958 gallons per day (gpd), which includes domestic and irrigation uses. The preliminary water demand calculations are summarized in the PER. The Department of Education will work closely with Kehalani Mauka and your department to identify additional water source to meet the demand for the proposed school project.

The State of Hawaii Department of Education has also indicated interest in gaingin certification of project by US Green Building Council under the Leadership in Energy and Environmental Design (LEED) for Schools Silver rating. As such, the project will be designed to minimize environmental impacts and ensure that development is done in a sustainable manner. This project will incorporate water efficient technology and design, and appropriate vegetation and landscaping to moderate water irrigation demands. Single-pass, water-cooled systems will not be used in this project. Low-flow water conserving fixtures will be utilized and ground cover which does not require irrigation will be used in large quantities. Appropriate native Hawaiian and Polynesian-introduced plants as recommended in the Maui County Planting Plan – Plant Zone 4 will be used where practicable. Also, automated irrigation controllers will be equipped with rain-sensors or similar devices that allow real-time adjustments to the irrigation schedule based on hourly weather information. The recommended Best Management Practices (BMP) designed to minimize infiltration and runoff will be incorporated and implemented during construction to the extent possible.

We will provide your office with a copy of the Draft EA for your review. We appreciate your input and participation in the pre-consultation process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP, LEED AP
Principal Planner

LINDA LINGLE
GOVERNOR

MAJOR GENERAL ROBERT G. F. LEE
DIRECTOR OF CIVIL DEFENSE

EDWARD T. TEIXEIRA
VICE DIRECTOR OF CIVIL DEFENSE

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE DIRECTOR OF CIVIL DEFENSE
3949 DIAMOND HEAD ROAD
HONOLULU, HAWAII 96816-4495

PHONE (808) 733-4300
FAX (808) 733-4287

RECEIVED
JAN - 4 2010

December 30, 2009

Mr. Jeff Overton, Principal Planner
Group 70 International, Inc.
925 Bethel Street, 5th Floor
Honolulu, Hawaii 96813-4307

Dear Mr. Overton:

Pre-Consultation for Draft Environmental Assessment
Wailuku II Elementary School, Wailuku, Maui, Hawaii

Thank you for the opportunity to comment on this project. After review of the documents and the maps sent for this project, we have no suggestions to make at this time. We anticipate reviewing the Draft Environmental Assessment when it is completed and will then make any appropriate comments.

If you have any questions, please call Mr. Richard Stercho, Hazard Mitigation Planner, at (808) 733-4300, ext. 583.

Sincerely,

EDWARD T. TEIXEIRA
Vice Director of Civil Defense

CHARMAINE TAVARES
Mayor

TAMARA HORCAJO
Director

ZACHARY Z. HELM
Deputy Director

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

DEPARTMENT OF PARKS & RECREATION

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

January 4, 2010

RECEIVED
JAN 13 2010
GROUP 70 INT'L

Mr. Jeff Overton
Group 70 International, Inc.
925 Bethel Street, 5th Floor
Honolulu, Hawaii 96813-4307

Dear Mr. Overton:

SUBJECT: WAILUKU II ELEMENTARY SCHOOL
Pre-Consultation for Draft Environmental Assessment

Thank you for the opportunity to review and comment on the subject project. We are in support of the proposed action and would like to reserve the right for future comments on the project's plans as they become available.

Please feel free to contact me or Karla Peters, Parks Project Manager, at (808) 270-7981 if there are any questions.

Sincerely,

Tamara Horcajo

TAMARA HORCAJO
Director

TH:PTM:kp

c: Patrick Matsui, Chief of Parks Planning and Development

LINDA LINGLE
GOVERNOR OF HAWAII

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

LORRIN W. PANG, M. D., M. P. H.
DISTRICT HEALTH OFFICER

STATE OF HAWAII
DEPARTMENT OF HEALTH
MAUI DISTRICT HEALTH OFFICE
54 HIGH STREET
WAILUKU, MAUI, HAWAII 96793-2102

RECEIVED
JAN - 8 2010
GROUP 70 INT'L

January 7, 2010

Mr. Jeff Overton
Principal Planner
Group 70 International, Inc.
925 Bethel Street, 5th Floor
Honolulu, Hawai'i 96813-4307

Dear Mr. Overton:

Subject: Pre-Consultation for Draft Environmental Assessment Wailuku II Elementary School (Wailuku, Maui, HI)
TMK: (2) 3-5-001:67 (por), (2) 3-5-001:77 (por) and (2) 3-5-001:78 (por)

Thank you for the opportunity to comment on the early consultation. The following comments are offered:

1. National Pollutant Discharge Elimination System (NPDES) permit coverage may be required for this project. The Clean Water Branch should be contacted at 808 586-4309.

2. The noise created during the construction phase of the project may exceed the maximum allowable levels as set forth in Hawaii Administrative Rules, Chapter 11-46 "Community Noise Control". A noise permit may be required and should be obtained before the commencement of this project.

It is strongly recommended that the Standard Comments found at the Department's website: http://hawaii.gov/health/environmental/env-planning/landuse/landuse.html be reviewed, and any comments specifically applicable to this project should be adhered to.

Should you have any questions, please call me at 808 984-8230 or e-mail me at patricia.kitkowski@doh.hawaii.gov.

Sincerely,

Patti Kitkowski

Patti Kitkowski
Acting District Environmental Health Program Chief

GROUP 70
INTERNATIONAL

February 2, 2010

Patti Kitkowski, Maui District Health Office
State of Hawaii Department of Health
54 High Street
Wailuku, Maui, HI 96793

Subject: **Pre-Consultation for Draft Environmental Assessment**
Wailuku II Elementary School
Wailuku, Maui, Hawai'i
(2) 3-5-001:67, 77, 78 (pors.)

PRINCIPALS

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James L. Stone
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Paul Bierman-Lytle
M. Arch., AIA, LEED AP

Katherine M. MacNeil
AIA, LEED AP

Tom Young
AIA

Dear Ms. Kitkowski:

Thank you for your Pre-Consultation comment letter dated January 7, 2010 concerning the Draft EA for the Wailuku II Elementary School.

In response to your comments the proposed project will comply with the Hawai'i Administrative Rules (HAR) Chapters 11-46, 11-54, and 11-55. An application for a National Pollution Discharge Elimination System (NPDES) permit will be submitted to the State Department of Health for review and approval. A noise permit will be obtained before the commencement of this project.

We will provide your office with a copy of the Draft EA for your review. We appreciate your input and participation in the pre-consultation process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP, LEED AP
Principal Planner

LINDA LINGLE
GOVERNOR

RECEIVED
JAN 12 2010
GROUP 70 INT'L

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

BRENNON T. MORIOKA
DIRECTOR

Deputy Directors
MICHAEL D. FORMBY
FRANCIS PAUL KEENO
BRIAN H. SEKIGUCHI
JIRO A. SUMADA

IN REPLY REFER TO:

STP 8.0009

January 8, 2009

Mr. Jeff Overton
Principal Planner
Group 70 International
925 Bethel Street, 5th Floor
Honolulu, Hawaii 96813-4307

Dear Mr. Overton:

Subject: Wailuku II Elementary School
Pre-Consultation for Draft Environmental Assessment (DEA)

Thank you for providing the subject project for the State Department of Transportation's (DOT) review and comments.

DOT understands that the subject project proposes to construct a Grades K-5 elementary school complex for 550 students, that will also serve as a community center, with 171 parking stalls on a 16-acre parcel. This project is located to the west of the State highway, Honoapiilani Highway and is part of the Kehalani Mauka development by Kehalani Mauka, LLC.

The DEA should discuss and evaluate project-generated traffic impacts to nearby State highway facilities, such as, but not limited to the following issues.

1. The DEA should address and analyze the subject project's contribution to the cumulative traffic impacts to Honoapiilani Highway.

2. A Traffic Impact Assessment Report (TIAR) should be submitted to DOT for review and approval.

3. Discuss and analyze the subject project at full build-out and the types of use and hours of activity, especially beyond normal school session hours, as a community center.

4. If a park, adjoining the subject project school facility, is planned or anticipated, then this should be noted and addressed in the TIAR and DEA, especially if the park includes facilities such as a gymnasium, swimming pool, parking or a multi-purpose center, etc.

Mr. Jeff Overton
Page 2
January 8, 2009

STP 8.0009

DOT requests at least four copies of the DEA when available. If there are any other questions, please contact Mr. David Shimokawa of the DOT Statewide Transportation Planning Office at telephone number (808) 587-2356.

Very truly yours,

Francis Paul Keno

for BRENNON T. MORIOKA, Ph.D., P.E.
Director of Transportation

GROUP 70
INTERNATIONAL

PRINCIPALS

Francis S. Oda
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James L. Stone
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Paul Bierman-Lytle
M. Arch., AIA, LEED AP

Katherine M. MacNeil
AIA, LEED AP

Tom Young
AIA

February 2, 2010

Brennon T. Morioka, Ph D., PE, Director of Transportation
State of Hawaii Department of Transportation
869 Punchbowl Street
Honolulu, HI 96813

Subject: **Pre-Consultation for Draft Environmental Assessment**
Wailuku II Elementary School
Wailuku, Maui, Hawai'i
(2) 3-5-001:67, 77, 78 (pors.)

Dear Mr. Morioka:

Thank you for your Pre-Consultation comment letter dated January 8, 2010 concerning the Draft EA for the Wailuku II Elementary School.

In clarification, the proposed project will not serve as a community center, however, the school facilities will be available for general community uses when not otherwise used for instructional purposes. This policy is in accordance with the Hawai'i Administrative Rules Department of Education Title 8 Subtitle 2. Currently, there is no park adjoining the subject school facility.

A traffic impact analysis was completed by AECOM, Inc in November 2009 as part of this project. The report concludes that the proposed elementary school project is forecast to add a small number of trips to the roadway system outside the Kehalani Mauka subdivision. The school traffic is not anticipated to have an adverse impact on traffic operations. The roadway system is expected to accommodate the increase in ambient traffic and school-generated traffic with adequate mitigation.

According to the study, the projected levels of service of the three signalized intersections (Honoapiilani Highway and Kehalani Parkway, Honoapiilani Highway and Kuikahi Drive, and Honoapiilani Highway and Waiko Drive) will not change. The Kuikahi Drive intersection will require mitigation to operate at levels of service C during both peak hours. The Kuikahi Drive eastbound approach is forecast to operate at levels of service D in both peak hours since its green phase would be shortened by the high volumes of opposing left turns. The two Waiko Drive approaches are currently operating at levels of service D in the morning peak hour, and are forecast to remain at this level. During the future afternoon peak the intersection is forecast to operate at levels of service D due to the single lane on the Waiko Drive westbound approach. This also causes the northbound approach of Honoapiilani Highway to operate at levels of service E. Several locations were identified as needing mitigation in the future regardless of the proposed project. The recommended mitigation measures are summarized in the Traffic Impact Assessment Report (TIAR).

We will provide your office with four copies of the Draft EA per your request. A copy of the TIAR will also be submitted for your review and approval. We appreciate your input and participation in the pre-consultation process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP, LEED AP
Principal Planner

Group 70 International • 925 Bethel Street, 5th Floor • Honolulu, HI 96813-4307 • tel. 808.523.5866 • fax. 808.523.5874 • www.group70int.com

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

RECEIVED
JAN 13 2010
GROUP 70 INT'L

January 11, 2010

Group 70 International
925 Bethel Street 5th Floor
Honolulu, Hawaii 96813

Attention: Mr. Jeff Overton

Ladies and Gentlemen:

Subject: Pre-Consultation for Draft Environmental Assessment for Wailuku II Elementary School

Thank you for the opportunity to review and comment on the subject matter. The Department of Land and Natural Resources' (DLNR), Land Division distributed or made available a copy of your report pertaining to the subject matter to DLNR Divisions for their review and comment.

Other than the comments from Division of Aquatic Resources, Engineering Division, the Department of Land and Natural Resources has no other comments to offer on the subject matter. Should you have any questions, please feel free to call our office at 587-0433. Thank you.

Sincerely,

Charlene E. Unoki
for Morris M. Atta
Administrator

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

December 5, 2009

RECEIVED
LAND DIVISION
2009 JAN -4 A 7:47
DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

MEMORANDUM

TO: **DLNR Agencies:**
x Div. of Aquatic Resources
~~Div. of Boating & Ocean Recreation~~
x Engineering Division
~~Div. of Forestry & Wildlife~~
Div. of State Parks
x Commission on Water Resource Management
Office of Conservation & Coastal Lands
x Land Division – Barbara
x Historic Preservation

FROM: for Morris M. Atta Charlene
SUBJECT: Pre-Consultation for Draft Environmental Assessment for Proposed Wailuku II Elementary School
LOCATION: Island of Maui
APPLICANT: Group 70 International on behalf of Department of Education

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by January 8, 2010.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

( ) We have no objections.
( ) We have no comments.
(✓) Comments are attached.

Signed: Vicky Lee
Date: 12-28-09

'09 DEC 07 AM 11:24 ENGINEERING

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LD/ Morris Atta
Ref.: Early Consultation for DEA for Proposed Wailuku II Elementary School
Maui.002

COMMENTS

(X) We confirm that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Zone X. The National Flood Insurance Program (NFIP) does not regulate developments within Zone X.

( ) Please take note that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Zone ___.

( ) Please note that the correct Flood Zone Designation for the project site according to the Flood Insurance Rate Map (FIRM) is ___.

( ) Please note that the project must comply with the rules and regulations of the National Flood Insurance Program (NFIP) presented in Title 44 of the Code of Federal Regulations (44CFR), whenever development within a Special Flood Hazard Area is undertaken. If there are any questions, please contact the State NFIP Coordinator, Ms. Carol Tyau-Beam, of the Department of Land and Natural Resources, Engineering Division at (808) 587-0267.

Please be advised that 44CFR indicates the minimum standards set forth by the NFIP. Your Community's local flood ordinance may prove to be more restrictive and thus take precedence over the minimum NFIP standards. If there are questions regarding the local flood ordinances, please contact the applicable County NFIP Coordinators below:

( ) Mr. Robert Sumitomo at (808) 768-8097 or Mr. Mario Siu Li at (808) 768-8098 of the City and County of Honolulu, Department of Planning and Permitting.
( ) Mr. Frank DeMarco at (808) 961-8042 of the County of Hawaii, Department of Public Works.
( ) Mr. Francis Cerizo at (808) 270-7771 of the County of Maui, Department of Planning.
( ) Mr. Mario Antonio at (808) 241-6620 of the County of Kauai, Department of Public Works.

( ) The applicant should include project water demands and infrastructure required to meet water demands. Please note that the implementation of any State-sponsored projects requiring water service from the Honolulu Board of Water Supply system must first obtain water allocation credits from the Engineering Division before it can receive a building permit and/or water meter.

(X) The applicant should provide the water demands and calculations to the Engineering Division so it can be included in the State Water Projects Plan Update.

( ) Additional Comments: _____

( ) Other: _____

Should you have any questions, please call Mr. Dennis Imada of the Planning Branch at 587-0257.

Signed: _____
CARTY CHANG, ACTING CHIEF ENGINEER

Date: 12-29-09

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

December 5, 2009

AQUATIC RESOURCES: 2755

DIRECTOR	
COMM. FISH.	
AQ RES/ENV	
AQ REC	
PLANNER	
STAFF SVCS	
RCUH/UH	
STATISTICS	
AFRC/FED AID	
EDUCATION	
SECRETARY	
OFFICE SVCS	
ASST	X
Return:	
Notes:	
Comments:	
Due Date:	

SH

RECEIVED DEC 8 2009 AQUATIC RESOURCES

RECEIVED 2009 JAN 11 P 3:08 DEPT. OF LAND & NATURAL RESOURCES STATE OF HAWAII

MEMORANDUM

TO: **DLNR Agencies:**
x Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
x Engineering Division
__Div. of Forestry & Wildlife
__Div. of State Parks
x Commission on Water Resource Management
__Office of Conservation & Coastal Lands
x Land Division – Barbara
x Historic Preservation

FROM: for Morris M. Atta Charlene
SUBJECT: Pre-Consultation for Draft Environmental Assessment for Proposed Wailuku II Elementary School
LOCATION: Island of Maui
APPLICANT: Group 70 International on behalf of Department of Education

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by January 8, 2010.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

( ) We have no objections.
(X) We have no comments.
( ) Comments are attached.

Signed: Francis Cerizo (for DP)
Date: 1-8-10

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M. Arch., AIA, LEED AP

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AIA, LEED AP

Tom Young
AIA

February 2, 2010

Carty Chang, Acting Chief Engineer, Engineering Division
State of Hawaii Department of Land and Natural Resources
P.O. Box 621
Honolulu, HI 96809

Subject: **Pre-Consultation for Draft Environmental Assessment**
Wailuku II Elementary School
Wailuku, Maui, Hawai'i
(2) 3-5-001:67, 77, 78 (pors.)

Dear Mr. Chang:

Thank you for your Pre-Consultation comment letter dated December 29, 2009 concerning the Draft EA for the Wailuku II Elementary School.

In response to your comments we have attached a preliminary water calculation for your use (subject to change). We will provide your office with a copy of the Draft EA for your review. We appreciate your input and participation in the pre-consultation process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP, LEED AP
Principal Planner

Group 70 International • 925 Bethel Street, 5th Floor • Honolulu, HI 96813-4307 • tel. 808.523.5866 • fax. 808.523.5874 • www.group70int.com

PRELIMINARY WATER DEMAND CALCULATIONS

Project Site Description

*Students – 550
*Faculty/Staff – 69
*Transient Visitors – 10

Total = 629 persons

Department of Water Supply Standard

(Table 100-18, Water System Standards)

Students **60 gallons / student

60 gallons/day x 550 students = **33,000 gallons/day** (includes domestic and landscape)

Average Daily Demand

(Table 3.3, AWWA Water Distribution Systems Handbook)

School, with cafeteria and showers ***18 gallons / person

Domestic Water Demand

550 students x (18 gallons / person / day) = 9,900 gals/day
69 faculty/staff x (18 gallons / person / day) = 1,242 gals/day
10 transient visitors x (18 gallons / person / day) = 180 gals/day

TOTAL **11,322 gals/day**

Landscape Irrigation Demand

****20,636 gallons/day**

Total Demand

11,322 + 20,636 = **31,958 gallons/day**

31,958 gallons/day < 33,000 gallons/day OK

Project: Wailuku II Elementary School
Wailuku, Maui, Hawaii
TMK: (2) 3-5-001: Por. of 067, 077 & 078

Job No: M-07-510
Computed by: GKT
Date: February 2010 [1 of 2]

Austin, Tsutsumi & Associates, Inc. ● Civil Engineers ● Surveyors
1871 Wili Pa Loop ● Suite A ● Wailuku, HI 96793 ● (808) 244-8044

Yearly Demand

*Assumptions: 180 school days per year for students
220 days per year for faculty/staff and transient visitors

550 students x (18 gallons / person / day) x (180 days / year) = 1,782,000 gals/year
69 faculty/staff x (18 gallons / person / day) x (220 days / year) = 273,240 gals/year
10 transient visitors x (18 gallons / person / day) x (220 days / year) = 39,600 gals/year

TOTAL **2,094,840 gals/year**

* Numbers provided by the Department of Education.
** Includes provisions for staff/faculty and landscape irrigation per Department of Water Supply.
*** 18 gallons/person derived by averaging the 16-21 gallons/person range per Water Distribution Systems Handbook and rounding down.
**** Landscape Irrigation Demand provided by Walters, Kimura, Motoda, Inc., January 14, 2010.

Austin, Tsutsumi & Associates, Inc. ● Civil Engineers ● Surveyors
1871 Wili Pa Loop ● Suite A ● Wailuku, HI 96793 ● (808) 244-8044

LINDA LINGLE
GOVERNOR OF HAWAII

RECEIVED
LAND DIVISION
2010 JAN 14 P 3:12
DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

RECEIVED
LAND DIVISION
2010 JAN 14 P 2:53
DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

LAURA H. THIELEN
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WILLIAM D. BALFOUR, JR.
SUMNER ERDMAN
NEAL S. FUJIWARA
CHIYOME L. FUKINO, M.D.
DONNA FAY K. KIYOSAKI, P.E.
LAWRENCE H. MIIKE, M.D., J.D.
KEN C. KAWAHARA, P.E.
DEPUTY DIRECTOR

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

January 13, 2010

TO: Morris Atta, Administrator
Land Division

FROM: Ken C. Kawahara, P.E., Deputy Director
Commission on Water Resource Management

SUBJECT: Proposed Wailuku II Elementary School Pre-consultation for Draft EA

FILE NO.: N/A
TMK NO.: (2) 3-5-001:077 & 078

Thank you for the opportunity to review the subject document. The Commission on Water Resource Management (CWRM) is the agency responsible for administering the State Water Code (Code). Under the Code, all waters of the State are held in trust for the benefit of the citizens of the State, therefore, all water use is subject to legally protected water rights. CWRM strongly promotes the efficient use of Hawaii's water resources through conservation measures and appropriate resource management. For more information, please refer to the State Water Code, Chapter 174C, Hawaii Revised Statutes, and Hawaii Administrative Rules, Chapters 13-167 to 13-171. These documents are available via the Internet at http://www.hawaii.gov/dlnr/cwrm.

Our comments related to water resources are checked off below.

☒ 1. We recommend coordination with the county to incorporate this project into the county's Water Use and Development Plan. Please contact the respective Planning Department and/or Department of Water Supply for further information.

☒ 2. We recommend coordination with the Engineering Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.

☐ 3. We recommend coordination with the Hawaii Department of Agriculture (HDOA) to incorporate the reclassification of agricultural zoned land and the redistribution of agricultural resources into the State's Agricultural Water Use and Development Plan (AWUDP). Please contact the HDOA for more information.

☒ 4. We recommend that water efficient fixtures be installed and water efficient practices implemented throughout the development to reduce the increased demand on the area's freshwater resources. Reducing the water usage of a home or building may earn credit towards Leadership in Energy and Environmental Design (LEED) certification. More information on LEED certification is available at http://www.usgbc.org/leed. A listing of fixtures certified by the EPA as having high water efficiency can be found at http://www.epa.gov/watersense/pp/index.htm.

☒ 5. We recommend the use of best management practices (BMP) for stormwater management to minimize the impact of the project to the existing area's hydrology while maintaining on-site infiltration and preventing polluted runoff from storm events. Stormwater management BMPs may earn credit toward LEED certification. More information on stormwater BMPs can be found at http://hawaii.gov/dbedt/czm/initiative/lid.php.

☒ 6. We recommend the use of alternative water sources, wherever practicable.

☐ 7. There may be the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.

Permits required by CWRM:
Additional information and forms are available at http://hawaii.gov/dlnr/cwrm/resources_permits.htm.

☒ 8. The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit is required prior to use of water.

☐ 9. A Well Construction Permit(s) is (are) required any well construction work begins.

☐ 10. A Pump Installation Permit(s) is (are) required before ground water is developed as a source of supply for the project.

☐ 11. There is (are) well(s) located on or adjacent to this project. If wells are not planned to be used and will be affected by any new construction, they must be properly abandoned and sealed. A permit for well abandonment must be obtained.

☐ 12. Ground water withdrawals from this project may affect streamflows, which may require an instream flow standard amendment.

☐ 13. A Stream Channel Alteration Permit(s) is (are) required before any alteration(s) can be made to the bed and/or banks of a stream channel.

☐ 14. A Stream Diversion Works Permit(s) is (are) required before any stream diversion works is (are) constructed or altered.

☐ 15. A Petition to Amend the Interim Instream Flow Standard is required for any new or expanded diversion(s) of surface water.

☒ 16. The planned source of water for this project has not been identified in this report. Therefore, we cannot determine what permits or petitions are required from our office, or whether there are potential impacts to water resources.

☒ OTHER:

Proposed new wells in this vicinity are intended to replace use of Well No. 5330-05, whose yield is fully in use already. The Maui Water Use and Development Plan should be consulted in determining where new supplies for this project may be available. No amounts for this project have yet been identified.

If there are any questions, please contact Charley Ice at 587-0218.

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February 2, 2010

Ken C. Kawahara, P.E., Deputy Director
DLNR Commission on Water Resource Management
P.O. Box 621
Honolulu, HI 96809

Subject: **Pre-Consultation for Draft Environmental Assessment**
Wailuku II Elementary School
Wailuku, Maui, Hawai'i
(2) 3-5-001:67, 77, 78 (pors.)

Dear Mr. Kawahara:

Thank you for your Pre-Consultation comment letter dated January 11, 2010 concerning the Draft EA for the Wailuku II Elementary School.

In response to your comments a Preliminary Engineering Report (PER) was completed by Austin Tsutsumi & Associates, Inc. in January 2010 as part of this project. The projected average daily water demand for this project is approximately 31,958 gallons per day (gpd), which includes domestic and irrigation uses. The preliminary water demand calculations are summarized in the PER. Currently, the Department of Education (DOE) is working closely with Kehalani Mauka developer to identify additional water source to meet the demand for the proposed school project. Subsequently, an application for Water Use Permit will be submitted for review and approval. The Kahalani Mauka and DOE team will coordinate with the Engineering Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.

The State of Hawaii Department of Education has also indicated interest in gaingin certification of project by US Green Building Council under the Leadership in Energy and Environmental Design (LEED) for Schools Silver rating. As such, the project will be designed to minimize environmental impacts and ensure that development is done in a sustainable manner. This project will incorporate water efficient technology and design, and appropriate vegetation and landscaping to moderate water irrigation demands. The Best Management Practices (BMP) designed to minimize infiltration and runoff will be incorporated and implemented to minimize the impact of the project to the existing area's hydrology.

We will provide your office with a copy of the Draft EA for your review. We appreciate your input and participation in the pre-consultation process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP, LEED AP
Principal Planner

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

January 19, 2010

RECEIVED
JAN 21 2010
GROUP 70 INT'L

Group 70 International
925 Bethel Street 5th Floor
Honolulu, Hawaii 96813

Attention: Mr. Jeff Overton

Ladies and Gentlemen:

Subject: Pre-Consultation for Draft Environmental Assessment for Wailuku II Elementary School

Thank you for the opportunity to review and comment on the subject matter. The Department of Land and Natural Resources' (DLNR), Land Division distributed or made available a copy of your report pertaining to the subject matter to Commission on Water Resource Management for their review and comment.

The Department of Land and Natural Resources has no other comments to offer on the subject matter. Should you have any questions, please feel free to call our office at 587-0433. Thank you.

Sincerely,

for Morris M. Atta
Administrator

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, HONOLULU DISTRICT
FORT SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF:

January 25, 2010

Regulatory Branch POH-2009-00350

RECEIVED
JAN 26 2010
GROUP 70 INT'L

Jeff Overton
Group 70 International, Inc.
925 Bethel Street, 5th Floor
Honolulu, Hawaii 96813-4307

Dear Mr. Overton:

This responds to your request for comments for a draft Environmental Assessment (dEA) which will address activities and impacts of the proposed Wailuku II Elementary School located in Kehalani Mauka development, Wailuku, Island of Maui, Hawaii (TMKs: (2)3-5-001:67(por), (2)3-5-001:77(por), and (2)3-5-001:78(por)).

The dEA should indicate whether waters of the United States (WOUS), as typically represented by perennial or intermittent streams and wetlands, are in, adjacent to, or absent from, the proposed project area. The dEA should state in appropriate sections whether there is the potential for WOUS to be impacted, directly or indirectly, by construction of project structures and associated ground disturbing activities. Upon our receipt of the dEA for the Wailuku II Elementary School, we will provide a determination whether a Department of Army (DA) permit is required for activities and waters regulated under Section 404 of the Clean Water Act.

Section 404 of the Clean Water Act (Section 404) requires a DA permit be obtained for the placement or discharge of dredged and/or fill material into WOUS, including wetlands, prior to conducting the work (33 U.S.C. 1344). For regulatory purposes, the U.S. Army Corps of Engineers (Corps) defines wetlands as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

Thank you for providing us the opportunity to comment at this early stage. Please contact Mr. Robert Deroche, of my staff, at 808-438-2039 (FAX: 808-438-4060) or by email at robert.d.deroche2@usace.army.mil if you have questions or need additional information. Please refer to File Number POH-2009-00350 in all future correspondence regarding this project.

Sincerely,

George P. Young, P.E.
Chief, Regulatory Branch

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M. Arch., AIA, LEED AP

Katherine M. MacNeil
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Tom Young
AIA

February 2, 2010

George P. Young, Regulatory Branch Chief
US Army Corps of Engineers, Honolulu District
Fort Shafter, HI 96858

Subject: **Pre-Consultation for Draft Environmental Assessment**
Wailuku II Elementary School
Wailuku, Maui, Hawai'i
(2) 3-5-001:67, 77, 78 (pors.)

Dear Mr. Young:

Thank you for your Pre-Consultation comment letter dated January 25, 2010 concerning the Draft EA for the Wailuku II Elementary School.

In response to your comments there is no perennial, intermittent stream, or wetland presented in or adjacent to the proposed project area. Direct and indirect impact to the Waters of the United States (WOUS) by construction of project structures and associated ground disturbing activities is not anticipated.

We will provide your office with a copy of the Draft EA for your review. We appreciate your input and participation in the pre-consultation process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

Jeffrey H. Overton, AICP, LEED AP
Principal Planner

Group 70 International • 925 Bethel Street, 5th Floor • Honolulu, HI 96813-4307 • tel. 808.523.5866 • fax. 808.523.5874 • www.group70int.com