H. Air Quality Impact Assessment

(B.D. Neal & Associates)

B.D. NEAL & ASSOCIATES
Applied Meteorology • Air Quality • Computer Science
P.O. BOX 1808 · KAILUA-KONA, HAWAII 96745 · TELEPHONE (808) 329-1627 · FAX (808) 325-6739
EMAIL: bdneal@bdneal.com

September 15, 2008

Mr. Scott Ezer
Helber Hastert & Fee, Planners
733 Bishop Street, Suite 2590
Honolulu, HI 96813

Subject: Hawaiian Memorial Park Expansion Project
Air Quality Impact Assessment

Dear Mr. Ezer:

In response to your request, we have examined the potential air quality impacts related to the proposed Hawaiian Memorial Park Expansion Project located at Kaneohe, Oahu. The results of this examination along with background information related to this issue and recommended mitigation measures are summarized below.

Project Description

Clark & Green Associates is proposing to expand the Hawaiian Memorial Park on the island of Oahu at Kaneohe. The project includes approximately 57 acres of land adjacent to the Hawaii State Veterans Cemetery, which next to the existing 72-acre Hawaiian Memorial Park. Three project alternatives (A, B and C) are being considered. Alternatives A and B include a small residential component, whereas Alternative C includes the memorial park expansion only. It is expected that the proposed cemetery expansion area would be open for burials by the year 2011.

Ambient Air Quality Standards

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 Climatology

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 Kaneohe area is very much affected by its windward and near coastal situation and by nearby mountains. Winds are predominantly trade winds from the east or northeast and provide good ventilation much of the time. Wind speeds typically vary between about 10 and 25 miles per hour. Temperatures in the Kaneohe area are generally very consistent and moderate with an average daily temperature range of about 68°F to 79°F. Average annual rainfall in the area amounts to about 45 inches or more.

Existing Air Quality Conditions

Air quality in the vicinity of the project presently is mostly affected by emissions from natural, industrial, agricultural and/or vehicular sources with the latter probably being the dominant factor. The little air quality monitoring data available for the area from the Department of Health suggest that air quality standards are currently being met, although carbon monoxide measurements from Honolulu suggest that concentrations could exceed the state standards on occasion near high-volume traffic congested areas. The present air quality of the Kaneohe area is believed to be good.

Air Quality 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 project construction: (1) fugitive dust from soil excavation and vehicle movement; and (2) exhaust emissions from on-site construction equipment. Indirectly, there also could be short-term air quality impacts from the disruption of traffic on nearby roadways, from slow-moving construction equipment traveling to and from the project site and from a temporary increase in local traffic caused by commuting construction workers.

Fugitive dust emissions from construction activities are difficult to estimate accurately because of their elusive nature

of emission and because the potential for dust 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 U.S. EPA 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 from project construction would likely be somewhere near this level. In any case, State of Hawaii Air Pollution Control Regulations prohibit visible emissions of fugitive dust from construction activities at the project property line. Thus, an effective dust control plan for the project construction phase should be prepared.

Adequate fugitive dust control can usually be accomplished by the establishment of a frequent watering program to keep bare-dirt surfaces in active construction areas from becoming significant sources of dust. On days without rainfall, construction areas should be watered at least twice during the workday to help keep dust to a minimum. Control regulations further stipulate that open-bodied trucks be covered at all times when in motion if they are transporting materials likely to give rise to airborne dust. Haul trucks tracking dirt onto paved streets from unpaved areas are oftentimes a significant source of dust in construction areas. Some means to alleviate this problem, such as tire washing or road cleaning, may be appropriate. Dust monitoring could be considered as a means to quantitatively evaluate the effectiveness of dust control measures.

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

Indirectly, slow-moving construction vehicles on roadways leading to and from the project site could obstruct the normal flow of traffic to such an extent that overall vehicular emissions are

increased. This impact can be mitigated by moving heavy construction equipment during periods of low traffic volume. Likewise, the schedules of commuting construction workers can be adjusted to avoid peak hours in the project vicinity.

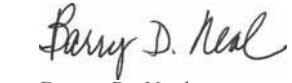
After the period of construction, long-term impacts on air quality from motor vehicle exhausts can potentially occur at or near any project that attracts large volumes of motor vehicle traffic. Carbon monoxide emissions are usually the primary issue, and public areas near traffic-congested intersections are the main concern. Project Alternative B, which includes the largest number of residential units, is shown in the traffic study to generate the most traffic for the three project development alternatives being considered. The project traffic study examined several roadway intersections in the project vicinity along Kaneohe Bay Drive, Kamehameha Highway, Mokulele Drive and Namoku Street. Traffic associated with the proposed project will likely use these roads and intersections to gain access to the project. The project traffic study indicates that with project Alternative B at full build-out that the project would contribute at most 18 vehicles per hour during the peak hours at the intersection of Lipalu Street and Namoku Street. Other intersections in the area would experience lower increases in traffic volumes. Future (year 2011) traffic level-of-service conditions with or without the project at signalized intersections in the project area are estimated in the project traffic study to operate at acceptable levels. The estimated traffic level-of-service at some unsignalized intersections, such as at Kamehameha Highway and HMP Driveway and at Kaneohe Bay Drive and Namoku Street, indicate congested conditions on some approaches (with or without the project).

Based on extensive experience in assessing traffic-related air quality impacts, traffic volume increases of less than about 5 percent or less than about 100 vehicles per hour and traffic approach volumes of less than about 1,000 vehicles per hour do not cause any significant impacts on air quality if adequate traffic level-of-service is provided. While the estimated traffic level-of-service on some approaches at some intersections in the project area is less than adequate, considering the small project-related traffic volumes that are expected, traffic from the proposed project should have no significant long-term impacts on maximum air pollution levels in the project area. Although a detailed air quality modeling study could be performed to quantitatively predict project impacts, such an analysis is probably unwarranted.

In summary, any long-term impacts on air quality from traffic related to this project will likely be negligible. Short-term impacts from fugitive dust during project construction may occur. Because of this, an effective dust control plan should be prepared and implemented.

Please call me if you have any questions concerning the information presented herein or if you wish to discuss this matter further.

Very truly yours,



Barry D. Neal
Certified Consulting Meteorologist

I. Noise Review

(D.L. Adams Associates, Ltd.)

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

August 19, 2008

Mr. Scott Ezer
Helber Hastert & Fee, Planners
733 Bishop Street, Suite 2590
Honolulu, HI 96813

RE: Hawaiian Memorial Park Expansion EIS Noise Review (DLAA #08-38)

Dear Mr. Ezer:

As requested, this letter summarizes our acoustical and noise control comments relating to the Environmental Impact Statement report submitted for the Hawaiian Memorial Park Expansion project. Please note we have not completed any computational analyses or noise modeling for the project. We also have not completed any noise measurements or visits to the project site. Rather, our work contained herein is based on our general observations of the project documents and professional experience in the areas of acoustics and noise control. We understand that this letter may be used as supplemental information for the Environmental Impact Statement.

The project consists of an expansion of the existing Hawaiian Memorial Park Cemetery, and a development of 20 single-family residential lots. The project area includes a 56.6 acre portion of the 164.4 acre land parcel, and is adjacent to a quiet neighborhood in Kaneohe, Hawaii.

State Noise Regulation

The Hawaii Administrative Rules, Title 11, Chapter 46 states maximum allowable noise limits due to stationary mechanical noise (measured at the property line or nearest listener location). The maximum noise limit for a single family home residential area is 55 dBA during the daytime hours (7AM – 10PM) and 45 dBA during the nighttime hours (10PM – 7AM).

Construction Noise

Development of project areas will involve excavation, grading, and other typical construction activities during construction. The various construction phases of the project may generate significant amounts of noise. The actual noise levels produced during construction will be a function of the methods employed during each stage of the construction process. In cases where construction noise exceeds, or is expected to exceed the State's "maximum permissible" property line noise levels, a permit must be obtained from the State DOH to allow the operation of vehicles, cranes, construction equipment, power tools, etc., which emit noise levels in excess of the "maximum permissible" levels.

970 N. KALAHEO AVE. • SUITE A311 • KAILUA, HAWAII 96734
808/254-3318 • FAX 808/254-5295
www.dlaa.com • hawaii@dlaa.com

In order for the State DOH to issue a construction noise permit, the Contractor must submit a noise permit application to the DOH, which describes the construction activities for the project. The Contractor should use reasonable and standard practices to mitigate noise, such as using mufflers on diesel and gasoline engines, using properly tuned and balanced machines, etc. However, the State DOH may require additional noise mitigation, such as temporary noise barriers, or time of day usage limits for certain kinds of construction activities.

The DOH noise permit does not limit the noise *level* generated at the construction site, but rather the *times* at which noisy construction can take place. Therefore, noise mitigation for construction activities should be addressed using project management, such that the time restrictions within the DOH permit are followed.

Project Generated Stationary Mechanical Noise

The proposed 20-lot residential subdivision may incorporate stationary mechanical equipment that is typical for residential buildings, such as air handling equipment, condensing units, etc. Noise from this mechanical equipment and other stationary equipment must meet the State DOH noise rules, which stipulate maximum permissible noise limits at the property line. Mitigation of mechanical noise to meet the State DOH noise rules should be incorporated into the project design.

Project Generated Traffic Noise

A traffic noise analysis was not completed by D. L. Adams Associates, Ltd. Based on the Traffic Impact Analysis Study (April 2008) prepared by Perazim Consulting LLC, the peak hour traffic counts shows only minor changes. The traffic noise along the primary roads of Kaneohe Bay Drive and Kamehameha Highway are likely to have a very minimal effect (most likely much less than a 1 dB increase in noise level due to the project). Similarly, noise along other secondary roads, such as Namoku Street, Mokulele Drive, and other nearby roads is not expected to significantly increase due to the project. Lipalu Street shows some increase in the peak hour traffic; however, the total traffic counts and vehicle speeds are not expected to cause a significant noise impact.

Please let me know if you have any questions.

Sincerely,

Digitally signed by Todd Beiler
Date: 2008.08.19 13:38:57 -10'00'

Todd Beiler, P.E.
Vice President

J. Cultural Impact Assessment

(Cultural Surveys Hawai‘i, Inc.)

Cultural Impact Assessment for the Hawaiian Memorial Park Expansion Area, Kāneʻohe Ahupuaʻa, Koʻolaupoko District, Oʻahu Island

TMK: [1] 4-5-033:001

Prepared for

Helber, Hastert & Fee Planners

Prepared by

Hallett H. Hammatt, Ph.D.

Cultural Surveys Hawaiʻi, Inc.

Kailua, Hawaiʻi

(Job Code: KANEO 3)

April 2008

Oʻahu Office
P.O. Box 1114
Kailua, Hawaiʻi 96734
Ph.: (808) 262-9972
Fax: (808) 262-4950

www.culturalsurveys.com

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

Management Summary

Reference	Cultural Impact Assessment for the Kāneʻohe Hawaiian Memorial Park Expansion Area Project, Kāneʻohe Ahupuaʻa, Koʻolaupoko District, Island of Oʻahu
Date	April 2008
Project Number (s)	Cultural Surveys Hawaiʻi Inc. (CSH) Job Code: KANEO 3
Agencies	State of Hawaiʻi Department of Health / Office of Environmental Quality Control (DOH / OEQC)
Project Location	The CSH project area is bordered on its *mauka* extent by the Hawaiian Memorial Park, and extends *makai* to the Pohai Nani Retirement Community, from the south and east by Kapaʻa Ridge, and the northwest by a housing development and Namoku Street. This petition area is depicted on USGS 7.5 minute topographic quadrangle Kaneohe, HI (1998).
Land Ownership	Hawaiian Memorial Life Plan Ltd.
Project Description	Proposed development within the petition area is described as new burial areas, automobile circulation and a residential subdivision. Minimally, the land alteration would include surface grubbing and grading, excavations associated with the installation of sub-surface utilities, housing construction and landscaping. According to information provided by Helber, Hastert & Fee Planners: Hawaiian Memorial Park, opened in 1961 with a current extent of 80 acres, will run out of usable space in the next few years. The cemetery owners are now planning for its future expansion, on land they own, to the east of the existing cemetery. This parcel of land is about 164 acres in size, but the expansion will only use approximately 56 acres of this area. Part of the proposed expansion (about 4 acres) is being proposed for residential purposes, on land adjacent to the Pohai Nani Retirement Home. The owners of the cemetery are planning to develop about 20 single-family lots on this portion of the property. The build-out of the expansion would not begin for several years, and could last over 20 years or so, the expansion may include 4 mausoleums, each about 3,500 square feet in size, and one-story in height. Approximately 15 acres of the 56-acre Project Area will be graded and revegetated with native species, and there will be a vegetated buffer between the cemetery and existing

	homes. Otherwise, the land will be cleared and planted similar to the existing cemetery grounds.
Project Acreage	The CSH project area consisted of approximately 66 acres. The petition area, located within the project area is approximately 56.6 acres
Area of Potential Effect (APE) and Survey Acreage	For the purposes of this cultural impact assessment, the APE is defined by the the entire CSH project area, approximately 66 acres. While this investigation focused on the project APE, the study area included the entire *ahupua‘a* of Kāne‘ohe.
Document Purpose	The project requires compliance with the State of Hawai‘i environmental review process [Hawai‘i Revised Statutes (HRS) Chapter 343], which requires consideration of a proposed project’s effect on cultural practices. At the request of Helber, Hastert & Fee Planners, CSH undertook this cultural impact assessment. Through document research and cultural consultation efforts this document provides information pertinent to the assessment of the proposed project’s impacts to cultural practices (per the OEQC’s Guidelines for Assessing Cultural Impacts). The document is intended to support the project’s environmental review and may also serve to support the project’s historic preservation review under HRS Chapter 6E-42 and Hawai‘i Administrative Rules (HAR) Chapter 13-284.
Consultation Effort	Hawaiian organizations, agencies and community members were contacted in order to identify potentially knowledgeable individuals with cultural expertise and/or knowledge of the project area and the vicinity. The organizations consulted included the State Historic Preservation Division (SHPD), the Office of Hawaiian Affairs (OHA), the O‘ahu Island Burial Council (OIBC), and organizations that *mālama* (take care of, protect) the Kawa‘ewa‘e Heiau (e.g., Sierra Club, Queen Emma Hawaiian Civic Club, Moanalua Gardens Foundation, Ko‘olaupoko Hawaiian Civic Club, Windward Lions Club).
Cultural Impact Results	Thirty-two people were contacted for the purposes of this cultural impact assessment, 27 people responded, and 10 *kūpuna* and/or *kama‘āina* were interviewed for more in-depth contributions to the cultural impact survey. The findings of this cultural impact assessment suggest that there are three major cultural concerns (and several ancillary ones) regarding the proposed HMP expansion project. 1. The preservation and protection of the Kawa‘ewa‘e Heiau *and* contiguous cultural properties. A number of participants emphasized that the Kawa‘ewa‘e Heiau is part of a “complex”,

	and should not be viewed as a discrete site. 2. Gathering practices, particularly the on-going collection of *hula* and *lei* plants in the proposed project area, should be recognized and accommodated by HMP. 3. There is a possibility of burial sites, or *iwi kūpuna* (ancestral remains) in the project area.
Cultural Impact Recommendations	As with any development project, there are a variety of viewpoints and concerns voiced by the individuals who have participated in this assessment, ranging from those who believe that appropriate project design and planning can improve and enhance access to cultural and natural resources, to those who are concerned that the potential project impacts cannot be reasonably mitigated. The following mitigation measures are recommended by CSH to address the potential adverse impacts of the proposed action on Hawaiian cultural beliefs, practices and resources by the HMP expansion project: 1. Recognize that the Kawa‘ewa‘e Heiau is part of a complex of cultural sites, not a discrete site. It is recommended that plans and the design for the cemetery be integrated with the religious significance of the area surrounding Kawa‘ewa‘e Heiau and it be ensured that significant archaeological sites and cultural features of the landscape are buffered and protected from any roadways, bulldozing or other intrusive activity. Additionally, Kawa‘ewa‘e Heiau complex should be protected and seen in relationship to other sacred sites in the Ko‘olaupoko District. **The owner has stated the intent to preserve the significant archaeological sites, and to incorporate buffer zones (*kīpuka*) as recommended by CSH and as indicated in the proposed project plans.** **2.** The Kawa‘ewa‘e Heiau (SIHP # 50-80-10-354), currently on the National Register of Historic Places, has been evaluated as significant under both Criterion D and E of the Hawai‘i Register of Historic Places and should be registered with the State. **The owner has stated the intent to register SIHP #. 50-80-10-354 with the State of Hawai‘i.** **3.** All cultural properties and archaeological sites in and near the project area should be investigated, preserved and protected through the creation of *kīpuka* (protected areas and buffers) as appropriate. *Kīpuka* should be designed in careful consideration of site boundaries and in relationship to contiguous sites. **The owner has stated the intent to preserve the significant archaeological sites, and to incorporate buffer zones (*kīpuka*) as recommended by CSH and as indicated in the proposed**

	project plans. **4. The owner has stated the intent to continue consultation with appropriate state agencies, such as OHA, throughout the planning and development process to ensure appropriate evaluation and protection of archaeological and cultural resources. This consultation is required by law and will be continued throughout the process.** **5.** The owner is invited to have the project reviewed by OHA's Native Hawaiian Historic Preservation Council (NHHPC) if there is need for further consultation regarding handling of archaeological sites. **The owner has stated the intent to continue to consult with all appropriate groups such as the NHHPC concerning the handling of archaeological sites.** **6.** Personnel involved in development activities in the project area should be informed of the possibility of inadvertent cultural finds, including human remains. Should cultural or burial sites be identified during ground disturbance, all work should immediately cease, and the appropriate agencies notified pursuant to applicable law. **The owner has stated the intent to provide a mandatory education program for any entity or personnel working within the project site to ensure that appropriate protective and notification action is undertaken should any inadvertent cultural or archaeological finds take place.** **7.** Cultural monitoring should be conducted during all phases of development. **The owner has stated the intent to ensure that a cultural and archaeological monitor shall observe all grading and excavation activities to provide verification that cultural and archaeological finds have been protected.** **8.** On-going cultural practices, such as the gathering of *hula* and *lei* plants, should be recognized and accommodated (subject to safety and liability issues). **As provided by law and subject to appropriate safety and liability indemnification, the owner has stated the intent to accommodate native Hawaiian gathering of *hula* and *lei* plants. To the degree feasible, these plant communities shall be enhanced and expanded within the buffer areas and permanent open space areas as appropriate.** **9.** In particular, protect the areas where *lauaʻe* (*Phymatosorus grossus*) is most concentrated. *Lauaʻe* found in the project area is noteworthy for its physiological characteristics of thickness, color and fragrance, and is especially valuable to several *hula hālau* in Kāneʻohe and neighboring windward communities. It is

	recommended that the availability, abundance and quality of *lauaʻe* ferns be protected through the creation of plant gathering *kīpuka*, including maintenance of an intact overstory. **The owner has stated the intent to protect overstory for all undisturbed areas and to enhance *lauaʻe* fern plant communities to the degree feasible and practicable.** 10. Community members and groups responsible for the long-term care of the Kawaʻewaʻe Heiau, as well as cultural practitioners who utilize the area for gathering and cultural education activities, should be further consulted regarding the above issues and other concerns throughout the planning, development and operation of the proposed HMP expansion. This consultation should include all interested community groups and individuals who have a stake in the project area through their involvement in long-term care of the Kawaʻewaʻe Heiau, plant-gathering or other cultural issues. **The owner has requested of various members of community groups wishing to have access to and maintenance permission for the *heiau* and related areas to begin the process of forming an appropriate master organization and preparing a master plan for the long term management, enhancement, maintenance, visitation activities, and financial requirements for the *heiau* complex and related issues such as plant gathering and plant community enhancement and other important cultural activities. The owner has stated the desire to continue to work with the appropriate individuals and groups on this matter and to participate at some appropriate level in the development of this master plan document.**

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Section 1 Introduction

1.1 Project Background

At the request of Helber Hastert & Fee, Planners, Cultural Surveys Hawai‘i, Inc. (CSH) conducted a cultural impact assessment of the proposed Hawaiian Memorial Park (HMP) expansion project to support an Environmental Impact assessment being prepared for a Petition to amend the State Land Use boundaries of the project site from the State Conservation District to the State Urban District. Although the area of the proposed petition is only 56.6 acres, the cultural assessment and archaeological inventory project area studied by CSH is 66 acres (Figure 1). The extra acreage was added as a study element in order to properly encompass potential archaeological and cultural sites, after the intial site visits, a literature search, and site plan changes required a reconsideration of the extent of the project area. For the purposes of this assessment, the 56.6 acres that comprise the area for State land use redesignation will be reffered to as the "Petition Area." The 66 acres that comprise the area physically investigated by CHS will be referred to as the "Project Area."

The current project area is located adjacent to the existing HMP, Kāne‘ohe Ahupua’a, Ko‘olaupoko District, Island of O‘ahu (TMK: [1] 4-05-033:001) (Figure 2 and Figure 3). The *mauka* side of the project area is bordered by the HMP and extends *makai* to Pohai Nani Retirement Community. From the south and east it is bounded by Kapa‘a ridge, and to the northwest by a housing development and Namoku Street. The project area extends *mauka* to approximately 170 m (557 ft) elevation. For the purposes of this CIA study, inquiry focused on the project area in the context of the entire Kāne‘ohe Ahupua’a, including questions regarding the Kawa‘ewa‘e Heiau and other cultural properties and resources in and around the project area.

The project area consists of a privately owned, undeveloped area utilized mainly for unauthorized hiking and paintball activities. Proposed developments within the project area include new interment areas, a residential subdivision and associated roadways. Minimally, the land alteration would include, surface grubbing and grading excavations associated with the installation of sub-surface utilities, housing construction, and landscaping.

According to information provided by Helber Hastert & Fee, Planners:

> Hawaiian Memorial Park, opened in 1961 with a current extent of 80 acres, will run out of usable space in the next few years. The cemetery owners are now planning for its future expansion, on land they own, to the east of the existing cemetery. This parcel of land is about 164 acres in size, but the expansion will only use approximately 56 acres of this area. Part of the proposed expansion (about 4 acres) is being proposed for residential purposes, on land adjacent to the Pohai Nani Retirement Home. The owners of the cemetery are planning to develop about 20 single-family lots on this portion of the property. The build-out of the expansion would not begin for several years, and could last over 20 years or so, The expansion may include 4 mausoleums, each about 3,500 square feet in size, and one-story in height. Approximately 15 acres of the 56-acre Project Area will be graded and revegetated with native species, and there will be a vegetated buffer between the cemetery and existing homes. Otherwise, the land will be cleared and planted similar to the existing cemetery grounds.

1.1.1 Archaeological Inventory Survey

An archaeological inventory survey including a surface survey and subsurface testing was conducted for the project area. The results of the archaeological study are presented in a companion report titled, "Archaeological Inventory Survey for the HMP expansion, Kāne‘ohe Ahupua‘a, Ko‘olaupoko District, Island of O‘ahu TMK: [1] 4-05-033:001" (McCurdy and Hammatt 2008).

1.1.2 Summary of Archaeology Inventory Survey Findings

A total of 11 historic properties were observed within or near the petition area. Six of these were previously recorded, SIHP #s 50-80-10-354, 50-80-10-4680, 50-80-10-4681, 50-80-10-4683, 50-80-10-4684 and 50-80-10-4686. The remaining five are new discoveries, SIHP #s 50-80-10-6929, 50-80-10-6930, 50-80-10-6931, 50-80-10-6932, and 50-80-10-6933. Seven of the historic properties are located within the petition area. They include, SIHP #s -4680, -4683, -4684, -4686, -6930, -6932 and -6933. Four of the properties (SIHP #'s -354, -4681 -6929, and -6931) are located outside of the current petition area but close enough for consideration. Of these sites, six are considered pre-Contact and five historic. In addition SIHP # 50-80-10-4682, previously recorded by Szabian et al. (1989), located in the vicinity of the petition area was determined to be non-Cultural in nature and therefore is not considered a historic property.

The archaeological inventory survey for the HMP expansion project identified eleven historic properties within or near the survey area that will likely, or potentially, be affected by the proposed project. Seven historic properties identified within the petition area are recommended eligible to the Hawai‘i Register. Four historic properties identified in the vicinity of the petition area are recommended eligible to the Hawai‘i Register. For AIS complete findings and mitigation recommendations, please refer to McCurdy and Hammatt (2008).

1.2 Scope of Work

The scope for the cultural impact assessment includes:

1. Examination of historical documents, Land Commission Awards, and historic maps with the specific purpose of identifying traditional Hawaiian activities including gathering of plant, animal and other resources or agricultural pursuits as may be indicated in the historic record.
2. A review of the existing archaeological information pertaining to the sites on the property as they may allow us to reconstruct traditional land use activities and identify and describe the cultural resources, practices and beliefs associated with the parcel and identify present uses, if appropriate.
3. Interviews with persons knowledgeable about the historic and traditional practices in the project area and region.

4. Preparation of a report on items 1-3 summarizing the information gathered related to traditional practices and land use. The report will assess the impact of the proposed action on the cultural practices and features identified.

1.3 Environmental Setting

1.3.1 Natural Environment

The project area is located within the Windward O‘ahu district of Ko‘olaupoko, and is situated within the *ahupua‘a* (traditional land division) of Kāne‘ohe. Kāne‘ohe is a large *ahupua‘a* of approximately 11,000 acres, extending from the Windward base of the Ko‘olau Range to include most of the Mōkapu Peninsula and is bordered by the *ahupua‘a* of He‘eia to the west and Kailua to the east of Kāne‘ohe. Annual rainfall is high at approximately 1500 millimeters (50 inches) (Giambelluca et al. 1986). Soils in, and in proximity to, the proposed project area include Kāne‘ohe silty clay (KHOF), 30-65% slopes; Aleloa silty clay (AeE), 15-35 % slopes; and Aleloa silty clay (ALF), 40-70 % slopes; Helemano silty clay (HLMG), 30-90% slopes; Kāne‘ohe silty clay (KgC), 8-15% slopes (Foote et al. 1972). Kaneohe series soils are generally well-drained soils on terraces and alluvial fans on the windward side of Oahu. These soils developed in alluvium and colluvium derived from basic igneous rock. In a few places they developed in volcanic ash and in material weathered from cinders. The soils are gently sloping to very steep. Elevations range from 100 to 1,000 feet (Soil Survey of the State of Hawaii 2007). See Figure 4.

The project area also has a number of rivulets and the Kawa Stream is approximately 110 m west and south of the project area. Kawa Stream is a short (~4.1 km), perennial stream located mostly in the Pikoiloa Tract of southern Kāne‘ohe Town. The central branch of the stream arises within the National Veterans Cemetery and the stream eventually discharges into the south basin of Kāne‘ohe Bay. Kawa Stream has a drainage area of 4.0 km^2 (1.56 sq. mile) that includes the National Veterans Cemetery and most of HMP, nearly all of the residential developments east of Kamehameha Highway from the cemetery down to Kāne‘ohe Bay Drive and the Bay View Golf Course (http://www.pixi.com/~isd/KawaStr.html).

Vegetation within and in the immediate vicinity of the project area is dominated by alien, oftentimes invasive species such as albizia trees (*Falcataria moluccana*), Christmas berry (*Schinus terebinthifolius)*, *he‘e* - octopus tree (*Schefflera actinophylla)*, Java plum (*Syzygium cumini*) lemon and strawberry guava (*Psidium guajava, Psidium cattleianum*), ironwood (*Casuarina* spp.), Cook and/or Norfolk Island pine (*Auracaria* spp.), cinnamon trees (*Cinnamomum* sp.), African tulip tree (*Spathodea campanulata*), and cultivar fruit trees such as mango (*Mangifera indica*), to name a few. There are a few possible Polynesian introductions such as *kukui* (*Aleurites moluccana*), (true) *kamani* (*Calophyllum inophyllum*), *hau* (*Hibiscus tiliaceus*), *kī* or *tī* (*Cordyline fruticosa*), *noni* (*Morinda citrifolia*), *‘ohe* (possibly *Bambusa vulgaris* and/or *Schizostachyum glaucifolium*), and *mai‘a* - banana (*Musa* spp., possibly *M. paradisiaca*). Understory plants include primarily non-native grasses such as *honohono* - basketgrass (*Oplismenus hirtellus*), ferns such as *laua‘e* or *maile*-scented fern (*Phymatosorus grossus*), bamboo orchid (*Arundina graminifolia*), and more. There are also a few native plants within the project area, primarily on the ridges, such as the indigenous fern *pala‘ā* (*Sphenomeris chinensis)*, *neke* fern (*Cyclosorus interruptus*), wood fern (*Dryopteris* sp.), the native fern

palapalai (*Microlepia setosa*), *ōhi‘a lehua* trees (*Metrosideros* spp.), and the shrub/bush *‘ūlei* or Hawaiian rose (*Osteomeles anthyllidifolia*).

1.3.2 Built Environment

The project area consists of a privately owned, undeveloped area. Field survey work revealed that portions of the project area are being utilized for unauthorized hiking and paintball activities. The *mauka* side the project area is bordered by the HMP and extends *makai* to the Pohai Nani Retirement Community. From the south and east it is bounded by Kapa‘a ridge, and to the northwest by a housing development and Namoku Street.

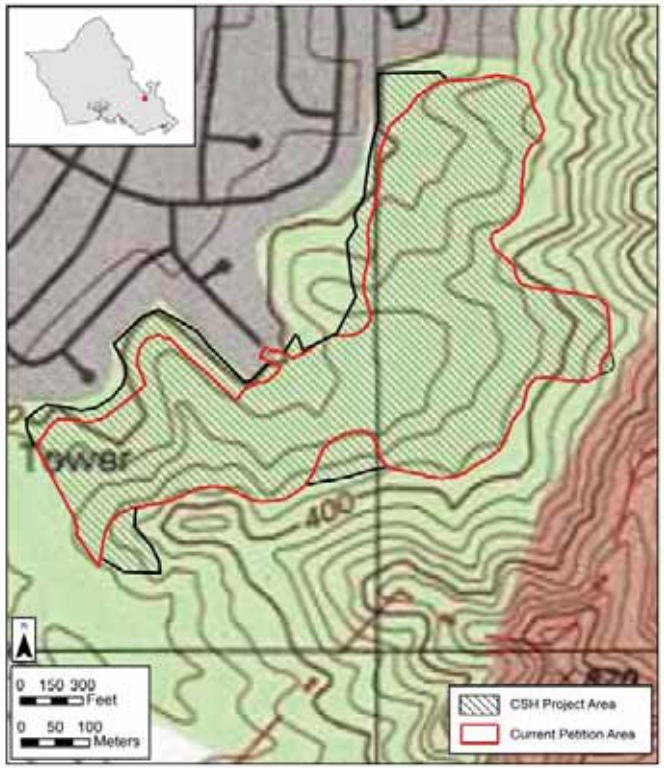


Figure 1. U.S. Geological Survey 7.5 Minute Series topographic map, Kāne‘ohe Quadrangle, showing project area location

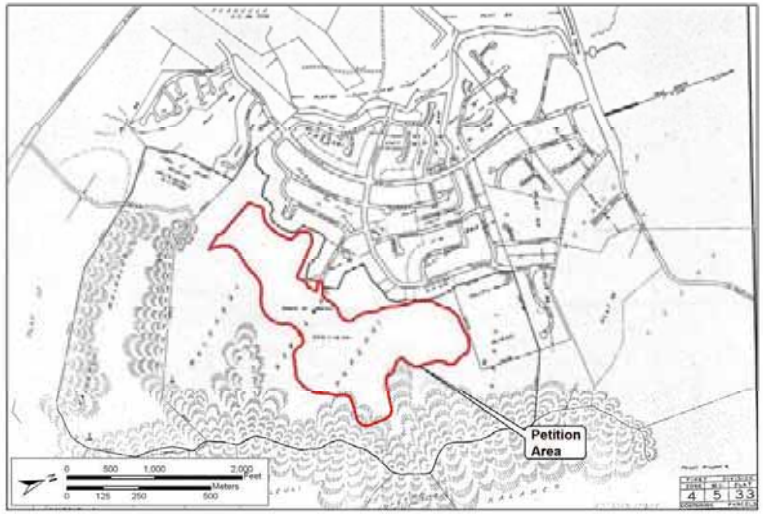


Figure 2. Tax Map Key (TMK: [1] 4-05-033:001) showing the current petition area

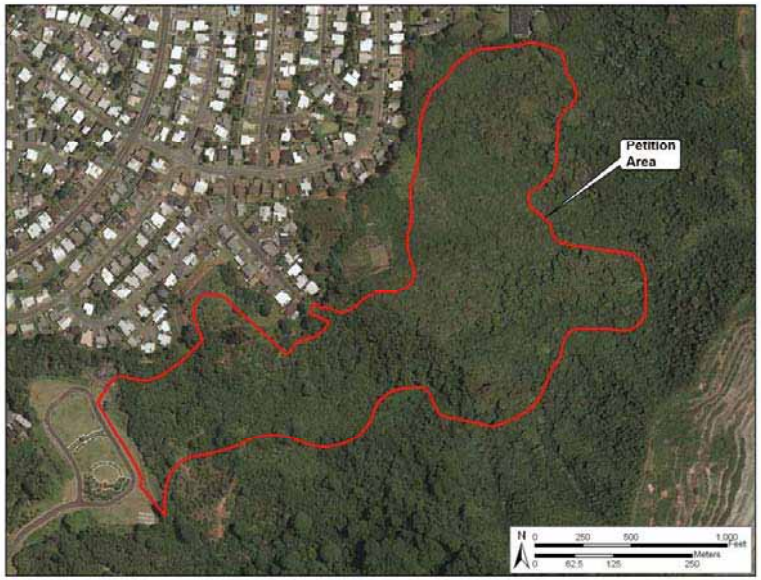


Figure 3. A 2005 aerial photograph showing the location of the current petition area (U.S. Geological Survey Orthoimagery 2005)

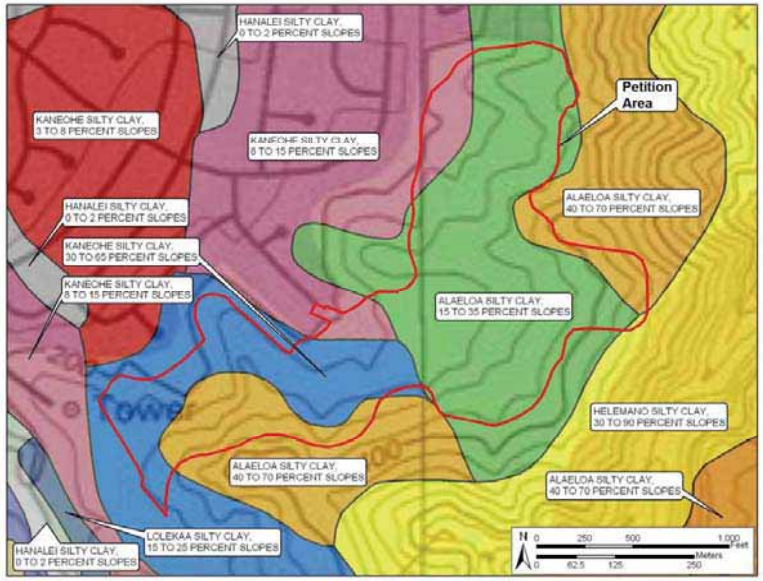


Figure 4. Overlay of Soil Survey of the State of Hawai‘i (Foote et al. 1972), indicating sediment types within the petition area (source: Soils Survey Geographic Database [SSUGRO] 2001, U.S. Department of Agriculture)

Section 2 Methods

Historical documents, maps and existing archaeological information pertaining to the sites in the vicinity of this project were researched at the CSH library. Information on Land Commission Awards was accessed through Waihona Aina Corporation's Māhele Data Base (www.waihona.com). The State Historic Preservation Division, Office of Hawaiian Affairs, O'ahu Island Burial Council, and members of community organizations such as organizations responsible for cleaning and maintaining the Kawa'ewa'e Heiau, were contacted in order to identify potentially knowledgeable individuals with cultural expertise and/or knowledge of the project area and the surrounding vicinity. The names for potential community contacts were also provided by colleagues at CSH and from the lead author's familiarity with people who live in or around the project area. The cultural specialist conducting research on this assessment employed snowball and judgment sampling methods, an informed consent process and semi-structured interviews according to standard ethnographic methods (as suggested by Bernard 2005). Some of the prospective community contacts were not available to be interviewed as part of this project.. A discussion of the consultation process can be found in Section 4 on Community Consultations. Please refer to Table 4, Section 5 for a complete list of individuals and organizations contacted.

Section 3 Traditional and Historic Background

3.1 Mythological and Traditional Accounts

There are several myths and legends associated with Kāne'ohe. A few stories provide the origin of the name of the *ahupua'a* of Kāne'ohe. The word "Kāne" in Kāne'ohe has been interpreted variously as "husband", "man", or as a reference to the god Kāne, the god of creation, while *'ohe* means "bamboo". One account attributes the name to a story about a woman who compared her husband's cruelty to the cutting edge of a bamboo knife (Pukui et al. 1974, Clark 2002). Kāne'ohe may also be derived from *'ohe*, which is said to be one of the *kinolau* (body forms) of the god Kāne (Abbott 1992:15). Another account is as follows:

> In Kaneohe proper, the people learned a new use for the Ohe…In olden times anyone who did not conform to the way of life lived so industriously by the shore people, was called E-epa, or non-conformist. The E'epa were not actually "touched in the head", or lo-lo [crazy], but just different. They liked to wander off by themselves and dwell among the mysteries of the upland forests where they listened to the music of Nature, and often became poets or musicians.
>
> Those upland reaches, all unexplored territory and sacred to the Spirits or Akua of Nature, were referred to as the Wao [inland forest], or places of mystery. In order to keep children from wandering to the uplands, their elders told the little ones, "Do not go up there or the Bamboo Man may keep you. We would mourn your absence in loneliness. Remain at home and learn your useful duties."
>
> Hano-ihu…longed to explore. Pu'ili…longed to accompany her playmate, Hano-ihu, when he wandered far. But, being more timid, she contented herself during the boy's absences and kept his secret of those upland trips he enjoyed.
>
> One sad day, Hano-ihu did not return. The people searched and could find no trace of the disobedient boy. Finally, the villagers decided the boy had died, and they told the other children that the Bamboo Man had taken the boy-wanderer.
>
> Pu'ili…decided that he was not dead and she must search for him. Acting upon the thought, the little girl followed the direction often taken by the boy and was soon alone in the dark recesses of the forest lands of Wao, the Mysterious.
>
> She saw nothing to fear. Rather, she delighted in the beauty of the forests, the fragrance of the ferns and blossoms growing besides singing rills of sweet waters, and danced along happily to the whistling of the Wind Gods in the tree tops touching the blue sky far above.
>
> Soon she realized the whistling was not actually the Wind, for it had a bird-like note that repeated itself in a gentle rhythm. Also, she saw the bamboo moving in the breeze and heard how it rattled its branches. She found two lengths of a

> bamboo branch and, one in each hand, beat time on the two sticks while she followed the plaintive note calls.
>
> Before her…she saw her beloved playmate sitting on the bank. Beside him was a tall, thin man whose eyes watched the boy, while the child blew upon a bamboo length. The man's lean hands waved to the rhythm of the notes, and the girl went dancing toward the pair, keeping time with her pair of bamboo sticks.
>
> Hano-ihu and the tall man finished their melody, then praised the little Pu‘ili for joining them….She sat with them and learned that the man was Kane‘ohe, the Bamboo Man who, as a child, had followed the lure of Wao and had invented a bamboo flute. Kindly, the old man explained to the children how the art of creativity often is lost unless those inspired do follow the call. He told them, "Now we shall return to the village, for I have answered the call and you two little ones will be musicians like me. In honor of this occasion, I shall name the flute after you, my boy...we shall name the time-keeping sticks for her."
>
> Gaily, the three went down the forest trail of Wao the Inspiring. They were welcomed with feasting and joy. That is how we have the...Bamboo, instruments today. The Hano-ihu or Nose flute; and the Pu‘ili, or notched Bamboo sticks; and the hula named for these gifts of Kane‘ohe, the Bamboo Man. (Paki 1972:29-30)

The Kawa‘ewa‘e Heiau borders the west side of the project area (see McCurdy and Hammatt 2008). The word "kāwa‘ewa‘e" literally refers to a type of stone or coral used for polishing canoes, or in rubbing off pig bristles (Pukui and Elbert 1986). Windward O‘ahu is famous for legends of Kamapua‘a; the half man, half pig demigod renowned for making mischief and for his masterful escapes from retribution for his chicken and taro thievery. One story centers on Kamapua‘a and the Kawa‘ewa‘e Heiau. Thrum reports that Kawa‘ewa‘e Heiau was erected in the beginning of the 12th century by the high chief ‘Olopana (1906:48). Kawa‘ewa‘e Heiau was said to have been constructed by *menehune* (legendary race of small people who built structures by night) (Fornander 1878:23). ‘Olopana, depending on which story is being told, is said to have been the father or uncle of the notorious Kamapua‘a. In the version of the story presented by King David Kalākaua (1990), Kamapua‘a, embittered by ‘Olopana's rejection of this hog-child, retreats to the mountains where he attracts a band of like-minded thieves and commences to "harass the estates of Olopana", stealing ‘Olopana's pigs, fowls and fruits as well as taking pleasure in breaking his nets, cutting adrift his canoes and robbing his fish-ponds (Kalākaua 1990:143). Enraged by Kamapua‘a's pillage and acts of rebellion, ‘Olopana orders his capture. After several battles and failed attempts to catch Kamapua‘a, ‘Olopana's army succeeds in delivering Kamapua‘a to the high chief to the "great joy and relief of the people of Koolau" (p.145). Kalākaua relates the following:

> Olopana had erected a *heiau* at Kaneohe, Lonoaohi officiated as high priest, and thither he resolved to take his rebellious son or nephew, and offer him as a sacrifice to the gods. Hina [Kamapua‘a's mother] pleaded for the life of Kamapuaa, but Olopana could not be moved. Satisfied that he would listen to no appeals for mercy, she determined to save her son, even at the sacrifice of her

> husband, and to that end secured the assistance of the high priest, through whose treachery to Olopana the life of Kamapuaa was saved.
>
> On the day fixed for the sacrifice Kamapuaa…was taken to the *heiau*, followed by Olopana, who was anxious to witness the ghastly ceremonies, and with his own eyes see that his troublesome enemy was duly slain and his body laid upon the altar. In offering human sacrifices the victim was taken without the walls of the *heiau* and slain with clubs by the assistants of the high-priest. The body was then brought in and placed upon the altar in front of the entrance to the inner court, or sanctuary, when the left eye was removed by the officiating priest, and handed…to the chief who had ordered the sacrifice….
>
> Standing with three or four attendants, at the door of his tabued retreated…Olopana saw his victim preliminarily led to the place of sacrifice, and a few minutes after motioned for the ceremonies to begin. Kamapuaa was taken without the walls of the temple to be slain….Passing beyond the outer wall the party entered a small walled enclosure adjoining, and the executioner raised his club and brought it down upon the head of his victim. Kamapuaa smiled, but did not move. Twice, thrice with mighty sweep the club descended upon the head of Kamaupuaa, but scarcely bent the bristly hairs upon his crown.
>
> With a semblance of wonder the executioner, whose tender blows would have scarcely maimed a mouse, dropped his club and said:
>
> "Three times have I tried and failed to slay him! The gods refuse the sacrifice!"
>
> "It is so, it is so, it is so!" chimed his companions….
>
> Therefore, instead of slaying Kamapuaa, the assistants, as they had been secretly instructed to do by the high-priest, removed the cords from his limbs, smeared his hair, face and body with the fresh blood of a fowl, and on their shoulders bore him back and placed him upon the altar as if dead.
>
> The high-priest approached the apparently lifeless body, and bent for a moment over the face, as if to remove the left eye; then placing on a wooden tray the eye of a large hog, which had been procured for that purpose, he sent an assistant with it to Olopana, at the same time retiring within the inner court, and leaving by the side of Kamapuaa, and near his right hand, as if by accident, the sharp ivory *pahoa*, or dagger, with which he had, to all appearance, been operating.
>
> Giving but a single glance at the eye presented to him by the assistant of the high-priest, Olopana passed it to an attendant without the customary semblance of eating it, and approached the altar alone. Kamapuaa did not breathe. His face was streaked with blood, his eyelids were closed, and not a single muscle moved to indicate life.

> Olopana looked at the hated face for a moment, and then turned to leave the *heiau*….As he did so Kamapuaa clutched the dagger besides his hand, and, springing from the altar, drove the blade into the back of Olopana. Again and again he applied the weapon until the chief, with a groan of anguish, fell dead at the feet of his slayer. (Kalākaua 1990:145-146)

Kalākaua goes on to describe how Kamapua‘a is released from custody by the high-priest, and how as the people of the district had “suffered through his plundering visitations, and hundreds of lives had been sacrificed in his pursuit and final capture, the people rose almost in a body to hunt him down and destroy him” (p.147). Kamapua‘a and his cohorts eventually sail off O‘ahu for the windward islands in search of refuge.

3.2 Pre-Contact Period

In pre-Contact times, the *ahupua‘a* of Kāne‘ohe offered fresh water from *mauka* (upland) springs and a well-developed fishpond system, making it both an agricultural and aquacultural center, and one of the primary population centers on O‘ahu (Devaney et al. 1982:6). Handy and Handy (1972) described Kāne‘ohe as:

> ...an area of little hills with many small streams between them. In 1935 it was still one of the most active communities in planting commercial taro. A goodly proportion of its lowland *lo‘i*, tucked away in pockets flanked and often hidden by low hills or near the town itself, was then still planted in taro by Hawaiians who owned the land and by Orientals who leased land or were hired to cultivate it. (Handy and Handy 1972:455)

Pre-Contact land use would have consisted mainly of *kalo* (wetland taro) and *kula* (dryland) cultivation of *hala* - pandanus (used for making household furnishings such as mats), *wauke* – paper mulberry (used for making *tapa/kapa* cloth), bananas and sweet potatoes (Handy and Handy 1972:456). Kāne‘ohe Bay, with about two-dozen walled fishponds, was a bountiful source of fish (Devaney et al. 1982:6).

3.3 Early Historic Period to Mid 1800s

Kāne‘ohe has long been viewed as a valuable *ahupua‘a* both in terms of agricultural and fishery productivity. In 1830 the chiefs of Hawai‘i, Maui, and O‘ahu, in a council meeting concerning the “late doings on Oahu”, referred to Kāne‘ohe as the “most valuable part” of the district of Ko‘olaupoko (Kamakau 1992:303). Kāne‘ohe held a unique position in the history of *‘awa* cultivation. The relaxant drink prepared from rootstock of the *Piper methysticum* plant was regarded as immoral by missionaries who sought to restrict consumption of the “intoxicant” brew. In 1846 obliging lawmakers created licensing laws and set up a system of *‘awa* agents to plant and sell *‘awa* on the various islands. The argument for this system was that, although *‘awa* was considered morally hazardous, it had medicinal value. There were 2 *‘awa* agents assigned to O‘ahu: one was William Harbottle who was authorized to grow *‘awa* on 2 acres of land in Kāne‘ohe (Greer 1970:66-67).

Describing the early historical times of Hawaiian *ali‘i* (monarchy) in Kāne‘ohe, Devaney et al. (1982) state:

> …when Kahanahana ruled O‘ahu [circa 1773-1783], he sometimes lived in Kaneohe. After defeating Kahanahana circa 1783, Maui Chief Kahekili and most of his famous warriors lived in Koolaupoko at Kailua, Kaneohe, and Heeia (Fornander 1969:225; Kamakau 1961:138). When Kamahameha I apportioned the conquered O‘ahu lands in 1795 to his warrior chiefs and counselors (Ii 1959:69-70), he retained as his personal property the *ahupua‘a* of Kaneohe… Much of Kaneohe and all of Kahaluu and Kualoa were inherited as personal lands by Kamehameha’s sons Liholiho and Kauikeaouli, Kamehameha II and III (*Indices*…1920:27-28). (Devaney et al. 1982:5)

3.3.1 The Māhele (Land Divisions)

The Organic Acts of 1845 and 1846 initiated the process of the Māhele - the division of Hawaiian lands - that introduced private property into Hawaiian society. In 1848, the crown and the *ali‘i* (royalty) received their land titles. *Kuleana* awards to commoners for individual parcels within the *ahupua‘a* were subsequently granted in 1850. Kamehameha III, as mentioned above, had inherited Kāne‘ohe and retained the bulk of the *ahupua‘a* during the Māhele. After his death, his wife, Queen Kalama (Hakaleleponi), retained their portion of Kāne‘ohe (Barrère 1994, Kame‘eleihiwa 1992).

The crown lands were considered the private lands of the monarch, and many lands were sold or mortgaged during the reigns of Kamehameha III and IV to settle debts to foreigners. To end this practice, in 1865 the Crown lands were made inalienable, and their dispensation was regulated by a Board of Commissioners of Crown Lands, which effectively put them under the administrative control of foreign-born residents (Kame‘eleihiwa 1992:310).

Before the passage of the Act of January 3, 1865, which made Crown Lands inalienable, Kamehameha III and his successors did as they pleased with the Crown Lands, selling, leasing, and mortgaging them at will (Chinen 1958:27).

In 1850, the Privy Council passed resolutions that would affirm the rights of the commoners or native tenants. To apply for fee-simple title to their lands, native tenants were required to file their claim with the Land Commission within the specified time period of February 1846 and February 14, 1848. The *Kuleana* Act of 1850 confirmed and protected the rights of native tenants. Under this act, the claimant was required to have two witnesses who could testify they knew the claimant and the boundaries of the land, knew that the claimant had lived on the land for a minimum of two years, and knew that no one had challenged the claim. The land also had to be surveyed.

Not everyone who was eligible to apply for *kuleana* lands did so and, likewise, not all claims were awarded. Some claimants failed to follow through and come before the Land Commission, some did not produce two witnesses, and some did not get their land surveyed. For whatever reason, out of the potential 2,500,000 acres of Crown and Government lands “less than 30,000 acres of land were awarded to the native tenants” (Chinen 1958:31).

As a result of the *Kuleana* Act of 1850, a total of 242 land claims were made for Kāne‘ohe Ahupua‘a, but only a bit more than half of those were awarded (www.waihona.com). The average *kuleana* award was 2.38 acres (Kelly 1976:8). However, these claims were not only for commoners, as chiefs and/or *konohiki* (headmen) were also awarded lots. The bulk of Kāne‘ohe

Ahupua'a eventually went to Queen Hakaleleponi Kalama (1817-1870), eleven *konohiki,* and 3 non-*konohiki* (privileged awardees who received large parcels of land) (Kelly 1976:7). The primary type of land claimed in Kāne'ohe was taro land, identified in the claims, testimony, and awards as *lo'i*, but there was also fishponds and *kula* (dryland crops) as well. The present project area straddles the *'ili* (land section, usually a subdivision of an *ahupua'a*) of Kalokoai and Pakui. Table 1 provides LCAs issued within Kalokoai and Pakui, as well as *'ili* in proximity to the project area. Figures 5 to 7 present historic maps depicting *'ili* and Māhele awards in and around the project area.

Table 1. LCAs Awarded in Kalokoai and Pakui and nearby 'Ili of Kāne'ohe

LCA #	*'Ili*	Claimant	Land Use	Awarded
2444	Kalokoai	Keawekukahi	2 *lo'i*; 1 house lot; 3 fish ponds	3 *'āpana*; 1.808 Acres
2806	Kalokoai	Kahilikoolani	2 *lo'i*	1 *'āpana*; .839 Acres
1899	Pakui, Kaluapuhi, Puuiki	Opunui	12 *lo'i*; 1 house lot; *loko*; *pali* (cliff, ridge), *kula* (dryland crops)	3 *'āpana*; 3.85 Acres
7171	Pakui, Waikalua	Kamakahi	6 *lo'i*; 1 house lot; *muliwai* (river)	2 *'āpana*; 1.15 Acres

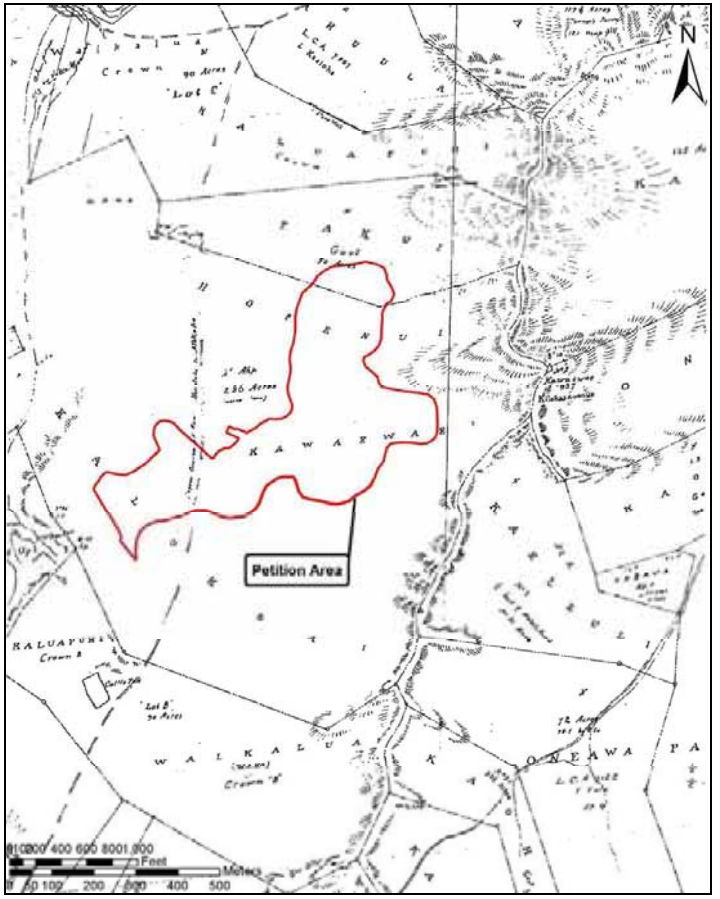


Figure 5. Portion of 1874 Lyons Map of Kāne'ohe O'ahu with West Kailua showing locations of LCAs in the vicinity of the petition area.

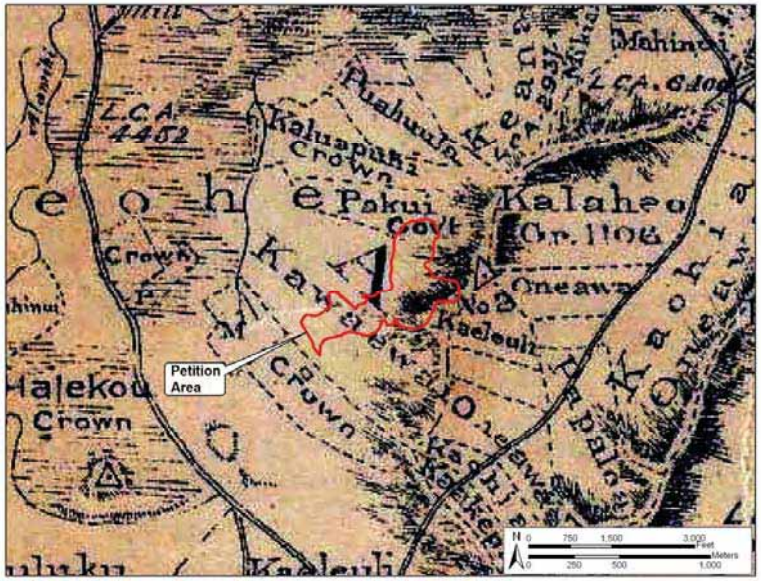


Figure 6. Portion of 1881 Hawaiian Government Survey map by C.L. Lyons showing locations of Crown and Government lands and LCAs in the vicinity of the project area

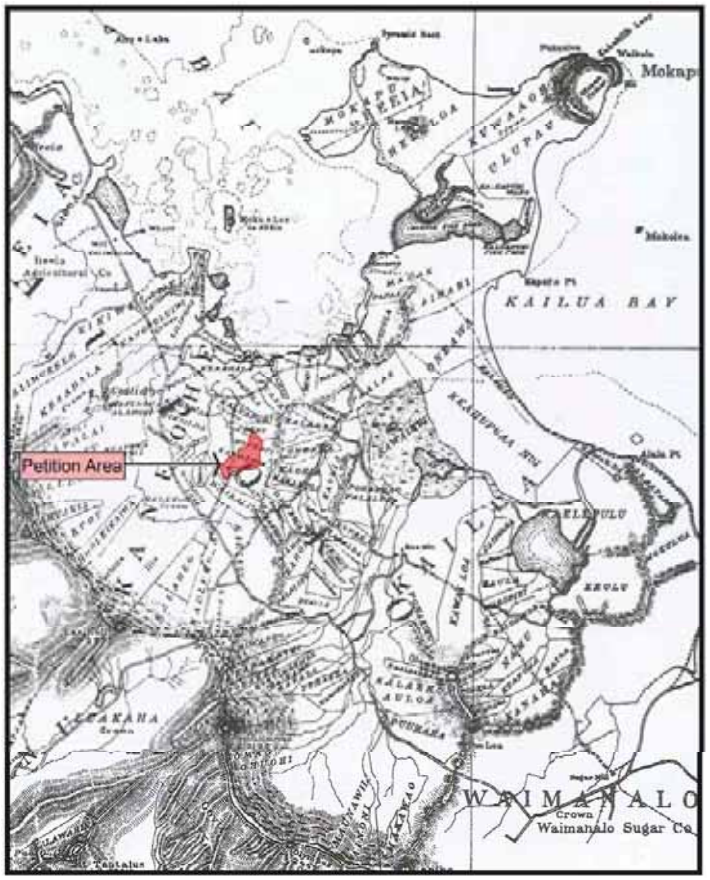


Figure 7. Portion of 1901 John Donn Map of Kailua and Kāne'ohe subdivided into *'ili*

3.3.2 1860s to 1920s: Sugar and Rice

In the 1860s, both commercial sugar cane and rice cultivation began in Kāne'ohe. One of the earliest sugar plantations on O'ahu was owned by Charles Coffin Harris, who came to Hawai'i in 1850 with a plan to practice law. He established the Kaneohe Sugar Plantation Company (c. 1865) on 7,000 acres of Queen Kalama's land (Dorrance and Morgan 2000:41). In 1871, C. C. Harris bought Queen Kalama's Ko'olaupoko properties from her heir, Charles Kanaina, as well as some land in Honolulu for $22,448. The sale included "…livestock, tool, fishponds, and fishing rights" (Bur. Of Conv. Book 34:53; in Devaney et al. 1976:29). C.C. Harris's plantation shut down in 1891, when the sugar yield was not enough to support the operation (Dorrance and Morgan 2000:41). Judge C.C. Harris's daughter and heir, Mrs. David Rice, incorporated the lands as Kaneohe Ranch and converted it to stock farming, to be eventually purchased by James B. Castle in 1907 (Montgomery 1971 in Dorrance and Morgan 2000:42). Harold K.L. Castle, the only child of James B. Castle, owned most of the *ahupua'a* of Kāne'ohe in the early 1900s (www.kaneoheranch.com), and in 1917 he purchased the land from Harris's daughter (Henke 1929:62).

Rice cultivation was to eventually supersede taro and dominate the lowlands of Kāne'ohe. The ancient taro *lo'i* and *'auwai* irrigation systems and additional new ditches were built to support rice cultivation. During the height of rice cultivation (c. 1880-1920), Chinese dominated the business. "To a great extent the rice business, growing and milling was controlled by Chinese *hui* (firms), which recruited laborers from China, handled investment capital from rich absentee landlords, and tallied profits" (Devaney et al. 1982:49). By the late 1880s, virtually the entire floodplain areas of Kāne'ohe were under rice cultivation. In 1892-3, the Kaneohe Rice Mill was erected and put into production on property adjoining Waikalua Stream. There was a flume that brought water from the river to the rice mill. About twice a week a steamer came into Kāne'ohe Bay to pick up and transport rice to market in Honolulu (Ching, personal communication, in Allen 1987:295).

By the 1920s, rice had gradually declined in importance due to a number of factors. Two of the primary reasons for this decline include the beginning of rice production in California as well as the "annexation of Hawaii by the United States in 1898 resulted in restrictions on the number of Chinese laborers arriving from the Far East" (Devaney et al. 1982:53). However, rice as well as some taro cultivation continued up to c. 1960.

3.3.3 Ranching

In the mid 19th century, ranching became a major enterprise. Cattle and sheep had been left on O'ahu by the English Captain George Vancouver in 1793 (Henke 1929:8), and the former had multiplied into a large herd by the 1840s (Devaney et al. 1982:70). At its peak, Kaneohe Ranch extended from the ocean in Kailua to the Pali and included 12,000 acres and 2,000 head of cattle (Henke 1929:62). By the mid 1860s, the cattle were so numerous as to cause environmental degradation. Alien grasses and other species, such as pigeon peas, were introduced to the area as cattle fodder (Henke 1929:62). Much of the land modification in the upland and hilly portions of Kāne'ohe may be the result of heavy cattle grazing over a long period of time:

A view from the Pali looking toward Kaneohe in 1854 revealed that there were "hundreds of cattle…feeding on the rich pasture with which these plains were covered (Bates 1854:104). By the mid-1860s, we have an indication that livestock was altering the landscape. The undulating plains at the foot of Nuuanau Pali (Kekele lands) were described as "a rich land a while ago but now there are not many plants because animal are permitted there" (Sterling and Summers Ms.:207). (Devaney et al. 1982:70)

Figure 8. 1893 Photograph by J.J. Williams of *poi* pounding, taken near Kawa Stream in Kāne'ohe south and west of the project area. Note grasses and degraded landscape. (Scott 1968)

3.3.4 1890s to Present: Pineapple and Dairy

The commercial cultivation of pineapple began in the 1890s and the first decade of the 1900s in Kāne‘ohe. From approximately 1910 to 1925, pineapple cultivation was a major industry in this area. In 1911, the company of Libby, McNeill and Libby built a pineapple cannery in He‘eia. At its peak, 2,500 acres were under pineapple cultivation on Windward O‘ahu (Harper 1972) stretching from Kāne‘ohe to Kahalu‘u. A large percentage of this acreage was in Kāne‘ohe located below the Pali where the golf course, Hawaii Loa College, and the Hawaiian Memorial Park are today (Kelly in Allen 1987:295-296). A *heiau*, Kaualauki Heiau in He‘eia, was mostly destroyed by pineapple field clearance during this time – a likely fate of many archaeological sites (Kelly in Allen 1987). In 1919, the Kaneohe Ranch Company and Heeia Agricultural Co., Ltd. leased 1,000 acres of land in He‘eia, Kāne‘ohe, and Kailua, formerly planted in sugar, to the Libby company for a term of 17 years. In 1917, Libby leased an additional 600 acres in He’eia (Libby, McNeill & Libby Ms:2, cited in Kawachi 1990). While the rice fields that covered old taro lands were mainly located near streams and near the coast, the pineapple fields were grown on the slopes of higher lands, usually on land subleased to individual Japanese farmers:

> Pineapples were planted by individual Chinese and Japanese farmers on moderately sloped hill land where rice and taro could not be grown . . . these areas included the dissected alluvial terraces and the lower slopes and spurs of the Ko‘olau range. (Miyagi 1963:115)

The change to the windward landscape in the first decades of the twentieth century as a result of pineapple cultivation is illustrated by the following passage:

> At last we reached the foot of the Pali. . . . Joe and I looked over the surrounding hills, but looked in vain for the great areas of guava through which but a few months ago we had fought and cut our way. As far as the eye could reach pineapple had taken the place of the forest of wild guava. The newest industry in Hawaii was beginning even to press upon the cane fields of this side of the island. (Alexander 1914:318, cited in Devaney et al. 1982:62)

The pineapple fields were abandoned when Moloka‘i and Lāna‘i pineapple cultivation began to boom, and Libby pulled out of the Ko‘olaupoko enterprise (Kelly 1976:47). The cannery closed in 1923 (Dorrance 1998:95). Most of the former pineapple land went to grass, and some of it was used to graze cattle. Several of the small farmers returned to rice cultivation. (Kelly 1975:47).

In 1918 the first military reservation was built on the Mōkapu Peninsula at Kāne‘ohe Bay; Fort Hase was commissioned and was known as the Kuwaahoe Military Reservation. Now known as the Marine Corps Base Hawaii (MCBH), the base helped lead to a boom in commercial and residential development in and around Kāne‘ohe.

By the end of World War II, ranching was no longer economically viable for the Kaneohe Ranch, and the ranch became primarily a landlord to other farmers (www.kaneoheranch.com). After World War II, residential developments changed the face of Kāne‘ohe Ahupua‘a. The opening of the Wilson Tunnel and the expansion of the Pali Highway in the 1950s and 60s creating an easier passage from Honolulu through the Ko‘olau mountains to windward

communities led the way to a development boom on the windward side of O‘ahu. High tax rates on real estate sales forced many old-time landowners to lease their land to residential developers rather than sell on a fee-simple basis. Kaneohe Ranch at one time leased their land to over 5,000 single family residential lots in Kailua and Kāne‘ohe. The vast majority of the leaseholds were sold to the lessees (www.kaneoheranch.com).

The dairy industry rose to prominence over beef cattle ranching in the post-war years. The shortage of available land due to urban expansion, the shortage of fee simple land, and the high price of land leases forced farmers in the dairy districts near Honolulu (e.g., Koko Head) to relocate to more remote areas of O‘ahu (Durand Jr. 1959:241). In the 1950s Kailua-Kāne‘ohe was an important dairy district of Windward O‘ahu. Dairy farming was dominated by white (Caucasians) particularly of Portuguese and Spanish ancestry, and secondarily Japanese, farmers (Durand Jr. 1959:235). “Among the names of island dairymen, illustrating the Portuguese-Spanish-Mainland importance…are…Brazil, Carlos, Campos, Costa, Ferreria, Foster, Freitas, Knowles, Medeiros, Moniz, Ornellas, Rapoza, Santos, Toledo, Vause and White” (Durand Jr. 1959:235). The Souza Brothers Dairy, which opened in the 1950s, was located near the project area. However, this period was relatively short-lived as the opening of the Pali route, exorbitant land prices in Honolulu, and more automobiles on O‘ahu contributed to rapid urbanization in Kailua-Kāne‘ohe (Durand Jr. 1959:244-245). Many landowners decided to develop their land for suburban housing and terminated leases with farm leaseholders. Figures 9 to 13 present historic maps of the project area and vicinity.

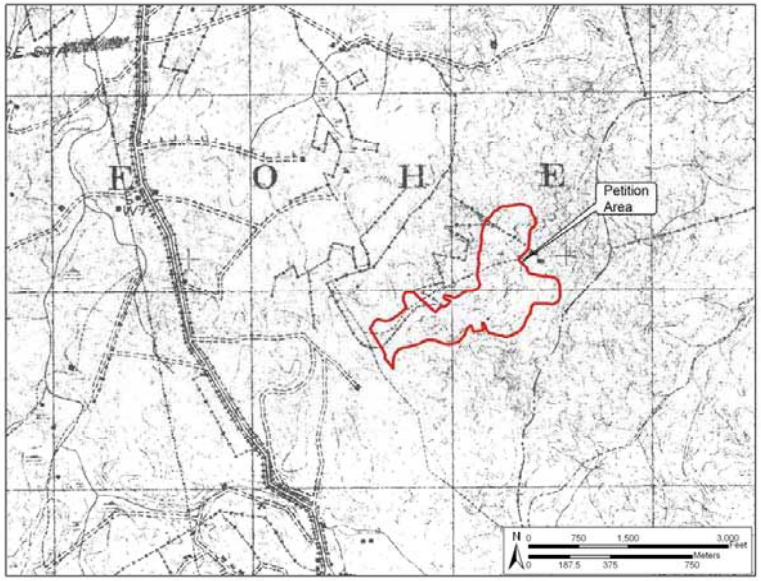


Figure 9. 1919 War Department Kāne‘ohe Quad map and project area

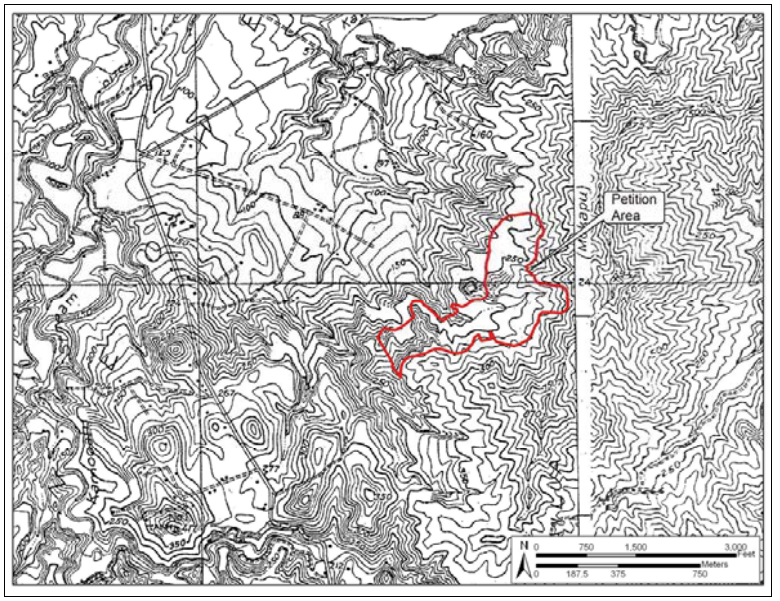


Figure 10. Portion of 1928 U. S. Geological Survey Kāne‘ohe and Mōkapu Quad map and project area

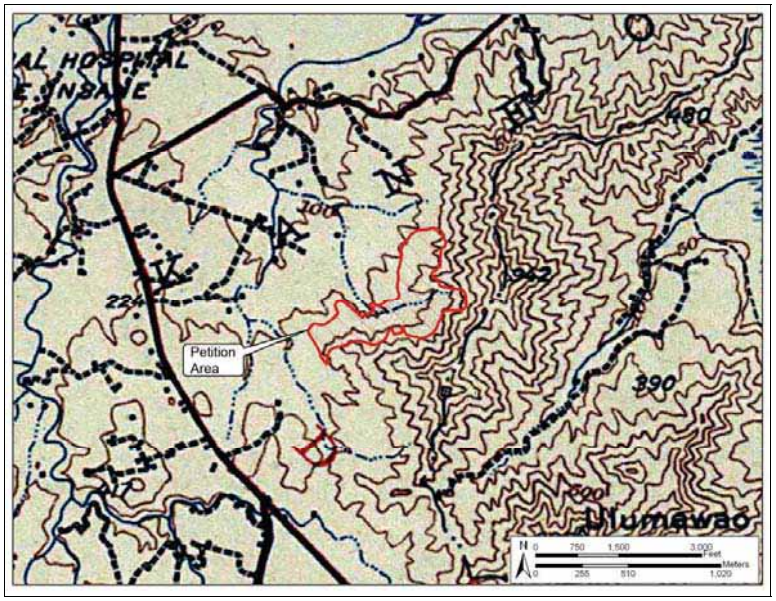


Figure 11. 1938 USGS topographical map of 1927-1930 survey of O‘ahu and project area

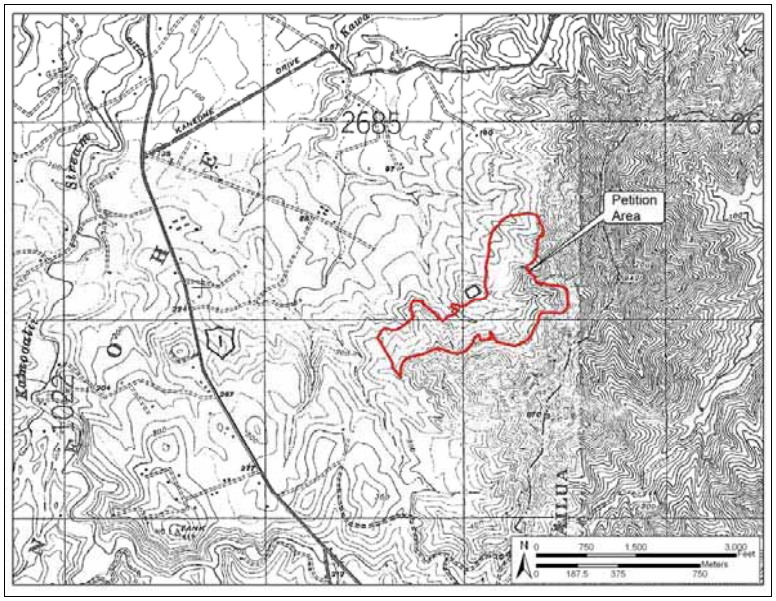


Figure 12. Portion of 1943 War Department Kāne‘ohe Quad map showing vicinity of project area

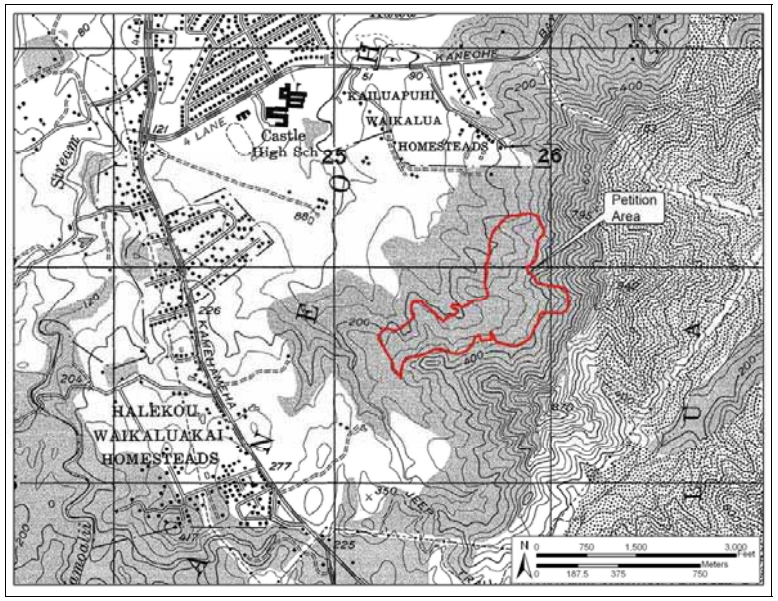


Figure 13. 1955 Army Map Service map and project area

Section 4 Previous Archaeological Research

A number of archaeological investigations have been conducted in Kāne'ohe Ahupua'a. This section provides a brief overview of the research and findings of previous archaeology in the general area surrounding the present project. For a more detailed summary see McCurdy and Hammatt 2008.

4.1 Previous Studies Adjacent to or Including Portions of the Project Corridor

4.1.1 McAllister

The earliest systematic archaeological coverage of Kāne'ohe was by J.G. McAllister (1933) who recorded major sites throughout O'ahu in the early 1930s. McAllister recorded a number of fishponds and other sites in the vicinity of the current project area (Figure 14). The following are brief descriptions of sites near the current project area (McAllister 1933 in Sterling and Summers 1978:210-221):

> Site 349. Waikalua Fishpond, adjacent to Waikalua, Kaneohe. The rebuilding of the pond has been completed. The wall was 1420 feet long of waterworn basalt 3 to 4 feet high but somewhat wider. The pond covers 11 acres.
>
> Site 350. Two ponds, Kailua side of Waikalua. The pond in use is said to be Keana with an area of 3.5 acres. According to Bell, the name of the other is Kalokohanahou. Its wall is broken. Both were built of waterworn basalt. The dirt-filled wall of Keana is wide enough for trees to grow on it.
>
> Site 351. Three adjacent ponds, located off the lands of Mikiola and Mahinui in Kaneohe. The two end ponds were probably built first, the middle pond being added later so as to take advantage of the walls of the other two. The pond on the east is known as Mahinui and that on the west as Mikiola. The name of the middle pond is Kaluoa, according to John Bell, but appears as Kapuu on a map in the Bishop Estate office. The wall of Mikiola is broken.
>
> Site 352. Ahukini heiau, Keana, Kaneohe. A small structure, 70 by 127 feet, built on the top of an elevation 1200 feet from the sea…The only features remaining are the low walls, unusual because they are built of stones a few inches in size…most of the remains are scattered, for it is very easy for the cattle to disturb the small stones…When the drums at this heiau were beaten they could be heard over Kaneohe, but not just on the other side of the low ridge in Kailua.
>
> Site 353. A spring on the land known as Keana, called Kinikailua-Manokaneohe, as it is said that the people from both Kailua and Kaneohe died in great numbers from drinking its waters.

Site 354. Kawa‘ewa‘e Heiau, this is one of the five heiaus said by John Bell to have been erected by Olopana. Ahukini, Pahukini, Holomakani, and Puumakani are the other four. It is on top of a small knoll and consists of one large enclosure 120 by 253 feet with a small terrace on the north side which follows the contours of the land. As the structure was used as a cattle pen for many years any traces of heiau features have been obliterated, and it is not known where the opening to the heiau was situated. The walls are massive, averaging about 5 feet in width and from 4 to 7 feet in height according to the contours of the land. The inside corners of the wall are rounded; the outside corners appear more angular.

Thrum notes that this heiau was “Built by Olopana about the opening of the 12th century”. It was mentioned as one of the heiaus constructed by the menehunes. Lonoaohi is said to have officiated as high priest.

This is the heiau to which Olopana had Kamapuaa brought for sacrifice. Through treachery Kamapuaa is said to have killed Olopana and escaped. [See and 16].

Site 355. Small round hill, the name of which is not remembered, near the mountain side of Kawa‘ewa‘e Heiau. Said by John Bell to have been the location of a holua. This he saw destroyed when an attempt was made to plant pineapples in this section. Without doubt this is the site of the slide described by Bates in 1853.

Before reaching the mission station at Kaneohe, the road leads through a narrow but fertile ravine, tenanted by a few natives. In leaving the ravine, a low round hill, to the right of the path, is rather conspicuous from a long, narrow depression or channel on its side. It was an indication that one of the favorite games of the old Hawaiians had been played there. This game was called the holua, and was one of their favorite games of chance…

This same site was seen by Briggs in 1881:”Dewight pointed out to me a long narrow depression on some of the hills to be seen from our path, where old Hawaiians used to play one of their favorite games of chance”.

Site 356. Puumakani Heiau, Kalapuhi, Waikalua, Kaneohe. This heiau was on the ridge facing the Nuuanu Pali, but the stones were removed and used for building a cattle corral farther down the slope. The heiau is said to have been built by Olopana.

Site 357. Kamaikola across from the Japanese store at the first bridge beyond the end of Nuuanu Pali descent.

Many generations ago there lived at the foot of the Pali a Hawaiian of questionable habits. His name was Pakuanui and he lived on the land known as Kamaikola. Here he had his grass hut, the rock foundation of which was to be found only a few years ago. In one version of the story his wife used to be

stationed at the head of the Pali to signal to her husband when but one or two travelers laden with goods descended the trail. Pakuanui waited in ambush, fell upon them with his spear, disposed of the bodies and appropriated the goods.

According to background research and historic maps, Site 355, the *hōlua* slide, was located in the southwestern portion of the project area. Site 354, Kawa‘ewa‘e Heiau, borders the northern boundary and Site 356, Puumakani Heiau, was located near the southern boundary of the project area. Additional information about Kawa‘ewa‘e Heiau is available in McCurdy and Hammatt 2008: Appendix A.

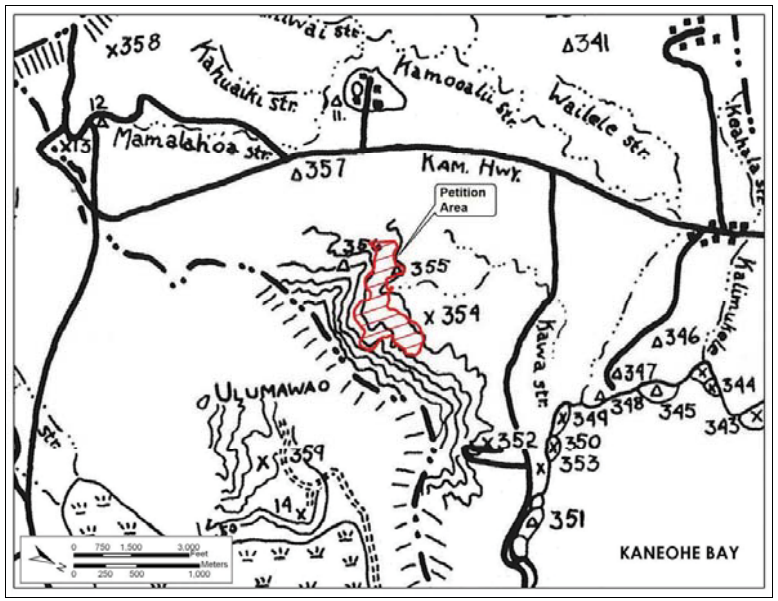


Figure 14. Portion of 1959 Bishop Museum map showing the locations of archaeological sites identified by McAllister (1933) in relation to the current petition area (adapted from Sterling and Summers 1978)

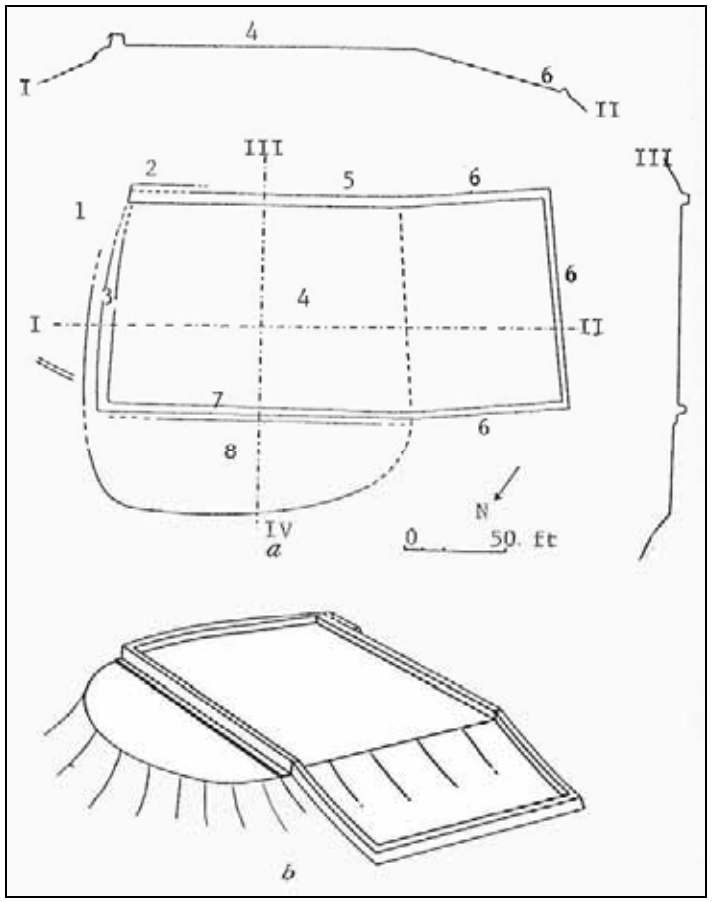


Figure 15. Kawa'ewa'e Heiau (adapted from McAllister 1933:180)

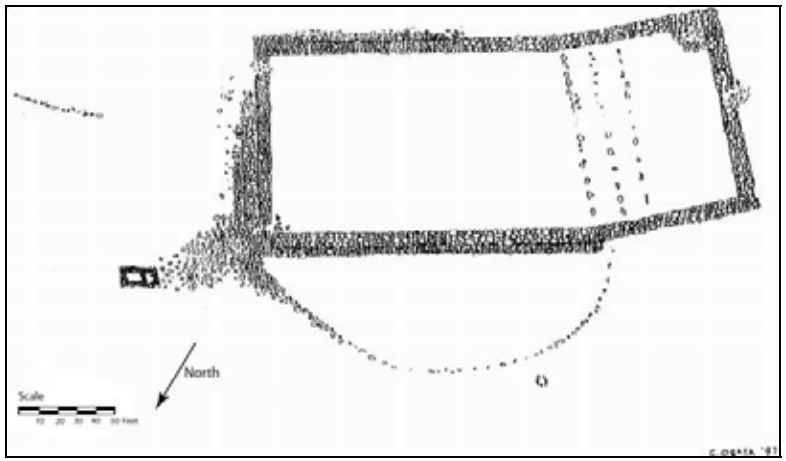


Figure 16. A sketch of Kawa‘ewa‘e Heiau provided by Mr. Charles Ogata (see Section 6)

4.1.1.1 Szabian et al.

From May 25 to June 3, 1989 Szabian et al. conducted an archaeological reconnaissance survey for the proposed Pikoiloa Cemetery. In addition to Kawa’ewa’a Heiau (SIHP # -354), listed on the National Register of Historic Places since 1972, 11 sites were recorded with at least 25 associated features. Of these four were interpreted as pre-Contact and seven as historic in nature. On the field map provided by Szabian et al. (1989:2) it appears that six of these sites are located within the current petition area (Figure 17). They include SIHP# -4680,-4681, -4682, -4683, -4684, and -4686. Subsequent to the investigation conducted by Szabian et al. SIHP#’s -4681 and -4682 were determined to be outside the current petition area (Figure 17). In addition SIHP # 50-80-10-4682 was determined to be non-Cultural (see McCurdy and Hammatt 2008). All of the sites previously recorded by Szabian et al. are summarized in Table 2.

Table 2. Historic Properties identified in Szabian et al. 1989 Archaeological Survey

SIHP # (50-80-10-)	# of Features	Formal Site Type	Probable Function	Estimated Age	Description
Historic Properties Located Within the Current Petition Area					
4680	1	Terrace	Agricultural/ Water control	Historic	Historic erosion control and water diversion terrace.
***4681**	5	Complex-Enclosures and Terracing	Agricultural/ Habitation	Pre-Contact	A habitation site consisting of several c-shaped structures, a terrace wall and a circular rock feature situated on a north-facing slope. This historic property is located outside of the petition area.
***4682**	0	Natural terracing, Platform	Natural	Non-Cultural	This is a series of natural "terraces" formed by lava rocks, which rolled down slope and were caught by exposed bedrock outcrops.
4683	1	Pit feature	Charcoal kiln	Historic	Consists of a rectangular pit 3.6 m by 2.5 m and some natural terracing. The walls of the pit show evidence of burning, likely the remnants of a charcoal kiln or some similar processing area.
4684	7	Complex-Enclosure, and Terracing	Habitation	Pre-Contact	Habitation site consisting of several c-shaped structures, a terrace wall, a circular rock feature and several house terraces.
4686	1	Stone alignment	Boundary marker	Historic	This site consists of two features. Feature A is a rock alignment constructed of boulders running east/west parallel to a large stream cut. Feature B, previously described as a series of stone alignments, appears to have been badly disturbed due to landscaping and rubbish piling.

SIHP # (50-80-10-)	# of Features	Formal Site Type	Probable Function	Estimated Age	Description
Historic Properties Located in the Vicinity of the Current Petition Area					
4676	9	Complex of walls, stepped terracing	Agricultural and habitation	Pre-Contact	A site complex adjacent to KLEI radio tower along a tributary to the Kawa Stream.
4677	2	Wall remnant, earthen mound	Agricultural	Historic	Located adjacent to the Kawa Stream, it consists of a remnant stone wall and a large earthen mound.
4678	2	Wall remnant, earthen mound	Agricultural or habitation	Historic	Located approximately 70 m north of SIHP 4677. Consists of an alignment and a large earthen mound.
4679	1	Wall remnant	Boundary of habitation	Historic ?	Located at the base of the slope below KLEI radio tower and consisting of an L-shaped alignment of weathered basal stones.
4685	2+	Remnant walls, terracing	Habitation/ agricultural	Historic	Located on a ridge between two deep stream cuts consisting of a level terraced area with facing and an undetermined number of possible terrace facings downstream.
* Subsequent to the investigation conducted by Szabian et al. SIHP#'s -4681 and -4682 were determined to be outside the current petition area					

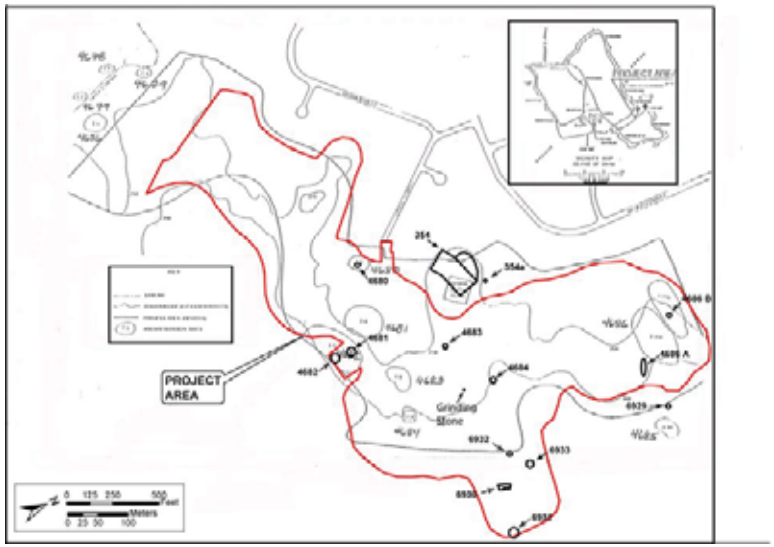


Figure 17. Map showing the current petition area and site locations in relation to the Szabian et al. field map (adapted from Szabian et al. 1989:2)

4.1.2 Summary of Previous Archaeological Studies

Previous archaeological studies in the vicinity of the current project area are indicated on Figure 18 and are summarized in Table 3.

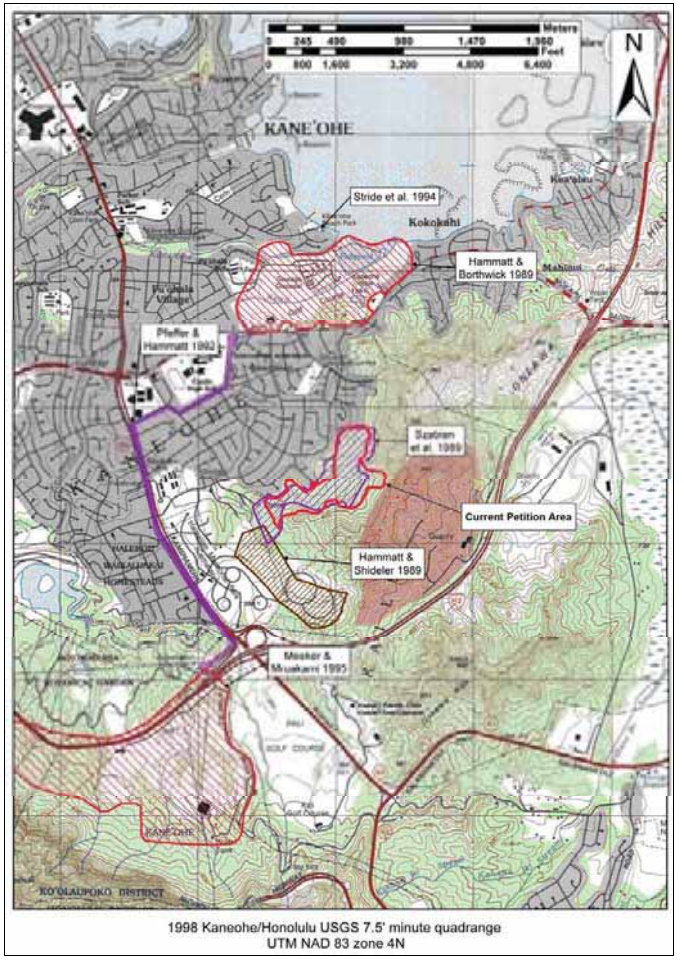


Figure 18. Portion of US Geological Survey Kāne'ohe and Mōkapu quad map showing locations of previous archaeological studies in the vicinity of the current petition area

Table 3. Previous Archaeological Studies in the Vicinity of Current Project Area

Reference	Type of Investigation	Location	Findings
McAllister 1933	Island-wide survey	Island wide	Identified 9 sites in the vicinity of the current project area, 3 of which were heiau
Sterling & Summers 1978	Island-wide survey	Island wide	Section concerning Kāne'ohe includes legendary references to the naming of Kāne'ohe and other sites and the descriptions of McAllister's (1933) sites
Hammatt & Borthwick 1989	Archaeological Survey & Assessment	90-acre Bay View Golf Course Expansion	Documents Waikalua-loko and Waikalua fishponds
Hammatt & Shideler 1989	Archaeological Survey	Veterans Cemetery 90-acres	No significant finds
Szabian et al. 1989	Reconnaissance Survey	N & W facing slope of ridge separating Kailua and Kāne'ohe	Describes 11 sites with 25 features, four pre-Contact, seven post-contact & Kawa'ewa'e Heiau
Pfeffer and Hammatt 1992	Archaeological Assessment	Transmission Corridor mostly along Kamehameha Hwy.	No finds
Stride et al. 1994	Inventory Survey & Subsurface Testing	Waikalua Road (TMK 4-5-05: 1,2, 12-14) 3.3 acres at shoreline	No significant finds in eight backhoe trenches
Meeker & Murakami 1995	Archaeological Monitoring and Data Recovery Investigations	Ko'olau Pali (TMK 4-5-42:1 and 6)	Seventeen sites investigated; of these, four were recommended for preservation. They include one set of dryland agricultural terraces, two open sites with lithic activity, and a single cluster of three stone mounds.

Section 5 Community Consultations

5.1 Community Consultation Effort

Throughout the course of this assessment, an effort was made to contact and consult with Hawaiian cultural organizations, government agencies, and individuals who might have knowledge of and/or concerns about traditional cultural practices specifically related to the project area. This effort was made by letter, e-mail, telephone and in person. The initial outreach effort was started in March, 2007. In the majority of cases, letters with a detailed description of the proposed action including project acreage and conceptual plan provided by Helber, Hastert & Fee, Planners along with a map and aerial photograph of the project area were mailed with the following text:

> At the request of Helber, Hastert & Fee, Planners, Cultural Surveys Hawai'i Inc. (CSH) is conducting a Cultural Impact Assessment for an expansion of the Hawaiian Memorial Park in Kāne'ohe Ahupua'a, Ko'olaupoko District, O'ahu Island Tax Map Key ([1] 4-5-033: por. 001). See enclosed maps of the project.
>
> Hawaiian Memorial Park, opened in 1961 with a current extent of 80 acres, will run out of usable space in the next few years. The cemetery owners are now planning for its future expansion, on land they own, to the east of the existing cemetery. This parcel of land is about 164 acres in size, but the expansion will only use about 40 acres of this area, and is shown on the attached aerial photo as the "Proposed Expansion Area." Part of the proposed expansion (about 4 acres) could be used for residential purposes, on land adjacent to the Pohai Nani Retirement Home. The owners of the cemetery are exploring the possibility of either having Pohai Nani take this land over for its possible expansion, or developing about 20 single-family lots. Neither of these options may work out, and the land may be used for the cemetery expansion instead. The build-out of the expansion would not begin for several years (possibly 5 or more), and could last over 20 years or so, The expansion may include 4 mausoleums, each about 3,600 square feet in size, and one-story in height. Otherwise, the land will be cleared and planted similar to the existing cemetery grounds. Drainage improvements and internal roadways are the two most important improvements for the project. Drainage is a particular concern, and the owners understand the need to consider stormwater impacts to downhill neighbors. Preliminary fieldwork has identified or re-located two archaeological sites within the expansion area, and two sites adjacent to the expansion area (including the Kawa'ewa'e Heiau). These are shown on the attached concept plan map, along with buffer zones around these sites.
>
> The purpose of this cultural study is to assess potential impacts to cultural practices as a result of future development in Kāne'ohe. We are seeking your *kōkua* and guidance regarding:

- **General history and present and past land use of the project area, including pineapple cultivation and dairy farming (Souza Dairy).**
- **Knowledge of cultural sites which may be impacted by future development of the project area - for example, historic sites, archaeological sites, and burials.**
- **Knowledge of traditional gathering practices in the project both past and ongoing.**
- **Cultural associations of the project area, such as legends and traditional uses.**
- **Referrals of *kūpuna* or elders and *kama'āina* who might be willing to share their cultural knowledge of the project area and the surrounding *ahupua'a* lands.**
- **Any other cultural concerns the community might have related to Hawaiian cultural practices within or in the vicinity of the project area.**

In August, 2007 new letters and figures were sent to all community contacts explaining that the owner had decided to expand the initial project area from approximately 40 acres to 56 acres (see Section 1.1) and inviting further commentary from cultural assessment study participants. Figure 19 depicts the old and new projects areas. Figures 20 and 21 present the figures sent to community contacts in August.

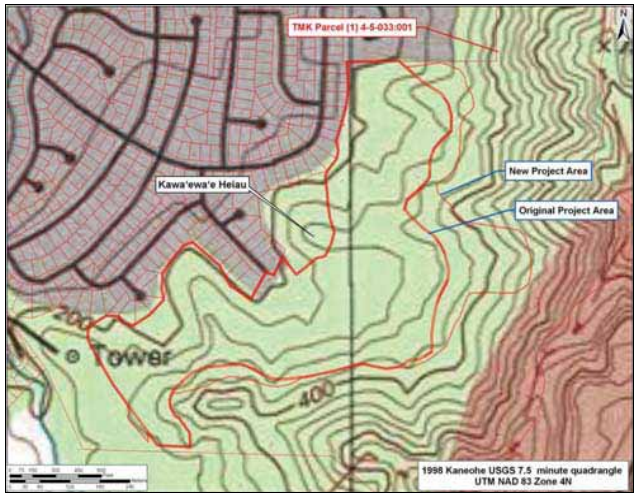


Figure 19. U.S. Geological Survey 7.5 Minute Series topographic map, Kāne'ohe Quadrangle, showing original and revised project location

Figure 20. Aerial photograph sent to community contacts depicting revised project area

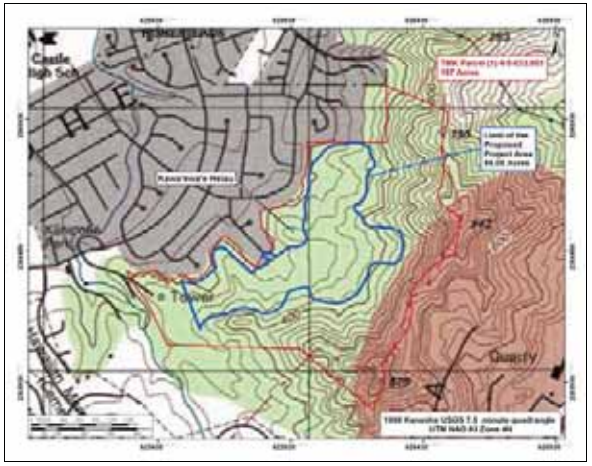


Figure 21. USGS map sent to community contacts depicting revised project area

Several (3-9) attempts were made to contact individuals, organizations, and agencies apposite to the cultural impact assessment for Kāne‘ohe. The results of the community consultation process are presented in the Table 4. A number of the organizations listed in the table are, or were, caretakers of the Kawa‘ewa‘e Heiau (namely, Sierra Club, Queen Emma Hawaiian Civic Club, Moanalua Gardens Foundation, Ko‘olaupoko Hawaiian Civic Club, Windward Lions Club). Excerpts from more extensive interviews and confidential statements specifically related to Kāne‘ohe and its environs are presented in Section 6 below.

Table 4. Results of Community Consultation

Name	Affiliation, Background	Comments
Ailā, William	Hui Mālama I Nā Kūpuna O Hawai‘i Nei, Wai‘anae Representative	In an email sent to CSH on November 26, 2007 in response to October 10, 2007 letter of invitation to comment on the proposed project, Mr. Ailā recommended: 1. As complete as possible archaeological inventory survey be conducted. 2. Any burials found should be preserved in place unless they are in the path of utility lines that cannot be rerouted. 3. No architectural plans be finalized until archaeological inventory [is] finalized, this [will] allow for redesign.
Brown, Steve	Hawaiian Trail and Mountain Club, Trails Committee Chair	In an email response sent to CSH on October 15, 2007 Mr. Brown wrote: “The Hawaiian Trail & Mountain Club does conduct a recreational hike in the area. It may be easiest to identify the route on your aerial view. We start in Friendship Garden, at Kokokahi Place, off of your aerial view to the north. We then follow roughly along the main ridgeline which eventually skirts the quarry, in approximately a southern direction. The final leg of the route descends from the main ridge in a northwest, or west-northwest direction, following a side ridge, and passing Kawaewae Heiau to terminate at the end of Lipalu Place. There are two such side ridge routes, either of which may be used on a particular hike. We have been hiking this route twice a

Name	Affiliation, Background	Comments
		year for the last ten years. In addition, there is one more organized group which conducts yearly hikes on this route, as well as many individuals who do it on their own. The route is unique, in that it affords panoramic views of the surrounding area, along with the opportunity to visit and appreciate the heiau. It is clear from the condition of the trail that usage of the route predates our usage by many years. It would be a shame to lose this valuable community resource to encroaching development.”
Burrows, Chuck	‘Ahahui Mālama I ka Lōkahi, President	See Charles Pe‘ape‘a Makawalu Burrows, Ed.D. (“Doc” Chuck Burrows) interview in Section 6. Dr. Burrows recommended CSH contact Earl “Buddy” Neller.
Camvel, Donna	Ko‘olaupoko Hawaiian Civic Club, 2nd Vice President	See Ko‘olaupoko Hawaiian Civic Club field interview summary in Section 6
Camvel, Wali	Ka ‘Ailehua, Operations Manager	See Ko‘olaupoko Hawaiian Civic Club field interview summary in Section 6
Chang, Linda	Hula practitioner, *kupuna* and *kama‘āina* of Kāne‘ohe	See interview summary in Section 6
Chinen, Melanie	State Historic Preservation Division	CSH sent a letter to the SHPD on March 5, 2007.
Ching, Randy	Hawai‘i Chapter of the Sierra Club, O‘ahu Chair	Referred CSH to Jim and Cindy Waddington
Cypher, Mahealani	Ko‘olaupoko Hawaiian Civic Club, Past President and current Recording Secretary, Cultural Interpreter	See Ko‘olaupoko Hawaiian Civic Club field interview summary in Section 6 and letter in Appendix A
Dunn, Elizabeth	Hawai‘i Chapter of the Sierra Club, O‘ahu Volunteer Coordinator	Referred CSH to Randy Ching

Name	Affiliation, Background	Comments
	and Membership Chair	
Gon, Samuel ‘Ohukaniohi‘a, III	The Nature Conservancy of Hawai‘i, Senior Scientist and Cultural Advisor; Kahuna Kakalaleo (Chant Practitioner)	Dr. Samuel ‘Ohukaniohi‘a Gon, III was contacted via email on October 2, 2007. In an email response sent on October 5, 2007 Dr. Gon explained that he can provide no substantive site-specific comments on the proposed project.
Hewett, Alice	*Kupuna* and *kama‘āina* of Kāne‘ohe	In a phone conversation on October 22, 2007 Ms. Hewett said that she would like to comment on the project (after reviewing the letter and figures) and will get back to CSH. She informed CSH that her son, Frank Hewett, is traveling in Japan and elsewhere over the next few months and may not be available for awhile. CSH left several follow-up phone messages for Aunty Alice.
Hewett, Frank Kawaikapuokalani	Kumu Hula	See above
Hiramatsu, Gary	Ko‘olaupoko Lions Club, President	CSH sent email inquiries inviting Mr. Hiramatsu’s comments on the project. CSH was unable to find a current phone number for Mr. Hiramatsu. See Motohiro below.
Lau, Elizabeth C.	Ko‘olaupoko Hawaiian Civic Club, Pelekikena (President)	See interview summary in Section 6
Leong, Marian	Moanalua Gardens Foundation, Director, Partners in Education Program	In a phone conversation with CSH on May 1, 2007 Ms. Leong stated that she has done little work at the Kawa‘ewa‘e Heiau and has no comments about the proposed project.
Mahi, Aaron	O‘ahu Island Burial Council, Ko‘olaupoko Representative	In a phone conversation with CSH on October 17, 2007, Mr. Mahi stated that he will reserve comments for now, and recommended CSH consult Kāne‘ohe *kūpuna*. He recommended contacting Elizabeth Lau and the Ko‘olaupoko Hawaiian Civic Club.
Mahoe, Chinky	Kumu Hula o	CSH sent email inquiries and followed up with phone messages inviting Mr. Mahoe’s

Name	Affiliation, Background	Comments
		comments and *mana‘o* on the project.
McQuivey, Jace	O‘ahu Island Burial Council, Chair	Referred CSH to Aaron Mahi
Merryman, Mahealani	Moanalua Gardens Foundation, Execultive Director	Referred CSH to Charlie Ogata and Dr. Chuck Burrows
Motohiro, Daniel	Pali Lion’s Club, Secretary	In a phone conversation with CSH on November 21, 2007, Mr. Motohiro stated that the Ko‘olaupoko Lion’s Club used to be involved with the restoration of the Kawa‘ewa‘e Heiau. Mr. Motohiro attempted to contact the Ko‘olaupoko branch of the Lion’s Club without success, and explained that the club is inactive at this time. He had no comments about the proposed project.
Nāmu‘o, Clyde	Office of Hawaiian Affairs, Administrator	In a letter dated April 5, 2007, OHA requested the submission of a summary of the known historic properties in the vicinity of the Kawa‘ewa‘e Heiau in order to make a more substantive recommendation, and advised contacting Elizabeth Lau, President of the Ko‘olaupoko Hawaiian Civic Club regarding recommendations specific to the proposed project (see full text of OHA letter in Appendix A). See subsequent, September 27, 2007 OHA letter sent to CSH below this table (Figure 20).
Neller, Earl “Buddy”	Archaeologist	Mr. Neller was referred to CSH by Chuck Burrows. See comments sent by Mr. Neller to CSH on October 23, 2007 below table.
Ogata, Charlie	Queen Emma Hawaiian Civic Club, member and former *kia‘i* (caretaker) of the Kawa‘ewa‘e Heiau	See interview summary in Section 6
Steinwascher, Kimo	Kaneohe Ranch Mgmt. Ltd., Vice President, Leasing & Development	In an email sent to CSH on April 27, 2007 Mr. Steinwascher, responding to CSH request for archival information on Kāne‘ohe and any comments on the project area, wrote:

Name	Affiliation, Background	Comments
		“Nothing that I am aware of”.
Wada, Susan	Queen Lili‘uokalani Children’s Center, Ko‘olau Poko Unit, Director	CSH sent letter on March 5, 2007 and left messages on several occasions for Ms. Wada at the QLCC inviting her *mana‘o* and participation in the CIA.
Waddington, Jim	Hawai‘i Chapter of the Sierra Club, O‘ahu Sierra Club, O‘ahu Group Hike Leader	In an email response sent to CSH on June 23, 2007 Jim Waddington wrote: “Sierra Club has not done regular service trips to Kawaewae Heiau for a couple of years, so I haven't been to the site in quite some time. The attachments to your email, however, are disturbing... especially the map which shows a road almost adjacent to one corner of the heiau. The upkeep of the heiau has been adopted by the Queen Emma Hawaiian Civic Club (QEHCC)... Sierra Club just provided some manpower for them. Two individuals who should definitely be contacted regarding the proposal and who could address your questions more aptly than I would be Cassina Waterman, president of QEHCC, and Charlie Ogata, a member of QEHCC who spear-headed the heiau's restoration.” In a phone conversation on October 10, 2007, Mr. Waddington also recommended CSH contact the Hawaiian Trail and Mountain Club.
Waterman, Casina K.	Queen Emma Hawaiian Civic Club, Pelekikena (President)	See Ms. Waterman’s comments below this table. Ms. Waterman recommended CSH contact Charlie Ogata, Frank Kawaikapuokalani Hewett and Sam Gon.
Yoshimori, Grant	Hui O‘ Piko‘iloa	In a letter sent to CSH dated June 14, 2007, Mr. Yoshimori stated that: “I am aware of several cultural practices taking place on the Mahinui Mountainside, and would like to share these with you. • There are at least four Hawaiian hula

Name	Affiliation, Background	Comments
		halau which visit the area to gather plants to make the traditional Hawaiian hula leis. • I have seen people going hunting into the hillside, and personally know someone who has hunted for pigs in the area. • Many people use the area for hiking. It is a well known hiking trail. And it has been sited [*sic*] in the Honolulu Advertiser by Richard McMahon. • Schools tour the archaeological sites and use it for cultural education purposes. I have personally seen Kamehameha Schools and Hakipu'u Learning Center visiting and learning about the area. • The area is also frequented by people who engage in combat exercises. As you can see, there are quite a few cultural uses of the land. I hope that Service Corporation International (dba Hawaiian Memorial Park) will endeavor to keep the land in its natural state so these cultural practices can continue." See Appendix A for full text of letter.

PHONE (808) 594-1888 FAX (808) 594-1

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

September 27, 2007 HRD07_2939B

Lisa Gollin, Projects Manager
Cultural Surveys Hawai'i, Inc.
P.O. Box 1114
Kailua, Hawai'i 96734

Dear Ms. Gollin:

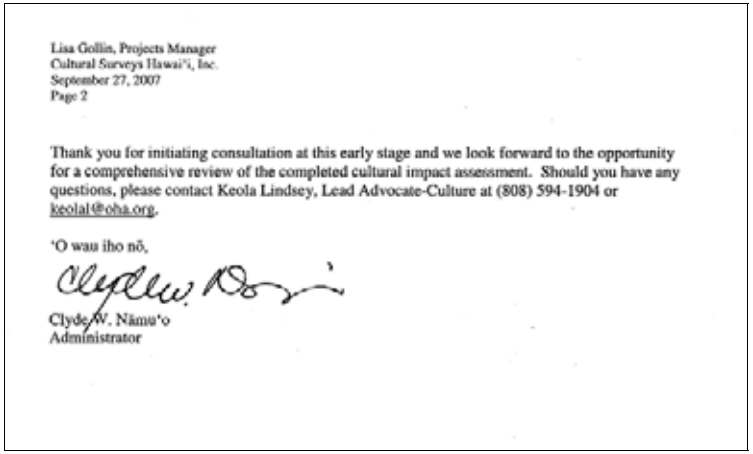
Re: Cultural Impact Assessment
Kane'ohe Ahupua'a, Ko'olaupoko District, Island of O'ahu
Tax Map Key: 4-5-033: por.001

The Office of Hawaiian Affairs (OHA) is in receipt of your August 13, 2007 letter initiating consultation ahead of a cultural impact assessment for a proposed expansion of the Hawaiian Memorial park.

OHA requests that a comprehensive archaeological inventory survey for the project area be conducted and submitted to the Department of Land and Natural Resources- Historic Preservation Division for review and approval. OHA should be allowed the opportunity to comment on the criteria assigned to any cultural or archaeological sites identified within the archaeological inventory survey pursuant to §13-284-6(c), Hawai'i Administrative Rules. Consideration should also be afforded to any individuals accessing the project area for constitutionally protected traditional and customary purposes.

As you know, Kawa'ewa'e Heiau is located on the subject tax map key parcel adjacent to the proposed expansion area. Certain accounts related to the epic tale of Kamapua'a identify Kawa'ewa'e Heiau as the location where Kamapua'a was taken for sacrifice following his capture by the forces of the high chief Olopana during a time when Lonoaohi was the high priest of the heiau. It was during this episode, that these same accounts detail the death of Olopana at Kawa'ewa'e Heiau.

OHA seeks assurances that if this project moves forward, should Native Hawaiian traditional, cultural, or burial sites be identified during ground disturbance, all work will immediately cease, and the appropriate agencies notified pursuant to applicable law.



Lisa Gollin, Projects Manager
Cultural Surveys Hawai'i, Inc.
September 27, 2007
Page 2

Thank you for initiating consultation at this early stage and we look forward to the opportunity for a comprehensive review of the completed cultural impact assessment. Should you have any questions, please contact Keola Lindsey, Lead Advocate-Culture at (808) 594-1904 or keolal@oha.org.

'O wau iho nō,

Clyde W. Nāmu'o
Administrator

Figure 20. September 27, 2007 review letter from the Office of Hawaiian Affairs

5.1.1 Casina Waterman, Pelekikena (President), Queen Emma Hawaiian Civic Club

Queen Emma Hawaiian Civic Club (QEHCC) is one of the community groups that has been care-taking the Kawa'ewa'e Heiau. In a telephone interview conducted by CSH on August 28, 2007 Ms. Casina Waterman, Pelekikena (President) of the QEHCC, kindly shared her knowledge of the project area and cultural concerns:

> The QEHCC goes to *mālama* [caretake] the Kawa'ewa'e Heiau about 3 to 4 times a year. Charlie Ogata was our *kahu* [caretaker] but he is in his 90s now. There have been cultural practices up there and there are archaeological sites back there. Hula *hālau* [hula groups] go and collect plants in the area. The group never got to GPS by the *luakini* [large *heiau* where ruling chiefs prayed and human sacrifices were offered]. There were sacrifices there. There could be *iwi* [human remains, bones] in the area. If you look at the dimensions of the *heiau*, it is a pretty large *heiau luakini*. On the *'ewa* side of the *heiau* there is a stone path and possibly a few homes [archaeological habitation sites]. Many years ago there was a family that used the *heiau* for a cattle pen (can't remember their name, maybe it was the Medieros family). There would be an impact if [the proposed project] comes close to the *heiau.* I am concerned that there are good buffer zones around the *heiau* and around the others sites. We need to *mālama* [all the sites]. A 100 foot buffer zone is not enough for the *heiau.* Would the buffer zone be 100 feet from [outside or inside] the walls of the *heiau* or from the center? One part of the *heiau* is higher. I think the north wall is 17 feet…16 feet on the Kailua side. One part is

> flat and goes down and then comes back up. At the boundary of one of the walls there is a terrace and houses [habitation sites] and not too far beyond that is where Charlie's property was. You can look up the dimensions of the *heiau*… The weather has changed over the years. There used to be more moisture. There is a native bird that is an endangered species that lives in the area. I'm not sure of name. Have you seen the old drawings of the Ko'olau Bluff [project]? It was a [subdivision] with million dollar homes done in the late 1980s. The community stopped that because they were scared of run-off and other logistical [problems].

5.1.2 Earl "Buddy" Neller

Earl "Buddy" Neller was referred to CSH by Dr. Chuck Burrows (see interview in Section 5). Mr. Neller is an archaeologist currently living in Washington. He formerly worked for the State of Hawai'i in the State Historic Preservation Office, the Office of Hawaiian Affairs, the National Park Service at Hawai'i Volcanoes National Park and Kalaupapa National Historical Park. Mr. Neller also taught a non-credit course in *heiau* sites at the University of Hawai'i in the College of Continuing Education. Mr. Neller offered the following comments regarding the Kawa'ewa'e Heiau and nearby sites in an email sent to CSH on October 23, 2007:

> Thanks for contacting me, and for asking me about sites in the area of Kawa'ewa'e Heiau. I have been to the area many times, generally related to my job as an archaeologist for the State of Hawaii.
>
> To my knowledge, the boundaries of Kawa'ewa'e Heiau are unknown. Generally, people think of the large stone wall forming a rectangular enclosure as the boundaries of the site, but it is known that there are visible stone features on the ground that extend beyond the enclosure, as described in Gilbert McAllister's report "Archaeology of Oahu" (1933), and as seen by myself and others during visits to the heiau. Understanding the boundaries of the heiau is important, because there may be features in your project area which could be relevant to the archaeological study and modern day use of the heiau.
>
> One of the problems with visiting Kawa'ewa'e Heiau is that there is no good access: no good parking area, no good trail.
>
> The current configuration of the heiau results partially from its use as a cattle enclosure, and partially from other activities during the historic period, such as the probable removal of rock for nearby construction. It is entirely possible that at some time in the past the heiau grounds were much larger than the rectangular enclosure (and appendages) that we easily see today. The extent of the heiau throughout its history is an archaeological question that has never been investigated.
>
> People talk about a heiau site as if the visible stone ruins were a heiau, rather than being the ruins of a heiau with much of the original structure gone. People talk about a heiau as if its boundaries are determined by the limits of the visible stone

pavings and rock alignments, as if landscape features such as springs, gardens and other landscape features such as akua represented by pohaku were not an integral part of the historic and cultural site. At the heiau site of Halulu, for instance, the pohaku known as Lohe is a part of the cultural tradition at the site, but it is located outside the boundaries of the enclosing walls and terraces, near the ko'a in the valley below. Plants, such as ti, are an integral part of heiau traditions, but they are generally not mentioned in archaeological surveys. Don't overlook the importance of Hawaiian plants growing in the project area. Ti is often found at heiau sites, and in Hawaiian gardens of old, and the leaves are still used in many ways. At Kalaupapa I used the ti leaves in my garden when I made kulolo [Pudding made of baked or steamed taro and coconut cream]. I have never had the chance to eat the baked roots of ti plants, but I look forward to it.

Archaeology of Oahu lists a heiau that should be in this land parcel, although it may not be in the project area, Site 356, Pu'u Makani Heiau. The stones were taken to build a cattle enclosure down slope from the heiau. The stone-walled corral is shown on an 1876 map of Kane'ohe, reg. map no. 585, DAGS Survey Division Archives. This heiau was probably located on the small hill delineated by the 400-420 foot contours on the topographic map. The remains of this destroyed heiau should be located.

While looking for Pu'u Makani Heiau many years ago, I found two sites on this parcel which should be noted. On the ridge above Kawa'ewa'e Heiau, along the boundary between Kailua and Kaneohe, I found the remains of a small, terraced heiau. The terraces were small, and there was not much stone to be seen. It seems possible that it was the site of Pu'u Makani Heiau. I do not believe it is big enough to provide the stone that must have been used to make the cattle corral below, nor is the location the same as that indicated by McAllister in Archaeology of Oahu.

Also, on the ridge leading down from the ahupua'a boundary (and above the small knoll where Pu'u Makani Heiau was probably located) I crossed a steeply sloping dirt ramp (covered in dense vegetation) that seemed to be man made, and I thought it may have served as a holua in ancient times. One of the interesting things about holua in this area is that they are described as earthen troughs, rather than sloping stone platforms.

Section 6 Summaries of *Kama'āina* "Talk Story" Interviews

6.1 Talk Story Interviews

Kama'āina and *kūpuna* with knowledge of the Kāne'ohe Ahupua'a and the area within the vicinity of the proposed Hawaiian Memorial Park Expansion Area project participated in "talk-story" sessions for this assessment. The approach of CSH to cultural impact studies affords community contacts an opportunity to review transcriptions and/or interview notes and to make any corrections, deletions or additions to the substance of their testimony.

CSH employed snowball sampling, an informed consent process and semi-structured interviews (Bernard 2005) with 10 *kūpuna* and *kama'āina.* To assist in discussion of natural and cultural resources and any cultural practices specific to the project area, CSH initiated the "talk-story" sessions with questions from the five broad categories. The categories include: Gathering Practices, Marine and Freshwater Resources, Burials, Trails and Historic Properties. Presented below are brief backgrounds of participants' "talk-story" sessions and their comments and concerns about the proposed project area.

6.1.1 Elizabeth Lau

Mrs. Elizabeth Lau, Pelekikena (President) of the Ko'olaupoko Hawaiian Civic Club, was interviewed at her home in Kahalu'u by CSH on May 18, 2007. Mrs. Lau, who is 88, kindly shared her early memories and knowledge of Kāne'ohe and the project area:

Mrs. Lau described the project area vicinity in the pre-World War II years, "There used to be pineapple down from the Pali…where the golf course is now….Below where Pohai Nani [Retirement Home] is now there were dairies like Souza's and Freitas's Dairy….The Souza dairy would use the Kawa'ewa'e Heiau as a cattle pen". Mrs. Lau recalled the collaboration between farming families; two of the dairy families in the area shared cows, "the Ruiz family owned the cow and the De Costa family milked the cow!" When she was a child, her father was a butcher. He would share meat and butter with the Portuguese families in exchange for Portuguese bread. There was also an egg farm. She and her brother worked there "candling eggs", referring to the process of holding a strong light above or below the egg to observe the embryo and any cracks in the egg. Mrs. Lau mentioned that there also was a *heiau* near the egg farm, but was uncertain of the name or exact location. "Souza's Dairy and others closed when the war came because they had to go to war." Her family had a "piggery down on Waikalua Road. During the war the area was turned into an Italian prisoner of war camp and the prisoners would work in the laundry across the street".

According to Mrs. Lau, the Pohai Nani Retirement Home was built on top of a *heiau.* She reported that when Pohai Nani was still new the elevator would mysteriously go up and down, and the doors in the apartments would open and shut on their own.

Mrs. Lau has no specific cultural concerns about the proposed cemetery expansion project. She commented that the memorial park is a "beautiful place for the [Kawa'ewa'e] *heiau*", but expressed her concern about the possible subdivision proposed for land adjacent to the Pohai Nani Retirement Home, "Better a cemetery than housing. If you have housing, that would

damage the *heiau*. The cemetery [referring to the current Hawaiian Memorial Park] is beautiful. If the cemetery [is expanded] they [Hawaiian Memorial Park] would have to care for the *heiau*. This would be educational for our younger people [and provide] a place to exercise, and a pretty place to sit and eat lunch." Mrs. Lau recommended that CSH contact Denise De Costa, who also goes by the name of Mahealani Cypher.

6.1.2 Ko'olaupoko Hawaiian Civic Club (Donna and Wali Camvel, Mahealani Cypher)

On June 23, 2007, two principals of the Ko'olaupoko Hawaiian Civic Club (KHCC) and one of Ka 'Ailehua joined CSH on a visit to four of the eleven archaeological sites identified during the archaeological inventory survey by CSH in or immediately adjacent to the proposed project area. The club participants were Donna Camvel (2nd Vice President), and Mahealani Cypher (Recording Secretary/Immediate Past President) of KHCC. Ka 'Ailehua was represented by Wali Camvel. Ka 'Ailehua is a non-profit organization whose mission is to perpetuate Hawaiian culture and *mālama* nationally recognized historic sites including the Kawa'ewa'e Heiau. The sites visited were CSH 2, 5 and 11 (later changed to CSH 12, SIHP-6929 and currently *outside* of the petition area) as well as the Kawa'ewa'e Heiau: CSH 2 (SIHP-4681) features include rock terraces and a temporary shelter; CSH 5 (SIHP-4684) includes terraces and a habitation site; CSH 11/12 (SIHP-6929) includes a possible *pōhaku* (rock-shrine) and a small rock quarry where a number of flakes, pre-forms and hammer-stones were found. For updated CSH site numbers and corresponding SHIP numbers see the companion Archaeological Inventory Survey report (McCurdy and Hammatt 2008). The group kindly shared their impressions, interpretations and *mana'o* about the sites with CSH:

The group first visited CSH 2 (SIHP-4681). The general consensus of Mahealani Cypher, Donna Camvel and Wali Camvel was that the terraces and other features of the landscape did not represent an agricultural complex, but has a distinct spiritual feel to it. The site must be viewed in relationship to the Kawa'ewa'e Heiau, as part of the *heiau* complex. Two large stones on a small rise above the shelter were noted, and it was suggested that they may be *pōhaku kia'i* or, stone guardians (Figures 23 and 24). One rock appears to be in the shape of a dog's head (see Figure 24), and Mahealani Cypher suggested that perhaps it was there to represent the Hawaiian god, Kāne. According to the group, together, the 2 *pōhaku kia'i* appear to guard the area which may have been used by chiefs and their retinue for preparation, prayer and/or sacrifice.

The point was emphasized that all the sites near the Kawa'ewa'e Heiau must be viewed in relationship to the *heiau* as part of a complex. Mahealani Cypher offered that CSH 2 (SIHP-4681), or features nearby, may have been where the Hale o Papa or women's *heiau*, and/or the Luakini, or men's prayer complex, associated with the Kawa'ewa'e Heiau may have been located. Hale o Papa were temples where the female chiefs worshiped. The Hale o Papa was located next or adjacent to the Luakini for the purposes of conducting ritual ceremony. Luakini were used by the ruling chiefs for prayer, human sacrifices and to perform temple work.

The group did not have many comments about CSH 5 (SIHP-4684), though noted that a large rock between sites 2 and 5 may also be a *pōhaku.* Wali Camvel expressed *mana'o* that perhaps this location could have been the house site for the *kahu* or caretaker of Kawa'ewa'e Heiau. He suggested the group follow the ridgeline for its proximity to the site. The group then followed the ridgeline extending from above CSH 5 (SIHP -4684) to Kawa'ewa'e Heiau. The group members

shared stories of the *heiau*, particularly 'Olopana's attempt to sacrifice Kamapua'a and the hog-god's brilliant escape through chicanery (see one version of the story in Section 3). Mahealani Cypher shared a version of the *mo'olelo* she learned from a translation provided by historian Dr. Lilikala Kame'eleihiwa in her book, "Kamapua'a". The point was made that there are several versions of the Kamapua'a legend, as well as stories about the origin of the Kawa'ewa'e Heiau. The group also mentioned that there is a *hōlua* (referring to the sled or sled course, used on mountain slopes) associated with the *heiau*, presumably on the ridges near the *heiau.* They were uncertain of the precise location of the *hōlua* and wondered if CSH has found archaeological evidence of the slides.

The final site visited by the group was CSH 11/12 (SIHP-6929), immediately south of Pohai Nani Retirement Home where participants viewed the *pōhaku* and noted the arrangement of old *kī* or *tī* (*Cordyline fruticosa*) planted around the *pōhaku* (Figure 25) and explored the small rock quarry upstream. Mahealani Cypher remarked that the area around the *pōhaku* had a number of mango trees and shared her theory that *kūpuna* long ago may have planted mango trees to mark sacred sites for future generations. She bases her belief on the observation that many sacred areas she has visited around the Hawaiian Islands have had mango trees planted around the sites. Around the 1820s (the time of the introduction of the mango to Hawai'i), pressure from Caucasian missionaries to Christianize Hawaiians, coupled with the overthrow of the *kapu* system by ruling chief Liholiho (Kamehameha II) in 1819, drove many Hawaiians to practice their native religion underground. She believes that clandestine practitioners of the indigenous religion, noticing the size and longevity of mango trees, decided to plant trees in sacred areas as indicators of religious sites for their descendants. Wali Camvel shared that that the walled structures located at this site could have included a *kuahu* (altar) and further added that the *ahu* might have been dedicated to the god Kāne.

Representatives from the Ko'olaupoko Hawaiian Civic Club and Ka 'Ailehua who visited the project area and vicinity made the following recommendations:

1. All the above sites — including the *pōhaku* between CSH 2 (SIHP-4681) and 5 — should be preserved and protected through the creation of *kīpuka*, referring to a calm or clear place, or oasis, in this case a protected area and buffer zone.
2. Identification and preservation of the *hōlua* (sled course).
3. The group looks forward to working with the planners and owner to establish a collaborative agreement for the care of the Kawa'ewa'e Heiau and associated sites.

6.1.3 Mahealani Cypher's Additional Comments

In a letter to CSH dated September 11, 2007 Mahealani Cypher contributed post-interview comments regarding the field trip (in addition to those offered by Donna and Wali Camvel via phone and email and incorporated into the above interview summary). Following are key points and excerpts from Ms. Cypher's letter (see full text of letter in Appendix A):

> 1. Kawa'ewa'e Heiau [is] a religious site sacred to native Hawaiians… [T]he surrounding area would also have religious significance as part of the heiau complex. With a luakini heiau as prominent as Kawa'ewa'e, there is little doubt that there would have been associated sections of the property nearby that

complete the full operation of the heiau in keeping with its use and purpose. Its connection with Chief Olopana and Kamapua'a, for example, would further support its having a complex of associated compartments – not just a hale for the kahuna – to include the hale o papa and other key elements.

2. Pohaku:…[M]y understanding is that stand-alone pohaku that had religious significance were usually known as "pohaku o Kane", which we consider to be religious shrines and places of worship. At the site referred to as "CSH 5"… [the] stone by itself…is likely to have been a "pohaku o Kane". I am not sure it would have marked the location of a caretaker's hale or the home of the kahuna (priests), but that is possible. But Pohaku o Kane were generally just outside the door of many hale, serving as a family protector or shrine. In the case of the two pohaku seen at the area designated as "CSH 2", I concur with Donna Camvel's thinking that these serve as guardians and hence would be "pohaku ki'ai". The proximity of the two stones in a site which appears to have multi-level platforms, the size and shape of the two stones, indicated to me (and possibly to Donna Camvel) that this was a very important site. These pohaku ki'ai may even have guarded the women of the hale o Papa, as the chiefess would have lived there and had the elevated status to warrant placement of such stones near her worship area.

3. Mo'olelo about Olopana and Kamapua'a: I believe the story I shared with you about Kamapua'a overcoming Olopana at Kawa'ewa'e was learned from a translation provided by historian Dr. Lilikala Kame'eleihiwa in her book, "Kamapua'a".

4. Holua slides: I recall I pointed out to you the two slopes, covered with trees and brush, just mauka of Kawa'ewa'e, where I believe the holua slides once were used by the chiefs for recreation. If the brush and trees were cleared and soft grasses re-planted on those slopes, they would adequately serve as fine holua slide areas. It is likely the nearby cemetery land once contained springs and ti leaf groves, and could have been the source of water needed to wet the slopes.

5. Location and Relationship to broader Kane'ohe ahupua'a and other heiau: Standing upon Kawa'ewa'e Heiau, it is clear that the heiau was constructed strategically to be in the sight-line with Kukuiokane Heiau, the largest and most important heiau in the Kane'ohe region. Also clearly visible from Kawa'ewa'e are the peaks of Pu'u Ma'eli'eli and 'Ohulehule, and the island known as Moku o Lo'e (Coconut Island). Also clear from this site are the peaks of Konahuanui and Keahiakahoe, all of which bring stronger mana to elevate the spiritual and religious strength or power of Kawa'ewa'e. Our mo'olelo tells us that the great chief Olopana (and others) occupied or visited at Kawa'ewa'e for some time; hence, it would have been a place where the po'e kahiko (people of ancient times) brought their pleas for kokua, for resolution of disputes, or other requests for help. A great chief's presence indicates the complex had to be quite extensive to support his entourage, his retainers and those who served the chief. Food had to be gathered by the kahuna and others from the surrounding area, and these goods

had to be managed by the priests and their helpers at Kawa'ewa'e. It was a thriving mini-community of its own within the 'ili of Kawa'ewa'e. Therefore, the location, prominence and connection with other major sites, and the historical record of Olopana's presence, tell me that the heiau was not limited to the rock lined walls atop the ridge of Kawa'ewa'e, but had to contain an entire complex of associated structures and dwellings that housed and accommodated all who would be needed for a heiau of this prominence.

6. Mango trees: I still maintain that the mango trees were chosen by some kahuna to mark important religious sites. This occurred after the heiau were torn down or burned by the Priest Hewahewa following the breaking of the kapu system….It's not just the planting of the trees that was interesting; but how the trees were planted, often in a circle around what may have been the piko, or center of mana in that heiau. I recall in the mid-1980s, I took a group of kupuna (elders) from Kane`ohe to see Kukuiokane Heiau. We stood in the fern-covered open center of a grove of large old mango trees that seemed to have been planted in this oval orientation, down the slope of Punalu`u mauka (some say it was 'ili Kihapa'i). After our pule (prayers) were said, the kupuna stood quietly, observant and calm. Later, they told me they felt the mana of the heiau was strongest here, in the piko, in the center of this circular grove of ancient mango trees. Although the mango is an alien species here on O`ahu, its appearance here a few short years after the heiau were destroyed would have been convenient and desirable to those kahuna wishing to mark their sacred sites with a tree that they were told would survive for a very long time.

7. Recommendation: It is my recommendation that the landowner consider integrating its plans with the religious significance of the area surrounding Kawa'ewa'e Heiau's walled enclosure, ensuring that the more obvious and significant cultural properties are buffered and protected from any roadways, bulldozing or other intrusive activity. In all likelihood, there are burials in the area, probably pre-Contact, and this should be addressed through other research. Although the area in modern times was used for farming and urban activities, the radius in the currently undeveloped landscape adjacent to the walled section of Kawa'ewa'e is relatively undisturbed (except from dirt-bikers and others) and was probably kept that way for a good reason. I request to be further consulted, should you proceed with additional research for the current or expanded project area.

In a subsequent email sent to CSH on October 22, 2007, Ms. Cypher added:

In paragraph 4, with reference to the location of the holua slides, I am not too uncertain [sic] as to the location of the slopes they used. If you are in the center of the walled Kawa'ewa'e Heiau looking mauka, you can see the slopes very clearly, albeit covered with brush and trees. It is a logical location. Further research, if necessary, could confirm or reject my observation. I was trying to

look at this through the eyes of my ancestors, the kupuna who lived and worked in the area.

In paragraph 6, sub-section #1, I am a little concerned about whether paved roadways would be appropriate through the undeveloped area we visited, all of which may be part of the heiau complex. On the day of our field trip, it was explained to us that the landowner wishes to build roadways in this area for the cemetery expansion. I would like to emphasize that this may be problematic.

Figure 21. The *pōhaku kia'i* (stone guardians) at the CSH 2 (SIHP-4681) site

Figure 22. One of the *pōhaku kia'i* appears to be the shape of a dog's head, representing the god Kāne, in the interpretation of KHCC interview participants

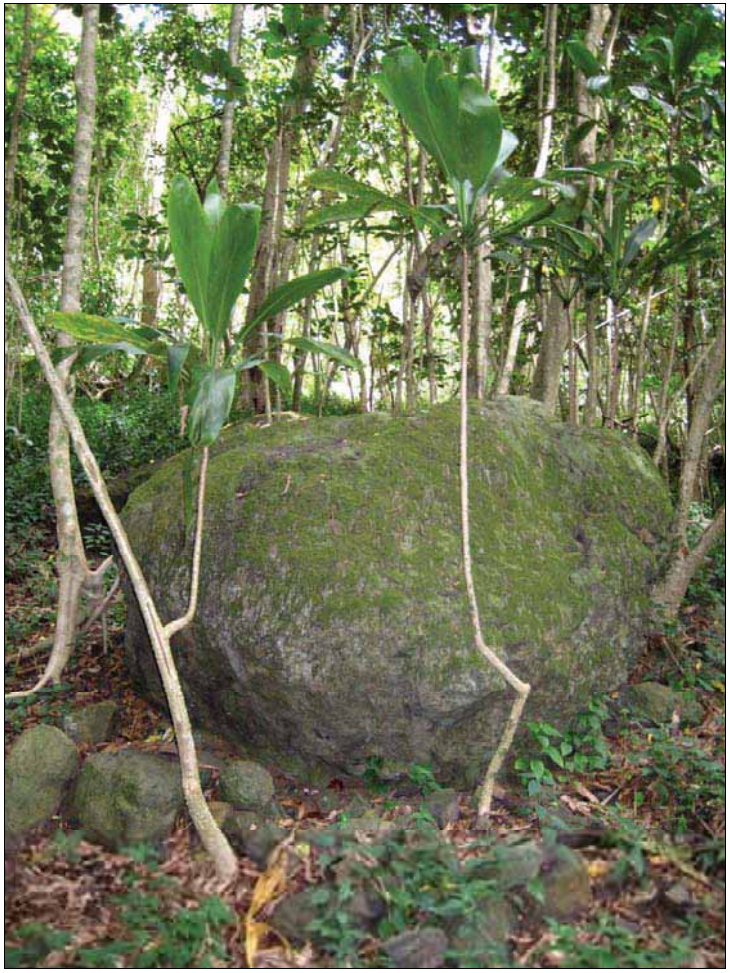


Figure 23. *Pōhaku* and *tī* plants

6.1.4 Charlie Ogata

Mr. Charlie Ogata is a member of the Queen Emma Hawaiian Civic Club and is considered the club’s longstanding *kia‘i* (caretaker) of the Kawa‘ewa‘e Heiau. At 82, Mr. Ogata no longer lives in the Pikoiloa neighborhood and has not had a chance to visit the *heiau* in a few years. Mr. Ogata was interviewed on September 13 and October 3, 2007 at the Kawa‘ewa‘e Heiau. He took CSH on a tour of sites in and around the *heiau*, recounting his son’s discovery of the *heiau* in the late 1970s, and generously sharing his scholarship on the Kawa‘ewa‘e Heiau and surrounding environs:

Mr. Ogata’s family moved to the Pikoiloa neighborhood in the late 1970s. His son, Kalani, and other kids from the neighborhood used to explore the mountainside behind the homes. His son reported finding a “pile of rocks” or rock wall in the understory. He took his father to the site, and later one of his teachers who expressed interest in seeing the site after Mr. Ogata’s son wrote an essay about the *heiau* for summer school. The teacher (Dr. Donald Kilolani Mitchell of Kamehameha Schools) having read about the Hawaiian sites of the area, ascertained the authenticity of the Kawa‘ewa‘e Heiau. Mr. Ogata recalls that this (re)discovery of the *heiau* was about 1978. “Do you remember in the 1970s there was a Hawaiian Renaissance? I became very interested in Hawaiian culture and language and started taking classes at the university.” Mr. Ogata became a devoted student of Hawaiian history and pre-history, and in particular, the Kawa‘ewa‘e Heiau. His model (Figure 24) and illustrations (Figure 25) depict his re-creation of how the *heiau* might have looked and functioned in ancient Hawaiian times.

“When my son found the *heiau* it was all grown over. I would come up here and cut the trees with my handsaw to clear the area. Eventually, I got help from others…with power tools.” Mr. Ogata spoke of the many years of volunteerism that went into the restoration of the *heiau.* The history of the *heiau* and the public effort to restore and protect the *heiau* is provided in a presentation Mr. Ogata made in 1986 to various organizations (Figure 26). Mr. Ogata learned that the Kawa‘ewa‘e Heiau was a *luakini*, a *heiau* of the largest class used for prayer and sacrificial offerings. According to his readings, the *heiau* was built by *menehune* (a legendary race of small people who worked at night, building temples, etc.) and rebuilt by Kahikiula for his brother Olopana who was the the *ali‘i nui* (high chief) of Ko‘olaupoko.

“‘Lua’ means ‘hole’ and ‘kini’ means ‘40,000’ or ‘many.’” He explained that the *lua*, holes or pits found inside and outside the *heiau*, were used to bury the bones of those sacrificed (Figures 27 and 28). “Human sacrifices were usually done outside of the *heiau*. [The priests] didn’t like blood in the *heiau* (blood was considered unclean) so they made the sacrifice on the big rocks outside of the *heiau*. You see that there are big rocks around the *heiau*? These were probably used to *hana make* (kill) the person or animal being sacrificed and then they were cleaned and placed on the *lele* platform in the *heiau*. The human sacrifices were usually law breakers…someone who had broken a *kapu*, or enemy warriors. But sometimes people would be tricked into breaking a *kapu*. They [the priests] would call people out after dark when a *kapu* was on and then catch them for sacrifice. Or sometimes, if they couldn’t find a human to sacrifice, they would use an *ulua* [certain species of crevalle, jack, or pompano fish] as a substitute probably because the name *ulua* also means ‘man’. Sometimes when they made a human sacrifice they would put a *maunu‘ia* [fish hook] in the person’s mouth.”

Walking up to the *heiau* Mr. Ogata noted that some *hula hālau* often come to the area to collect *hula* ferns. He pointed out a *koa* tree (*Acacia koa*) beside the trail he planted to commemorate his son's wedding. He also planted a *kukui* (*Aleurites moluccana*) and a coconut tree at the north end of the *heiau*, near what is now the entrance. "I noticed that there was no opening in the rock walls for an entrance. Well there is an opening now but I found out that this was made [more recently] by ranchers who used the *heiau* as a cattle pen. I asked myself, 'how did the ancients get into the *heiau*?', and saw the pile of rocks [pointing to rocks on the northeast side of the *heiau*] I think was used as a ramp up to the wall of the *heiau*" (Figure 29). Entering from the north opening of the *heiau*, Mr. Ogata explained that there were three levels to a *lananu'u mamao* (oracle tower): the *lana* or the lowest platform of the oracle tower where offerings were placed; the *nu'u* or the second platform in the tower; and, the *mamao* or the highest platform of the *lananu'u mamao*, where the high priest conducted services (Figures 32 to 32). He believes that the rocks that still carpet the upper, north end of the *heiau* are remnants of the rock platform and noted that the *ti* or *ki* (*Cordyline terminalis*) plants scattered in and around the *heiau* were there when Mr. Ogata and his son first visited the site. Walking over the west wall of the *heiau*, he pointed to a flat grassy area over the wall he believes may have been the site of the Hale o Papa, or the women's *heiau* (Figures 33 and 34). Moving to the center of the *heiau*, Mr. Ogata pointed out the lines of rocks that formed four terraces across the width of the *heiau* (Figure 24). He wonders if one purpose the rock terraces may have served was as a stadium for watching sledding competitions on the ridge directly south of the *heiau*, "After all, a *heiau* is only sacred during certain times of the year". Looking towards the ridge (Figure 35), he explained how Hawaiians created *hōlua* (sled course) by making a rock track, covering it with grasses, and wetting it down for speed. At the lower (south) end of the *heiau*, Mr. Ogata pointed out the *lua* adding that he has found another 2 *lua* outside of the *heiau* and believes there are more. He concluded his discussion of the features inside the *heiau* with a brief telling of the *mo'olelo* about Kamupua'a's chicken thievery and subsequent capture and escape from Olopana's attempt to sacrifice him at the Kawa'ewa'e Heiau (see Section 3).

Mr. Ogata mentioned, and in some cases identified for CSH, a number of sites outside of the Kawa'ewa'e Heiau and stated his regret that a more detailed archaeological survey has yet to be done on the features immediately adjacent, or in proximity, to the *heiau.* In addition to finding at least one other *lua* for the disposal of sacrificial bones (located approximately 25 yards north and *mauka* of the *heiau*), he found: a stone alignment extending about 50 yards on the north side of the *heiau;* a site that may be a human burial also north of the *heiau*; and what he thinks may be stairs or a stone pathway leading up to the *heiau* on the north and west/*makai* side (Figures 36 and 37) and a rectangular rock enclosure (Figure 38). He wonders if the latter was a burial site or a *kuahu* (altar). Mr. Ogata stressed that these sites should be viewed in relationship to the Kawa'ewa'e Heiau. Also, the Kawa'ewa'e Heiau should be considered in relationship to the other four *heiau* built by or for 'Olopana in the Ko'olaupoko area. Mr. Ogata theorizes that there is meaning, perhaps astrological or astronomical, to the alignment of the *heiau* around Ko'olaupoko and wondered aloud if anybody has explored the spatial relationships of these *heiau*?

Mr. Ogata spoke of the threat to the Kawa'ewa'e Heiau since the early 1800s when Kamehameha I died (1819), the American Protestant missionaries first started arriving in Hawai'i (1820) and began Christianizing Hawaiians, and Kamehameha II (Liholiho) ascended

the throne (1819) and discontinued the *kapu* system. Referring to Kamehameha I's wife, and the mother of Liholiho, Queen Ka'ahumanu, Mr. Ogata explained "Ka'ahumanu said destroy the *heiau*!" The Kawa'ewa'e Heiau was not destroyed, but was abandoned by Christianized Hawaiians who, in Mr. Ogata's words, "became very superstitious and fearful of the ancient sites". Mr. Ogata also mentioned the general disregard for Hawaiian cultural properties until the late 1970s when historic preservation laws were legislated in Hawai'i (Figure 26). Even so, many sites were destroyed because they were not recognized as significant. "There was another *heiau* built by Olopana where the [HMP] cemetery is now. The *heiau* was taken apart to build the cemetery and some of the rocks from the *heiau* were possibly used to construct a waterfall." Mr. Ogata continued, "I know [nowadays] they won't touch the *heiau.* But I am worried about the other sites that may not be considered significant to the cemetery [HMP]. Are they going to destroy the *hōlua* slide, the *ahu*...? Not too many people know about the *heiau* anymore…I'd like to see the archaeological sites excavated…and to [locate] and excavate all of the *lua.*"

Mr. Ogata commented that he hopes that the conservation land will not be developed "especially where they want to build the subdivision" and expressed cultural concerns regarding the Kawa'ewa'e Heiau and surrounding project area and offered the following recommendations:

1. An archaeology inventory survey of sites associated with the Kawa'ewa'e Heiau, particularly rock features immediately adjacent to or in proximity to the Kawa'ewa'e Heiau that may not have been covered in earlier works, should be conducted. The sites should be excavated (especially where *lua* are found) and preserved.
2. Other cultural properties in the project area, such as the *hōlua* (sled course) on the ridge line immediately south of the Kawa'ewa'e Heiau, should be preserved.
3. On-going cultural practices, such as the gathering of *hula* and medicinal plants, should be recognized and accommodated.
4. Hawaiians and people of Kāne'ohe gather and voice their opinions about the proposed project in a public hearing. Site should be verified to see if it is (still) on the state and/or federal register.

Figure 24. Charlie Ogata’s model of the Kawa‘ewa‘e Heiau viewed from the south (bottom of photograph) to the north (top)

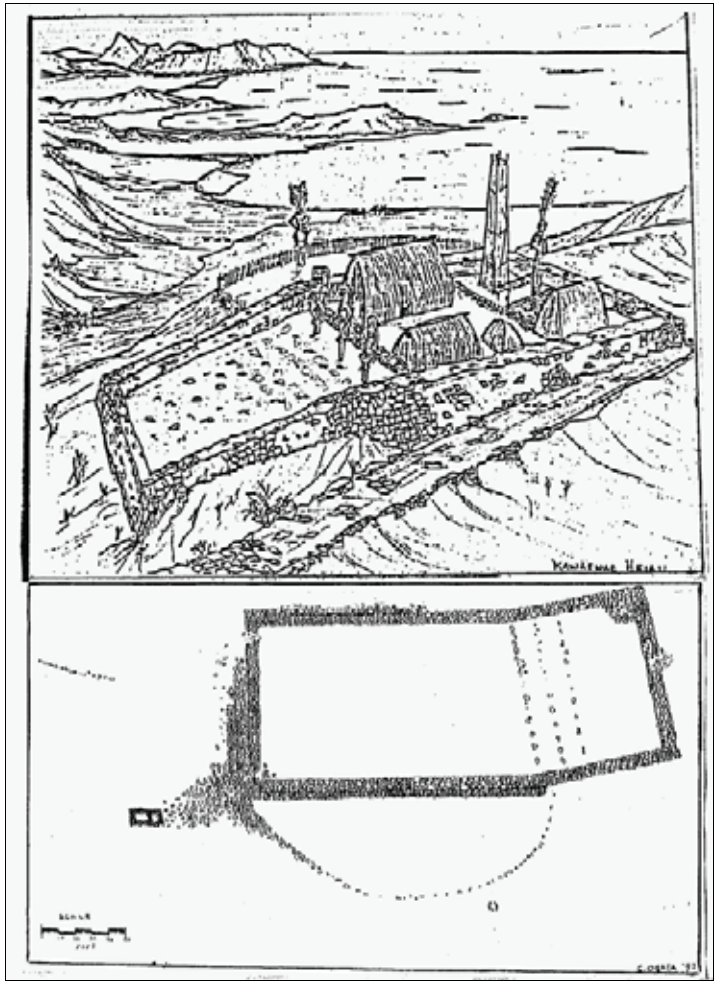


Figure 25. Two illustrations of the Kawa‘ewa‘e Heiau by Charlie Ogata

18 FEB 1986

TO WHOM IT MAY CONCERN:

Since the discovery of Hawai'i by Captain James Cook, other explorers, travelers, missionaries, and traders, took with them many of Hawai'i's valuable artifacts including feather cloaks, feathered and carved images and other irreplaceable objects of great historical value. Numerous objects of historical value were taken from burial sites and other historical sites by vandals and the curiousity seekers. Many historical sites, including heiau were and are being destroyed by developers even today.

In 1921 while Hawai'i was still a territory, a Historical Commission was set up by the Territorial Legislature, but its only accomplishment was to locate and identify several important sites. Although this was a good start, it did not stop the destruction of many historic sites. In 1951 the Legislature established a Historic Sites Comission which performed the same functions as its predecessors with some success in preserving certain sites.

In 1959, when Hawai'i became a state, the Constitution, in Article VIII, under Public Health and Welfare, Section 3, gave the state the power to 'conserve and develop places of historic or cultural interest'. Later the responsibility of the Historic Commission was placed under the Division of State Parks in the Department of Land and Natural Resources.

10 years ago, in 1976, the State Historic Preservation Office staff published an official document of historic preservation under the provisions of the National Historic Preservation Act of 1966, which was endorsed by governor George R. Ariyoshi. In this document is listed several preservation programs, recommendations, and planning, all of which are very ambitious and worthy of implementation. What has become or all these programs?

Today 1986, we still seem to be bogged down in bureaucratic muck when it comes to rendering any decision regarding the preservation of certain historic site/s, e.g. the Kawainui Marsh, certain salt water ponds in Kahala, the sites at the Banana patch in Kaneohe, etc. Surely with all the scientists, historians, and archeologists available to the state, decision regarding historical sites can be made in a more timely manner before they are compromised or destroyed.

The property in question today (Pikoiloa) contains a heiau of historic, religious, and traditional value. It is the Kawa'ewa'e Heiau, a registered Historic Site. According to Thrum, it was built in the 12th century by 'menehunes' and rebuilt by Kahikiula for his brother Olopana who was the Ali'i Nui of Koolaupoko. It is a Luakini type heiau, one of many others built in this general area. The kahuna nui was Lonoaohi. The heiau consists of an enclosure 120 by 260 feet and walls averaging 5 feet in width. Height anywhere from 3 feet to 7 feet. It is said that this was the heiau in which Kamapua'a the demigod was to have been sacrificed by Olopana, in the famous traditional stories of Kamapua'a. At the present time although the site is overgrown, and some portions destroyed by cattle ranching, it is in fairly good condition. It is hoped that the State will consider the possibility of preserving and restoring this site and include it in their general plan. As representative of the Queen Emma Hawaiian Civic Club, we offer our whole-hearted support toward this goal. Thank you.

Figure 26. 1986 testimony made by Charlie Ogata to restore and preserve the Kawa'ewa'e Heiau.

Figure 27. Mr. Ogata indicates where the *lua* for bones is located

Figure 28. A picture of the *lua* at the southeast corner of the Kawa'ewa'e Heiau

Figure 29. Rocks on the east and *mauka* side of the *heiau*, Mr. Ogata believes formed a ramp to the entrance

Figure 30. Charlie Ogata points to the north side the Kawa'ewa'e Heiau

Figure 31. A close-up of the *lananu'u mamao* (oracle tower), *hale pahu* (drum house) (center), *hale umu* (oven house), the *hale mana* (spirit house) (center, top) and the *hale wai ea* (spirit water house).

Figure 32. A close-up of the *ki'i akua* (temple images) and *lele* (sacrificial altar)

Figure 33. Mr. Ogata points out where he believes the Hale O Papa (women prayer complex) was located on the *komohana* (west) side of the *heiau*

Figure 34. A close-up of the Hale o Papa from Charlie Ogata's model of the *heiau*

Figure 35. A view of the south wall and the ridge line immediately south of the *heiau* where the *hōlua* (sled course) was located taken from the rock terraced area in the middle of the *heiau*

Figure 36. The north wall of the Kawa‘ewa‘e Heiau and possible steps leading to *makai* side trail

Figure 37. West wall of *heiau*, stairs leading downslope not visible in this photograph

Figure 38. The rectangular rock feature immediately downslope on the west and *makai* of the *heiau*. Mr. Ogata wonders if this was a guard shack for the *heiau*

6.1.5 Linda Chang

In an interview conducted by CSH on October 8, 2007, Mrs. Linda Chang, a *lei*-maker, *hula* practitioner and longtime resident of Kāne‘ohe, discussed her background and knowledge of the project area. Mrs. Chang recently moved with her husband to Hilo, Hawai‘i for the quiet and lush environment that is ideal for growing and gathering *lei* plants. Formerly, her family lived on Nāmoku Street, a few blocks away from the proposed HMP expansion project area, since 1978. She has danced *hula* for the last 15 years and has been associated with floral arrangements, *lei* making, and native plants for over 40 years. She has conducted *lei* making classes/workshops, and has made many of the adornments for the *hula hālau* she danced with for over 14 years, Hālau Hula ‘O Nāpunaheleonāpua. Mrs. Chang developed her *lei*-making skills through this experience and has been producing *lei*(s) and adornments professionally for the last 12 years. She has also participated as a judge for several years in the City of Honolulu's Lei Day Contest.

Mrs. Chang stressed the importance of the proposed project area for collection of the *hula* plant *lauaʻe* (*Phymatosorus grossus*) because of its superior color, thickness and *maile*-like scent, and noted that the closest area where *lauaʻe* of this quality can be found is on a trail at the top of the Pali, but that it is difficult to access. Mrs. Chang has also been involved in cultural education through her *hula hālau.* She noted that the *hula hālau* always takes responsibility for tending the areas from which plants are collected and commented, “The *hālau* realizes the importance of preserving the native flora for future generations to enjoy. How we have done this and continue to do this, is by taking the *haumāna* [students] to sites where our *kumu* and *kōkua* have gone to harvest the *lauaʻe*, and the *palapalai* [native fern, *Microlepia setosa*] and we teach them how to look for the mature branches and how to pick the stems without damaging the plant. They are also cautioned to take only what they need and not to over-harvest, not to waste.”

Mrs. Chang emphasized that in Hawaiian culture, culture and environment are “intertwined”. She shared her *manaʻo* and cultural-conservation concerns about the proposed project area:

> The [proposed project area] is a place to find respite. How many parcels will be destroyed before the last greenbelt is all gone? Where will we be able to go to listen to the wind blow through the trees? Dollars speak louder than the grace and beauty of a place. We take children in the *hālau* to see the context of *hula* plants. Going to a park is not the same as taking them to the natural environment [in which *hula* plants are gathered]. The context of *hula* plants is very important.

Mrs. Chang recommended CSH contact Kumu Hula Frank Kawaikapuokalani Hewett and Aunty Alice Hewett.

6.1.6 Dr. Charles Peʻapeʻa Makawalu Burrows

Dr. Charles Peʻapeʻa Makawalu Burrows, familiarly known as “Doc” Chuck Burrows, is the President of ‘Ahahui Mālama i ka Lōkahi, a nonprofit organization devoted to developing, promoting and practicing a native Hawaiian conservation ethic. Dr. Burrows leads volunteer groups in the cultural and ecological restoration of Ulupō Heiau and Na Pohaku o Hauwahine in Kawai Nui Marsh of the Kailua Ahupuaʻa. Ulupō Heiau is located in Kailua Ahupuaʻa, approximately 2.2 miles east-south-east of the project area (Figure 39). Ulupō Heiau is said to

have been built by the first Polynesians arriving to the shores of the Kawai Nui lagoon 1500 years ago. In an interview conducted by CSH at the Ulupō Heiau on October 11, 2007, Dr. Burrows lead CSH on an extensive tour of the *heiau* pointing out cultural features of the landscape and sharing his knowledge of *heiau* in the Koʻolaupoko district and his *manaʻo* on the proposed project area.

Dr. Burrows explained that the reason this site was chosen for a *heiau* was most likely the *punawai* or fresh water springs found at the base of the *heiau* and used by the early *kāhuna* (priests) for ritual purposes, drinking and irrigation of their *loʻi kalo* (taro pond fields):

> There are very few *heiau* associated with *loʻi kalo* and the growing of other ethnobotanical crops. Below the *heiau* complex and into the marsh, extending to Maunawili Valley, was grown with taro. The dryland slopes were cultivated with the growing of sweet potato, banana, breadfruit and sugarcane. One part of the marsh, about 450 acres, was constructed as an inland *loko iʻa* (fishpond), the largest of its kind in the Hawaiian Islands at that time.

Dr. Burrows pointed out *ʻauwai* (irrigation ditches) and other cultural sites that can be seen from the Ulupō Heiau such as the Pahukini Heiau, across the marsh on the slopes of Kapaʻa, and Holomakani Heiau -- two of five *heiau*, including Kawa`ewa`e Heiau, purported to have been built by the high chief ‘Olopana. The Pahukini Heiau once overlooked the site of an ancient Hawaiian adze quarry. Pahukini Heiau, also in Kailua Ahupuaʻa, is approximately 1.02 miles east-south-east of the project area (Figure 39). Dr. Burrows described the Ulupō Heiau in pre-Contact times and now:

> When you think about Ulupō Heiau, it is more than what you see here…more than just the *heiau*. It’s a whole complex where present buildings, houses, churches, roadways have been constructed during the historic and modern periods. There was a *kahuna* and *konohiki* (*ahupuaʻa* land manager) who lived in the *heiau* complex who took care of the *heiau* and managed the growing of food crops and other useful plants not only for the rituals that took place at the *heiau* but also for the community’s food subsistence. In the Ulupō Heiau state property of 28 acres are the last remnants of the ancient Hawaiian archaeological and historic sites still existing and serves as a cultural *kīpuka* [island, buffer zone] for future generations. A cultural *kīpuka* in Kailua serves as seeds for new growth that perpetuates the Hawaiian and historic cultures but also for the restoration of its biological ecosystems. It provides the seeds for renewal, culturally and ecologically and is at once our past, present and future.

Regarding the Kawaʻewaʻe Heiau and the proposed HMP expansion project, Dr. Burrows is particularly concerned about the archaeological sites in the project area, possibly associated with the *heiau*. “Sewer lines [and other aspects of the development], especially where the subdivision is planned, could impact the sites.” He suggested that CSH also try and contact “Buddy” Earl Neller, and offered the following recommendations:

1. The project should be reviewed by the Office of Hawaiian Affairs’ Native Hawaiian Historic Preservation Council (NHHPC) which serves to advise the

OHA trustees on matters pertaining to Hawaiian archaeological sites and also the OHA Administrator (see Clyde Nāmu‘o, OHA in Table 4). Dr. Burrows sits on the NHHPC and noted that the Council would be interested in seeing a survey of all the archaeological sites in and around the project area “right up to the ridge line”.

2. In designing a plan for protecting the sites, the owner should consult and work directly with the Queen Emma Hawaiian Civic Club and the Ko‘olaupoko Hawaiian Civic Club.

3. There should be cultural monitoring during all phases of the planned development.

Figure 39. Ulupō Heiau in relation to Kawa‘ewa‘e Heiau and other neighboring *heiau*

6.2 Additional Statements

Because a few of the community contacts approached for this cultural impact study actively oppose the proposed cemetery expansion, and/or are concerned about trespassing issues related to gathering plants on Hawaiian Memorial Park owned land, the following Kāne‘ohe cultural practitioners have agreed to contribute their comments to the study on the condition that their names are withheld.

6.2.1 Cultural Practitioner and Educator

On September 18, 2007 CSH interviewed a cultural practitioner and educator who has been actively involved in the Ko‘olaupoko Hawaiian Civic Club, in helping to clean (weed) the Kawa‘ewa‘e Heiau, and in gathering plants in the area for a number of years. The study participant shared the following information about the project area:

S/he is from a neighboring *ahupua‘a* to Kāne‘ohe, and has been visiting and utilizing the project area since s/he was a child. “All those properties used to be pasture land. We used to run in those mountains [when we were kids]... There used to be a dairy... I think it was ‘Santos Dairy’. I’ve been hearing ‘Souza Dairy’, but it wasn’t Souza that was somewhere else. We used to see the *heiau* when we were young, but when you’re young you don’t think about it. We didn’t really know what it is…. A lot of historical sites we can’t get to because they are on private land, we can’t touch it with a ten foot pole…” The study participant painted a picture of the landscape that is quite different than it is today, “If you look at pictures from the 1920s and 30s there were no trees. You have to visualize [in and around the *heiau*] from point A to B with no trees.” S/he noted that another large *heiau* s/he is familiar with (located in Wailua), like the Kawa‘ewa‘e Heiau, was used for sacrifices. S/he observed that in some parts of the *heiau* in Wailua, the surface rocks appeared to be hollow. S/he reached down below the surface and found that the rocks underneath were white, like coal, “The place was like a massive furnace”. S/he described indications of ancient Hawaiian habitation near the *heiau*: “a kahuna lived there and there is noni, mango and there was a *lo‘i*…. I haven’t really explored the back of the valley, but I know that people hunt back there and play paint ball”.

The interviewee has been involved in cultural work in the area for the last ten years. “We go to the *heiau* on the weekends to clean…to weed whack. We go when we need plants…*laua‘e* to make leis and for table decorations…when we need volume. It is easy to pick there. The plants are easy to get and they are clean. They’re growing in the shade, under the canopy.” S/he went on to explain that the variety that grows in the area is more fragrant and that, “when they don’t have seeds [spores] they don’t have a fragrance,” (referring to the more ornamental *laua‘e* commonly grown in peoples’ yards) “Pick the mature *laua‘e.* You can feel the stem. When the stem is brown, snap it right off…. Look at the leaves… you can tell the fragrant *laua‘e.*” The study participant reported that s/he takes *hula hālau* to the area to teach them what and how to pick ferns. S/he also mentioned that “kids from Kamehameha Schools” visit the Kawa‘ewa‘e Heiau. “Now it’s almost rainy season. We have to go fertilize the *laua‘e* patches. It’s not just about take take take. We give back too.”

The study participant expressed the following concerns regarding the proposed Hawaiian Memorial Park expansion project:

> Leave it alone. It's conservation land. We're trying to clean-up Kāne'ohe Bay. There is already an invasive *limu* [seaweed, algae] problem. I am concerned about all the run-off from the cemetery – fertilizers, pesticides… it kills the fish.

6.2.2 Kāne'ohe Kama'āina and Hula Practitioner

On October 8, 2007 CSH interviewed a longtime resident of the Pikoiloa neighborhood. S/he has been dancing hula since s/he was a small child and is currently a member of the Hālau Hula 'O Nāpunaheleonāpua. The study participant shared information about the project area.

S/he has been dancing hula since the age of 5 or 6 and has been a member of a number of hula hālau. S/he is aware that *hula hālau* gather hula plants in the project area. "We collect *lauaʻe* there because it is the darkest, greenest, thickest and most fragrant…the best for making head, wrist [and other] lei. I think this is because of the lush trees…the thickness of the trees and the breeze. The shade, dampness and coolness makes the *lauaʻe* more fragrant…. This is an important place for hula adornments. The only other place to collect *lauaʻe* of this quality is up on the Pali, but that is not easily accessible." The interviewee explained that the best way to pick lauaʻe is to take only the leaves and leave the roots. "When our *kumu* picks he also tends the *lauaʻe*."

The interviewee drew a connection between *hula*, the land and natural and cultural conservation: "Hawaiian culture and the land are one. Everything has a spirit. When we go to pick something, we always ask permission first and then give an offering after. I was brought up in a *hula* culture and that means respect for the land. The land goes with our names, our genealogy… Access to pick *hula* plants [if the cemetery expands] is not enough. [The proposed project] will violate our ancestors land." S/he further expressed his/her cultural, conservation and additional concerns regarding the proposed cemetery expansion project:

1. Protect the areas where *lauaʻe* is concentrated. *Lauaʻe* found in the project area is noteworthy for its physiological characteristics of thickness, color and fragrance, and especially valuable to *hula hālau* for making adornments. It is abundant *mauka* of the Kawaewaʻe Heiau and in the gulleys below the *heiau* that can be easily accessed from Lipalu Street.

2. Generally, "Don't touch conservation land. Preserve the flora and fauna…. Green space is increasingly rare on this island."

3. Sites such as the Kawaʻewaʻe Heiau and associated sites in the project area should be protected and seen in relationship to other sacred sites in the Koʻolaupoko area such as Mōkapu that were "training grounds for warriors." The area is used for cultural education. For example, his/her daughter's girlscout troop will be studying the Kawaʻewaʻe Heiau to earn a Hawaiiana patch.

4. There is community concern that the cemetery will bring more traffic and crime, and generally disrupt the quiet of the neighborhood. "[Now] the neighborhood is safe and protected. Any stranger comes up here and everybody knows it." S/he is concerned that people could use the cemetery to access homes. "We have already seen people come down from the [HMP] graveyard at night. We saw flashlights coming down the hill…they went into someone's backyard. Maybe they were just kids, but still it is easy to get into a person's backyard from the graveyard."

5. The community is concerned about drainage issues. There was a mud slide and flood in the 1980s that ran through peoples' homes and killed one person.

6.2.3 Kāne'ohe Kama'āina and Kumu Hula

In a phone conversation on October 17, 2007, CSH spoke with a Kāne'ohe *hula* instructor regarding the proposed Hawaiian Memorial Park expansion project. His/her *hula* group gathers plants for *hula* adornments in the project area. The interviewee shared the following comments regarding the proposed project:

> We feel that it is important for Hawaiian cultural practices that this area is preserved. We collect *lauaʻe* [in and near the project area]. *Lauaʻe* is picked in honor of Laka, the god of *hula.* This area is important for *lauaʻe*: 1) although you can find *lauaʻe* throughout the island, this is one of the few places you can find it in abundance. If you need *lei*(s) for 25 people, you can go to this one place [rather than having to go to more than one site to pick enough] and 2) the quality of the *lauaʻe* ferns are better – the ferns are mature, darker green in color, firm, and have no bumps [spores], preferred for *hula lei* and other adornments.

Section 7 Cultural Landscape of the Project Area

Discussions of specific aspects of traditional Hawaiian culture as they may relate to the project area are presented below. This section examines resources and practices identified within the project area in the broader context of the encompassing Kāne‘ohe Ahupua‘a landscape. As emphasized by a number of the participants in this cultural impact assessment, the entire project area must be seen in light of its association with the Kawa‘ewa‘e Heiau *and* in relation to neighboring *heiau* in the Ko‘olaupoko district. Dr. Chuck Burrows described *heiau* as part of a “complex” of sites serving habitation, agricultural, ceremonial and ritual purposes. Findings of the archaeological inventory survey for the Hawaiian Memorial Park expansion project enumerate several pre-Contact sites that suggest association with Kawa‘ewa‘e Heiau as well as, possibly, a ceremonial/*heiau* structure (SIHP# 50-80-10-6930) (McCurdy and Hammatt 2008). Excerpts from talk story sessions are incorporated throughout this section where applicable.

7.1 Hawaiian Habitation and Agriculture

In pre-Contact times, the *ahupua‘a* of Kāne‘ohe offered fresh water from *mauka* (upland) springs and a well-developed fishpond system, making it both an agricultural and aquacultural center, and one of the primary population centers on O‘ahu (Devaney et al. 1982:6). Handy and Handy (1972) described Kāne‘ohe as:

> ...an area of little hills with many small streams between them. In 1935 it was still one of the most active communities in planting commercial taro. A goodly proportion of its lowland *lo‘i*, tucked away in pockets flanked and often hidden by low hills or near the town itself, was then still planted in taro by Hawaiians who owned the land and by Orientals who leased land or were hired to cultivate it. (Handy and Handy 1972:455)

Pre-Contact land use would have consisted mainly of *kalo* (wetland taro) and *kula* (dryland) cultivation of *hala* - pandanus (used for making household furnishings such as mats), *wauke* – paper mulberry (used for making *tapa/kapa* cloth), bananas and sweet potatoes (Handy and Handy 1972:456).

Cultural and ecological conservationist Dr. Burrows discussed the significance of water in relationship to the Ulupō Heiau. He explained that the reason the sight was chosen for a *heiau* was most likely due to the *pūnāwai* or fresh water springs found at the base of the *heiau* and used by the early *kāhuna* (priests) for ritual purposes, drinking and irrigation of their *lo‘i kalo* (taro pond fields). One of the contributors to this cultural assessment (see Section 6.2.1) described what s/he believes are indications of ancient Hawaiian habitation near the Kawa‘ewa‘e Heiau, “a kahuna lived there and there is *noni*, mango and there was a *lo‘i*…”

Archaeologist Earl “Buddy” Neller, adjuring archaeologists to pay closer attention to vegetation associated with historic and cultural sites, commented in an email:

> Plants, such as ti, are an integral part of heiau traditions, but they are generally not mentioned in archaeological surveys. Don't overlook the importance of Hawaiian plants growing in the project area. Ti is often found at heiau sites, and in Hawaiian gardens of old, and the leaves are still used in many ways.

Charlie Ogata, *kia‘i* (caretaker) of the Kawa‘ewa‘e Heiau, pointed out the *tī* or *kī* (*Cordyline terminalis*) plants scattered in and around the *heiau.* He mentioned that the plants were there when Mr. Ogata and his son first visited the site in the 1970s.

It is worth noting that *tī/kī*, a Polynesian introduced cultivar, in addition to its use for food and the (post-contact) distilled liquer *‘okolehao*, was of ceremonial and ritual importance:

> *Ti* received heavy ceremonial use… and was frequently planted around *heiau*. Priests wore leaves about their necks as an indication of high rank or divine power, and it was among the plants customary on the altar of the *hālau hula*, representing Laka, the goddess of hula. (Abbott 1992:115)

7.2 Gathering of Plant Resources

In ancient Hawai‘i, upland forest regions provided various woods needed for canoes, tools and more, as well as cordage, food and herbs (Abbott 1992). Several of the plants within the project area have past and present ethnobotanical uses for native Hawaiians (e.g., as medicinal, building, weaving, *hula* and *lei* plants). Many of these plants are (possible) Polynesian introductions such as *kukui* (*Aleurites moluccana*), (true) *kamani* (*Calophyllum inophyllum*), *hau* (*Hibiscus tiliaceus*), *kī* or *tī* (*Cordyline fruticosa*), *noni* (*Morinda citrifolia*), *‘ohe* (possibly *Bambusa vulgaris* and/or *Schizostachyum glaucifolium*), and *mai‘a* - banana (*Musa* spp., possibly *M. paradisiaca*). Some of these Hawaiian canoe plants (plants brought by the early Polynesians in their canoes) are indicators of former Hawaiian habitation. For example, *kamani* was often planted around *heiau* (temples), and considered a sacred tree in parts of Polynesia; the same is true of *kī/tī*; both *kī/tī* and *mai‘a* were planted around taro *lo‘i* (pondfields); and, the latter, *mai‘a*, was planted around dwellings (http://www.canoeplants.com).

There are also a small number of native plants in, and in the immediate vicinity of, the proposed project area such as the indigenous fern *pala‘ā* (*Sphenomeris chinensis)*, *neke* fern (*Cyclosorus interruptus*), wood fern (*Dryopteris* sp.), *possibly* the native fern *palapalai* (*Microlepia strigosa*), ‘*ōhia lehua* trees (*Metrosideros* spp.), and the shrub/bush *ūlei* (*Osteomeles anthyllidifolia*), many of which have ethnobotanical applications. Most significantly, *palapalai* and *pala‘ā* are culturally valued native *hula* and *lei* fern. Although *M. strigosa* and *S. chinensis* are not listed as endangered or threatened, a study conducted by researchers at the University of Hawai‘i Department of Botany found that cultural practitioners were concerned that the availability of these species is declining dramatically (Ticktin et al. 2006).

Contributors to this cultural assessment rarely mentioned past or ongoing plant gathering with the singular exception of frequent reference to the continued collection and value of *lei/hula* plants gathered in the area, particularly *laua‘e* or *maile*-scented fern (*Phymatosorus grossus*). Mr. Ogata indicated that people collect *hula* and medicinal plants in the area. Though there are a number of plants that can be used as *lei* and *hula* plants in the project area, the focus of most study participants’ comments and concern was on the naturalized non-native fern, *laua‘e*. Hula practitioners such as Linda Chang and other study participants (see Sections 6.2.1-3), detailed the care, collection and use of *laua‘e*. As one contributor explained, “*Laua‘e* found in the project

area is noteworthy for its physiological characteristics of thickness, color and fragrance, and especially valuable to *hula hālau* for making adornments." Plant gatherers also mentioned that the proposed project area is the only easily accessible area in Kāne'ohe where *laua'e* can be found in enough abundance to gather for *hula hālau.* One gatherer explained:

> We collect *laua'e* there because it is the darkest, greenest, thickest and most fragrant…the best for making head, wrist [and other] lei. I think this is because of the lush trees…the thickness of the trees and the breeze. The shade, dampness and coolness makes the *laua'e* more fragrant…. This is an important place for hula adornments. The only other place to collect *laua'e* of this quality is up on the Pali, but that is not easily accessible.

P. grossus is a very common alien fern found as a ground cover plant from coastal to shaded moist low-elevation forests and windswept ridges. It is also a popular ornamental yard plant. It is ubiquitous in the Hawaiian Islands, particularly in environments disturbed by humans, either directly or indirectly by their agents (e.g., grazing animals, bulldozers). For the purposes of this cultural impact assessment it is critical to understand the cultural and botanical reasons the *laua'e* in the proposed project area is especially valued. Community consultants have repeatedly emphasized the qualities of color, thickness, fragrance and lack of sori as most desirable for *hula* adornments. They have also discussed the context in which *hula* plants are gathered.

Laua'e patches found in the project area are understory plants, and differ considerably from plants encountered in open sunny areas. Plants in sunny areas tend to be, in the words of the Maya Le Grand (botanist conducting the floral inventory for the project EIS) more chlorotic, referring to yellowing of green plant tissues due to decreased chlorophyll often due to nutrient deficiencies, infection or toxicity (Maya Le Grand, personal communication 2008). Full sun will cause fronds to be lighter green, less culturally desirable than darker fronds (CTAHR, 2002:100). There is evidence that *laua'e* tends to bear a much higher proportion of spore-bearing fronds in sunny habitats. The sori (cluster of sporangia – the spore-bearing structure of ferns) are less aesthetically pleasing to *hula* practitioners, and of greater significance, cause skin irritation and itching and are therefore avoided by gatherers.

The crushed leaves of *P. grossus* have a faint, but distinctive smell reminiscent of another popular *hula* plant *maile* (*Alyxia oliviformis*). Coumarins, the chemical component that gives *laua'e* its characteristic smell, are ubiquitous in plants including ferns in the Polypodiaceae family (of which *P. grossus* is a member) (Harborne et al. 1999), lavender, licorice, cherries and sweet clover, etc. (http://www.phytochemicals.info/phytochemicals/coumarin.php). While un- or mildly scented when fresh and green, as coumarin-containing plants dry and age they develop a sweet fragrance often compared to vanilla or new-mown hay. This helps explain why *hula* plant gatherers and *lei*-makers, who experience the plant fresh and as it dries, have a greater awareness, knowledge and preference for the more fragrant *laua'e* found in certain habitats.

Puanani Anderson-Fung, an ethnobotanist at the University of Hawai'i, specializes in the study of all plants known to the Hawaiian community as *laua'e.* An initial objective of her research was to determine the identity of the *laua'e* mentioned in hawaiian chants and lore prior to 1900, since the plant identified today as *laua'e* (a fern known scientifically as both *Phymatosorus grossus* and *Microsorum scolopendria* is thought to have been introduced to the

islands around 1900 (Wilson 2005: 43). Her work provides evidence that the original *laua'e*, which is deeply and emotionally connected to Hawaiian culture, is a native species found no where else in the world outside of Hawai'i. She refers to the native species (*Microsorum spectrum*) as *laua'e maoli ("true laua'e")* in order to distinguish it from the non-native *laua'e* that is abundant and easily accessible to all residents of Hawai'i. Through her extensive research regarding both the original native and the post-Contact *laua'e*, Ms. Anderson-Fung has acquired a thorough understanding of the physical features and habitats of both species.

Based on extensive field observations and ethnographic interviews Ms. Anderson-Fung concludes that *P. grossus* fronds are darker, thicker, more fragrant and with fewer sori in shady areas with high rainfall. She notes that the orographic rainfall that falls at the base of the Ko'olau Range provides ideal moisture conditions for achieving abundant, luxuriant and healthy stands of the most coveted forms *laua'e*. Ms. Anderson-Fung suggested that one mitigation measure that could be taken to protect the quality of *laua'e* in the project area would be to maintain a tree canopy surrounding stands set aside for gatherers as shade from an intact overstory is essential to maintaining a *laua'e* understory that is both fragrant and robust. She added that, ideally, the overstory should be replanted with native and Polynesian introductions, such as *kukui* (*Aleurites moluccana*).

Ms. Anderson-Fung, who serves on the advisory board of 'Ahahui Mālama I Ka Lōkahi, a Native Hawaiian conservation organization which exists to give voice to both Hawaiian cultural values and the conservation science aspects of Hawaiian environmental and resource management issues, acknowledges the scientific-physiologic and biogeographic reasons for *laua'e* selection preferences in the proposed project area. She also emphasizes the need to recognize the cultural significance of gathering the plant *in situ* and its reference to the, now rare, endemic Hawaiian plant *M. spectrum.* In an email sent to CSH and followup phone call on February 21, 2008, Ms. Anderson-Fung explained:

> The non-native fern identified today as *Laua'e* has become a vital part of Hawaiian culture. I use the term "vital" in the literal sense, to indicate that *Laua'e* is truly a source of support of the life of the culture. In the days before European contact, our ancestors related to plants in a deeply personal and emotional way and they used the plants in their vicinity on a daily basis. The French botanist Gaudichaud, who visited Hawai`i in 1819 observed that Hawaiians wore lei on a daily basis and availed themselves of all the fragrant plants, flowers and fruits in their local environment (see Anderson-Fung and Maly 2002). Unfortunately those plants and places are gone now. *Laua'e* has become a *lā'au hānai* , a term that I use to indicate that the plant has been "adopted" into Hawaiian culture and serves to "feed," or provide sustenance, to the host culture. My research has shown that all of the emotional and cultural importance of the fragrant and beloved native *Laua'e maoli (Microsorum spectrum)* has, over the years, been conferred upon the non-native *laua'e.* This change occurred gradually and imperceptibly, and it may be said that the newcomer holds virtually all of the significance of its native predecessor. Furthermore, since the native *Laua'e maoli* populations have become rare and sparse due to human activities and the introduction of non-native understory plants, using the non-native *Laua'e*

also removes collecting pressure from the now uncommon endemic *Laua'e maoli* fern.

As a vessel of Hawaiian cultural belief and values, collecting the *Laua'e* that grows in today's almost wholly alien environment provides native Hawaiians the ability to practice the uniquely Hawaiian protocols that engage us with the physical environment in a deeply respectful, emotional, and spiritual way that is at the very core of our culture and is a great part of what makes us Hawaiians. This is why I think it is very important that Hawaiians be allowed to gather in the old Hawaiian ways in an intact forest -- even if the vegetation of this forest is predominantly non-native. When we offer our entry chants and our gathering chants and offer our thanks to the non-human beings that live in the forest, we practice what it is to be Hawaiian. This can not be accomplished by picking ferns in a back yard or in an urban commercial setting. In summary, the *Laua'e* of this forest is not the *Laua'e* of the time of our ancestors, but, practially speaking, it is the only *Laua'e* we have left. It is a vessel for carrying our deeply emotional, profoundly spiritual Hawaiian ties to the land into a modern context.

Figures 40 and 41 present views of forest understory *laua'e* in the proposed project area.

Figure 40. *Laua'e* or *maile*-scented fern (*Phymatosorus grossus*), found in abundance in the project area, is noted for its superior glossy texture, thickness, color and fragrance

Figure 41. Understory *lauaʻe* located *mauka* of the Kawaʻewaʻe Heiau

7.3 Marine and Freshwater Resources

In pre-Contact times, the *ahupuaʻa* of Kāneʻohe offered fresh water from *mauka* (upland) springs and a well-developed fishpond system, making it both an agricultural and aquacultural center, and one of the primary population centers on Oʻahu (Devaney et al. 1982:6). Kāneʻohe Bay, with about two-dozen walled fishponds, was a bountiful source of fish (Devaney et al. 1982:6). McAllister recorded a number of fishponds in the vicinity of the current project area (Figure 14). Beyond Dr. Burrows reference to the *loko iʻa* (fishpond) in relationship to Ulupō Heiau, cultural consultations for this study did not discuss freshwater resources in or around the proposed project area.

7.4 Cultural Properties

For a complete consideration of the archaeological sites in and near the project area see the AIS report by McCurdy and Hammatt 2008. The proposed project area is noteworthy for several sites and features, many of which may be associated with the Kawaʻewaʻe Heiau. McAllister described the *heiau* as follows:

> Site 354. Kawaʻewaʻe Heiau, this is one of the five heiaus said to by John Bell to have been erected by Olopana. Ahukini, Pahukini, Holomakani, and Puumakani are the other four. It is on top of a small knoll and consists of one large enclosure 120 by 253 feet with a small terrace on the north side which follows the contours of the land. As the structure was used as a cattle pen for many years any traces of heiau features have been obliterated, and it is not known where the opening to the heiau was situated. The walls are massive, averaging about 5 feet in width and from 4 to 7 feet in height according to the contours of the land. The inside corners of the wall are rounded; the outside corners appear more angular.
>
> Thrum notes that this heiau was "Built by Olopana about the opening of the 12th century". It was mentioned as one of the heiaus constructed by the menehunes. Lonoaohi is said to have officiated as high priest.
>
> This is the heiau to which Olopana had Kamapuaa brought for sacrifice. Through treachery Kamapuaa is said to have killed Olopana and escaped. (McAllister 1933 in Sterling and Summers 1978:218).

The Kawaʻewaʻe Heiau was of primary interest to many of the community contacts interviewed for this assessment. Charles Ogata shared his many years of scholarship on the Kawaʻewaʻe Heiau, detailing his understanding of the features both inside and around the *luakini heiau* (Figures 24 to 38) and stressed that Kawaʻewaʻe Heiau should be viewed in relationship to the other four *heiau* built for ʻOlopana in the Koʻolaupoko area. Mr. Ogata theorizes that there is meaning, perhaps astrological or astronomical, to the alignment of the *heiau* and suggested exploring the spatial relationships of these *heiau*. In a follow up letter regarding the project, Mahealani Cypher (Culturer Interpreter) also discussed the importance of viewing the Kawaʻewaʻe Heiau as part of a complex of cultural features of the landscape and in association with other *heiau*:

> Standing upon Kawa‘ewa‘e Heiau, it is clear that the heiau was constructed strategically to be in the sight-line with Kukuiokane Heiau, the largest and most important heiau in the Kane‘ohe region. Also clearly visible from Kawa‘ewa‘e are the peaks of Pu‘u Ma‘eli‘eli and ‘Ohulehule, and the island known as Moku o Lo‘e (Coconut Island). Also clear from this site are the peaks of Konahuanui and Keahiakahoe, all of which bring stronger mana to elevate the spiritual and religious strength or power of Kawa‘ewa‘e. Our mo‘olelo tells us that the great chief Olopana (and others) occupied or visited at Kawa‘ewa‘e for some time; hence, it would have been a place where the po‘e kahiko (people of ancient times) brought their pleas for kokua, for resolution of disputes, or other requests for help. A great chief’s presence indicates the complex had to be quite extensive to support his entourage, his retainers and those who served the chief. Food had to be gathered by the kahuna and others from the surrounding area, and these goods had to be managed by the priests and their helpers at Kawa‘ewa‘e. It was a thriving mini-community of its own within the ‘ili of Kawa‘ewa‘e. Therefore, the location, prominence and connection with other major sites, and the historical record of Olopana’s presence, tell me that the heiau was not limited to the rock lined walls atop the ridge of Kawa‘ewa‘e, but had to contain an entire complex of associated structures and dwellings that housed and accommodated all who would be needed for a heiau of this prominence.

Earl Neller, Casina Waterman (President, Queen Emma Hawaiian Civic Club), the principals and members of the Ko‘olaupoko Hawaiian Civic Club (Elizabeth Lau, Mahealani Cypher, Donna and Wali Camvel) all spoke extensively of their understanding of the *heiau* and associated features, and expressed their concerns and recommendations regarding protection of the Kawa‘ewa‘e Heiau and surrounding sites (see Section 8).

A few of the cultural consultants for this study also commented on the *hōlua* or slide described by McAllister as Site 353 (McAllister 1933 in Sterling and Summers 1978:219). According to background research and historic maps, Site 355 was located in the southwestern portion of the project area. Mr. Ogata explained how Hawaiians created the sled course by making a rock track, covering it with grasses, and wetting it down for speed. He believes that the *hōlua* may have been on the ridge immediately south of the *heiau*, and that during certain seasons spectators would watch *hōlua* competition from the terraced midsection inside the *heiau.* During the group field interview of Mahealani Cypher, and Donna and Wali Camvel, all three expressed an interest in locating the *hōlua.* Ms. Cypher later wrote in a letter regarding the project:

> I recall I pointed out to you the two slopes, covered with trees and brush, just mauka of Kawa‘ewa‘e, where I believe the holua slides once were used by the chiefs for recreation. If the brush and trees were cleared and soft grasses re-planted on those slopes, they would adequately serve as fine holua slide areas. It is likely the nearby cemetery land once contained springs and ti leaf groves, and could have been the source of water needed to wet the slopes.

Mr. Neller shared his understanding of the location and type of *hōlua*:

> Also, on the ridge leading down from the ahupua‘a boundary (and above the small knoll where Pu‘u Makani Heiau was probably located) I crossed a steeply sloping dirt ramp (covered in dense vegetation) that seemed to be man made, and I thought it may have served as a holua in ancient times. One of the interesting things about holua in this area is that they are described as earthen troughs, rather than sloping stone platforms.

7.5 Burials

No human burials have been documented within the present project area (McCurdy and Hammatt 2008). Study contributors did not *specifically* mention knowledge of *iwi kūpuna* (ancestral remains) in the project area. However, Mr. Ogata explained that the *lua* or pits found inside and outside the *luakini* (lit, ‘many holes’) *heiau*, were used to bury the bones of those sacrificed. He is aware of at least one other *lua* for the disposal of sacrificial bones and suspects there could be more worthy of further investigation. Mr. Ogata refered to a stone alignment north of the *heiau* he believes may be a human burial site. In a site visit with CSH on October 3, 2007 Mr. Ogata was unable to locate the *lua*. It has been many years since he has visited the area and vegetation has overtaken the sites we visited hoping to locate *lua* and the possible human burial site. Further, Casina Waterman, William Ailā (Hui Mālama I Nā Kūpuna O Hawai‘i Nei), Mahealani Cypher and the Office of Hawaiian Affairs all expressed their concern that there could be *iwi kūpuna* in the area. Ms. Cypher commented that, “In all likelihood, there are burials in the area, probably pre-Contact, and this should be addressed through other research”.

7.6 Trails

Trails once served to connect the various settlements throughout O‘ahu. The most popular was the coastal route which circled O‘ahu. There were many trails traversing the mountain ranges (‘Ī‘ī 1959). John Papa ‘Ī‘ī (1959) documented early post-contact trails on the leeward side of O‘ahu Island. There is scant information on the network of *alaunui*, or pathways that once undoubtedly connected Kāne‘ohe to outlying communities. During the October 3, 2007 field visit to the Kawa‘ewa‘e Heiau, Mr. Ogata pointed out a trail (still used by hikers) he believes may have been used to connect ‘Olopana’s *heiau.*

Oneawa is a popular hiking trail still utilized today. The trail begins at the Friendship Garden on Kokokahi Street, off Kāne‘ohe Bay Drive. It follows the ridge formed by the Oneawa Hills, than descends to the end of Lipalu Street just below the Kawa‘ewa‘e Heiau. Oneawa is the name of an *‘ili* east of the project area (Figures 6 and 7). Steve Brown of the Hawai‘i Trail and Mountain Club shared that the club has been “hiking this route twice a year for the last ten years….The route is unique, in that it affords panoramic views of the surrounding area, along with the opportunity to visit and appreciate the heiau. It is clear from the condition of the trail that usage of the route predates our usage by many years.” He also mentioned that there are other groups that may be utilizing the area for hiking.

7.7 *Wahi Pana* (Storied Places)

Kāne‘ohe is rich in *mo‘olelo* (legends) concerning legendary references to the naming of Kāne‘ohe Ahupua‘a and other sites (Clark 2002, Paki 1972; Pukui et al. 1974; Sterling and Summers 1978). Of particular relevance to this cultural assessment are stories of the Kawa‘ewa‘e Heiau. Thrum (1906:48) reported that Kawa‘ewa‘e Heiau was erected in the beginning of the 12th century by the high chief ‘Olopana and constructed by *menehune* (legendary race of small people who built structures by night) (Fornander 1878:23). There are many versions of the story of Kamapua‘a (the notorious pig-god) and his capture and escape from sacrifice at the Kawa‘ewa‘e Heiau as told in books (e.g., Kalākaua 1990; Kame‘eleihiwa 1996) and by contributors to this cultural assessment (Charlie Ogata, Mahealani Cypher).

There are many cultural features of the landscape that are apart of, as Dr. Burrows called it, a *heiau* complex. During the June 23, 2007 field outing with Donna and Wali Camvel, and Mahealani Cypher, the group pointed out two large stones on a small rise above a temporary shelter. It was suggested that they may be *pōhaku kia‘i* or, stone guardians (Figures 21 and 22). One rock appears to be in the shape of a dog’s head (Figure 22), and Mahealani Cypher suggested that perhaps it was there to represent the Hawaiian god, Kāne. According to the group, together, the 2 *pōhaku kia‘i* appear to guard the area which may have been used by chiefs and their retinue for preparation, prayer and/or sacrifice. Ms. Cypher provided further explanation in her September 11, 2007 letter:

> My understanding is that stand-alone pohaku that had religious significance were usually known as “pohaku o Kane”, which we consider to be religious shrines and places of worship. At the site referred to as “CSH 5”… [the] stone by itself…is likely to have been a “pohaku o Kane”. I am not sure it would have marked the location of a caretaker’s hale or the home of the kahuna (priests), but that is possible. But Pohaku o Kane were generally just outside the door of many hale, serving as a family protector or shrine. In the case of the two pohaku seen at the area designated as “CSH 2”, I concur with Donna Camvel’s thinking that these serve as guardians and hence would be “pohaku ki‘ai”. The proximity of the two stones in a site which appears to have multi-level platforms, the size and shape of the two stones, indicated to me (and possibly to Donna Camvel) that this was a very important site. These pohaku ki‘ai may even have guarded the women of the hale o Papa, as the chiefess would have lived there and had the elevated status to warrant placement of such stones near her worship area.

Ms. Cypher also put forth the theory that *kūpuna* long ago may have planted mango trees to mark sacred sites for future generations. She bases her belief on the observation that many sacred areas she has visited around the Hawaiian Islands have had mango trees planted, often in a circle, around what may have been the *piko*, or center of *mana* (supernatural or divine power) of the *heiau.*

Section 8 Summary and Recommendations

At the request of Helber Hastert & Fee, Planners, Cultural Surveys Hawai‘i, Inc. (CSH) conducted a cultural impact assessment of the proposed Hawaiian Memorial Park (HMP) expansion project to support an Environmental Impact assessment being prepared for a Petition to amend the State Land Use boundaries of the project site from the State Conservation District to the State Urban District. Although the area of the proposed petition is only 56.6 acres, the cultural assessment and archaeological inventory project area studied by CSH is 66 acres (see Figure 1). The extra acreage was added as a study element in order to properly encompass potential archaeological and cultural sites, after the intial site visits, a literature search, and site plan changes required a reconsideration of the extent of the project area. For the purposes of this assessment, the 56.6 acres that comprise the area for State land use redesignation will be reffered to as the “Petition Area.” The 66 acres that comprise the area physically investigated by CHS will be referred to as the “Project Area.”

The owners are planning to expand the HMP on land they own, to the east of the existing HMP cemetery. In addition to building roads, mausoleums and other structures in the cemetery expansion area, the owners are planning to develop about 20 single-family lots on an approximately 4-acre part of the property on land adjacent to the Pohai Nani Retirement Home.

Background research indicated the importance of Kāne‘ohe Ahupua‘a and the proposed project area during the pre-Contact period. Kāne‘ohe Ahupua‘a and the project area vicinity were prime areas containing extensive natural and cultural resources including taro *lo‘i*, streams, and fishponds. The Kawa‘ewa‘e Heiau, which borders the northern boundary of the project area, was a center of religious activity with several associated habitation, agricultural, ceremonial and other sites extending throughout the project area (McCurdy and Hammatt 2008). In post-contact years, Kāne‘ohe has been widely used for the cultivation of rice, sugar and pineapple, and eventually beef cattle ranching and dairy farming. The post-World War II years, with the expansion of the Pali Highway connecting Honolulu to windward communities, coupled with economic factors, brought a development boom to Kāne‘ohe. Ranching and farming areas were replaced by residential subdivisions.

An effort was made to contact and consult with Hawaiian cultural organizations, government agencies, and individuals who might have knowledge of and/or concerns about the project area. Thirty-two people were contacted for the purposes of this cultural impact assessment, 27 people responded, and 10 *kūpuna* and/or *kama‘āina* were interviewed for more in-depth contributions to the cultural survey. Because a few of the community contacts approached for this cultural impact study actively oppose the proposed cemetery expansion, and/or are concerned about trespassing issues related to gathering plants, hunting, hiking and other cultural or recreational activities on HMP owned land, 3 of the cultural practitioners who contributed their comments to this study preferred to have their names withheld.

The findings of this cultural impact assessment suggest that there are two *primary* cultural concerns (and several ancillary ones) regarding the proposed HMP expansion project. The first is the preservation and protection of the Kawa‘ewa‘e Heiau and contiguous cultural properties. The second is gathering practices, particularly the on-going collection of *hula* and *lei* plants in the proposed project area. Community contacts interviewed for this assessment were divided

about whether the proposed cemetery expansion would aid or hinder the effort to *mālama* (care take, tend) Kawa‘ewa‘e Heiau and associated archaeological sites, and whether the proposed expansion would negatively impact the gathering of *hula* plants and other cultural and educational activities (e.g., hunting, school and *hula* groups visit the area to learn about Kawa‘ewa‘e Heiau and gathering practices).

Several interviewees and community contacts explicitly stated their complete opposition to the proposed HMP expansion project citing mainly cultural and conservation reasons (see, for example, Steve Brown, Linda Chang, Charlie Ogata, Grant Yoshimori, Casina Waterman, and the 3 unnamed interviewees). One interviewee explained that in Hawaiian perspective, culture and the environment are inextricably linked:

> Hawaiian culture and the land are one. Everything has a spirit. When we go to pick something, we always ask permission first and then give an offering after. I was brought up in a *hula* culture and that means respect for the land. The land goes with our names, our genealogy… Access to pick *hula* plants [if the cemetery expands] is not enough. [The proposed project] will violate our ancestors land.

Mrs. Chang lamented the loss of green spaces on the island of O‘ahu and also drew a link to cultural practice:

> The [proposed project area] is a place to find respite. How many parcels will be destroyed before the last greenbelt is all gone? Where will we be able to go to listen to the wind blow through the trees? Dollars speak louder than the grace and beauty of a place. We take children in the *hālau* to see the context of *hula* plants. Going to a park is not the same as taking them to the natural environment [in which *hula* plants are gathered]. The context of *hula* plants is very important.

Mrs. Elizabeth Lau, Pelekikena (President) of the Ko‘olaupoko Hawaiian Civic Club (KHCC), Mahealani Cypher, and Donna and Wali Camvel view the proposed HMP expansion as an opportunity to better preserve the Kawa‘ewa‘e Heiau and contiguous archaeological sites through the careful creation of *kīpuka*, or a protected area and buffer zone. Mrs. Lau commented that the HMP is “a beautiful place for the [Kawa‘ewa‘e] *heiau*….The cemetery is beautiful. If the cemetery [is expanded] they [Hawaiian Memorial Park] would have to care for the *heiau*. This would be educational for our younger people [and provide] a place to exercise, and a pretty place to sit and eat lunch.” The KHCC is currently the most active group care-taking the Kawa‘ewa‘e Heiau. They offered their assistance and *mana‘o* (thoughts, ideas, theories) and expressed their interest in establishing a collaborative agreement with the planners and owner regarding the protection and preservation of the Kawa‘ewa‘e Heiau and associated sites.

Boundaries and buffer zones (*kīpuka*) for the Kawa‘ewa‘e Heiau and associated sites were key topics of discussion. For example, study contributors Charlie Ogata, Earl Neller, Dr. Chuck Burrows and Casina Waterman questioned the boundaries of the *heiau* in regard to a proposed buffer zone. Ms. Waterman wondered if a buffer of “100 feet” from the walls of the heiau would adequately cover the sites just outside the walls of the heiau, including “a terrace and houses”. Mr. Ogata took CSH on a walking tour of the sites adjacent to the *heiau.* Mr. Neller wrote, “Understanding the boundaries of the heiau is important, because there may be features in your project area which could be relevant to the archaeological study and modern day use of the

heiau…. The extent of the heiau throughout its history is an archaeological question that has never been investigated.”

A few participants spoke about the proposed infrastructure and access to the Kawa‘ewa‘e Heiau. Jim Waddington (Hawai‘i Chapter of the Sierra Club) wrote in an email, “The attachments to your email…are disturbing... especially the map which shows a road almost adjacent to one corner of the heiau.” Earl Neller, sent an email stating, “One of the problems with visiting Kawa‘ewa‘e Heiau is that there is no good access: no good parking area, no good trail.” Regarding proposed roadways Mahealani Cypher wrote, “I am a little concerned about whether paved roadways would be appropriate through the undeveloped area we visited, all of which may be part of the heiau complex. On the day of our field trip, it was explained to us that the landowner wishes to build roadways in this area for the cemetery expansion. I would like to emphasize that this may be problematic.”

Some participants discussed the possibility of **burial sites**, or *iwi kūpuna* (ancestral remains) in the project area. Mr. Ogata explained that the *lua* or pits found inside and outside the *luakini* (lit, ‘many holes’) *heiau*, were used to bury the bones of those sacrificed. He also reported to have seen in the past what he believes is a burial site in the vicinity of the Kawa‘ewa‘e Heiau. Casina Waterman, William Ailā, Mahealani Cypher and the Office of Hawaiian Affairs all expressed their concern that there could be *iwi kūpuna* within the project area.

Hula and other cultural practitioners stressed the continued significance of **collection of *lei/hula* plants** gathered in the area. Though there are a number of plants that can be used as *lei* and *hula* plants in the project area (see Section 7: Gathering of Plant Resources) the focus of most study participants’ comments and concern was on *lauaʻe* or *maile*-scented fern (*Phymatosorus grossus*). Hula practitioners such as Linda Chang, and 3 unnamed study participants, detailed the care, collection and use of *lauaʻe*. As one contributor explained, “*Lauaʻe* found in the project area is noteworthy for its physiological characteristics of thickness, color and fragrance, and especially valuable to *hula hālau* for making adornments.” These interviewees also emphasized that common ornamental *lauaʻe* found in yards, in fact ubiquitous on O‘ahu, differ significantly from the type of *lauaʻe* most desired by cultural practitioners. According to these cultural specialists, *lauaʻe* found in the project area is unique, and cannot easily be found in Kāne‘ohe in such abundance outside of the proposed project area (with the exception of a remote patch off of the Pali Highway). As one participant commented, “…although you can find *lauaʻe* throughout the island, this is one of the few places you can find it in abundance. If you need *lei*(s) for 25 people, you can go to this one place.”

Again, there was a divergence of opinion regarding continued accessibility to *hula/lei* plants. Acknowledging that there are trespassing and liability issues at stake, some participants saw the HMP expansion project as a threat to continued access and fear destruction of plant resources and the “context” of gathering *hula* plants, while others view this as an opportunity to protect *lauaʻe* (and other plant resources) and establish a formal protocol for accessing plants. The September 27, 2007 letter from the Office of Hawaiian Affairs recommended: “Consideration be afforded to any groups or individuals accessing the project area for constitutionally protected traditional and customary purposes.”

Among study participants for this cultural assessment there was consensus that the proposed residential subdivision planned adjacent to the Pohai Nani Retirement Home would endanger the

integrity of the Kawa‘ewa‘e Heiau and associated sites. For example, Dr. Chuck Burrows commented, “Sewer lines [and other aspects of the development], especially where the subdivision is planned, could impact the sites.” Mrs. Lau, though a strong proponent of the proposed HMP expansion, expressed her concern about the possible subdivision, “Better a cemetery than housing. If you have housing, that would damage the *heiau*.” There is also shared sentiment that conservation land should not be developed. In the words of one participant, “Don’t touch conservation land. Preserve the flora and fauna…. Green space is increasingly rare on this island.”

The companion archaeological inventory survey reports that eleven **archaeological sites** were recorded within or near the current project area (McCurdy and Hammatt 2008). This confirms the observations and assumptions of cultural consultants for this assessment that the Kawa‘ewa‘e Heiau is a *complex* with potentially several associated cultural properties to be identified (e.g., *hōlua* sled course, Hale o Papa), investigated and protected for current and future generations. The point was repeatedly made that the Kawa‘ewa‘e Heiau and environs are frequently visited by school and other community groups (e.g., Kamehameha Schools and Hakipu‘u Learning Center, KHCC) and is vital to cultural education.

Beyond cultural concerns, there are other issues some of the community contacts raised in regard to the proposed development. Some community contacts are concerned that the cemetery will bring more traffic and crime, and generally disrupt the quiet of the neighborhood. One participant remarked, “[Now] the neighborhood is safe and protected. Any stranger comes up here and everybody knows it.” Flooding in the Pikoiloa neighborhood is another issue raised by a few of the community contacts: “The community is concerned about drainage issues. There was a mud slide and flood in the 1980s that ran through peoples’ homes and killed one person.”

As with any development project, there are a variety of viewpoints and concerns voiced by the individuals who have participated in this assessment, ranging from those who believe that appropriate project design and planning can improve and enhance access to cultural and natural resources, to those who are concerned that the potential project impacts cannot be reasonably mitigated. Over the course of conducting this assessment, CSH received numerous phone calls, emails and letters expressing opposition to the proposed HMP expansion. For the purposes of this cultural impact assessment, only communiqués directly related to cultural concerns are included in the report recommendations. The following mitigation measures are recommended by CSH to address the potential adverse impacts of the proposed action on Hawaiian cultural beliefs, practices and resources by the HMP expansion project:

1. Recognize that the Kawa‘ewa‘e Heiau is part of a complex of cultural sites, not a discrete site. It is recommended that plans and the design for the cemetery be integrated with the religious significance of the area surrounding Kawa‘ewa‘e Heiau and it be ensured that significant archaeological sites and cultural features of the landscape are buffered and protected from any roadways, bulldozing or other intrusive activity. Additionally, Kawa‘ewa‘e Heiau complex should be protected and seen in relationship to other sacred sites in the Ko‘olaupoko District. **The owner has stated the intent to preserve the significant archaeological sites, and to incorporate buffer zones (*kīpuka*) as recommended by CSH and as indicated in the proposed project plans.**

2. The Kawa‘ewa‘e Heiau (SIHP # 50-80-10-354), currently on the National Register of Historic Places, has been evaluated as significant under both Criterion D and E of the Hawai‘i Register of Historic Places and should be registered with the State. **The owner has stated the intent to register SIHP #. 50-80-10-354 with the State of Hawai‘i.**
3. All cultural properties and archaeological sites in and near the project area should be investigated, preserved and protected through the creation of *kīpuka* (protected areas and buffers) as appropriate. *Kīpuka* should be designed in careful consideration of site boundaries and in relationship to contiguous sites. **The owner has stated the intent to preserve the significant archaeological sites, and to incorporate buffer zones (*kīpuka*) as recommended by CSH and as indicated in the proposed project plans.**
4. **The owner has stated the intent to continue consultation with appropriate state agencies, such as OHA, throughout the planning and development process to ensure appropriate evaluation and protection of archaeological and cultural resources. This consultation is required by law and will be continued throughout the process.**
5. The owner is invited to have the project reviewed by OHA’s Native Hawaiian Historic Preservation Council (NHHPC) if there is need for further consultation regarding handling of archaeological sites. **The owner has stated the intent to continue to consult with all appropriate groups such as the NHHPC concerning the handling of archaeological sites.**
6. Personnel involved in development activities in the project area should be informed of the possibility of inadvertent cultural finds, including human remains. Should cultural or burial sites be identified during ground disturbance, all work should immediately cease, and the appropriate agencies notified pursuant to applicable law. **The owner has stated the intent to provide a mandatory education program for any entity or personnel working within the project site to ensure that appropriate protective and notification action is undertaken should any inadvertent cultural or archaeological finds take place.**
7. Cultural monitoring should be conducted during all phases of development. **The owner has stated the intent to ensure that a cultural and archaeological monitor shall observe all grading and excavation activities to provide verification that cultural and archaeological finds have been protected.**
8. On-going cultural practices, such as the gathering of *hula* and *lei* plants, should be recognized and accommodated (subject to safety and liability issues). **As provided by law and subject to appropriate safety and liability indemnification, the owner has stated the intent to accommodate native Hawaiian gathering of *hula* and *lei* plants. To the degree feasible, these plant communities shall be enhanced and expanded within the buffer areas and permanent open space areas as appropriate.**
9. In particular, protect the areas where *lauaʻe* (*Phymatosorus grossus*) is most concentrated. *Lauaʻe* found in the project area is noteworthy for its physiological

characteristics of thickness, color and fragrance, and is especially valuable to several *hula hālau* in Kāne'ohe and neighboring windward communities. It is recommended that the availability, abundance and quality of *lauaʻe* ferns be protected through the creation of plant gathering *kīpuka*, including maintenance of an intact overstory. **The owner has stated the intent to protect overstory for all undisturbed areas and to enhance *lauaʻe* fern plant communities to the degree feasible and practicable.**

10. Community members and groups responsible for the long-term care of the Kawa'ewa'e Heiau, as well as cultural practitioners who utilize the area for gathering and cultural education activities, should be further consulted regarding the above issues and other concerns throughout the planning, development and operation of the proposed HMP expansion. This consultation should include all interested community groups and individuals who have a stake in the project area through their involvement in long-term care of the Kawa'ewa'e Heiau, plant-gathering or other cultural issues. The owner has requested of various members of community groups wishing to have access to and maintenance permission for the *heiau* and related areas to begin the process of forming an appropriate master organization and preparing a master plan for the long term management, enhancement, maintenance, visitation activities, and financial requirements for the *heiau* complex and related issues such as plant gathering and plant community enhancement and other important cultural activities. **The owner has stated the desire to continue to work with the appropriate individuals and groups on this matter and to participate at some appropriate level in the development of this master plan document.**

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Appendix A: Community Consultation Letters

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

HRD06/2039

April 5, 2007

Lisa Gollin
Cultural Surveys Hawaii, Inc.
P.O. Box 1114
Kailua, HI 96734

RE: Cultural Impact Assessment Consultation for the Proposed Expansion of Hawaiian Memorial Park, Kāne'ohe, O'ahu, TMK (1) 4-5-003: por. 1.

Dear Lisa Gollin,

The Office of Hawaiian Affairs (OHA) is in receipt of your March 5, 2007 submission and offers the following comments:

Please submit a summary (type and function assessments, significance evaluations, plan view maps, etc.) of the known historic properties within the vicinity of Kawa'ewa'e Heiau as adjunct to the above-listed consultation request. The above-listed correspondence does not contain the type of information that would allow our staff to make substantive recommendations at this time. The ambiguity regarding the size and scale of the proposed action also makes it difficult for our staff to make meaningful recommendations.

You may wish to contact Elizabeth Lau of the Ko'olaupoko Hawaiian Civic Club as she may have information or recommendations specific to the proposed action. Thank you for your correspondence.

OHA 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 (SHPD/DLNR) shall be contacted.

Thank you for the opportunity to comment. If you have further questions or concerns, please contact Jesse Yorck, Native Rights Policy Advocate, at (808) 594-0239 or jesseyo@oha.org.

Aloha,

Clyde W. Nāmu'o
Administrator

A.1 Initial April 5, 2007 review letter from the Office of Hawaiian Affairs

June 14, 2007

Ms. Lisa Gollin
Cultural Surveys Hawaii, Inc.
P.O Box 1114
Kailua, HI 96734

Dear Ms. Gollin:

I'm responding to your May 2007 flyer entitled "Requesting Your Mana'o and Kokua on a Cultural Survey". I am aware of several cultural practices taking place on the Mahinui Mountainside, and would like to share these with you.

- There are at least four Hawaiian hula halau which visit the area to gather plants to make their traditional Hawaiian hula leis.
- I have seen people going hunting into the hillside, and personally know someone who has hunted for pigs in the area.
- Many people use the area for hiking. It is a well known hiking trail. And it has been sited in the Honolulu Advertiser by Richard McMahon.
- Schools tour the archeological sites and use it for cultural education purposes. I have personally seen Kamehameha Schools and Hakipu'u Learning Center children visiting and learning about the area.
- The area is also frequented by people who engage in combat exercises.

As you can see, there are quite a few cultural uses of the land. I hope that Service Corporation International (dba Hawaiian Memorial Park) will endeavor to keep the land in its natural state so these cultural practices can continue.

Sincerely,

Grant Yoshimori
45-464 Lipalu St.
Kaneohe, HI 96744

cc: B.Harris
J.McCreedy
L.Ching
R.Kim

A.2 June 14, 2007 letter from Grant Yoshimori, Hui O 'Piko'iloa

M A H E A L A N I C Y P H E R
P. O. Box 4749
Kane`ohe, HI 96744
malamapono@aol.com

September 11, 2007

Ms. Lisa Gollin, Projects Manager
Cultural Impact Assessments
Cultural Surveys Hawai`I, Inc.
Post Office Box 1114
Kailua, HI 96734

Re: Comments Regarding Your Notes Concerning our Site Visit
to TMK (1) 4-5-033:001, Hawaiian Memorial Park Expansion

Dear Ms. Gollin:

Mahalo for this opportunity to comment on your field notes of our recent site visit to the property on which Hawaiian Memorial Park is contemplating making improvements. My comments are as follows:

1. Overall: You are correct in noting that all of us who visited the area agree that it has connection with Kawa`ewa`e Heiau, a religious site sacred to native Hawaiians. As such, the surrounding area would also have religious significance as part of the heiau complex. With a luakini heiau as prominent as Kawa`ewa`e, there is little doubt that there would have been associated sections of the property nearby that complete the full operation of the heiau in keeping with its use and purpose. Its connection with Chief Olopana and Kamapua`a, for example, would further support its having a complex of associated

compartments – not just a hale for the kahuna – to include the hale o papa and other key elements. (see item #5)

2. Pohaku: you refer to certain stones as "pohaku", although my understanding is that stand-alone pohaku that had religious significance were usually known as "pohaku o Kane", which we consider to be religious shrines and places of worship. At the site referred to as "CSH 5", you mention a stone by itself as a "pohaku" when it is likely to have been a "pohaku o Kane". I am not sure it would have marked the location of a caretaker's hale or the home of the kahuna (priests), but that is possible. But Pohaku o Kane were generally just outside the door of many hale, serving as a family protector or shrine. In the case of the two pohaku seen at the area designated as "CSH 2", I concur with Donna Camvel's thinking that these serve as guardians and hence would be "pohaku ki`ai". The proximity of the two stones in a site which appears to have multi-level platforms, the size and shape of the two stones, indicated to me (and possibly to Donna Camvel) that this was a very important site. These pohaku ki`ai may even have guarded the women of the hale o Papa, as the chiefess would have lived there and had the elevated status to warrant placement of such stones near her worship area.

3. Mo`olelo about Olopana and Kamapua`a: I believe the story I shared with you about Kamapua`a overcoming Olopana at Kawa`ewa`e was learned from a translation provided by historian Dr. Lilikala Kame`eleihiwa in her book, "Kamapua`a".

4. Holua slides: I recall I pointed out to you the two slopes, covered with trees and brush, just mauka of Kawa`ewae, where I believe the holua slides once were used by the chiefs for recreation. If the brush and trees were cleared and soft grasses re-planted on those slopes, they would adequately serve as fine holua slide areas. It is likely the nearby cemetery land once contained springs and ti leaf groves, and could have been the source of water needed to wet the slopes.

5. Location and Relationship to broader Kane`ohe ahupua`a and other heiau: Standing upon Kawa`ewa`e Heiau, it is clear that the heiau was constructed strategically to be in the sight-line with Kukuiokane Heiau, the largest and most important heiau in the Kane`ohe region. Also clearly visible from Kawa`ewa`e are the peaks of Pu`u Ma`eli`eli and `Ohulehule, and the island known as Moku

o Lo`e (Coconut Island). Also clear from this site are the peaks of Konahuanui and Keahiakahoe, all of which bring stronger mana to elevate the spirititual and religious strength or power of Kawa`ewa`e. Our mo`olelo tells us that the great chief Olopana (and others) occupied or visited at Kawa`ewa`e for some time; hence, it would have been a place where the po`e kahiko (people of ancient times) brought their pleas for kokua, for resolution of disputes, or other requests for help. A great chief's presence indicates the complex had to be quite extensive to support his entourage, his retainers and those who served the chief. Food had to be gathered by the kahuna and others from the surrounding area, and these goods had to be managed by the priests and their helpers at Kawa`ewa`e. It was a thriving mini-community of its own within the `ili of Kawa`ewa`e. Therefore, the location, prominence and connection with other major sites, and the historical record of Olopana's presence, tell me that the heiau was not limited to the rock lined walls atop the ridge of Kawa`ewa`e, but had to contain an entire complex of associated structures and dwellings that housed and accommodated all who would be needed for a heiau of this prominence.

6. Mango trees: I still maintain that the mango trees were chosen by some kahuna to mark important religious sites. This occurred after the heiau were torn down or burned by the Priest Hewahewa following the breaking of the kapu system. Your recollection of what I told you – my "mango tree theory" – is a very good rendering – mahalo. It's not just the planting of the trees that was interesting; but how the trees were planted, often in a circle around what may have been the piko, or center of mana in that heiau. I recall in the mid-1980s, I took a group of kupuna (elders) from Kane`ohe to see Kukuiokane Heiau. We stood in the fern-covered open center of a grove of large old mango trees that seemed to have been planted in this oval orientation, down the slope of Punalu`u mauka (some say it was `ili Kihapa`i). After our pule (prayers) were said, the kupuna stood quietly, observant and calm. Later, they told me they felt the mana of the heiau was strongest here, in the piko, in the center of this circular grove of ancient mango trees. Although the mango is an alien species here on O`ahu, its appearance here a few short years after the heiau were destroyed would have been convenient and desirable to those kahuna wishing to mark their sacred sites with a tree that they were told would survive for a very long time.

7. Recommendation: It is my recommendation that the landowner consider integrating its plans with the religious significance of the area surrounding

Kawa`ewa`e Heiau's walled enclosure, ensuring that the more obvious and significant cultural properties are buffered and protected from any roadways, bulldozing or other intrusive activity. In all likelihood, there are burials in the area, probably pre-contact, and this should be addressed through other research. Although the area in modern times was used for farming and urban activities, the radius in the currently undeveloped landscape adjacent to the walled section of Kawa`ewa`e is relatively undisturbed (except from dirt-bikers and others) and was probably kept that way for a good reason. I request to be further consulted, should you proceed with additional research for the current or expanded project area.

Again, thank you for this opportunity to offer comment.

Malamapono,

MAHEALANI CYPHER

Cultural Interpreter

A.3 September 11, 2007 letter from Mahealani Cypher

K. Traffic Impact Study

(Perazim Consulting, LLC)

LINDA LINGLE
GOVERNOR

BRENNON T. MORIOKA
DIRECTOR

Deputy Directors
MICHAEL D. FORMBY
FRANCIS PAUL KEENO
BRIAN H. SEKIGUCHI
JIRO A. SUMADA

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

IN REPLY REFER TO:

HWY-PS
2.9209

September 18, 2008

Mr. Jay Morford
Hawaiian Memorial Life Plan, Ltd.
130 Maunakea Street
Honolulu, Hawaii 96813

Dear Mr. Morford:

Subject: Hawaiian Memorial Park Cemetery Expansion

The proposed expansion—grave sites and residential—is not anticipated to have a significant impact on our State highway facilities. However, we request that the Hawaiian Memorial Park provide a traffic signal warrant study for our Highways Traffic Branch. The particulars for the study have already begun between our Traffic Branch and the Hawaiian Memorial Park consultants.

If there are any questions regarding this letter, please contact Ken Tatsuguchi, Head Planning Engineer, Highways Division, at 587-1830. Please reference file review number 08-229 in all contacts and correspondence.

Very truly yours,

BRENNON T. MORIOKA, Ph.D., P.E.
Director of Transportation

TRAFFIC IMPACT ANALYSIS STUDY

HAWAIIAN MEMORIAL PARK EXPANSION

KANEOHE, OAHU, HAWAII

APRIL 2008

Prepared For:

CLARK & GREEN ASSOCIATES

150 Paularino Avenue, Suite 160

Costa Mesa, California 92626

Prepared By:

PERAZIM CONSULTING, LLC

P.O. Box 700466

Kapolei, Hawaii 96709-0466

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TRAFFIC IMPACT ANALYSIS STUDY

HAWAIIAN MEMORIAL PARK EXPANSION

KANEOHE, OAHU, HAWAII

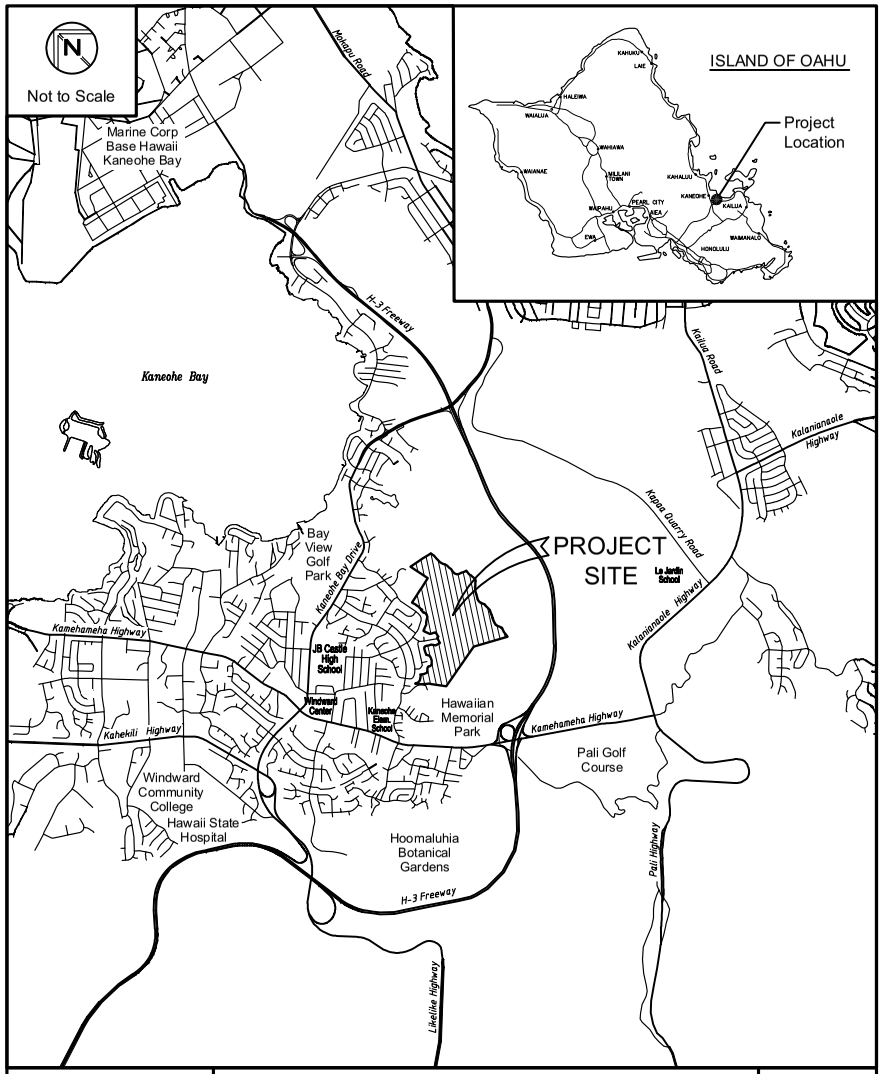
I. INTRODUCTION

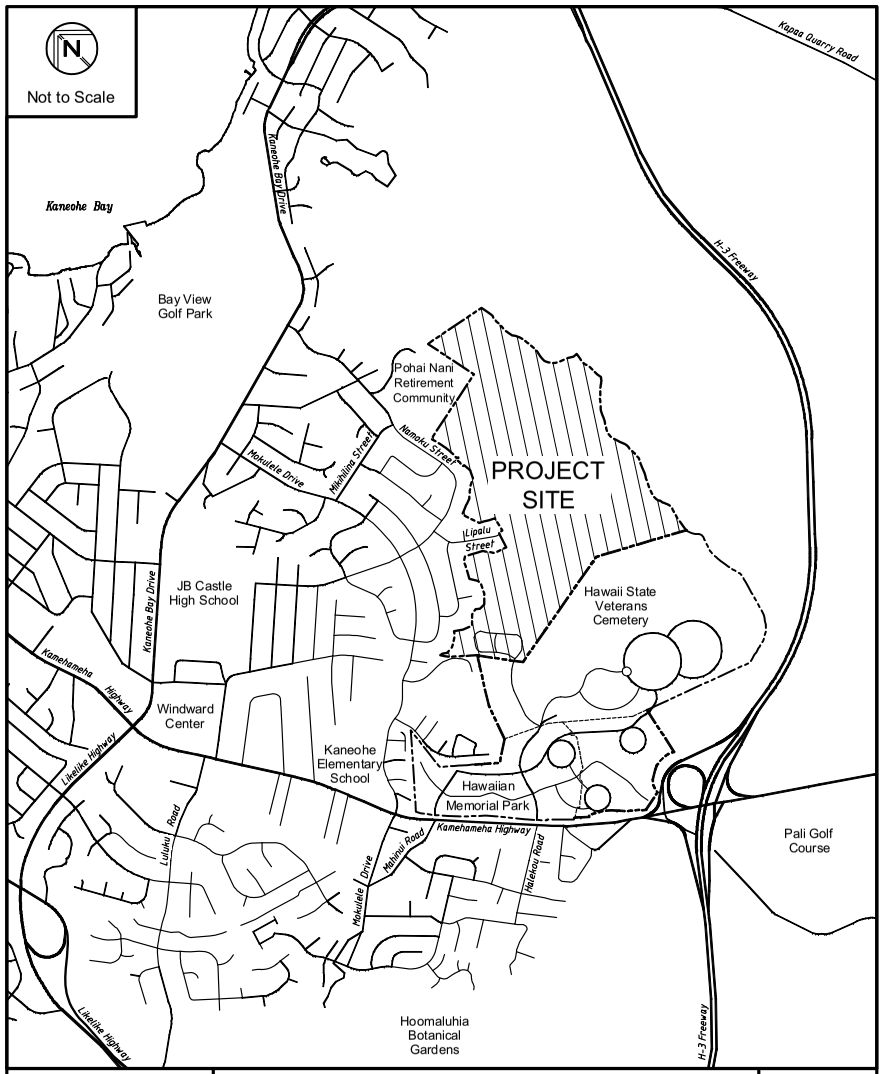
This report summarizes the analysis and findings of a traffic study for three alternatives for the proposed expansion of Hawaiian Memorial Park (HMP), located in Kaneohe on the island of Oahu. This traffic study describes the potential traffic impacts of the proposed land use alternatives and identifies mitigation measures, as appropriate.

II. PROJECT DESCRIPTION

A vicinity map for the Hawaiian Memorial Park is displayed in Figure 1 and a location map is given in Figure 2. The existing Hawaiian Memorial Park contains 72.00 acres and is located at TMK 4-5-34:013 and TMK 4-5-35:008. The neighboring Hawaii State Veterans Cemetery of 122.50 acres is designated as TMK: 4-5-33:002. The Hawaiian Memorial Park and Hawaii State Veterans Cemetery currently share the same driveway connections at the Kamehameha Highway intersection with Halekou Road and at the Kamehameha Highway intersection with Mahinui Road. The primary memorial park driveway is located across Halekou Road and secondary driveway is aligned directly across Mahinui Road

The proposed Hawaiian Memorial Park expansion area of 56.6 acres is situated within TMK 4-5-33:001. Three alternative land use scenarios, referred to as Alternative A, Alternative B, and Alternative C are analyzed in this traffic study.



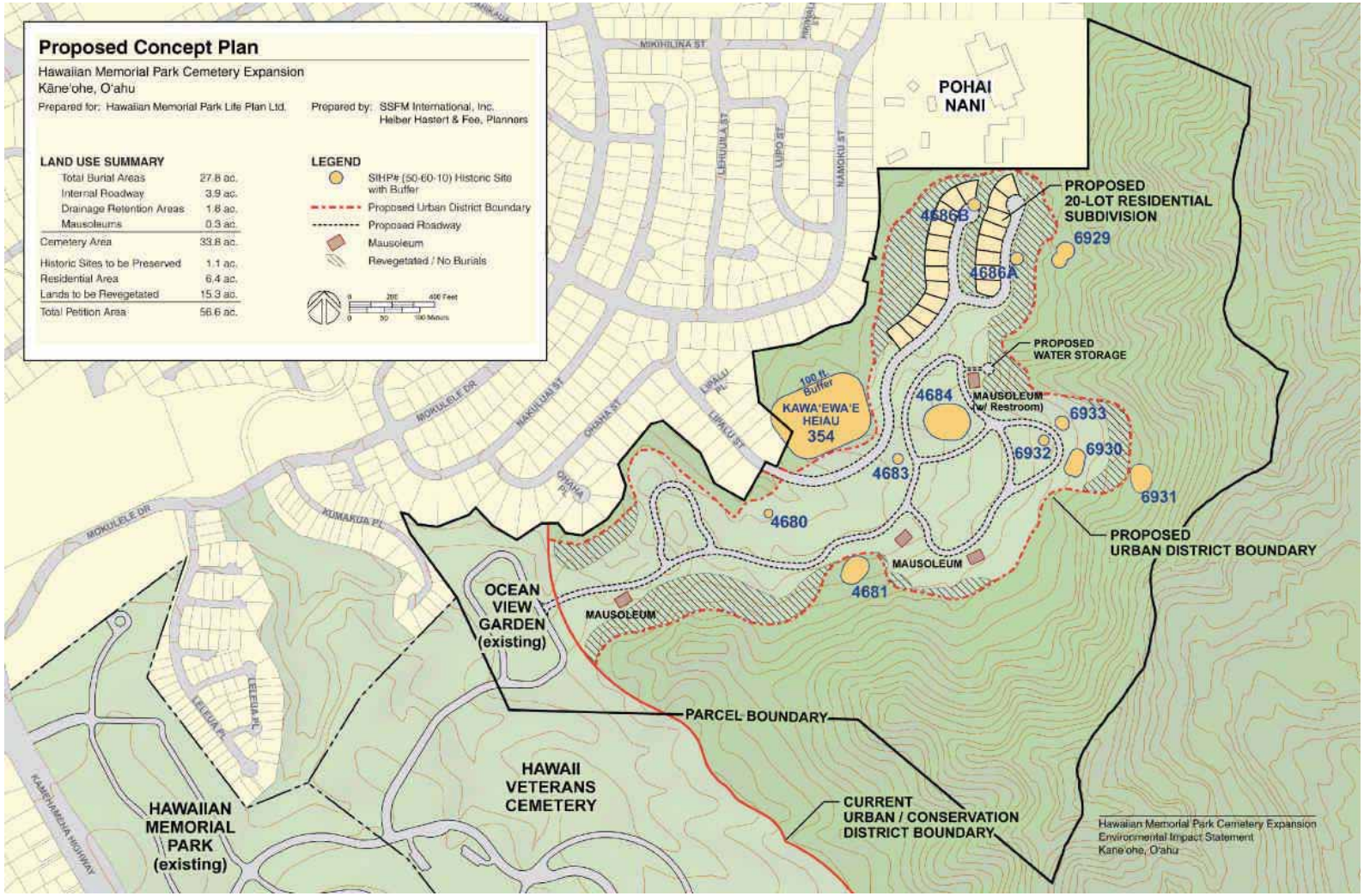


PERAZIM CONSULTING, LLC	Hawaiian Memorial Park Expansion Location Map	FIGURE 2

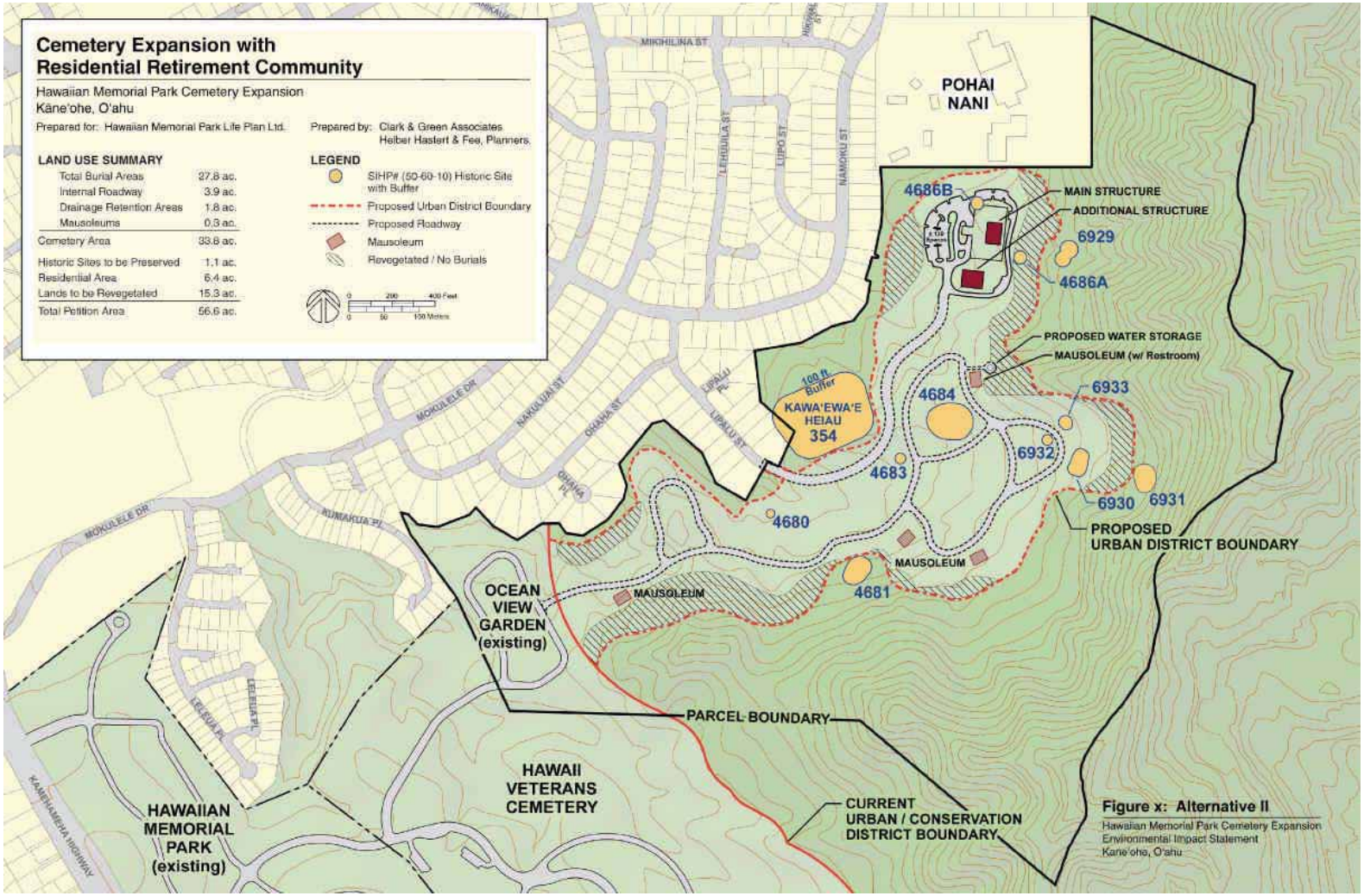
For Alternative A, the Hawaiian Memorial Park will be expanded and a residential subdivision of 20 single-family units is proposed. The residential subdivision would have access onto Lipalu Street while the memorial park expansion would utilize the two existing driveways at the Kamehameha Highway intersection with Halekou Road and at the Kamehameha Highway intersection with Mahinui Road. The Alternative A layout is depicted in Figure 3.

With Alternative B, the Hawaiian Memorial Park will be expanded and a residential retirement community would be constructed containing approximately 125 senior apartment units. Access for the new senior apartment units would be via Lipalu Street. The expanded area of the Hawaiian Memorial Park would served by the two existing Kamehameha Highway intersections at Halekou Road and at Mahinui Road. The site map for Alternative B is shown in Figure 4.

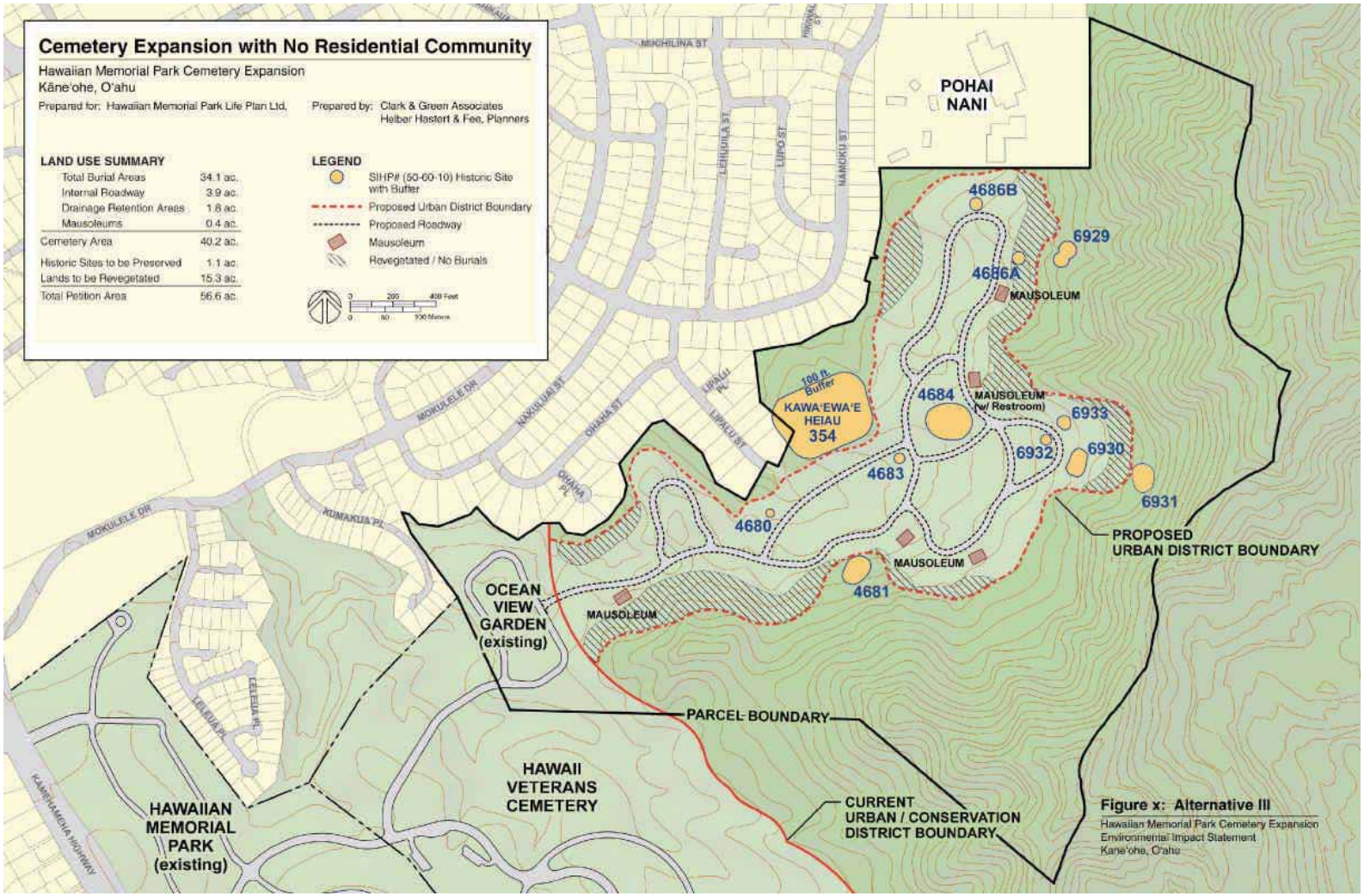
For Alternative C, the Hawaiian Memorial Park cemetery would be expanded. There would be no residential component. Access to the expanded cemetery area would be through the primary driveway at the Kamehameha Highway intersection with Halekou Road and the secondary driveway the Kamehameha Highway intersection at Mahinui Road. The site plan for Alternative C is given in Figure 5.



PERAZIM CONSULTING, LLC	ALTERNATIVE A SITE PLAN HAWAIIAN MEMORIAL PARK EXPANSION AND RESIDENTIAL SUBDIVISION	FIGURE 3



PERAZIM CONSULTING, LLC	ALTERNATIVE B SITE PLAN HAWAIIAN MEMORIAL PARK EXPANSION WITH RESIDENTIAL RETIREMENT COMMUNITY	FIGURE 4



PERAZIM CONSULTING, LLC	ALTERNATIVE C SITE PLAN HAWAIIAN MEMORIAL PARK EXPANSION WITH NO RESIDENTIAL COMMUNITY	FIGURE 5

III. STUDY METHODOLOGY

Various types of traffic information, including roadway laneage and traffic volume data, are collected to establish existing traffic conditions. Future traffic forecasts without the proposed alternatives are developed to identify future baseline conditions. Project traffic volumes are estimated and the future traffic assignments with Alternative A, Alterative B and Alternative C are analyzed. The analytical comparison of future traffic conditions with and without Alternatives A, B and C determines the project-related traffic impacts. Traffic mitigation measures are identified as needed.

IV. EXISTING TRAFFIC CONDITIONS

The analysis of existing traffic conditions establishes the current traffic operating conditions for the traffic study. Existing data, such as roadway geometrics, traffic volume data, current traffic signal phasing and timing, intersection laneage and signage are collected for this analysis.

The existing Hawaiian Memorial Park site shares two driveways with the neighboring Hawaii State Veterans Cemetery. The site is bordered by existing residential subdivisions to the northwest, Kamehameha Highway to the southwest, H-3 Freeway to the south and hilly terrain on the eastern side of the property.

A. Existing Roadway System

Kamehameha Highway is a State highway that links the Kaneohe area with the communities along the northeast coast of Oahu and into Central Oahu, Pearl City and Honolulu. In vicinity of the project, Kamehameha Highway is a divided four-lane highway with 12-foot travel lanes and left turn lanes within the median area at selected intersections.

Kaneohe Bay Drive links Kaneohe town and Kailua town. Kaneohe Bay Drive begins as a four-lane divided highway with 12-foot travel lanes at its connection to Likelike Highway and transitions to a two-lane undivided highway with 12-foot travel lanes between Castle High School and Nohea Place.

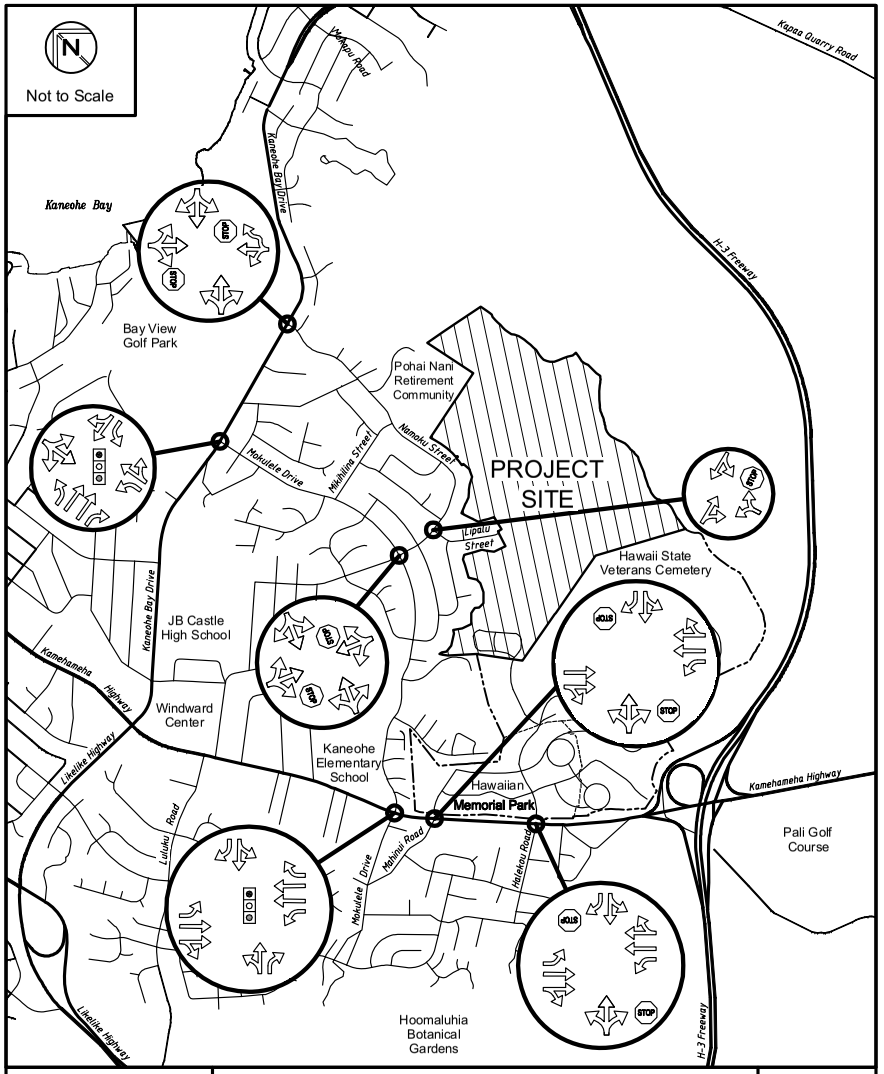
Halekou Road and Mahinui Road are two-lane collector roads for the residential subdivisions on the west side of Kamehameha Highway. Mokulele Drive, Namoku Street are collector roads while Mihikilina Street and Lipalu Street are two-lane local roadways within the residential subdivisions on the east side of Kamehameha Highway. Mokulele Driveway terminates at Kamehameha Highway and at Kaneohe Bay Drive in signalized intersections. Parking is allowed along these residential streets, but most motorists park away from the intersections which permits right turn movements to travel around other motorists waiting to execute left turn or through movements at the intersections.

For this study, seven study intersections were selected for analysis to identify the potential traffic impacts for Alternative A and Alternative B. The intersection laneage configurations are identified in Figure 6.

- Kamehameha Highway and Halekou Road
  (Alternatives A, B and C cemetery expansion primary access)
- Kamehameha Highway and Mahinui Road
  (Alternative A, B and C cemetery expansion secondary access)
- Kamehameha Highway and Mokulele Street
- Kaneohe Bay Drive and Mokulele Street
- Kaneohe Bay Drive and Namoku Street
- Mokulele Street and Namoku Street
- Namoku Street and Lipalu Street
  (Alternative A residential subdivision access and
  Alternative B residential retirement community access)

B. Traffic Counts

Manual turning movement count data and field observations were collected at the ten study intersections. The traffic counts were conducted on April 11-12 and 18-19, 2007. Weather conditions varied from sunny to cloudy and rainy, which are typical for Windward Oahu.



PERAZIM CONSULTING, LLC	Hawaiian Memorial Park Expansion Existing Intersection Configurations	FIGURE 6

The manual traffic count data is contained in Appendix A. The existing morning and afternoon peak hour traffic volumes are presented in Figure 7.

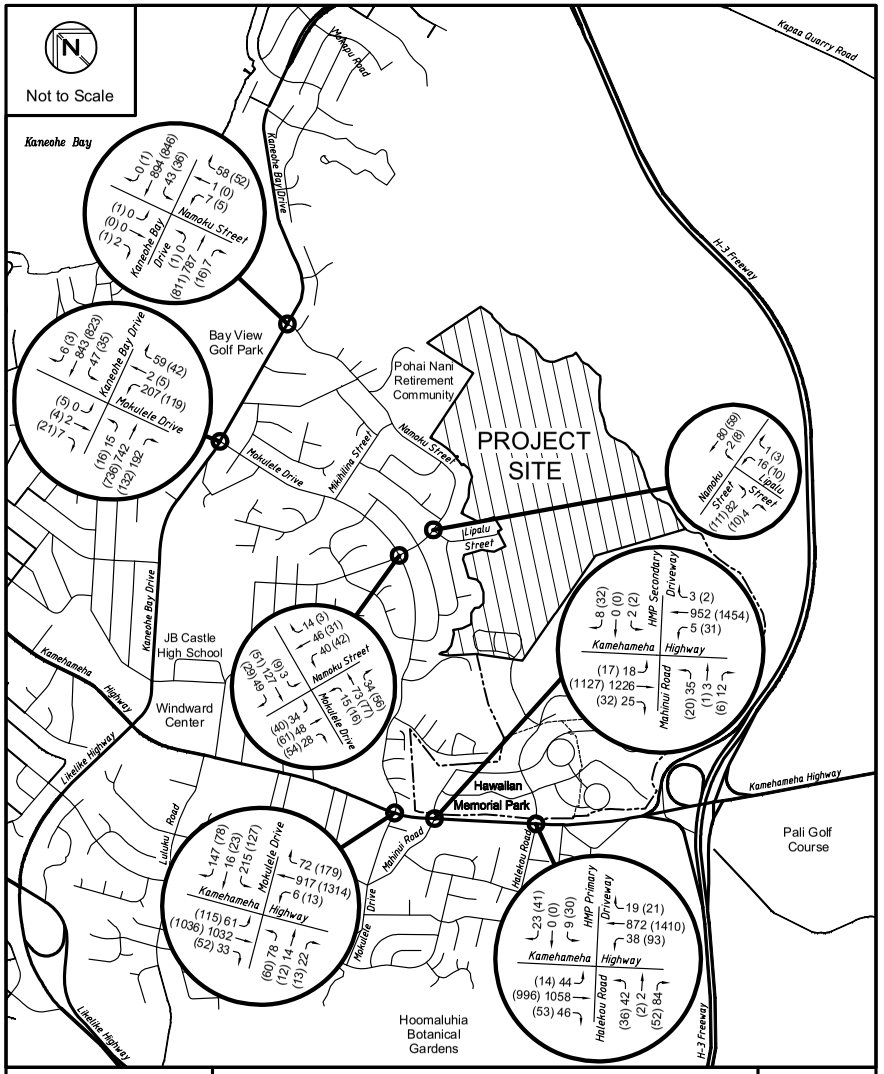
C. Analysis Results

This report utilizes the Highway Capacity Manual (HCM) 2000 analytical methodology for unsignalized intersections and signalized intersections. The analysis results provide Level of Service conditions, which are rated from A to F (best to worst), and capacity conditions. Level of Service represents a qualitative measure of traffic operating conditions and considers speed, travel time, freedom to maneuver, types of traffic controls and interruptions as well as driver comfort and convenience. Level of service definitions for unsignalized intersections and signalized intersections are summarized in Appendix B.

The analysis results of the five unsignalized study intersections are summarized in Table 1. The morning peak hour conditions at the unsignalized intersection of Kamehameha Highway, Halekou Road and the HMP primary driveway are at Level of Service D or better. However, the primary cemetery driveway experiences Level of Service F conditions during the afternoon peak hour.

For the unsignalized intersection of Kamehameha Highway, Mahinui Road and HMP secondary driveway, the Mahinui Road approach experiences Level of Service E conditions during the morning and afternoon peak hours. The left turn and through movements at the cemetery secondary driveways experience Level of Service E conditions during the afternoon peak hour.

The unsignalized intersection of Kaneohe Bay Drive and Namoku Street has Level of Service F conditions at the northbound left turn and through movements during the morning and afternoon peak hours. The southbound approach operates with Level of Service E conditions during the afternoon peak hour; this approach provides access for the Bay View Estates subdivision currently under construction.



PERAZIM CONSULTING, LLC

Hawaiian Memorial Park Expansion

Existing Traffic Volumes

FIGURE 7

Table 1

EXISTING TRAFFIC CONDITIONS
UNSIGNALIZED INTERSECTION ANALYSIS RESULTS

	AM Peak Hour Delay (seconds)	AM Peak Hour LOS	PM Peak Hour Delay (seconds)	PM Peak Hour LOS
Kamehameha Highway, Halekou Road and HMP Primary Driveway				
Kamehameha Highway				
Northbound Left Turn	11.1	B	11.4	B
Southbound Left Turn	10.0	B	12.9	B
Halekou Road				
Eastbound Approach	30.7	D	34.8	D
HMP Primary Driveway				
Westbound Approach	16.7	C	44.6	E
Westbound Left Turn/Through Movement	29.7	D	84.1	F
Westbound Right Turn	11.6	C	15.7	C
Kamehameha Highway, Mahinui Road and HMP Secondary Driveway				
Kamehameha Highway				
Northbound Left Turn	11.6	B	11.3	B
Southbound Left Turn	10.2	B	13.1	B
Mahinui Road				
Eastbound Approach	36.8	E	36.0	E
HMP Secondary Driveway				
Westbound Approach	14.5	B	17.4	C
Westbound Left Turn/Through Movement	25.6	B	44.6	E
Westbound Right Turn	11.8	B	15.7	C
Kaneohe Bay Drive and Namoku Street				
Kaneohe Bay Drive				
Eastbound Left Turn	9.7	A	9.6	A
Westbound Left Turn	9.6	A	9.7	A
Namoku Street				
Northbound Approach	22.7	C	20.4	C
Northbound Left Turn/Through Movement	72.9	F	66.0	F
Northbound Right Turn	15.7	C	16.0	C
Southbound Approach	15.6	C	44.6	E
Mokulele Drive and Namoku Street				
Mokulele Drive				
Northbound Left Turn	7.6	A	7.4	A
Southbound Left Turn	7.4	A	7.5	A
Namoku Street				
Eastbound Approach	11.6	B	11.1	B
Westbound Approach	11.9	B	11.6	B
Namoku Street and Lipalu Street				
Namoku Street				
Northbound Left Turn	7.4	A	7.4	A
Lipalu Street				
Eastbound Approach	9.4	A	9.4	A

The unsignalized intersection of Mokulele Drive and Namoku Street operates with short or little delays at Level of Service A and B during the morning and afternoon peak hours.

For the unsignalized intersection of Namoku Street and Lipalu Street, there is little or no delay with Level of Service A conditions during the morning and afternoon peak hours.

The analysis results for the two signalized study intersections are presented in Table 2. For the signalized intersection of Kamehameha Highway and Mokulele Drive, the Mokulele Drive westbound left turn and through movement is at Level of Service E during the morning and afternoon peak hours. Overall, the intersection operates at Level of Service C during both peak hours

The turning movements at the intersection of Kaneohe Bay Drive and Mokulele Drive are at Level of Service D or better the morning and afternoon peak hours. Overall, this intersection is at Level of Service C.

D. Operational Observations

The wide median along Kamehameha Highway allows motorists to cross the highway in a two-step process by first crossing one direction of traffic, then utilizing the median area as a waiting area to cross or merge with traffic in the other direction. At the unsignalized intersection of Kamehameha Highway, Halekou Road and HMP primary driveway, some motorists waited for two to three minutes for each step of their crossing or merging with Kamehameha Highway traffic. Thus, motorists on the Halekou Road or HMP primary driveway approaches experienced delays at Level of Service F, longer than indicated by the analysis results. Sometimes waiting vehicles in the median area caused delays for other movements that also utilize the median area. For instance, the northbound or southbound left turn motorists on Kamehameha Highway may not be able execute their movement until the other vehicles waiting to cross the highway have completed their movement. Also, Kamehameha Highway motorists commonly drive at 40-45 miles per hour which is higher than the posted

Table 2

EXISTING TRAFFIC CONDITIONS
SIGNALIZED INTERSECTION ANALYSIS RESULTS

	AM Peak Hour			PM Peak Hour		
Intersection	v/c	Delay (seconds)	LOS	v/c	Delay (seconds)	LOS
Kamehameha Highway and Mokulele Drive						
Northbound Approach	--	19.3	B	--	21.6	C
Left Turn	0.06	44.6	D	0.12	53.1	D
Through Movement	0.60	19.6	B	0.75	22.3	C
Right Turn	0.10	14.3	B	0.22	14.0	B
Southbound Approach	--	14.9	B	--	14.9	B
Left Turn	0.24	37.1	D	0.57	52.8	D
Through Movement	0.58	13.7	B	0.52	10.9	B
Eastbound Approach	--	34.5	C	--	46.9	D
Left Turn/Through Movement	0.53	35.7	D	0.49	47.8	D
Right Turn	0.06	29.4	C	0.05	42.1	D
Westbound Approach	--	48.8	D	--	56.3	E
Left Turn/Through Movement	0.85	58.9	E	0.75	62.3	E
Right Turn	0.42	32.9	C	0.32	44.7	D
Overall Intersection	0.62	22.4	C	0.72	22.2	C
Kaneohe Bay Drive and Mokulele Drive						
Northbound Approach	--	44.9	D	--	36.7	D
Left Turn	0.77	48.5	D	0.50	37.7	D
Through/Right Turn	0.20	32.9	C	0.17	34.2	C
Southbound Approach	0.03	31.4	C	0.11	33.6	C
Eastbound Approach	--	16.0	B	--	25.6	C
Left Turn	0.31	50.8	D	0.17	45.4	D
Through Movement	0.74	16.9	B	0.84	27.5	C
Right Turn	0.22	9.3	A	0.17	12.8	B
Westbound Shared Approach	--	18.5	B	--	19.1	B
Left Turn	0.41	46.7	D	0.22	42.0	D
Through Movement/Right Turn	0.79	16.9	B	0.79	18.2	B
Overall Intersection	0.77	20.7	C	0.69	23.8	C

speed limit of 35 miles per hour. The close proximity to the H-3 Freeway Halekou Interchange may contribute to higher speeds as ramp traffic merges or diverges with Kamehameha Highway traffic.

There are similar long delays at the Kamehameha Highway intersection with Mahinui Road and HMP secondary driveway. Northbound or southbound left turns or some of the motorists exiting Halekou Road or the HMP secondary driveway experience long delays with Level of Service F conditions.

During the afternoon peak period, the northbound queuing from the signalized intersection of Kamehameha Highway and Mokulele Drive extended past the secondary driveway for the Hawaiian Memorial Park. Thus, most motorists that desired to execute a left turn movements used the internal cemetery road and exited at the primary driveway. Despite the long queues, the traffic on each leg cleared the Kamehameha Highway and Mokulele Drive intersection during their green phase of the traffic signal cycle.

Field observations of the operations at the intersections of Kamehameha Highway with Mokulele Drive, Kaneohe Bay Drive with Mokulele Drive, Kaneohe Bay Drive with Namoku Street, Mokulele Street with Namoku Street, and Namoku Street with Lipalu Street generally concur with the analysis results.

E. Traffic Signal Peak Hour Warrants

There are two unsignalized intersections which have existing Level of Service F conditions for left turns or through movements: Kamehameha Highway Intersection with Halekou Road/HMP primary driveway and the Kaneohe Bay Drive intersection with Namoku Street. The existing traffic volumes at these two intersections were assessed by the technical criteria for the Manual of Uniform Traffic Control Devices (MUTCD) traffic signal peak hour warrants. There is a modified peak hour warrant (70% factor) which can be used where the local community population is less than 10,000 or where speeds on the major street are above 40 miles per hour. The peak hour warrant assessment is summarized in Table 3. The morning traffic volumes at the Kamehameha Highway

Intersection with Halekou Road/HMP primary driveway meet the regular peak hour warrant; however, both morning and afternoon peak hour traffic volumes meet the technical criteria for the modified peak hour warrant. The traffic volumes at Kaneohe Bay Drive intersection with Namoku Street do not satisfy the peak hour warrant criteria.

Table 3
Existing Traffic Conditions
Peak Hour Warrant Assessment

	Regular Peak Hour Warrant		Modified Peak Hour Warrant*	
	AM	PM	AM	PM
Kamehameha Highway, Halekou Road and HMP primary driveway	Yes	No	Yes	Yes
Kaneohe Bay Drive and Namoku Street	No	No	--	--

Note: * Speeds above 40 miles per hour on the major street.

E. Mitigation Measures

The intersection of Kamehameha Highway, Halekou Road and the HMP primary driveway was further analyzed as a signalized intersection; the analysis results are given in Table 4. While some left turn movements or approaches would be at Level of Service D, the intersection would operate with overall Level of Service B conditions during the morning and afternoon peak hours. The installation of traffic signals at the Kamehameha Highway, Halekou Road and the HMP primary driveway intersection would be adequate for mitigation improvements for this intersection. The enforcement of existing Kamehameha Highway posted speed limits by police would also be helpful for Halekou Road and HMP traffic.

No mitigation measures are proposed for the Kaneohe Bay Drive intersection with Namoku Street as traffic volumes do not satisfy the peak hour warrants.

Table 4

EXISTING TRAFFIC CONDITIONS
SIGNALIZED INTERSECTION ANALYSIS RESULTS WITH MITIGATION

Intersection	AM Peak Hour v/c	AM Peak Hour Delay (seconds)	AM Peak Hour LOS	PM Peak Hour v/c	PM Peak Hour Delay (seconds)	PM Peak Hour LOS
Kamehameha Highway and Mokulele Drive						
Northbound Approach	--	19.6	B	--	14.3	B
Left Turn	0.35	47.1	D	0.32	37.8	D
Through Movement/Right Turn	0.52	18.4	B	0.65	12.8	B
Southbound Approach	--	14.0	B	--	17.2	B
Left Turn	0.15	36.4	D	0.13	45.1	D
Through Movement	0.54	13.1	B	0.57	16.8	B
Eastbound Approach	0.34	32.0	C	0.31	35.5	D
Westbound Approach	--	29.3	C	--	33.8	C
Left Turn/Through Movement	0.02	29.1	C	0.12	33.8	C
Right Turn	0.06	29.4	C	0.13	33.9	C
Overall Intersection	0.47	17.6	B	0.54	16.7	B

V. FUTURE TRAFFIC CONDITIONS WITHOUT THE PROJECT

Future baseline traffic assignments without the project were developed for Year 2011 when the proposed cemetery expansion area within the Hawaiian Memorial Park cemetery is scheduled to be opened for burials.

Research of historical traffic volume data, traffic generated by nearby projects and regional traffic forecasts was conducted to develop future Year 2011 traffic assignment without the proposed project. For the regional traffic growth, historical traffic volumes collected by the State of Hawaii Department of Transportation were reviewed. The historical traffic data indicates that Kamehameha Highway traffic volumes in the vicinity of the proposed project have been been increasing at approximately 1.4 percent per year. However, regional traffic volumes on Kaneohe Bay Drive in vicinity of the two study intersections have been declining by about 0.7 percent per year. The decrease in Kaneohe Bay Drive traffic volumes may be attributable to the deployment of Kaneohe Marine Corps troops to Iraq and Afghanistan.

For this study, a growth factor of 1.4 percent per year was applied to Kamehameha Highway to account for future increase in regional highway volumes. For Kaneohe Bay Drive, a growth factor of 0.7 percent per year was utilized with the assumption that some of the declining traffic would return in the future conditions without the project.

Nearby projects include project 27 single family residential units for the Bay View Estates project and two single family residential units on Namoku Street. Sales and construction for Bay View Estates were ongoing at the time of the traffic counts. The north leg at the intersection of Kaneohe Bay Drive and Namoku Street serves as access for this new subdivision. Two new single family homes are presently under construction on Namoku Street. The new homes have will have access onto Namoku Street and are situated about two blocks from the intersection of Kaneohe Bay Drive and Namoku Street. The single famity trip rates are identified in Table 5. The new trips for the nearby projects are shown in Table 6.

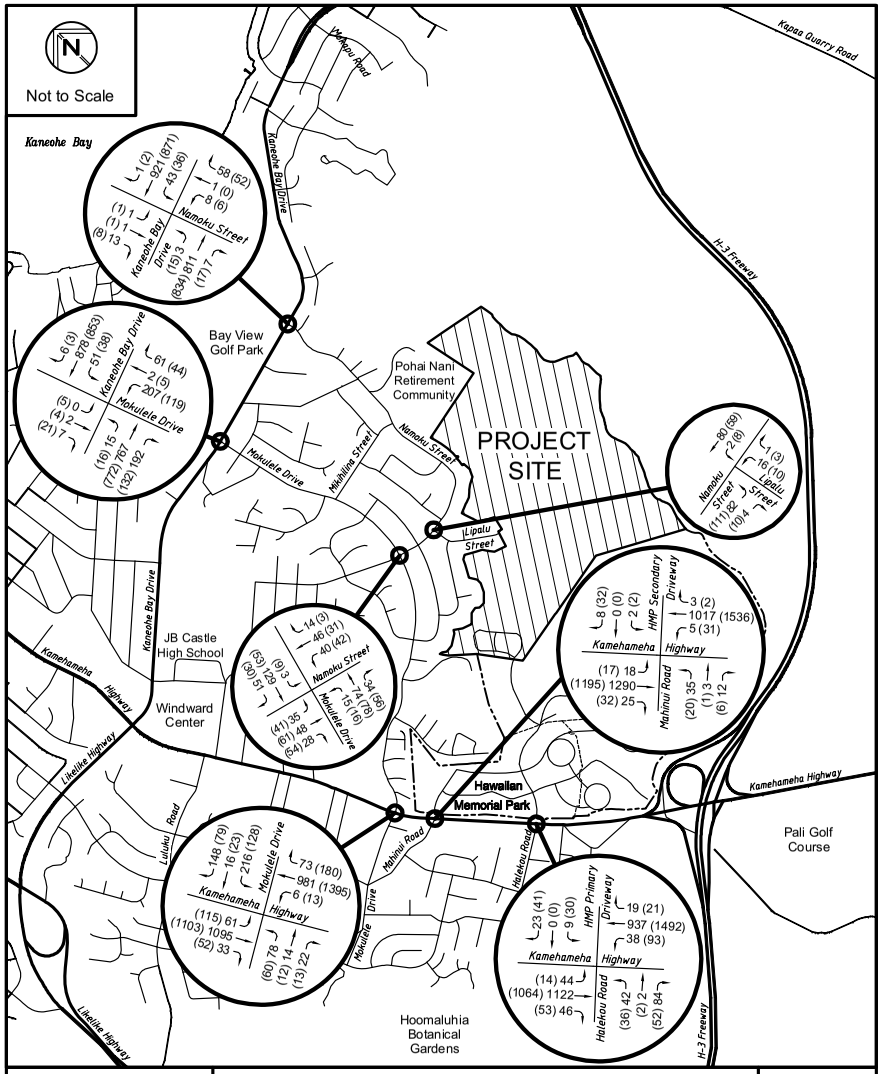
Table 5
RESIDENTIAL TRIP RATES

Land Use	Parameter	AM Peak Hour Enter	AM Peak Hour Exit	PM Peak Hour Enter	PM Peak Hour Exit
Residential Single Family	Dwelling Units	0.19	0.56	0.65	0.36

Table 6
TRIPS FOR NEARBY PROJECTS

	AM Peak Hour Enter	AM Peak Hour Exit	PM Peak Hour Enter	PM Peak Hour Exit
Bay View Estates				
27 single family dwelling units	5	15	17	10
Namoku Street				
2 single family dwelling units	0	1	1	1
Total	5	16	18	11

The future Year 2011 traffic assignment without the project is provided in Figure 8. Construction traffic from the Bay View Estates subdivision and two single family units on Namoku Street were deducted where field observations during the manual traffic counts identified construction traffic volumes.



A. Analysis Results

The future traffic conditions without the project would result in slightly longer delays at the several of the study intersections. The unsignalized analysis results are provided in Table 7 while the signalized intersection analysis results are shown in Table 8.

For the Kamehameha Highway, Halekou Road and HMP primary driveway unsignalized intersection, the Halekou Road approach would drop from Level of Service D to Level of Service E during the morning and afternoon peak hours. The westbound left turn and through movements at HMP primary driveway would continue to experience Level of Service F conditions.

At the Kaneohe Bay Drive unsignalized intersection with Namoku Street, the northbound left turn/through movement would continue to operate with long delays with Level of Service F conditions.

E. Traffic Signal Peak Hour Warrants

The technical criteria for the Manual of Uniform Traffic Control Devices (MUTCD) traffic signal peak hour warrant assess the need for signalization of an intersection. Altthough the posted speed limit on Kamehameha Highway is 35 miles per hour, the modified peak hour warrant (70% factor) can be utilized as motorists commonly drive at speeds between 40 and 45 miles per hour. The peak hour warrant assessment is summarized in Table 9.

The traffic volumes at Kamehameha Highway Intersection with Halekou Road/ HMP primary driveway meet the regular peak hour warrant for the morning peak hour; this intersection also satisfies the technical criteria for the modified peak hour warrant during both morning and afternoon peak hours.

The traffic volumes at Kaneohe Bay Drive intersection with Namoku Street do not satisfy the peak hour warrant criteria.

Table 7

FUTURE TRAFFIC CONDITIONS WITHOUT PROJECT
UNSIGNALIZED INTERSECTION ANALYSIS RESULTS

	AM Peak Hour Delay (seconds)	AM Peak Hour LOS	PM Peak Hour Delay (seconds)	PM Peak Hour LOS
Kamehameha Highway, Halekou Road and HMP Primary Driveway				
Kamehameha Highway				
Northbound Left Turn	11.5	B	11.8	B
Southbound Left Turn	10.4	B	13.5	B
Halekou Road				
Eastbound Approach	35.5	E	40.0	E
HMP Primary Driveway				
Westbound Approach	17.7	C	53.1	F
Westbound Left Turn/Through Movement	32.3	D	103.1	F
Westbound Right Turn	12.0	B	16.5	C
Kamehameha Highway, Mahinui Road and HMP Secondary Driveway				
Kamehameha Highway				
Northbound Left Turn	12.0	B	11.8	B
Southbound Left Turn	10.5	B	13.8	B
Mahinui Road				
Eastbound Approach	41.2	E	39.9	E
HMP Secondary Driveway				
Westbound Approach	15.2	C	18.3	C
Westbound Left Turn/Through Movement	27.5	D	49.4	E
Westbound Right Turn	12.1	B	16.4	C
Kaneohe Bay Drive and Namoku Street				
Kaneohe Bay Drive				
Eastbound Left Turn	9.9	A	9.7	A
Westbound Left Turn	9.7	A	9.8	A
Namoku Street				
Northbound Approach	25.9	D	23.2	C
Northbound Left Turn/Through Movement	88.6	F	81.5	F
Northbound Right Turn	16.1	C	16.4	C
Southbound Approach	25.2	D	27.9	D
Mokulele Drive and Namoku Street				
Mokulele Drive				
Northbound Left Turn	7.6	A	7.4	A
Southbound Left Turn	7.4	A	7.5	A
Namoku Street				
Eastbound Approach	11.6	B	11.1	B
Westbound Approach	11.9	B	11.6	B
Namoku Street and Lipalu Street				
Namoku Street				
Northbound Left Turn	7.4	A	7.4	A
Lipalu Street				
Eastbound Approach	9.4	A	9.4	A

Table 8

FUTURE TRAFFIC CONDITIONS WITHOUT PROJECT
SIGNALIZED INTERSECTION ANALYSIS RESULTS

Intersection	AM Peak Hour v/c	AM Peak Hour Delay (seconds)	AM Peak Hour LOS	PM Peak Hour v/c	PM Peak Hour Delay (seconds)	PM Peak Hour LOS
Kamehameha Highway and Mokulele Drive						
Northbound Approach	--	20.1	C	--	23.1	C
Left Turn	0.06	44.6	D	0.12	53.1	D
Through Movement	0.64	20.3	C	0.79	24.0	C
Right Turn	0.10	14.3	B	0.23	14.0	B
Southbound Approach	--	15.4	B	--	15.1	B
Left Turn	0.24	37.1	D	0.57	52.8	D
Through Movement	0.61	14.2	B	0.55	11.3	B
Eastbound Approach	--	34.6	C	--	47.0	D
Left Turn/Through Movement	0.53	35.8	D	0.50	47.9	D
Right Turn	0.06	29.4	C	0.05	42.1	D
Westbound Approach	--	49.2	D	--	56.6	E
Left Turn/Through Movement	0.85	59.6	E	0.76	62.8	E
Right Turn	0.42	32.9	C	0.33	44.8	D
Overall Intersection	0.64	22.7	C	0.75	22.9	C
Kaneohe Bay Drive and Mokulele Drive						
Northbound Approach	--	45.5	D	--	36.7	D
Left Turn	0.77	49.4	D	0.50	37.7	D
Through/Right Turn	0.21	32.9	C	0.18	34.2	C
Southbound Approach	0.03	31.4	C	0.11	33.6	C
Eastbound Approach	--	16.8	B	--	29.9	C
Left Turn	0.31	50.9	D	0.17	45.4	D
Through Movement	0.76	18.0	B	0.89	32.5	C
Right Turn	0.22	9.3	A	0.17	12.8	B
Westbound Shared Approach	--	20.4	C	--	20.9	C
Left Turn	0.45	47.2	D	0.23	42.1	D
Through Movement/Right Turn	0.83	18.8	B	0.82	20.0	B
Overall Intersection	0.79	21.9	C	0.71	26.5	C

Table 9

Existing Traffic Conditions Without Project

Peak Hour Warrant Assessment

	Regular Peak Hour Warrant AM	Regular Peak Hour Warrant PM	Modified Peak Hour Warrant* AM	Modified Peak Hour Warrant* PM
Kamehameha Highway, Halekou Road and HMP primary driveway	Yes	No	Yes	Yes
Kaneohe Bay Drive and Namoku Street	No	No	--	--

Note: * Speeds above 40 miles per hour on the major street.

C. Mitigation Measures

For the intersection of Kamehameha Highway, Halekou Road and the HMP primary driveway, the installation of traffic signals would alleviate delays and the individual turning movements would be at Levels of Service D or better. The overall intersection would operate with Level of Service B conditions during the morning and afternoon peak hour. The analysis results are given in Table 10.

The enforcement of the posted speed limit of 35 miles per hour on Kamehameha Highway would slow highway traffic and create larger gap times for left turning and through movements on the Halekou Road and HMP primary driveway. Also, the lowering of the existing Kamehameha Highway posted speed limit of 45 miles per hour on the south side of the Halekou Interchange should be considered.

No traffic improvements are proposed for the intersection of Kaneohe Bay Drive and Namoku Street as this intersection does not meet the peak hour warrants criteria. Also, the northbound left turn/through movements are low and some of these motorists could utilize the signalized Kaneohe Bay Drive/Mokulele Drive intersection to turn left onto Kaneohe Bay Drive.

Table 10

FUTURE TRAFFIC CONDITIONS WITHOUT PROJECT
SIGNALIZED INTERSECTION ANALYSIS RESULTS WITH MITIGATION

Intersection	AM Peak Hour v/c	AM Peak Hour Delay (seconds)	AM Peak Hour LOS	PM Peak Hour v/c	PM Peak Hour Delay (seconds)	PM Peak Hour LOS
Kamehameha Highway and Mokulele Drive						
Northbound Approach	--	20.0	C	--	15.0	B
Left Turn	0.35	47.1	D	0.32	37.8	D
Through Movement/Right Turn	0.56	19.0	B	0.69	13.5	B
Southbound Approach	--	14.4	B	--	17.8	B
Left Turn	0.15	36.4	D	0.13	45.1	D
Through Movement	0.57	13.6	B	0.61	17.5	B
Eastbound Approach	0.34	32.0	C	0.31	35.5	D
Westbound Approach	--	29.3	C	--	33.8	C
Left Turn/Through Movement	0.02	29.1	C	0.12	33.8	C
Right Turn	0.06	29.4	C	0.13	33.9	C
Overall Intersection	0.49	17.9	B	0.57	17.2	B

VI. PROJECT TRAFFIC

For the proposed Hawaiian Memorial Park expansion, there are three proposed land use alternatives. Alternative A includes the cemetery expansion and a single family residential subdivision. Alternative B would provide senior apartments with the cemetery expansion. Alternative C cemetery expansion has no residential component. The project traffic forecasts for these three alternatives are developed through a three-step procedure of trip generation, trip distribution and traffic assignment.

A. Trip Generation

In trip generation, the estimates of project traffic volumes are typically quantified through the trip rates compiled in the informational report entitled, Trip Generation, Seventh Edition, by the Institute of Transportation Engineers (ITE). The project land uses are listed in Table 11 for each of the three alternatives.

Table 11
HAWAIIAN MEMORIAL PARK EXPANSION LAND USES

Alternative A
- 30 acres cemetery expansion
- 20 single family dwelling units

Alternative B
- 30 acres cemetery expansion
- 125 senior apartment dwelling units

Alternative C
- 34 acres cemetery expansion
- No residential uses

Although cemeteries typically have long usage periods of 40 to 50 years, overall visitor traffic generally remain stable over time because the frequency of visits by family or friends to a deceased's grave site or columbarium niche decline over

the years as family members grow older or move away. As new areas of a cemetery are opened for new burials or columbarium buildings, then visitor traffic shifts to the newer areas of the cemetery and visitor traffic slowly declines in the older areas of the cemetery. The existing HMP cemetery is at approximately 80 percent utilization which includes advance reservations for burial/niche sites. The HMP cemetery originally opened in Year 1961 with 8 acres and has expanded to 72 acres. The Hawaii State Veterans Cemetery, which opened in Year 1991 and contains 122.5 acres, is at about 10 percent utilization and does not take advance reservations.

The cemetery burial/niche occupancy rate depends upon the actual interment market demand. The overall size of a cemetery in terms of acreage serves as a better parameter to estimate visitor traffic because the utilization rate changes as the cemetery decides to open new acreage for internment usage. Thus, the total acreage in the expanded cemetery area for each alternative serves as the parameter to estimate new cemetery visitor trips for future year 2011. In actuality, the cemetery would open new acreage incrementally, based on market demand. The use of full burial acreage in this traffic study provides a conservative estimate of cemetery traffic when the new expansion area is opened.

Current HMP cemetery operations limit burial and inurnment ceremonies to mid-day time periods, typically from 9:00 a.m. to 3:00 p.m. Funerals are also restricted to similar mid-day time periods. Some funeral services are scheduled during the evenings, starting at 6:00 p.m. Thus, the cemetery activities that would draw the largest crowds are intentionally scheduled during the non-peak mid-day or evening time periods when there are lower traffic volumes and less congestion on Kamehameha Highway.

For this study, traffic volume data were collected at the two HMP driveways on Kamehameha Highway and at the Pohai Nani driveway on Namoku Street at the same time the April 2007 manual traffic counts to compare existing cemetery and retirement community traffic volumes with trips estimated with ITE rates. For the HMP, it was found that morning peak hour trips to and from the cemetery are

about four times than estimated through ITE rates. The cemetery afternoon trip rates derived from the manual traffic counts were about the same as the ITE cemetery rates. The Pohai Nani morning trip rates estimated from the manual traffic counts were about 17 percent higher than ITE trip rates, but the afternoon derived trip rates similar to ITE afternoon trip rates. The comparison of ITE and derived trip rates from the manual traffic counts is contained in Appendix C.

The significantly higher morning trip rates derived from the HMP driveway traffic counts were attributed to local residents, especially senior adults, who also use the HMP cemetery as a recreational/exercise facility. Field observations during the manual traffic counts indicate that several people walked through the cemetery roads for exercise by themselves or with dogs, especially during the morning peak periods. Some of the cemetery visitors brought their own gardening tools to tend to grave sites. The rolling terrain within HMP cemetery offers scenic views of the Koolau Mountains, Kaneohe town and Kaneohe Bay which encourages some residents to visit the cemetery for restful breaks during lunch period or at other times during the work day. In addition, some of the higher morning trips are attributable to the neighboring Hawaii State Veterans Cemetery, a public facility, which shares driveways with the HMP cemetery.

The morning trip rates derived from traffic counts for HMP as well as the derived morning and afternoon trip rates for Pohai Nani were applied in lieu of the ITE morning trip for cemetery and senior apartment land uses; the afternoon ITE trip rates for the cemetery were retained since they provided similar estimates as the trip rates derived from the manual traffic counts. The trip rates utilized for this traffic study are listed in Table 12. The estimates for project traffic volumes are Alternative A, Alternative B and Alternative C are presented in Table 13.

Table 12
PROJECT TRIP RATES

Land Use	Parameter	AM Peak Hour Enter	AM Peak Hour Exit	PM Peak Hour Enter	PM Peak Hour Exit
Cemetery*	Acreage	0.46	0.22	0.28	0.56
Residential Single Family	Dwelling Units	0.19	0.56	0.65	0.36
Residential Senior Apartments*	Dwelling Units	0.15	0.06	0.11	0.18

Note: * indicates morning trip rates derived from manual traffic counts.

Table 13
PROJECT TRIPS

	AM Peak Hour Enter	AM Peak Hour Exit	PM Peak Hour Enter	PM Peak Hour Exit
Alternative A				
30 acres cemetery expansion	14	7	8	17
20 single family dwelling units	4	11	13	7
Total	18	18	21	14
Alternative B				
30 acres cemetery expansion	14	7	8	17
125 senior apartment dwelling units	19	7	13	23
Total	33	14	21	40
Alternative C				
34 acres cemetery expansion only	16	7	10	19

B. Trip Distribution

In trip distribution, the general direction of trips traveling to and from the project site is identified. Information about existing and future travel patterns, population and employment on Oahu and the manual traffic count data at the study intersections were utilized to determine the direction of travel for external trips entering and exiting the project site. The trip distribution is provided in Table 14.

For the cemetery, the distribution of population on Oahu was used to estimate the direction of travel. Most of the population on Oahu lives on the Leeward side of the island. Yet, it is also recognized that many Windward residents would prefer Hawaiian Memorial Park because of its close proximity to their homes.

For the residential subdivision, the distribution of employment on Oahu serves as an indication for direction of travel. Most of the jobs are located in Leeward Oahu and a lower proportion of jobs are situated in Windward Oahu.

The morning trips for the retirement community would be expected to be mostly employee traffic and the direction of travel is based on Oahu population. In the afternoon, the retirement community traffic is likely to contain a mixture of employee traffic as well as retirees returning from medical appointments, shopping trips or other recreational activities located in the Kaneohe area. Thus, it is expected that a higher proportion of the afternoon retirement community trips would remain on the Windward side of Oahu.

Table 14
Project Trip Distribution

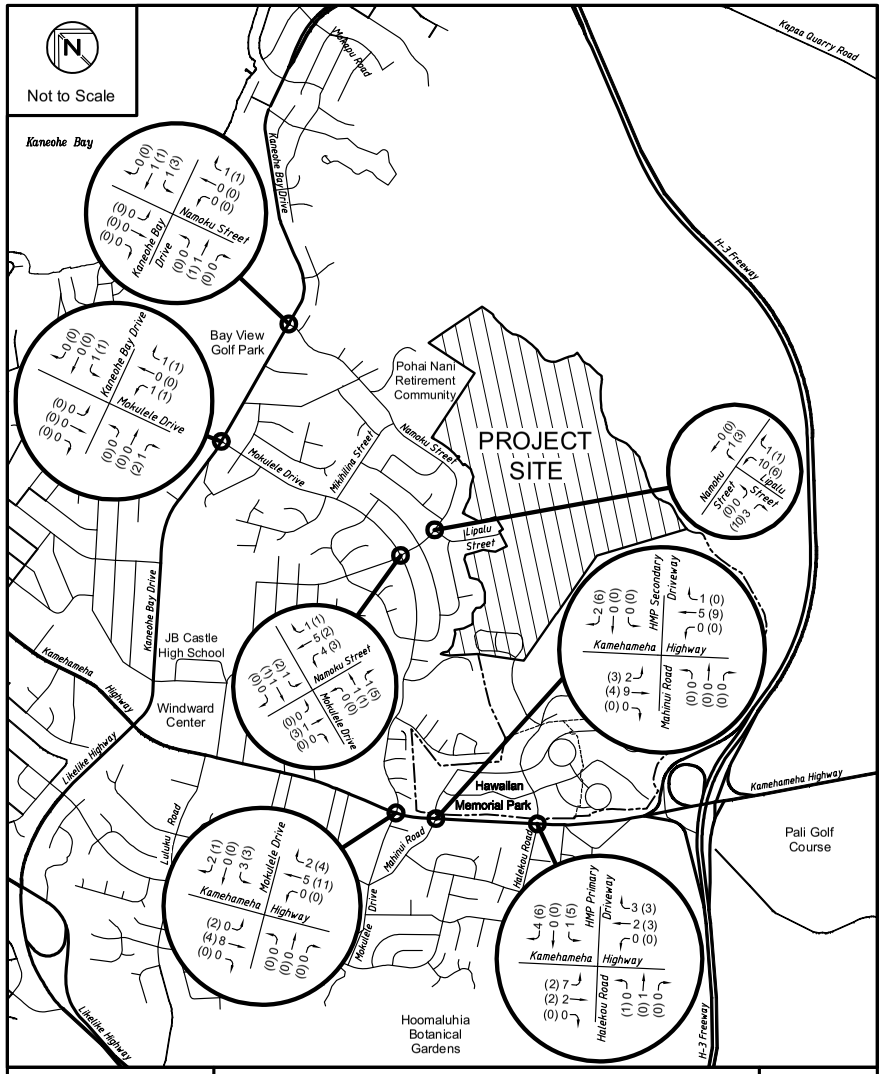
	Cemetery and Residential Subdivision	Retirement Community	
	AM and PM	AM	PM
Honolulu/Leeward Oahu-West	70%	70%	40%
Kaneohe/Mokapu/Kailua-East	10%	10%	20%
Kaneohe -North	10%	10%	30%
Kailua-Soutth	10%	10%	10%
Total	100%	100%	100%

C. Traffic Assignment

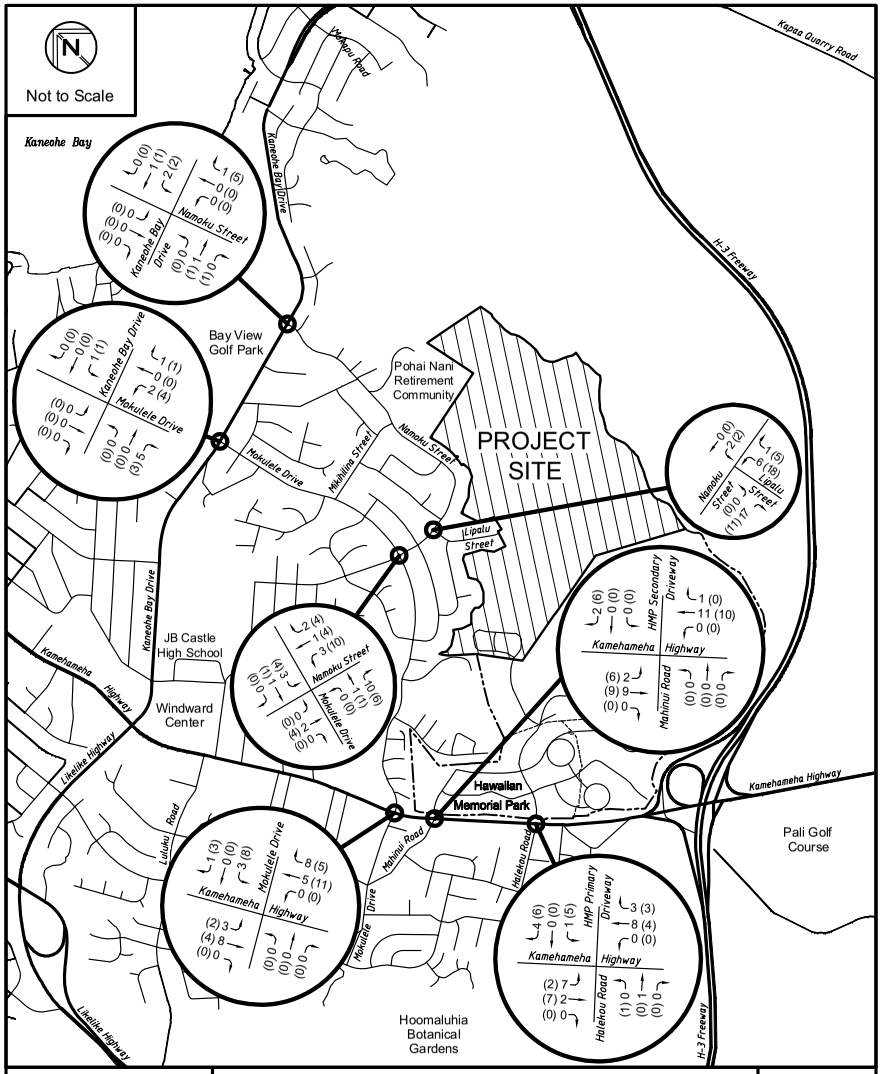
Traffic assignment defines the specific roadways that would be utilized by the project traffic as well as the proportion of project traffic volumes on each of these roadways. The trips related to the cemetery expansion component of Alternatives A, B and C must utilize HMP primary or secondary driveways at the Kamehameha Highway/Halekou Road intersection and Kamehameha Highway/Mahinui Road intersection to reach the expansion site. Vehicular access for Alternative A residential subdivision trips and the Alternative B retirement community trips will be via Lipalu Street.

Some of the parents living in the Alternative A residential subdivision are likely to drop off or pick up their children at schools on their way to and from work. Kaneohe Elementary School has a driveway on Kamehameha Highway and a rear loading area accessed via Akimala Street. Alternative A residents can travel to Akimala Street via Namoku Street and Koa Kahiko Street. King Intermediate School is located on Kamehameha Highway in the Heeia area. Castle High School is situated on Kaneohe Bay Drive and it also has a rear driveway on Namoku Street.

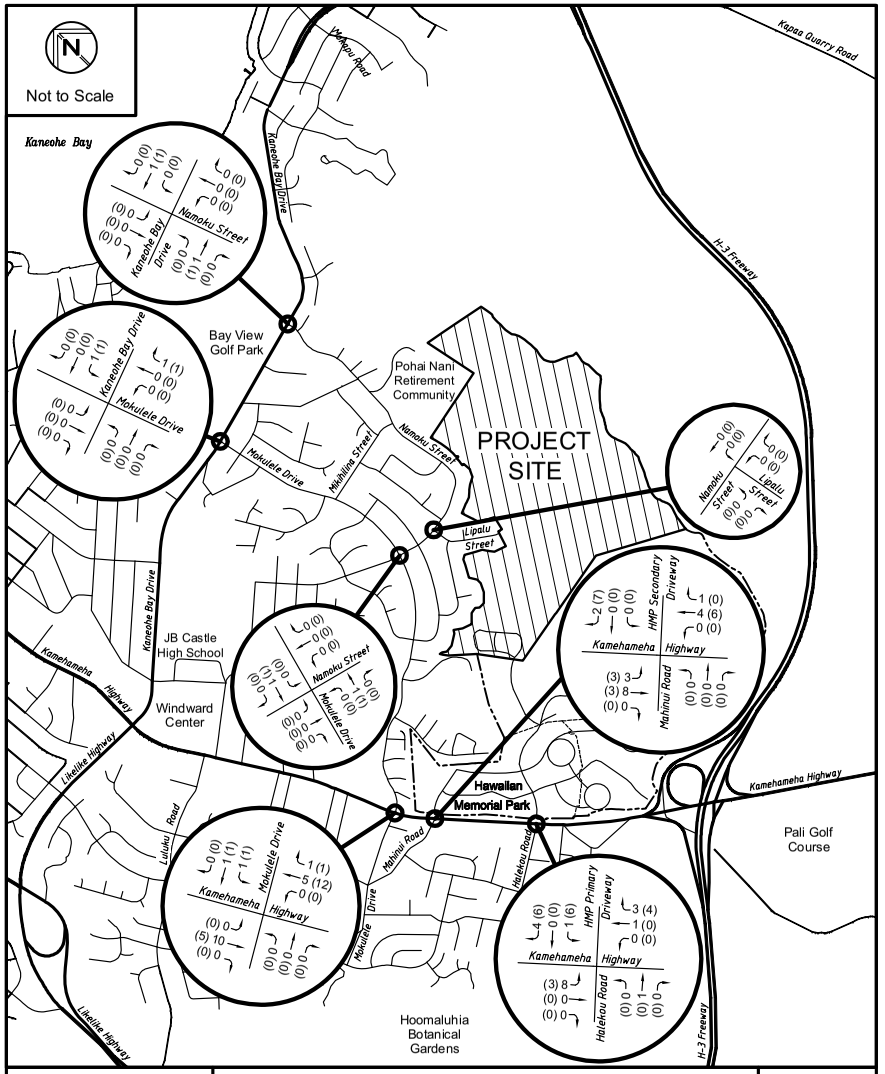
Residents traveling to work on the Leeward side of Oahu could travel via Pali Highway, Likelike Highway and the H-3 Freeway. Kaneohe residents can access the H-3 Freeway at its Halekou Interchange with Kamehameha Highway and at its Kaneohe Interchange with Likelike Highway. Trips to/from Kailua can utilize, Kaneohe Bay Drive and Pali Highway/Kalanianaole Highway. Most of the retirement community trips within in Kaneohe town would use Kamehameha Highway to reach medical offices, shopping centers or other recreational destinations.



PERAZIM CONSULTING, LLC	Alternative A Project Traffic Hawaiian Memorial Park Expansion With Residential Subdivision	FIGURE 9



PERAZIM CONSULTING, LLC	Alternative B Project Traffic Hawaiian Memorial Park Expansion With Retirement Community	FIGURE 10



PERAZIM CONSULTING, LLC	Alternative C Project Traffic Hawaiian Memorial Park Expansion With No Residential Community	FIGURE 11

VII. FUTURE TRAFFIC CONDITIONS WITH THE PROJECT

The future Year 2011 traffic forecasts with the project are developed by adding the future traffic assignment and the net project trips. The future traffic assignment with Alternative A, Alternative B and Alternative C traffic volumes are displayed in Figures 12, 13 and 14, respectively.

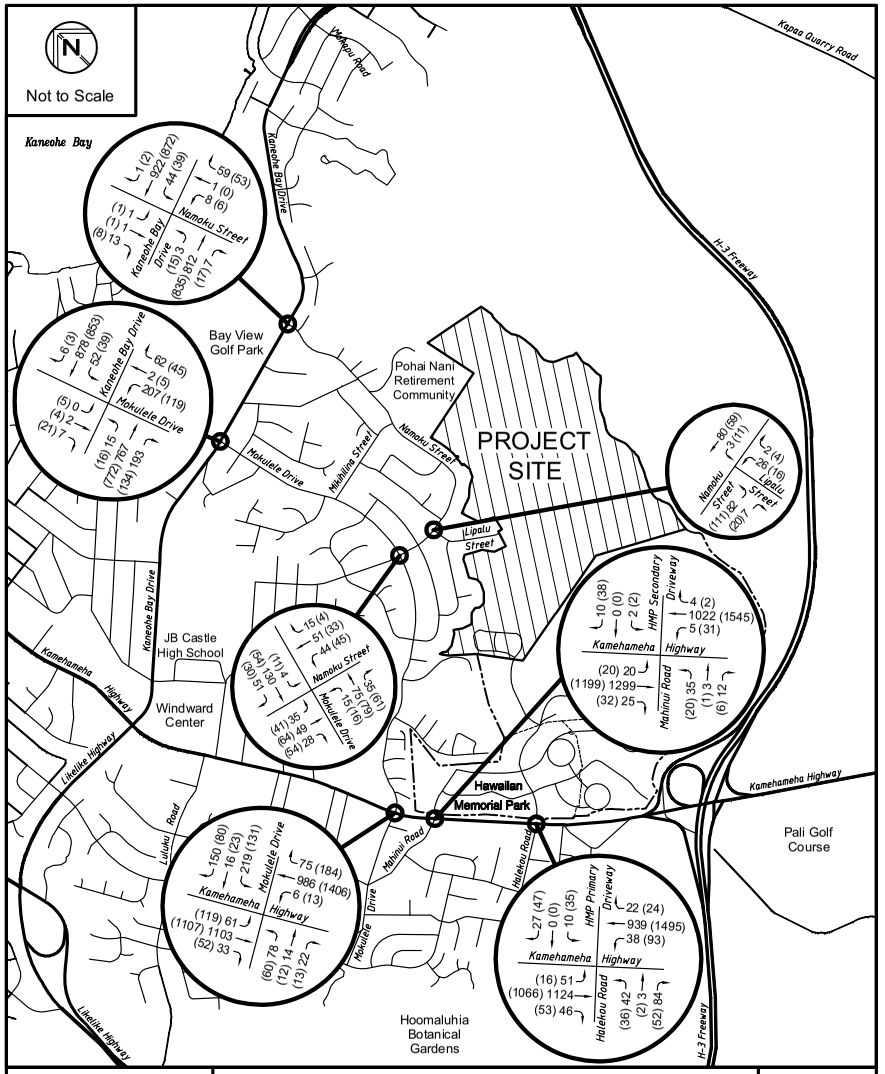
A. Analysis Results

The study intersection analysis results for future conditions with Alternative A are provided in Tables 15 and 16, Alternative B in Table 17 and 18 and Alternative C in Table 19 and 20.

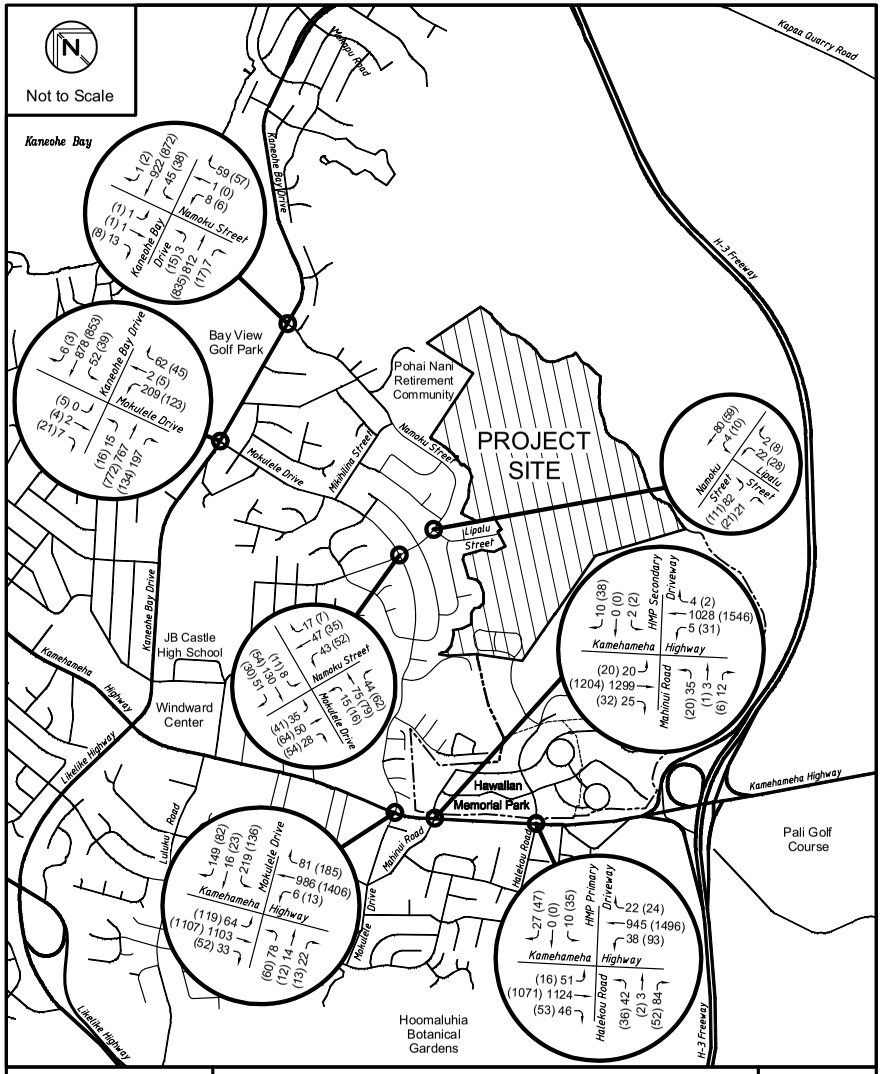
The unsignalized intersection analysis results are virtually the same for Alternatives A, B and C. The Level of Service conditions for the three alternatives are also the same as the future traffic conditions without the project.

For the unsignalized intersection of Kaneohe Bay Drive and Namoku Street, the northbound left turn/through movement continues with Level of Service F conditions.

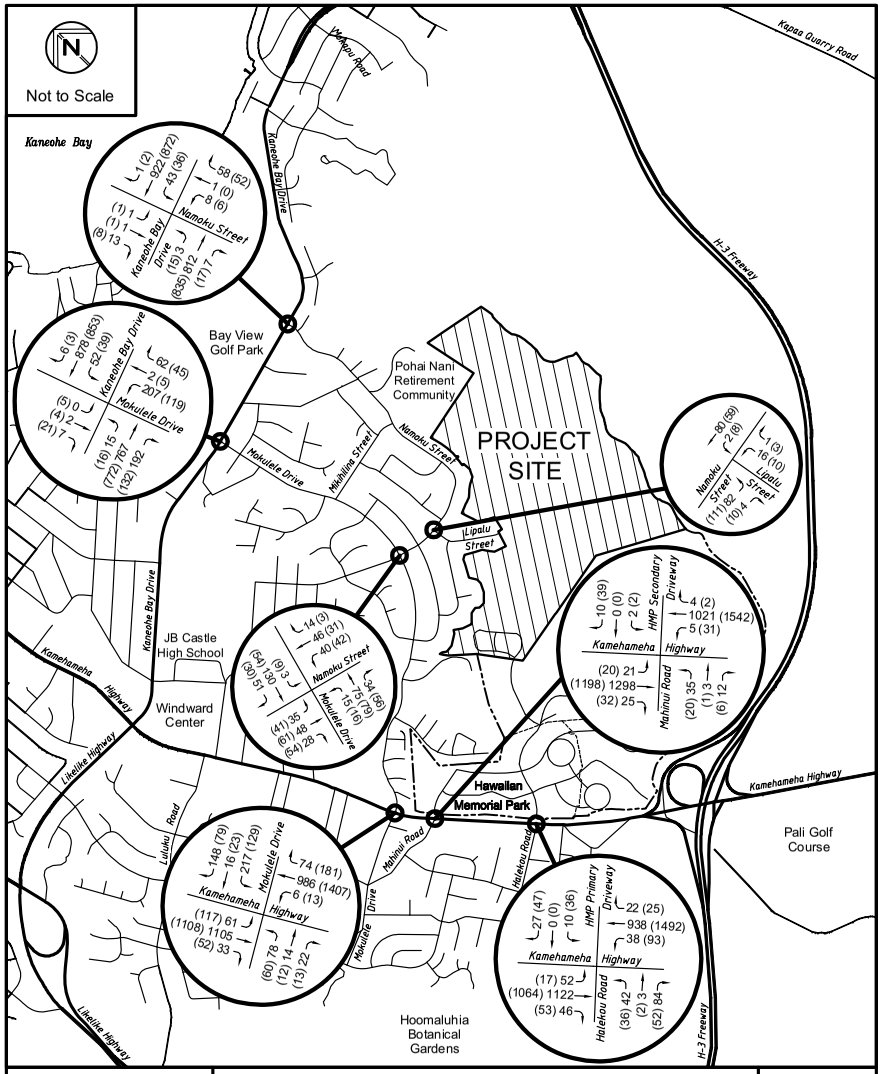
The signalized intersection analysis results for Alternative A, Alternative B and Alternative C remain the same as future traffic conditions without the project



PERAZIM CONSULTING, LLC	Future Traffic Assignment With Alternative A Hawaiian Memorial Park Expansion With Residential Subdivision	FIGURE 12



PERAZIM CONSULTING, LLC	Future Traffic Assignment With Alternative B Hawaiian Memorial Park Expansion With Retirement Community	FIGURE 13



PERAZIM CONSULTING, LLC	Future Traffic Assignment With Alternative C Hawaiian Memorial Park Expansion With No Residential Community	FIGURE 14

Table 15

FUTURE TRAFFIC CONDITIONS WITH ALTERNATIVE A
HAWAIIAN MEMORIAL PARK EXPANSION WITH RESIDENTIAL SUBDIVISION

UNSIGNALIZED INTERSECTION ANALYSIS RESULTS

	AM Peak Hour		PM Peak Hour	
	Delay (seconds)	LOS	Delay (seconds)	LOS
Kamehameha Highway, Halekou Road and HMP Primary Driveway				
Kamehameha Highway				
Northbound Left Turn	11.5	B	11.8	B
Southbound Left Turn	10.4	B	13.6	B
Halekou Road				
Eastbound Approach	37.7	E	41.4	E
HMP Primary Driveway				
Westbound Approach	17.8	C	59.6	F
Westbound Left Turn/Through Movement	33.3	D	117.2	F
Westbound Right Turn	12.1	B	16.8	C
Kamehameha Highway, Mahinui Road and HMP Secondary Driveway				
Kamehameha Highway				
Northbound Left Turn	12.0	B	11.8	B
Southbound Left Turn	10.5	B	13.9	B
Mahinui Road				
Eastbound Approach	42.4	E	41.0	E
HMP Secondary Driveway				
Westbound Approach	14.8	C	18.4	C
Westbound Left Turn/Through Movement	27.8	D	50.0	E
Westbound Right Turn	12.2	B	16.7	C
Kaneohe Bay Drive and Namoku Street				
Kaneohe Bay Drive				
Eastbound Left Turn	9.9	A	9.8	A
Westbound Left Turn	9.7	A	9.8	A
Namoku Street				
Northbound Approach	25.8	D	23.3	C
Northbound Left Turn/Through Movement	88.6	F	83.2	F
Northbound Right Turn	16.2	C	16.5	C
Southbound Approach	25.2	D	28.2	D
Mokulele Drive and Namoku Street				
Mokulele Drive				
Northbound Left Turn	7.6	A	7.4	A
Southbound Left Turn	7.4	A	7.5	A
Namoku Street				
Eastbound Approach	11.7	B	11.3	B
Westbound Approach	12.1	B	11.8	B
Namoku Street and Lipalu Street				
Namoku Street				
Northbound Left Turn	7.4	A	7.5	A
Lipalu Street				
Eastbound Approach	9.5	A	9.6	A

Table 16

FUTURE TRAFFIC CONDITIONS WITH ALTERNATIVE A
HAWAIIAN MEMORIAL PARK EXPANSION WITH RESIDENTIAL SUBDIVISION

SIGNALIZED INTERSECTION ANALYSIS RESULTS

	AM Peak Hour			PM Peak Hour		
Intersection	v/c	Delay (seconds)	LOS	v/c	Delay (seconds)	LOS
Kamehameha Highway and Mokulele Drive						
Northbound Approach	--	20.1	C	--	23.3	C
Left Turn	0.06	44.6	D	0.12	53.1	D
Through Movement	0.64	20.4	C	0.80	24.2	C
Right Turn	0.11	14.3	B	0.23	14.0	B
Southbound Approach	--	15.5	B	--	15.2	B
Left Turn	0.24	37.1	D	0.58	53.5	D
Through Movement	0.62	14.3	B	0.55	11.3	B
Eastbound Approach	--	34.8	C	--	47.3	D
Left Turn/Through Movement	0.53	36.0	D	0.51	48.2	D
Right Turn	0.06	29.4	C	0.05	42.1	D
Westbound Approach	--	50.6	D	--	58.2	E
Left Turn/Through Movement	0.86	61.8	E	0.77	65.2	E
Right Turn	0.43	33.0	C	0.33	44.8	D
Overall Intersection	0.64	23.0	C	0.76	23.3	C
Kaneohe Bay Drive and Mokulele Drive						
Northbound Approach	--	45.5	D	--	36.7	D
Left Turn	0.77	49.4	D	0.50	37.7	D
Through/Right Turn	0.21	32.9	C	0.18	34.2	C
Southbound Approach	0.03	31.4	C	0.11	33.6	C
Eastbound Approach	--	16.8	B	--	28.8	C
Left Turn	0.31	50.9	D	0.17	45.4	D
Through Movement	0.76	18.0	B	0.89	31.2	C
Right Turn	0.22	9.3	A	0.18	12.8	B
Westbound Shared Approach	--	20.4	C	--	20.7	C
Left Turn	0.46	47.4	D	0.24	42.2	D
Through Movement/Right Turn	0.83	18.8	B	0.82	19.8	B
Overall Intersection	0.79	21.9	C	0.71	25.9	C

Table 17

FUTURE TRAFFIC CONDITIONS WITH ALTERNATIVE B
HAWAIIAN MEMORIAL PARK EXPANSION WITH RESIDENTIAL RETIREMENT COMMUNITY

UNSIGNALIZED INTERSECTION ANALYSIS RESULTS

	AM Peak Hour		PM Peak Hour	
	Delay (seconds)	LOS	Delay (seconds)	LOS
Kamehameha Highway, Halekou Road and HMP Primary Driveway				
Kamehameha Highway				
Northbound Left Turn	11.5	B	11.9	B
Southbound Left Turn	10.5	B	13.6	B
Halekou Road				
Eastbound Approach	37.7	E	41.8	E
HMP Primary Driveway				
Westbound Approach	17.9	C	61.1	F
Westbound Left Turn/Through Movement	33.6	D	120.6	F
Westbound Right Turn	12.1	B	16.8	C
Kamehameha Highway, Mahinui Road and HMP Secondary Driveway				
Kamehameha Highway				
Northbound Left Turn	12.0	B	11.8	B
Southbound Left Turn	10.5	B	13.9	B
Mahinui Road				
Eastbound Approach	42.4	E	41.0	E
HMP Secondary Driveway				
Westbound Approach	14.8	C	18.3	C
Westbound Left Turn/Through Movement	27.9	D	50.0	E
Westbound Right Turn	12.2	B	16.7	C
Kaneohe Bay Drive and Namoku Street				
Kaneohe Bay Drive				
Eastbound Left Turn	9.9	A	9.8	A
Westbound Left Turn	9.7	A	9.8	A
Namoku Street				
Northbound Approach	26.1	D	23.0	C
Northbound Left Turn/Through Movement	90.6	F	83.2	F
Northbound Right Turn	16.2	C	16.6	C
Southbound Approach	25.5	D	28.2	D
Mokulele Drive and Namoku Street				
Mokulele Drive				
Northbound Left Turn	7.6	A	7.4	A
Southbound Left Turn	7.4	A	7.5	A
Namoku Street				
Eastbound Approach	11.9	B	11.3	B
Westbound Approach	12.2	B	11.9	B
Namoku Street and Lipalu Street				
Namoku Street				
Northbound Left Turn	7.4	A	7.5	A
Lipalu Street				
Eastbound Approach	9.5	A	9.6	A

Table 18

FUTURE TRAFFIC CONDITIONS WITH ALTERNATIVE B
HAWAIIAN MEMORIAL PARK EXPANSION WITH RESIDENTIAL RETIREMENT COMMUNITY

SIGNALIZED INTERSECTION ANALYSIS RESULTS

	AM Peak Hour			PM Peak Hour		
Intersection	v/c	Delay (seconds)	LOS	v/c	Delay (seconds)	LOS
Kamehameha Highway and Mokulele Drive						
Northbound Approach	--	20.1	C	--	23.3	C
Left Turn	0.06	44.6	D	0.12	53.1	D
Through Movement	0.64	20.4	C	0.80	24.2	C
Right Turn	0.12	14.4	B	0.23	14.1	B
Southbound Approach	--	15.5	B	--	15.2	B
Left Turn	0.25	37.2	D	0.58	53.5	D
Through Movement	0.62	14.3	B	0.55	11.3	B
Eastbound Approach	--	34.8	C	--	47.8	D
Left Turn/Through Movement	0.53	36.0	D	0.52	48.8	D
Right Turn	0.06	29.4	C	0.05	42.1	D
Westbound Approach	--	50.6	D	--	60.6	E
Left Turn/Through Movement	0.86	61.8	E	0.80	68.7	E
Right Turn	0.43	32.9	C	0.34	44.9	D
Overall Intersection	0.64	22.9	C	0.77	23.5	C
Kaneohe Bay Drive and Mokulele Drive						
Northbound Approach	--	46.1	D	--	37.0	D
Left Turn	0.77	50.1	D	0.52	38.1	D
Through/Right Turn	0.21	32.9	C	0.18	34.2	C
Southbound Approach	0.03	31.4	C	0.11	33.6	C
Eastbound Approach	--	16.7	B	--	29.9	C
Left Turn	0.31	50.9	D	0.17	45.4	D
Through Movement	0.76	18.0	B	0.89	32.5	C
Right Turn	0.23	9.4	A	0.18	12.8	B
Westbound Shared Approach	--	20.4	C	--	20.9	C
Left Turn	0.46	47.4	D	0.24	42.2	D
Through Movement/Right Turn	0.83	18.8	B	0.82	20.0	B
Overall Intersection	0.80	22.0	C	0.71	26.6	C

Table 19

FUTURE TRAFFIC CONDITIONS WITH ALTERNATIVE C
HAWAIIAN MEMORIAL PARK EXPANSION WITH RESIDENTIAL RETIREMENT COMMUNITY

UNSIGNALIZED INTERSECTION ANALYSIS RESULTS

	AM Peak Hour		PM Peak Hour	
	Delay (seconds)	LOS	Delay (seconds)	LOS
Kamehameha Highway, Halekou Road and HMP Primary Driveway				
Kamehameha Highway				
Northbound Left Turn	11.5	B	11.8	B
Southbound Left Turn	10.5	B	13.6	B
Halekou Road				
Eastbound Approach	37.9	E	41.4	E
HMP Primary Driveway				
Westbound Approach	17.8	C	63.3	F
Westbound Left Turn/Through Movement	33.3	D	124.1	F
Westbound Right Turn	12.1	B	16.7	C
Kamehameha Highway, Mahinui Road and HMP Secondary Driveway				
Kamehameha Highway				
Northbound Left Turn	12.0	B	11.8	B
Southbound Left Turn	10.5	B	13.9	B
Mahinui Road				
Eastbound Approach	42.4	E	41.0	E
HMP Secondary Driveway				
Westbound Approach	14.8	C	18.3	C
Westbound Left Turn/Through Movement	28.1	D	50.0	E
Westbound Right Turn	12.2	B	16.7	C
Kaneohe Bay Drive and Namoku Street				
Kaneohe Bay Drive				
Eastbound Left Turn	9.9	A	9.8	A
Westbound Left Turn	9.7	A	9.8	A
Namoku Street				
Northbound Approach	25.9	D	23.4	C
Northbound Left Turn/Through Movement	88.6	F	83.2	F
Northbound Right Turn	16.2	C	16.5	C
Southbound Approach	25.2	D	27.9	D
Mokulele Drive and Namoku Street				
Mokulele Drive				
Northbound Left Turn	7.6	A	7.4	A
Southbound Left Turn	7.4	A	7.5	A
Namoku Street				
Eastbound Approach	11.8	B	11.1	B
Westbound Approach	12.0	B	11.7	B
Namoku Street and Lipalu Street				
Namoku Street				
Northbound Left Turn	7.4	A	7.4	A
Lipalu Street				
Eastbound Approach	9.4	A	9.4	A

Table 20

FUTURE TRAFFIC CONDITIONS WITH ALTERNATIVE C
HAWAIIAN MEMORIAL PARK EXPANSION WITH RESIDENTIAL RETIREMENT COMMUNITY

SIGNALIZED INTERSECTION ANALYSIS RESULTS

	AM Peak Hour			PM Peak Hour		
Intersection	v/c	Delay (seconds)	LOS	v/c	Delay (seconds)	LOS
Kamehameha Highway and Mokulele Drive						
Northbound Approach	--	20.1	C	--	23.3	C
Left Turn	0.06	44.6	D	0.12	53.1	D
Through Movement	0.64	20.4	C	0.80	24.3	C
Right Turn	0.11	14.3	B	0.23	14.0	B
Southbound Approach	--	15.5	B	--	15.2	B
Left Turn	0.24	37.1	D	0.58	53.1	D
Through Movement	0.62	14.3	B	0.56	11.3	B
Eastbound Approach	--	34.7	C	--	47.1	D
Left Turn/Through Movement	0.53	35.9	D	0.50	47.9	D
Right Turn	0.06	29.4	C	0.05	42.1	D
Westbound Approach	--	49.7	D	--	57.0	E
Left Turn/Through Movement	0.85	60.3	E	0.76	63.4	E
Right Turn	0.42	32.9	C	0.33	44.8	D
Overall Intersection	0.64	22.8	C	0.76	23.1	C
Kaneohe Bay Drive and Mokulele Drive						
Northbound Approach	--	45.5	D	--	36.7	D
Left Turn	0.77	49.4	D	0.50	37.7	D
Through/Right Turn	0.21	32.9	C	0.18	34.2	C
Southbound Approach	0.03	31.4	C	0.11	33.6	C
Eastbound Approach	--	16.8	B	--	29.9	C
Left Turn	0.31	50.9	D	0.17	45.4	D
Through Movement	0.76	18.0	B	0.89	32.5	C
Right Turn	0.22	9.3	A	0.17	12.8	B
Westbound Shared Approach	--	20.4	C	--	20.9	C
Left Turn	0.46	47.4	D	0.24	42.2	D
Through Movement/Right Turn	0.83	18.8	B	0.82	20.0	B
Overall Intersection	0.79	22.0	C	0.71	26.6	C

B. Traffic Signal Peak Hour Warrants

The Manual of Uniform Traffic Control Devices (MUTCD) regular and modified traffic signal peak hour warrants assessment was undertaken for the unsignalized study intersections which have Level of Service F conditions to determine the need for signalization of the intersection. The peak hour warrant assessment is summarized in Table 21.

The Kamehameha Highway/Halekou Road/ HMP primary driveway intersection traffic volumes are adequate to meet the regular peak hour warrant for the morning peak hour; this intersection also qualifies according to the technical criteria for the modified peak hour warrant during both morning and afternoon peak hours. The traffic volumes at the intersection of Kaneohe Bay Drive and Namoku Street do not meet peak hour warrant technical criteria. This peak hour warrant assessment yields the same results as future traffic conditions without the project.

Table 21
Future Traffic Conditions With Project
Peak Hour Warrant Assessment

	Regular Peak Hour Warrant		Modified Peak Hour Warrant*	
	AM	PM	AM	PM
Kamehameha Highway, Halekou Road and HMP primary driveway	Yes	No	Yes	Yes
Kaneohe Bay Drive and Namoku Street	No	No	--	--

Note: * Speeds above 40 miles per hour on the major street.

C. Mitigation Measures

If traffic signals were installed at the intersection of Kamehameha Highway, Halekou Road and the HMP primary driveway, the turning movements at this intersection would be at Level of Service D or better. Overall, the intersection would operate with Level of Service B conditions. These analysis results apply to Alternatives A, B and C are presented in Tables 22, 23 and 24, respectively. Also, Kamehameha Highway posted speed limits should be enforced. These mitigation measures are identical to the future conditions without the project.

D. Project Traffic Percentages at Study Intersections

The percentages of the cumulative sum of existing Hawaiian Memorial Park traffic and net increase in future project traffic volumes to the total vehicles entering the intersections for the three Kamehameha Highway study intersections are provided in Table 25. The four other study intersections are located too far from the HMP driveways to identify the amount HMP traffic traveling through those intersections. The percentage of existing and future project traffic ranges between 1.4 percent and 5.1 percent. These estimated percentages attributable to HMP traffic could be utilized as the basis of fair share proportions for future traffic improvements.

The net increase in project traffic volume percentages at each study intersection is presented in Table 26 for Alternatives A, B and C. The proportion of the net increase ranges from 0.0 to 15.2 percent. The Namoku Street intersection with Lipalu Street and Mokulele Drive intersection with Namoku Street would have the highest percentages as a result of Alternative A and Alternative B because the existing traffic volumes at these two intersections are low in comparison the intersections along Kamehameha Highway and along Kaneohe Bay Drive. These percentages reflect the magnitude of changes that would be felt by residents living near these study intersections. However, turning movements at the Namoku Street/Lipalu Street intersection and Mokulele Drive/Namoku Street intersection would operate with no or little delay with Level of Service A or Level of Service B conditions.

Table 22

FUTURE TRAFFIC CONDITIONS WITH ALTERNATIVE A
HAWAIIAN MEMORIAL PARK EXPANSION WITH RESIDENTIAL SUBDIVISION

SIGNALIZED INTERSECTION ANALYSIS RESULTS WITH MITIGATION

	AM Peak Hour			PM Peak Hour		
Intersection	v/c	Delay (seconds)	LOS	v/c	Delay (seconds)	LOS
Kamehameha Highway and Mokulele Drive						
Northbound Approach	--	20.1	C	--	15.0	B
Left Turn	0.35	47.1	D	0.32	37.8	D
Through Movement/Right Turn	0.57	19.0	B	0.69	13.6	B
Southbound Approach	--	14.5	B	--	17.9	B
Left Turn	0.18	36.6	D	0.15	45.2	D
Through Movement	0.57	13.6	B	0.61	17.5	B
Eastbound Approach	0.34	32.0	C	0.31	35.5	D
Westbound Approach	--	29.4	C	--	34.0	C
Left Turn/Through Movement	0.03	29.1	C	0.14	33.9	C
Right Turn	0.07	29.4	C	0.15	34.0	C
Overall Intersection	0.49	18.0	B	0.57	17.3	B

Table 23

FUTURE TRAFFIC CONDITIONS WITH ALTERNATIVE B
HAWAIIAN MEMORIAL PARK EXPANSION WITH RESIDENTIAL RETIREMENT COMMUNITY

SIGNALIZED INTERSECTION ANALYSIS RESULTS WITH MITIGATION

	AM Peak Hour			PM Peak Hour		
Intersection	v/c	Delay (seconds)	LOS	v/c	Delay (seconds)	LOS
Kamehameha Highway and Mokulele Drive						
Northbound Approach	--	20.1	C	--	15.0	B
Left Turn	0.35	47.1	D	0.32	37.8	D
Through Movement/Right Turn	0.57	19.1	B	0.69	13.6	B
Southbound Approach	--	14.5	B	--	17.9	B
Left Turn	0.18	36.6	D	0.15	45.2	D
Through Movement	0.57	13.6	B	0.61	17.5	B
Eastbound Approach	0.34	32.0	C	0.31	35.5	D
Westbound Approach	--	29.4	C	--	34.0	C
Left Turn/Through Movement	0.03	29.1	C	0.14	33.9	C
Right Turn	0.07	29.4	C	0.15	34.0	C
Overall Intersection	0.49	18.1	B	0.57	17.3	B

Table 24

FUTURE TRAFFIC CONDITIONS WITH ALTERNATIVE C
HAWAIIAN MEMORIAL PARK EXPANSION WITH RESIDENTIAL RETIREMENT COMMUNITY

SIGNALIZED INTERSECTION ANALYSIS RESULTS WITH MITIGATION

	AM Peak Hour			PM Peak Hour		
Intersection	v/c	Delay (seconds)	LOS	v/c	Delay (seconds)	LOS
Kamehameha Highway and Mokulele Drive						
Northbound Approach	--	20.1	C	--	15.0	B
Left Turn	0.35	47.1	D	0.32	37.8	D
Through Movement/Right Turn	0.57	19.0	B	0.69	13.6	B
Southbound Approach	--	14.6	B	--	17.9	B
Left Turn	0.18	36.6	D	0.16	45.3	D
Through Movement	0.57	13.6	B	0.61	17.5	B
Eastbound Approach	0.34	32.0	C	0.31	35.5	D
Westbound Approach	--	29.4	C	--	34.0	C
Left Turn/Through Movement	0.03	29.1	C	0.14	34.0	C
Right Turn	0.07	29.4	C	0.15	34.0	C
Overall Intersection	0.49	18.0	B	0.57	17.3	B

Table 25
Hawaiian Memorial Park Expansion

Sum of Existing and Future Net Increase
Estimated Cumulative Project Traffic Percentage at Intersection

	Existing Traffic Conditions		Future Traffic Conditions without Project		Future Traffic Conditions with Alternative A		Future Traffic Conditions with Alternative B		Future Traffic Conditions with Alternative C	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Kamehameha Highway, Halekou Road and HMP Primary Driveway	4.3%	3.9%	4.1%	3.7%	4.9%	4.4%	5.1%	4.6%	4.8%	4.4%
Kamehameha Highway, Mahinui Road and HMP Secondary Driveway	1.5%	2.0%	1.4%	1.9%	2.2%	2.6%	2.4%	2.8%	2.1%	2.5%
Kamehameha Highway and Mokulele Drive	3.6%	3.4%	3.4%	3.3%	4.1%	4.0%	4.4%	4.2%	4.0%	3.9%
Kaneohe Bay Drive and Mokulele Drive	--	--	--	--	--	--	--	--	--	--
Kaneohe Bay Drive and Namoku Street	--	--	--	--	--	--	--	--	--	--
Mokulele Drive and Namoku Street	--	--	--	--	--	--	--	--	--	--
Namoku Street and Lipalu Street	--	--	--	--	--	--	--	--	--	--

Table 26
Hawaiian Memorial Park Expansion

Future Net Increase
Estimated Project Traffic Percentage at Intersection

	Future Traffic Conditions with Alternative A		Future Traffic Conditions with Alternative B		Future Traffic Conditions with Alternative C	
	AM	PM	AM	PM	AM	PM
Kamehameha Highway, Halekou Road and HMP Primary Driveway	0.8%	0.7%	1.0%	0.9%	0.8%	0.7%
Kamehameha Highway, Mahinui Road and HMP Secondary Driveway	0.8%	0.8%	1.0%	1.0%	0.7%	0.6%
Kamehameha Highway and Mokulele Drive	0.7%	0.8%	1.0%	1.0%	0.6%	0.6%
Kaneohe Bay Drive and Mokulele Drive	0.2%	0.3%	0.4%	0.4%	0.1%	0.1%
Kaneohe Bay Drive and Namoku Street	0.2%	0.3%	0.3%	0.5%	0.1%	0.1%
Mokulele Drive and Namoku Street	2.8%	3.7%	4.6%	6.1%	0.4%	0.4%
Namoku Street and Lipalu Street	7.5%	9.0%	12.3%	15.2%	0.0%	0.0%

VIII. FINDINGS AND RECOMMENDATIONS

The findings and proposed recommendations for this traffic study are listed below.

A. Existing Traffic Conditions

- Under existing traffic conditions, there are Level of Service F conditions for westbound left turn and through movements at the unsignalized intersection of Kamehameha Hghway, Halekou Road and the HMP primary driveway. The morning peak hour traffic volumes at the Kamehameha Highway, Halekou Road and the HMP primary driveway intersection meet the regular peak hour traffic signal warrant, but the afternoon peak hour traffic volumes do not satisfy the technical criteria.

- Police enforcement of the Kamehameha Highway posted speed limit of 35 miles per hour would be helpful in creating larger gap times for Halekou Road and HMP primary driveway left turn and through movements. Further study should be undertaken to determine if lowering the Kamehameha Highway posted speed limit of 45 miles per hour on the south side of the Halekou Interchange would contribute towards better motorists compliance to the posted 35 miles per hour speed limit in the vicinity of the Kamehameha Highway/Halekou Road/HMP primary driveway and Kamehameha Highway/Mahinui Road/HMP secondary driveway intersections.

- For the Kamehameha Hghway, Halekou Road and the HMP primary driveway, the modified peak hour traffic signal warrant (70 percent factor) can be utilized if Kamehameha Highway speeds continue to exceed 40 miles per hour. The morning and afternoon peak hour traffic volumes meet the modified technical criteria. If traffic signals are installed, the intersection would operate with overall Level of Service B conditions during the morning and afternoon peak hours.

- The Mahinui Road eastbound approach at the unsignalized intersection of Kamehameha Highway, Mahinui Road and the HMP secondary driveway is

at Level of Service E during the morning and afternoon peak hours. No traffic improvements are needed for the existing traffic conditions.

- The northbound left turn/through movement at the intersection of Kaneohe Bay Drive and Namoku Street has Level of Service F conditions during the morning and afternoon peak hours, but traffic volumes for this Namoku Street movement are low and do not meet the traffic signal warrant criteria. No traffic improvements are proposed for this intersection.

- The unsignalized intersections of Mokulele Drive with Namoku Street and Namoku Street with Lipalu Street operate with Level of Service B or better. Traffic improvements are not needed for the existing traffic conditions.

- The westbound left turn and through movement at the signalized intersection of Kamehameha Highway with Mokulele Drive and Kaneohe Bay Drive with Mokuele Drive experience Level of Service E conditions, but overall intersection operations are at Level of Service C. Overall, the signalized intersection of Kaneohe Bay Drive with Mokulele Drive is also at Level of Service C. Thus, no traffic improvements are proposed for these two signalized intersections.

B. Future Traffic Conditions Without Project

- The growth in the forecasted traffic volumes for the future traffic conditions without the project would slightly increase delays at the study intersections and need similar traffic improvements as the existing traffic conditions.

- The westbound left turn at the unsignalized intersection of Kamehameha Highway, Halekou Road and HMP primary driveway would continue to experience Level of Service F conditions. The morning peak hour traffic volumes meet the regular peak hour traffic signal warrant.

- Enforcement of Kamehameha Highway posted speed limit of 35 miles per hour would help create larger gap times for left turn and through movements

exiting at the Halekou Road and HMP primary driveway. Further study should be undertaken to determine if lowering the Kamehameha Highway posted speed limit of 45 miles per hour on the south side of the Halekou Interchange would contribute towards better motorist adherence to the lower 35 miles per hour speed limit posted on the north side of the interchange.

- If Kamehameha Higway operating speeds continue to exceed 40 miles per hour, then the modified peak hour traffic signal warrant can be applied to intersection of Kamehameha Highway, Halekou Road and HMP primary driveway. The technical criteria for the modified warrant is satisfied by both morning and afternoon peak hour traffic volumes. If traffic signals were installed at this intersection, then overall traffic operations would be at Level of Service B.

- The northbound left turn/through movement at the unsignalized intersection of Kaneohe Bay Drive and Namoku Street would also continue to experience Level of Service F conditions. However, the traffic volumes do not meet the regular or modified peak hour traffic signal warrants. No traffic improvements are proposed for this intersection.

- No traffic improvements would be needed at the unsignalized intersections of Kamehameha Highway/Mahinui Road/HMP secondary driveway, Mokulele Drive/Namoku Street and Namoku Street/Lipalu Street. Also, the signalized intersections of Kamehameha Highway/Mokulele Drive and Kaneohe Bay Drive/Mokulele Drive do not require traffic improvements.

C. Future Traffic Conditions With Project

- With Alternative A, the estimated new project trips onto the external roadway system would increase by 18 entering trips and 18 exiting trips during the morning peak hour period. Also, there would be an addition of 21 entering and 14 exiting project trips during the afternoon peak hour period.

- With Alternative B, new project traffic would consist of 33 entering trips and 14 exiting trips during the morning peak hour period. An increase of 21 entering project trips and 40 exiting project trips is estimated for the afternoon peak hour period.

- With Alternative C, the morning peak hour project trips would be 16 entering trips and 7 exiting trips. During the afternoon peak hour, there would be an addition of 10 entering and 19 exiting project trips on the external roadway system.

Although there are slight differences in the amount of delay in the analysis results for future traffic conditions with Alternative A, Alternative B and Alternative C, the Level of Service results are highly similar for all three alternatives. The following descriptions of the intersection analysis results and proposed traffic improvements are applicable to all three alternatives.

- For the unsignalized intersection of Kamehameha Highway, Halekou Road and the HMP primary driveway, the westbound left turn and through movement at the HMP primary driveway would be expected to operate with Level of Service F conditions. The Level of Service F delays already occur for this movement with the existing traffic conditions.

- Police enforcement of the Kamehameha Highway posted speed limit of 35 miles per hour would assist in creating larger gap times and crossing opportunities for left turn and through movements on Halekou Road and HMP primary driveway. Further study should be undertaken to determine if lowering of the existing Kamehameha Highway posted speed limit of 45 miles

per hour on the south side of Halekou Interchange would encourage better compliance to existing posted speed limit of 35 miles per hour in the vicinity of the Kamehameha Highay intersections at Halekou Road/HMP primary driveway and at Mahinui Road/HMP secondary driveway.

- If traffic signals were installed at the Kamehameha Highway intersection with Halekou Road and HMP primary driveway, the overall operations would be at Level of Service B during the morning peak hour period and afternoon peak hour period. The morning traffic volumes at this intersection satisfy the regular peak hour technical criteria. If the modified traffic signal peak hour warrant (70 percent factor) for highway speeds greater than 40 miles per hour is applied, the then morning and afternoon peak hour traffic volumes meet the modified technical criteria. Further traffic engineering warrant studies should be undertaken to better identify the need to install the traffic signal system at this intersection.

- At the Kaneohe Bay Drive and Namoku Street intersection, the northbound left turn and through movements operate with Level of Service F conditions during the morning and afternoon peak hours. The Level of Service F conditions for the northbound left turn and through movement are already experienced with the existing traffic conditions; however, there are less than ten vehicles per hour executing this movement during the morning and afternoon peak hour periods. No traffic improvements are recommended as the intersection traffic volumes do not meet the regular peak hour traffic signal warrants.

- Traffic improvements are not needed at the following locations:
    a) Mokulele Drive and Namoku Street unsignalized intersection,
    b) Namoku Street and Lipalu Street unsignalized intersection,
    c) Kamehameha Highway and Mokulele Drive signalized intersection and
    d) Kaneohe Bay and Mokulele Drive signalized intersection.

D. Project Traffic Percentages

- Cumulative sums of existing HMP traffic volumes and future net project traffic volumes can be calculated for the three Kamehameha Highway study intersections. As indicated in Table 25, the cumulative sums for existing and future HMP traffic volumes range between 1.4 percent and 5.1 percent of the total study intersection traffic volumes.

- If only future net project traffic increases with Alternative A, Alternative B or Alternative C are considered, then project traffic percentages range from 0.0 percent to 15.2 percent of the total traffic volumes at the various study intersections. The Namoku Street/Lipalu Street intersection and Mokulele Drive/Namoku Street intersection would have the higher percentages with Alternative A and Alternative B because the existing traffic volumes at these intersections are relatively low. However, these two unsignalized intersections would be expected to operate with Level of Service A and B conditions with or without the three proposed alternatives.

IX. REFERENCES

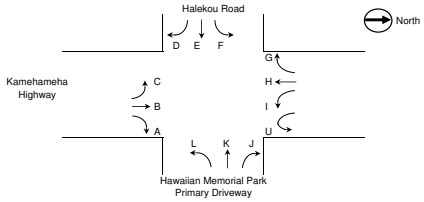
Institute of Transportation Engineers, Trip Generation, Seventh Edition, United States of America, 2003.

National Research Council, National Academy of Sciences, Highway Capacity Manual 2000, published by the Transportation Research Board, Washington, D.C., 2000.

State of Hawaii Department of Transportation, Highways Division, various traffic count data for various Kaneohe locations for various years.

U.S. Department of Transportation, Federal Highway Administration, Manual of Uniform Traffic Control Devices, United States of America, 2003.

Intersection: Kamehameha Highway at Halekou Road and
Hawaiian Memorial Park Primary Driveway
Date: Thursday, April 12, 2007
Time: AM Peak Period
Counted by: YL, JH



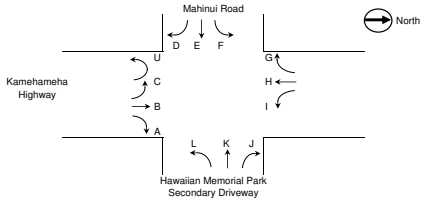
Time Period	A	B	C	D	E	F	G	H	I	U	J	K	L	Total	Hour
6:00 - 6:15 am	3	92	2	31	0	4	1	264	9	0	0	0	0	406	
6:15 - 6:30	4	107	3	37	1	2	1	289	4	0	2	1	0	451	
6:30 - 6:45	2	90	4	41	0	5	8	314	3	0	0	0	0	467	
6:45 - 7:00	2	119	7	37	0	9	6	300	3	0	6	0	2	491	1815
7:00 - 7:15	2	131	4	27	0	6	7	276	10	0	5	2	1	471	1880
7:15 - 7:30	5	214	12	21	0	12	11	276	11	0	5	0	4	571	2000
7:30 - 7:45	2	234	5	26	0	14	10	274	7	0	7	0	2	581	2114
7:45 - 8:00	5	219	9	22	1	9	14	240	17	0	3	0	2	541	2164
8:00 - 8:15	7	205	12	15	1	7	11	268	9	1	8	0	1	545	2238
8:15 - 8:30	7	198	10	17	0	8	6	242	0	1	3	1	1	494	2161
8:30 - 8:45	4	150	8	13	0	0	3	234	7	0	3	0	0	422	2002
8:45 - 9:00 am	9	193	11	23	0	7	7	193	9	0	2	1	4	459	1920
TOTAL	52	1952	87	310	3	83	85	3170	89	2	44	5	17	5493	
7:15 - 8:15 am	19	872	38	84	2	42	46	1058	44	1	23	0	9	2238	

Approach and Departure Time Period	ABC	DEF	GHIU	JKL	Hour ABC	Hour DEF	Hour GHIU	Hour JKL	AEI	BFJU	CGK	DHL	Hour AEI	Hour BFJU	Hour CGK	Hour DHL
6:00 - 6:15 am	97	35	274	0					12	96	3	295				
6:15 - 6:30	114	40	294	3					9	111	5	326				
6:30 - 6:45	96	46	325	0					5	95	12	355				
6:45 - 7:00	128	46	309	8	435	167	1202	11	5	134	13	339	31	436	33	1315
7:00 - 7:15	137	33	293	8	475	165	1221	19	12	142	13	304	31	482	43	1324
7:15 - 7:30	231	33	298	9	592	158	1225	25	16	231	23	301	38	602	61	1299
7:30 - 7:45	241	40	291	9	737	152	1191	34	9	255	15	302	42	762	64	1246
7:45 - 8:00	233	32	271	5	842	138	1153	31	23	231	23	264	60	859	74	1171
8:00 - 8:15	224	23	289	9	929	128	1149	32	17	221	23	284	65	938	84	1151
8:15 - 8:30	215	25	249	5	913	120	1100	28	7	210	17	260	56	917	78	1110
8:30 - 8:45	162	13	244	3	834	93	1053	22	11	153	11	247	58	815	74	1055
8:45 - 9:00 am	213	30	209	7	1047	123	1262	29	18	202	19	220	76	1017	93	1275
TOTAL	2091	396	3344	66					144	2079	177	3497				

APPENDIX A

MANUAL TRAFFIC COUNT DATA

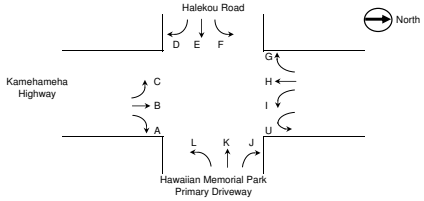
Intersection: Kamehameha Highway at Mahinui Road and
Hawaiian Memorial Park Secondary Driveway
Date: Thursday, April 12, 2007
Time: AM Peak Period
Counted by: KN, JR



Time Period	A	B	C	U	D	E	F	G	H	I	J	K	L	Total	Hour
6:00 - 6:15 am	0	91	0	0	10	0	4	2	285	0	0	0	1	393	
6:15 - 6:30	0	107	3	0	7	0	6	3	291	0	0	0	0	417	
6:30 - 6:45	0	95	0	0	3	0	3	4	338	0	0	0	0	443	
6:45 - 7:00	1	139	2	1	7	0	7	1	319	2	1	0	0	480	1733
7:00 - 7:15	0	150	2	1	3	0	1	6	300	3	0	0	1	467	1807
7:15 - 7:30	0	232	2	1	7	2	7	3	319	3	1	0	0	577	1967
7:30 - 7:45	2	256	0	0	2	0	17	6	304	5	1	0	0	593	2117
7:45 - 8:00	1	238	1	0	1	0	11	10	291	2	3	0	0	558	2195
8:00 - 8:15	0	226	1	0	2	1	0	6	312	8	3	0	2	561	2289
8:15 - 8:30	0	220	4	1	0	0	4	3	241	2	3	0	0	478	2190
8:30 - 8:45	2	147	2	4	3	0	5	4	236	6	6	0	0	415	2012
8:45 - 9:00 am	0	200	1	4	1	1	12	3	208	5	4	0	3	442	1896
TOTAL	6	2101	18	12	46	4	77	51	3444	36	22	0	7	5431	
7:15 - 8:15 am	3	952	4	1	12	3	35	25	1226	18	8	0	2	2289	

Approach and Departure Time Period	ABCU	DEF	GHI	JKL	Hour ABCU	Hour DEF	Hour GHI	Hour JKL	AEI	BFJ	CGK	DHLU	Hour AEI	Hour BFJ	Hour CGK	Hour DHLU
6:00 - 6:15 am	91	14	287	1					0	95	2	296				
6:15 - 6:30	110	13	294	0					0	113	6	298				
6:30 - 6:45	95	6	342	0					0	98	4	341				
6:45 - 7:00	143	14	322	1	439	47	1245	2	3	147	3	327	3	453	15	1262
7:00 - 7:15	153	4	309	1	501	37	1267	2	3	151	8	305	6	509	21	1271
7:15 - 7:30	235	16	325	1	626	40	1298	3	5	240	5	327	11	636	20	1300
7:30 - 7:45	258	19	315	1	789	53	1271	4	7	274	6	306	18	812	22	1265
7:45 - 8:00	240	12	303	3	886	51	1252	6	3	252	11	292	18	917	30	1230
8:00 - 8:15	227	3	326	5	960	50	1269	10	9	229	7	316	24	995	29	1241
8:15 - 8:30	225	4	246	3	950	38	1190	12	2	227	7	242	21	982	31	1156
8:30 - 8:45	155	8	246	6	847	27	1121	17	8	158	6	243	22	866	31	1093
8:45 - 9:00 am	205	14	216	7	1052	41	1337	24	6	216	4	216	28	1082	35	1309
TOTAL	2125	127	3531	29					46	2200	69	3497				

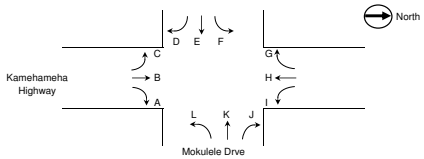
Intersection: Kamehameha Highway at Halekou Road and
Hawaiian Memorial Park Primary Driveway
Date: Wednesday, April 11, 2007
Time: PM Peak Period
Counted by: YL, JH



Time Period	A	B	C	D	E	F	G	H	I	U	J	K	L	Total	Hour
3:15 - 3:30 pm	8	288	22	8	1	6	8	220	10	1	3	0	3	578	
3:30 - 3:45	9	373	27	9	0	7	5	246	5	0	27	0	7	715	
3:45 - 4:00	9	350	22	7	0	9	3	220	6	1	20	0	11	658	
4:00 - 4:15	2	344	26	9	1	7	18	250	2	0	20	0	14	693	2644
4:15 - 4:30	6	341	21	20	0	9	7	241	5	0	14	0	7	671	2737
4:30 - 4:45	3	364	22	15	0	7	14	274	2	0	2	0	4	707	2729
4:45 - 5:00	10	361	24	8	1	13	14	231	5	0	5	0	5	677	2748
5:00 - 5:15	10	338	20	15	0	9	6	230	6	0	14	0	8	656	2711
5:15 - 5:30	11	341	23	8	0	10	9	260	6	0	7	0	7	682	2722
5:30 - 5:45	14	332	33	12	0	9	8	210	3	0	3	0	3	627	2642
5:45 - 6:00	10	313	28	8	0	2	8	222	7	0	6	0	3	607	2572
6:00 - 6:15	5	280	21	8	0	2	5	178	2	0	7	1	2	511	2427
6:15 - 6:30 pm	8	280	20	5	0	3	7	210	4	3	5	1	3	549	2294
TOTAL	105	4305	309	132	3	93	112	2992	63	5	133	2	77	8331	
4:00 - 5:00 pm	21	1410	93	52	2	36	53	996	14	0	41	0	30	2748	

Approach and Departure Time Period	ABC	DEF	GHIU	JKL	Hour ABC	Hour DEF	Hour GHIU	Hour JKL	AEI	BFJU	CGK	DHL	Hour AEI	Hour BFJU	Hour CGK	Hour DHL
3:15 - 3:30 pm	318	15	239	6					19	298	30	231				
3:30 - 3:45	409	16	256	34					14	407	32	262				
3:45 - 4:00	381	16	230	31					15	380	25	238				
4:00 - 4:15	372	17	270	34	1480	64	995	105	5	371	44	273	53	1456	131	1004
4:15 - 4:30	368	29	253	21	1530	78	1009	120	11	364	28	268	45	1522	129	1041
4:30 - 4:45	389	22	290	6	1510	84	1043	92	5	373	36	293	36	1488	133	1072
4:45 - 5:00	395	22	250	10	1524	90	1063	71	16	379	38	244	37	1487	146	1078
5:00 - 5:15	368	24	242	22	1520	97	1035	59	16	361	26	253	48	1477	128	1058
5:15 - 5:30	375	18	275	14	1527	86	1057	52	17	358	32	275	54	1471	132	1065
5:30 - 5:45	379	21	221	6	1517	85	988	52	17	344	41	225	66	1442	137	997
5:45 - 6:00	351	10	237	9	1473	73	975	51	17	321	36	233	67	1384	135	986
6:00 - 6:15	306	10	185	10	1411	59	918	39	7	289	27	188	58	1312	136	921
6:15 - 6:30	308	8	224	9	1344	49	867	34	12	291	28	218	53	1245	132	864
TOTAL	4719	228	3172	212					171	4536	423	3201				

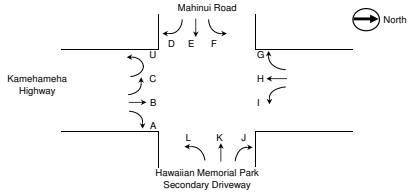
Intersection: Kamehameha Highway and Mokulele Drive
Date: Thursday, April 12, 2007
Time: AM Peak Period
Counted by: JE, JS



Time Period	A	B	C	D	E	F	G	H	I	J	K	L	Total	Hour
6:00 - 6:15 am	7	88	0	7	1	13	4	214	9	11	2	66	422	
6:15 - 6:30	6	107	0	11	1	14	4	217	6	18	3	66	453	
6:30 - 6:45	3	94	1	8	1	21	5	263	6	23	2	71	498	
6:45 - 7:00	15	130	2	14	4	21	1	240	11	26	4	68	536	1487
7:00 - 7:15	15	136	0	10	1	25	7	240	15	27	2	59	537	2024
7:15 - 7:30	20	218	2	10	4	22	9	269	18	39	6	46	663	2234
7:30 - 7:45	25	248	1	5	5	17	8	254	20	49	3	56	691	2427
7:45 - 8:00	13	238	1	4	4	20	10	235	15	33	5	64	642	2533
8:00 - 8:15	14	213	2	3	1	19	6	274	8	26	2	49	617	2613
8:15 - 8:30	12	212	3	3	3	16	11	204	8	16	3	39	530	2480
8:30 - 8:45	10	148	0	7	1	12	6	202	7	15	1	37	446	2235
8:45 - 9:00 am	13	200	3	8	2	7	10	178	11	9	3	30	474	2067
TOTAL	153	2032	15	90	28	207	81	2790	134	292	36	651	6087	
7:15 - 8:15 am	72	917	6	22	14	78	33	1032	61	147	16	215	2613	

Approach and Departure Time Period	ABC	DEF	GHI	JKL	Hour ABC	Hour DEF	Hour GHI	Hour JKL	AEI	BFJ	CGK	DHL	Hour AEI	Hour BFJ	Hour CGK	Hour DHL
5:00 - 5:15 am	95	21	227	79					17	112	6	287				
6:15 - 6:30	113	26	227	87					13	139	7	294				
6:30 - 6:45	98	30	274	96					10	138	8	342				
6:45 - 7:00	147	39	252	98	453	116	980	360	30	177	7	322	70	566	28	1245
7:00 - 7:15	151	36	262	88	509	131	1015	369	31	188	9	309	84	642	31	1267
7:15 - 7:30	240	36	296	91	636	141	1084	373	42	279	17	325	113	782	41	1298
7:30 - 7:45	274	27	282	108	812	138	1092	385	50	314	12	315	153	958	45	1271
7:45 - 8:00	252	28	260	102	917	127	1100	389	32	291	16	303	155	1072	54	1252
8:00 - 8:15	229	23	288	77	995	114	1126	378	23	258	10	326	147	1142	55	1269
8:15 - 8:30	227	22	223	58	982	100	1053	345	23	244	17	246	128	1107	55	1190
8:30 - 8:45	158	20	215	53	866	93	986	290	18	175	7	246	96	968	50	1121
8:45 - 9:00 am	216	17	199	42	830	82	925	230	26	216	16	216	90	893	50	1034
TOTAL	2200	325	3005	979					315	2531	132	3531				
7:15 - 8:15 am	995	114	1126	378					147	1142	55	1269				

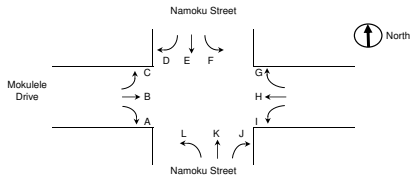
Intersection: Kamehameha Highway at Mahinui Road and
Hawaiian Memorial Park Secondary Driveway
Date: Wednesday, April 11, 2007
Time: PM Peak Period
Counted by: KN, JR



Time Period	A	B	C	U	D	E	F	G	H	I	J	K	L	Total	Hour
2:30 - 2:45 pm	0	0	0	0							0	0	0		
2:45 - 3:00	0	0	0	0							0	0	0		
3:00 - 3:15	0	0	0	0							0	0	0	0	
3:15 - 3:30	1	240	7	0	3	0	6	6	290	5	2	1	1	562	
3:30 - 3:45	1	381	4	0	1	0	5	9	272	8	4	0	2	687	
3:45 - 4:00	1	383	10	2	4	0	5	8	234	10	4	0	0	661	
4:00 - 4:15	1	365	5	1	3	0	7	13	271	9	19	0	0	694	2604
4:15 - 4:30	0	370	5	2	2	0	1	4	282	4	5	0	0	675	2717
4:30 - 4:45	1	370	6	5	0	1	6	6	316	3	5	0	0	719	2749
4:45 - 5:00	0	349	5	2	1	0	6	9	258	1	3	0	2	636	2724
5:00 - 5:15	1	358	10	2	2	1	5	8	269	9	3	0	1	669	2699
5:15 - 5:30	0	361	11	3	2	0	11	8	283	3	6	0	2	690	2714
5:30 - 5:45	1	370	6	0	1	0	3	5	235	6	1	0	1	629	2624
5:45 - 6:00	1	299	7	0	1	0	7	5	224	5	5	0	0	554	2542
6:00 - 6:15	1	281	10	4	0	0	7	5	188	2	5	0	1	504	2377
6:15 - 6:30 pm	1	283	7	3	1	0	10	9	217	0	6	0	0	537	2224
TOTAL	10	4410	93	24	21	2	79	95	3339	65	68	1	10	8217	
4:00 - 5:00 pm	2	1454	21	10	6	1	20	32	1127	17	32	0	2	2724	

Approach and Departure Time Period	ABCU	DEF	GHI	JKL	Hour ABCU	Hour DEF	Hour GHI	Hour JKL	AEI	BFJ	CGK	DHLU	Hour AEI	Hour BFJ	Hour CGK	Hour DHLU
2:30 - 2:45 pm	0	0	0	0					0	0	0	0				
2:45 - 3:00	0	0	0	0					0	0	0	0				
3:00 - 3:15	0	0	0	0					0	0	0	0				
3:15 - 3:30 pm	248	9	301	4	248	9	301	4	6	248	14	294	6	248	14	294
3:30 - 3:45	386	6	289	6	634	15	590	10	9	390	13	275	15	638	27	569
3:45 - 4:00	396	9	252	4	1030	24	842	14	11	392	18	240	26	1030	45	809
4:00 - 4:15	372	10	293	19	1402	34	1135	33	10	391	18	275	36	1421	63	1084
4:15 - 4:30	377	3	290	5	1531	28	1124	34	4	376	9	286	34	1549	58	1076
4:30 - 4:45	382	7	325	5	1527	29	1160	33	5	381	12	321	30	1540	57	1122
4:45 - 5:00	356	7	268	5	1487	27	1176	34	1	358	14	263	20	1506	53	1145
5:00 - 5:15	371	8	286	4	1486	25	1169	19	11	366	18	274	21	1481	53	1144
5:15 - 5:30	375	13	294	8	1484	35	1173	22	3	378	19	290	20	1483	63	1148
5:30 - 5:45	377	4	246	2	1479	32	1094	19	7	374	11	237	22	1476	62	1064
5:45 - 6:00	307	8	234	5	1430	33	1060	19	6	311	12	225	27	1429	60	1026
6:00 - 6:15	296	7	195	6	1355	32	969	21	3	293	15	193	19	1356	57	945
6:15 - 6:30 pm	294	11	226	6	1274	30	901	19	1	299	16	221	17	1277	54	876
TOTAL	4537	102	3499	79					77	4557	189	3394				

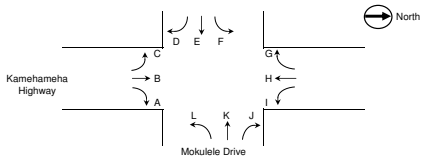
Intersection: Mokulele Drive and Namoku Street
Date: Thursday, April 19, 2007
Time: AM Peak Period
Counted by: YL



Time Period	A	B	C	D	E	F	G	H	I	J	K	L	Total	Hour
6:00 - 6:15 am	1	1	1	3	5	5	1	18	0	1	4	18	58	
6:15 - 6:30	4	2	0	2	6	0	1	19	0	0	9	12	55	
6:30 - 6:45	7	9	0	5	7	2	2	13	0	1	8	16	70	
6:45 - 7:00	6	12	3	4	9	5	4	20	1	3	15	13	95	220
7:00 - 7:15	7	18	0	10	9	2	7	20	0	1	11	8	93	313
7:15 - 7:30	5	24	4	7	9	9	16	27	0	3	14	12	130	388
7:30 - 7:45	7	13	5	10	14	11	14	40	0	7	20	10	151	469
7:45 - 8:00	13	22	4	5	14	8	13	41	2	1	6	8	137	511
8:00 - 8:15	9	14	2	6	11	6	6	19	1	3	6	10	93	511
8:15 - 8:30	14	7	0	6	8	3	3	13	2	0	5	8	69	450
8:30 - 8:45	8	14	3	7	10	3	3	10	1	1	3	10	73	372
8:45 - 9:00 am	6	9	0	3	12	1	1	13	1	0	5	6	57	292
TOTAL	87	145	22	68	114	55	71	253	8	21	106	131	1023	
7:15 - 8:15 am	34	73	15	28	48	34	49	127	3	14	46	40	511	

Approach and Departure Time Period	ABC	DEF	GHI	JKL	Hour ABC	Hour DEF	Hour GHI	Hour JKL	AEI	BFJ	CGK	DHL	Hour AEI	Hour BFJ	Hour CGK	Hour DHL
6:00 - 6:15 am	3	13	19	23					6	7	6	39				
6:15 - 6:30	6	8	20	21					10	2	10	33				
6:30 - 6:45	16	14	15	25					14	12	10	34				
6:45 - 7:00	21	18	25	31	46	53	79	100	16	20	22	37	46	41	48	143
7:00 - 7:15	25	21	27	20	68	61	87	97	16	21	18	38	56	55	60	142
7:15 - 7:30	33	25	43	29	95	78	110	105	14	36	34	46	60	89	84	155
7:30 - 7:45	25	35	54	37	104	99	149	117	21	31	39	60	67	108	113	181
7:45 - 8:00	39	27	56	15	122	108	180	101	29	31	23	54	80	119	114	198
8:00 - 8:15	25	23	26	19	122	110	179	100	21	23	14	35	85	121	110	195
8:15 - 8:30	21	17	18	13	110	102	154	84	24	10	8	27	95	95	84	176
8:30 - 8:45	25	20	14	14	110	87	114	61	19	18	9	27	93	82	54	143
8:45 - 9:00 am	15	16	15	11	125	103	129	72	19	10	6	22	112	92	60	165
TOTAL	254	237	332	258					209	221	199	452				

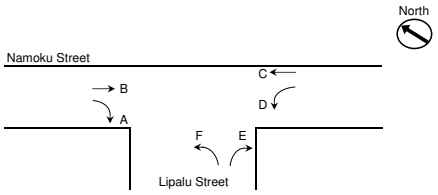
Intersection: Kamehameha Highway at Mokulele Drive
Date: Wednesday, April 11, 2007
Time: PM Peak Period
Counted by: JE, JS



Time Period	A	B	C	D	E	F	G	H	I	J	K	L	Total	Hour
3:15 - 3:30 pm	31	209	8	3	2	8	11	250	19	19	18	48	626	
3:30 - 3:45	35	353	2	1	0	15	17	247	16	23	2	41	752	
3:45 - 4:00	35	352	5	0	2	15	17	224	19	23	10	28	730	
4:00 - 4:15	60	328	3	4	4	15	15	258	32	22	6	31	778	2886
4:15 - 4:30	34	341	1	1	5	18	10	260	26	17	2	29	744	3004
4:30 - 4:45	47	332	2	5	1	13	13	287	30	13	7	33	783	3035
4:45 - 5:00	38	313	7	3	2	14	14	231	27	26	8	34	717	3022
5:00 - 5:15	46	319	1	2	4	9	20	247	21	17	4	37	727	2971
5:15 - 5:30	40	334	4	2	3	12	21	247	21	27	4	45	760	2987
5:30 - 5:45	47	323	4	3	3	8	12	213	21	20	3	30	687	2891
5:45 - 6:00	44	267	0	3	4	17	22	196	22	20	6	35	636	2810
6:00 - 6:15	45	243	5	6	3	12	13	167	25	22	8	22	571	2654
6:15 - 6:30 pm	43	253	3	5	1	14	15	186	17	21	6	35	599	2493
TOTAL	545	3967	45	38	34	170	200	3013	296	270	84	448	9110	
4:00 - 5:00 pm	179	1314	13	13	12	60	52	1036	115	78	23	127	3022	

Approach and Departure Time Period	ABC	DEF	GHI	JKL	Hour ABC	Hour DEF	Hour GHI	Hour JKL	AEI	BFJ	CGK	DHL	Hour AEI	Hour BFJ	Hour CGK	Hour DHL
3:15 - 3:30 pm	248	13	280	85					52	236	37	301				
3:30 - 3:45	390	16	280	66					51	391	21	289				
3:45 - 4:00	392	17	260	61					56	390	32	252				
4:00 - 4:15	391	23	305	59	1421	69	1125	271	96	365	24	293	255	1382	114	1135
4:15 - 4:30	376	24	296	48	1549	80	1141	234	65	376	13	290	268	1522	90	1124
4:30 - 4:45	381	19	330	53	1540	83	1191	221	78	358	22	325	295	1489	91	1160
4:45 - 5:00	358	19	272	68	1506	85	1203	228	67	353	29	268	306	1452	88	1176
5:00 - 5:15	366	15	288	58	1481	77	1186	227	71	345	25	286	281	1432	89	1169
5:15 - 5:30	378	17	289	76	1483	70	1179	255	64	373	29	294	280	1429	105	1173
5:30 - 5:45	374	14	246	53	1476	65	1095	255	71	351	19	246	273	1422	102	1094
5:45 - 6:00	311	24	240	61	1429	70	1063	248	70	304	28	234	276	1373	101	1060
6:00 - 6:15	293	21	205	52	1356	76	980	242	73	277	26	195	278	1305	102	969
6:15 - 6:30 pm	299	20	218	62	1277	79	909	228	61	288	24	226	275	1220	97	901
TOTAL	4557	242	3509	802					875	4407	329	3499				

Intersection: Namoku Street and Lipalu Street
Date: Thursday, April 19, 2007
Time: AM Peak Period
Counted by: JH

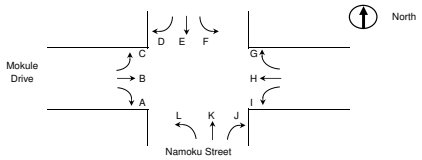


Time Period	A	B	C	D	E	F	Total	Hour
6:00 - 6:15 am	0	4	19	0	0	2	25	
6:15 - 6:30	1	5	17	1	0	4	28	
6:30 - 6:45	1	12	23	0	0	4	40	
6:45 - 7:00	0	15	19	0	0	3	37	130
7:00 - 7:15	2	14	16	0	3	1	36	141
7:15 - 7:30	1	12	22	0	1	6	42	155
7:30 - 7:45	1	21	25	1	0	7	55	170
7:45 - 8:00	1	30	15	1	0	2	49	182
8:00 - 8:15	1	19	18	0	0	1	39	185
8:15 - 8:30	4	17	13	0	0	1	35	178
8:30 - 8:45	1	15	11	0	1	1	29	152
8:45 - 9:00 am	1	16	12	0	0	1	30	133
TOTAL	14	180	210	3	5	33	445	
7:00 - 8:00 am	5	77	78	2	4	16	182	

Approach and Departure

Time Period	AB	CD	EF	Hour AB	Hour CD	Hour EF	AD	BE	CF	Hour AD	Hour BE	Hour CF
6:00 - 6:15 am	4	19	2				0	4	21			
6:15 - 6:30	6	18	4				2	5	21			
6:30 - 6:45	13	23	4				1	12	27			
6:45 - 7:00	15	19	3	38	79	13	0	15	22	3	36	91
7:00 - 7:15	16	16	4	50	76	15	2	17	17	5	49	87
7:15 - 7:30	13	22	7	57	80	18	1	13	28	4	57	94
7:30 - 7:45	22	26	7	66	83	21	2	21	32	5	66	99
7:45 - 8:00	31	16	2	82	80	20	2	30	17	7	81	94
8:00 - 8:15	20	18	1	86	82	17	1	19	19	6	83	96
8:15 - 8:30	21	13	1	94	73	11	4	17	14	9	87	82
8:30 - 8:45	16	11	2	88	58	6	1	16	12	8	82	62
8:45 - 9:00 am	17	12	1	74	54	5	1	16	13	7	68	58
TOTAL	194	213	38				17	185	243			

Intersection: Mokulele Drive at Namoku Street
Date: Wednesday, April 18, 2007
Time: PM Peak Period
Counted by: YL

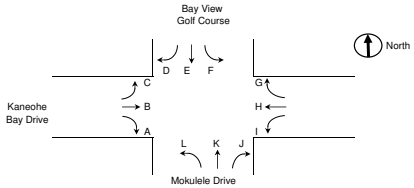


Time Period	A	B	C	D	E	F	G	H	I	J	K	L	Total	Hour
3:00 - 3:15 pm	6	15	3	7	17	3	7	14	2	3	3	11	91	
3:15 - 3:30	10	11	7	10	15	5	8	11	2	1	10	3	93	
3:30 - 3:45	12	29	7	9	13	8	12	12	0	2	10	8	122	
3:45 - 4:00	17	14	8	11	25	2	4	10	1	3	7	5	107	
4:00 - 4:15	12	27	5	14	12	17	6	17	3	1	8	14	136	458
4:15 - 4:30	10	16	3	16	16	6	7	13	1	2	8	7	105	470
4:30 - 4:45	21	16	6	15	16	8	8	11	2	0	8	13	124	472
4:45 - 5:00	13	18	2	9	17	9	8	10	3	0	7	8	104	469
5:00 - 5:15	14	17	5	7	20	11	9	11	1	3	12	12	122	455
5:15 - 5:30	16	16	4	9	13	6	10	21	2	3	9	12	121	471
5:30 - 5:45	15	17	2	14	15	12	6	15	2	1	11	8	118	465
5:45 - 6:00	14	17	4	11	12	5	6	7	1	0	9	5	91	452
6:00 - 6:15	18	19	3	15	18	14	3	9	2	1	5	5	112	442
6:15 - 6:30 pm	10	24	9	12	16	6	4	10	1	0	10	11	113	434
TOTAL	188	256	68	159	225	112	98	171	23	20	117	122	1559	
4:00 - 5:00 pm	56	77	16	54	61	40	29	51	9	3	31	42	469	

Approach and Departure

Time Period	ABC	DEF	GHI	JKL	Hour ABC	Hour DEF	Hour GHI	Hour JKL	AEI	BFJ	CGK	DHL	Hour AEI	Hour BFJ	Hour CGK	Hour DHL
3:00 - 3:15 pm	24	27	23	17					25	21	13	32				
3:15 - 3:30	28	30	21	14					27	17	25	24				
3:30 - 3:45	48	30	24	20					25	39	29	29				
3:45 - 4:00	39	38	15	15	139	125	83	66	43	19	19	26	120	96	86	111
4:00 - 4:15	44	43	26	23	159	141	86	72	27	45	19	45	122	120	92	124
4:15 - 4:30	29	38	21	17	160	149	86	75	27	24	18	36	122	127	85	136
4:30 - 4:45	43	39	21	21	155	158	83	76	39	24	22	39	136	112	78	146
4:45 - 5:00	33	35	21	15	149	155	89	76	33	27	17	27	126	120	76	147
5:00 - 5:15	36	38	21	27	141	150	84	80	35	31	26	30	134	106	83	132
5:15 - 5:30	36	28	33	24	148	140	96	87	31	25	23	42	138	107	88	138
5:30 - 5:45	34	41	23	20	139	142	98	86	32	30	19	37	131	113	85	136
5:45 - 6:00	35	28	14	14	141	135	91	85	27	22	19	23	125	108	87	132
6:00 - 6:15	40	47	14	11	145	144	84	69	38	34	11	29	128	111	72	131
6:15 - 6:30 pm	43	34	15	21	152	150	66	66	27	30	23	33	124	116	72	122
TOTAL	512	496	292	259					436	388	283	452				

Intersection: Kaneohe Bay Drive and Mokulele Drive
Date: Thursday, April 19, 2007
Time: AM Peak Period
Counted by: KN, JE



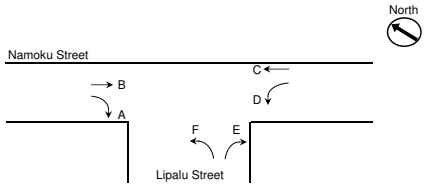
Time Period	A	B	C	D	E	F	G	H	I	J	K	L	Total	Hour
6:00 - 6:15 am	6	93	3	0	0	0	0	93	2	5	0	14	216	
6:15 - 6:30	11	101	2	0	0	0	0	109	9	5	0	26	263	
6:30 - 6:45	15	149	6	1	0	1	0	137	3	7	0	27	346	
6:45 - 7:00	26	200	0	2	0	0	1	174	3	18	3	33	460	1069
7:00 - 7:15	16	196	5	1	0	0	0	150	9	9	0	48	434	1503
7:15 - 7:30	31	214	4	2	1	0	0	213	10	16	0	38	529	1769
7:30 - 7:45	55	180	4	1	1	0	1	222	14	10	0	70	558	1981
7:45 - 8:00	80	159	4	2	0	0	2	212	19	21	1	63	563	2084
8:00 - 8:15	26	189	3	2	0	0	3	196	4	12	1	36	472	2122
8:15 - 8:30	17	146	4	0	0	0	0	34	0	8	1	20	230	1823
8:30 - 8:45	12	126	4	0	0	0	0	0	0	9	1	20	172	1437
8:45 - 9:00 am	12	127	3	2	0	0	2	130	4	4	0	20	304	1178
TOTAL	307	1880	42	13	2	1	9	1670	77	124	7	415	4331	
7:15 - 8:15 am	192	742	15	7	2	0	6	843	47	59	2	207	2122	

Approach and Departure

Time Period	ABC	DEF	GHI	JKL	Hour ABC	Hour DEF	Hour GHI	Hour JKL	AEI	BFJ	CGK	DHL	Hour AEI	Hour BFJ	Hour CGK	Hour DHL
6:00 - 6:15 am	102	0	95	19					8	98	3	107				
6:15 - 6:30	114	0	118	31					20	106	2	135				
6:30 - 6:45	170	2	140	34					18	157	6	165				
6:45 - 7:00	226	2	178	54	510	4	436	119	29	218	4	209	67	481	12	509
7:00 - 7:15	217	1	159	57	727	5	595	176	25	205	5	199	92	686	17	708
7:15 - 7:30	249	3	223	54	862	8	700	199	42	230	4	253	114	810	19	826
7:30 - 7:45	239	2	237	80	931	8	797	245	70	190	5	293	166	843	18	954
7:45 - 8:00	243	2	233	85	948	8	852	276	99	180	7	277	236	805	21	1022
8:00 - 8:15	218	2	203	49	949	9	896	268	30	201	7	234	241	801	23	1057
8:15 - 8:30	167	0	34	29	867	6	707	243	17	154	5	54	216	725	24	858
8:30 - 8:45	142	0	0	30	770	4	470	193	12	135	5	20	158	670	24	585
8:45 - 9:00 am	142	2	136	24	912	6	606	217	16	131	5	152	174	801	29	737
TOTAL	2229	16	1756	546					386	2005	58	2098				

Note: Movements D, E, F, G, H, and I data missed between 8:20 a.m. and 8:46 a.m.

Intersection: Namoku Street and Mikilihina Street
Date: Wednesday, April 18, 2007
Time: PM Peak Period
Counted by: JH

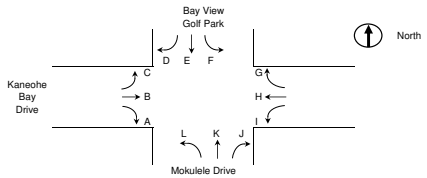


Time Period	A	B	C	D	E	F	Total	Hour
3:15 - 3:30 pm	7	44	25	0	3	3	82	
3:30 - 3:45	3	19	14	1	0	0	37	
3:45 - 4:00	3	31	13	0	1	4	52	
4:00 - 4:15	2	17	17	2	0	1	39	210
4:15 - 4:30	3	29	14	0	1	3	50	178
4:30 - 4:45	4	31	14	2	0	2	53	194
4:45 - 5:00	1	34	14	4	2	4	59	201
5:00 - 5:15	5	20	14	0	0	6	45	207
5:15 - 5:30	7	28	21	0	1	1	58	215
5:30 - 5:45	2	20	14	1	1	5	43	205
5:45 - 6:00	7	22	13	2	1	1	46	192
6:00 - 6:15	3	31	10	0	1	1	46	193
6:15 - 6:30 pm	4	21	20	0	1	1	47	182
TOTAL	51	347	203	12	12	32	657	
4:00 - 5:00 pm	10	111	59	8	3	10	201	

Approach and Departure

Time Period	AB	CD	EF	Hour AB	Hour CD	Hour EF	AD	BE	CF	Hour AD	Hour BE	Hour CF
3:15 - 3:30 pm	51	25	6				7	47	28			
3:30 - 3:45	22	15	0				4	19	14			
3:45 - 4:00	34	13	5				3	32	17			
4:00 - 4:15	19	19	1	126	72	12	4	17	18	18	115	77
4:15 - 4:30	32	14	4	107	61	10	3	30	17	14	98	66
4:30 - 4:45	35	16	2	120	62	12	6	31	16	16	110	68
4:45 - 5:00	35	18	6	121	67	13	5	36	18	18	114	69
5:00 - 5:15	25	14	6	127	62	18	5	20	20	19	117	71
5:15 - 5:30	35	21	2	130	69	16	7	29	22	23	116	76
5:30 - 5:45	22	15	6	117	68	20	3	21	19	20	106	79
5:45 - 6:00	29	15	2	111	65	16	9	23	14	24	93	75
6:00 - 6:15	34	10	2	120	61	12	3	32	11	22	105	66
6:15 - 6:30 pm	25	20	2	110	60	12	4	22	21	19	98	65
TOTAL	398	215	44				63	359	235			

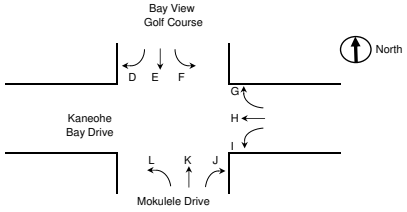
Intersection: Kaneohe Bay Drive at Mokulele Drive
Date: Wednesday, April 18, 2007
Time: PM Peak Period
Counted by: KN, JE



Time Period	A	B	C	D	E	F	G	H	I	J	K	L	Total	Hour
3:00 - 3:15 pm	28	155	2	3	1	1	0	159	7	16	4	18	394	
3:15 - 3:30	33	167	6	5	1	1	0	162	8	7	0	15	405	
3:30 - 3:45	28	181	2	4	1	0	5	209	5	10	2	20	467	
3:45 - 4:00	24	167	7	4	0	3	3	210	6	9	3	22	458	1724
4:00 - 4:15	21	180	6	9	2	0	2	188	9	8	1	39	465	1795
4:15 - 4:30	48	186	4	6	1	1	0	201	8	11	1	31	498	1888
4:30 - 4:45	19	186	1	7	0	1	2	200	13	8	1	25	463	1884
4:45 - 5:00	26	184	4	5	2	2	0	201	5	8	2	23	462	1888
5:00 - 5:15	39	180	7	3	1	1	1	221	9	15	1	40	518	1941
5:15 - 5:30	23	181	7	8	2	1	0	207	8	11	0	35	483	1926
5:30 - 5:45	28	196	8	7	1	1	0	196	8	9	0	20	474	1937
5:45 - 6:00	20	178	8	3	1	0	3	189	8	7	1	22	440	1915
6:00 - 6:15	29	180	16	10	2	6	3	181	8	11	2	25	473	1870
6:15 - 6:30 pm	28	172	5	4	1	2	3	156	8	10	2	26	417	1804
TOTAL	394	2493	83	78	16	20	22	2680	110	140	20	361	6417	
4:15 - 5:15 pm	132	736	16	21	4	5	3	823	35	42	5	119	1941	

Approach and Departure Time Period	ABC	DEF	GHI	JKL	Hour ABC	Hour DEF	Hour GHI	Hour JKL	AEI	BFJ	CGK	DHL	Hour AEI	Hour BFJ	Hour CGK	Hour DHL
3:00 - 3:15 pm	185	5	166	38					36	172	6	180				
3:15 - 3:30	206	7	170	22					42	175	6	182				
3:30 - 3:45	211	5	219	32					34	191	9	233				
3:45 - 4:00	198	7	219	34	800	24	774	126	30	179	13	236	142	717	34	831
4:00 - 4:15	207	11	199	48	822	30	807	136	32	188	9	236	138	733	37	887
4:15 - 4:30	238	8	209	43	854	31	846	157	57	198	5	238	153	756	36	943
4:30 - 4:45	206	8	215	34	849	34	842	159	32	195	4	232	151	760	31	942
4:45 - 5:00	214	9	206	33	865	36	829	158	33	194	6	229	154	775	24	935
5:00 - 5:15	226	5	231	56	884	30	861	166	49	196	9	264	171	783	24	963
5:15 - 5:30	211	11	215	46	857	33	867	169	33	193	7	250	147	778	26	975
5:30 - 5:45	232	9	204	29	883	34	856	164	37	206	8	223	152	789	30	966
5:45 - 6:00	206	4	200	30	875	29	850	161	29	185	12	214	148	780	36	951
6:00 - 6:15	225	18	192	38	874	42	811	143	39	197	21	216	138	781	48	903
6:15 - 6:30 pm	205	7	167	38	868	38	763	135	37	184	10	186	142	772	51	839
TOTAL	2970	114	2812	521					520	2653	125	3119				

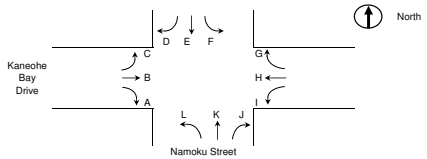
Intersection: Kaneohe Bay Drive and Mokulele Drive
Date: Thursday, April 26, 2007
Time: AM Peak Period
Counted by:



Time Period	A	B	C	D	E	F	I	J	K	L	Total	Hour
6:00 - 6:15 am	3	70	1	0	0	0	2	4	0	18	184	
6:15 - 6:30	14	97	4	1	0	1	11	3	0	19	261	
6:30 - 6:45	24	144	6	2	1	0	4	11	0	27	356	
6:45 - 7:00	18	196	1	1	1	0	5	13	2	33	411	1028
7:00 - 7:15	26	214	3	2	0	0	7	14	2	40	486	1514
7:15 - 7:30	35	237	2	2	0	2	17	15	0	47	549	1802
7:30 - 7:45	57	174	4	3	0	0	17	20	0	56	536	1982
7:45 - 8:00	88	193	2	2	0	0	13	9	0	76	612	2183
8:00 - 8:15	19	164	6	1	0	0	7	9	0	42	447	2144
8:15 - 8:30	11	155	6	1	0	0	4	8	0	22	360	1955
8:30 - 8:45	11	125	3	3	1	2	3	3	3	19	303	1722
8:45 - 9:00 am	11	132	1	1	2	0	3	7	2	19	314	1424
TOTAL	317	1901	39	19	5	5	93	116	9	418	4635	
7:00 - 8:00 am	206	818	11	9	0	2	54	58	2	219	2183	
7:15 - 8:15 am	199	768	14	8	0	2	54	53	0	221	2144	

Approach and Departure Time Period	ABC	DEF	GHI	JKL	Hour ABC	Hour JKL	AEI	BFJ	CGK	DHL	Hour AEI	Hour BFJ	Hour CGK	Hour DHL
6:00 - 6:15 am	74	0	88	22			5	74	1	104				
6:15 - 6:30	115	2	122	22			25	101	7	128				
6:30 - 6:45	174	3	141	38			29	155	6	166				
6:45 - 7:00	215	2	146	48	578	130	24	209	3	175	83	539	17	573
7:00 - 7:15	243	2	185	56	747	164	33	228	5	220	111	693	21	689
7:15 - 7:30	274	4	209	62	906	204	52	254	4	239	138	846	18	800
7:30 - 7:45	235	3	222	76	967	242	74	194	6	262	183	885	18	896
7:45 - 8:00	283	2	242	85	1035	279	101	202	2	307	260	878	17	1028
8:00 - 8:15	189	1	206	51	981	274	26	173	7	241	253	823	19	1049
8:15 - 8:30	172	1	157	30	879	242	15	163	7	175	216	732	22	985
8:30 - 8:45	139	6	133	25	783	191	15	130	8	150	157	668	24	873
8:45 - 9:00 am	144	3	139	28	927	219	16	139	4	155	173	807	28	1028
TOTAL	2257	29	1990	543			415	2022	60	2322				

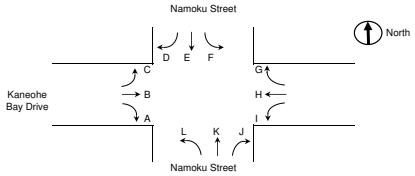
Intersection: Kaneohe Bay Drive at Namoku Street
Date: Wednesday, April 18, 2007
Time: PM Peak Period
Counted by: KL



Time Period	A	B	C	D	E	F	G	H	I	J	K	L	Total	Hour
2:30 - 2:45 pm	3	177	1	1	0	0	1	169	7	8	0	4	371	
2:45 - 3:00	5	141	1	1	0	0	1	156	11	12	0	3	331	
3:00 - 3:15	3	178	0	3	0	2	0	164	4	14	0	2	370	
3:15 - 3:30	0	166	0	4	0	2	1	171	11	13	0	1	369	
3:30 - 3:45	1	188	1	3	0	0	0	219	14	9	0	1	436	
3:45 - 4:00	2	177	0	0	0	0	0	209	5	14	0	2	409	
4:00 - 4:15	4	168	0	0	0	0	0	208	11	15	0	2	408	1622
4:15 - 4:30	4	196	0	1	0	0	0	200	7	9	0	3	420	1673
4:30 - 4:45	2	203	0	0	0	0	0	218	11	15	0	1	450	1687
4:45 - 5:00	5	199	0	0	0	1	0	209	6	13	0	0	433	1711
5:00 - 5:15	5	213	1	0	0	0	1	219	12	15	0	1	467	1770
5:15 - 5:30	2	174	0	0	0	0	0	215	11	10	0	2	414	1764
5:30 - 5:45	4	203	0	0	0	0	0	195	9	14	0	3	428	1742
5:45 - 6:00	2	178	0	2	0	0	0	196	12	8	0	2	400	1709
6:00 - 6:15	4	185	0	0	0	0	0	184	8	20	0	4	405	1647
6:15 - 6:30 pm	3	193	0	0	0	0	0	167	5	15	0	2	385	1618
TOTAL	49	2939	4	15	0	5	4	3099	144	204	0	33	6496	
4:15 - 5:15 pm	16	811	1	1	0	1	1	846	36	52	0	5	1770	

Approach and Departure Time Period	ABC	DEF	GHI	JKL	Hour ABC	Hour DEF	Hour GHI	Hour JKL	AEI	BFJ	CGK	DHL	Hour AEI	Hour BFJ	Hour CGK	Hour DHL
2:30 - 2:45 pm	181	1	177	12					10	185	2	174				
2:45 - 3:00	147	1	168	15					16	153	2	160				
3:00 - 3:15	181	5	168	16					7	194	0	169				
3:15 - 3:30	166	6	183	14	675	13	696	57	11	181	1	176	44	713	5	679
3:30 - 3:45	190	3	233	10	684	15	752	55	15	197	1	223	49	725	4	728
3:45 - 4:00	179	0	214	16	716	14	798	56	7	191	0	211	40	763	2	779
4:00 - 4:15	172	0	219	17	707	9	849	57	15	183	0	210	48	752	2	820
4:15 - 4:30	200	1	207	12	741	4	873	55	11	205	0	204	48	776	1	848
4:30 - 4:45	205	0	229	16	756	1	869	61	13	218	0	219	46	797	0	844
4:45 - 5:00	204	1	215	13	781	2	870	58	11	213	0	209	50	819	0	842
5:00 - 5:15	219	0	232	16	828	2	883	57	17	228	2	220	52	864	2	852
5:15 - 5:30	176	0	226	12	804	1	902	57	13	184	0	217	54	843	2	865
5:30 - 5:45	207	0	204	17	806	1	877	58	13	217	0	198	54	842	2	844
5:45 - 6:00	180	2	208	10	782	2	870	55	14	186	0	200	57	815	2	835
6:00 - 6:15	189	0	192	24	752	2	830	63	12	205	0	188	52	792	0	803
6:15 - 6:30 pm	196	0	172	17	772	2	776	68	8	208	0	169	47	816	0	755
TOTAL	2992	20	3247	237					193	3148	8	3147				

Intersection: Kaneohe Bay Drive and Namoku Street
Date: Thursday, April 19, 2007
Time: AM Peak Period
Counted by: KL



Time Period	A	B	C	D	E	F	G	H	I	J	K	L	Total	Hour
6:00 - 6:15 am	0	97	0	0	0	0	0	93	3	4	0	5	202	
6:15 - 6:30	1	100	2	0	0	0	0	113	4	6	0	2	228	
6:30 - 6:45	2	153	2	0	0	0	0	140	4	4	0	0	305	
6:45 - 7:00	2	208	2	0	0	0	2	171	9	10	0	4	408	941
7:00 - 7:15	2	204	3	0	0	0	1	162	10	14	0	2	398	1339
7:15 - 7:30	3	216	0	0	0	0	0	218	9	11	0	1	458	1569
7:30 - 7:45	1	196	0	1	0	0	0	241	7	16	0	0	462	1726
7:45 - 8:00	1	180	0	1	0	0	0	223	18	16	1	3	443	1761
8:00 - 8:15	2	195	0	0	0	0	0	212	9	15	0	3	436	1799
8:15 - 8:30	1	159	2	0	0	1	0	146	6	7	0	1	323	1664
8:30 - 8:45	3	131	0	0	0	0	0	127	3	9	0	2	275	1477
8:45 - 9:00 am	2	126	0	0	0	0	0	142	7	9	0	1	287	1321
TOTAL	20	1965	11	2	0	1	3	1988	89	121	1	24	4023	
7:15 - 8:15 am	7	787	0	2	0	0	0	894	43	58	1	7	1799	

Approach and Departure Time Period	ABC	DEF	GHI	JKL	Hour ABC	Hour DEF	Hour GHI	Hour JKL	AEI	BFJ	CGK	DHL	Hour AEI	Hour BFJ	Hour CGK	Hour DHL
6:00 - 6:15 am	97	0	96	9					3	101	0	98				
6:15 - 6:30	103	0	117	8					5	106	2	115				
6:30 - 6:45	157	0	144	4					6	157	2	140				
6:45 - 7:00	212	0	182	14	472	0	443	26	11	218	4	175	22	481	8	430
7:00 - 7:15	209	0	173	16	681	0	616	42	12	218	4	164	34	699	12	594
7:15 - 7:30	219	0	227	12	797	0	726	46	12	227	0	219	41	820	10	698
7:30 - 7:45	197	1	248	16	837	1	830	58	8	212	0	242	43	875	8	800
7:45 - 8:00	181	1	241	20	806	2	889	64	19	196	1	227	51	853	5	852
8:00 - 8:15	197	0	221	18	794	2	937	66	11	210	0	215	50	845	1	903
8:15 - 8:30	162	1	152	8	737	3	862	62	7	167	2	147	45	785	3	831
8:30 - 8:45	134	0	130	11	674	2	744	57	6	140	0	129	43	713	3	718
8:45 - 9:00 am	128	0	149	10	802	2	893	67	9	135	0	143	52	848	3	861
TOTAL	1996	3	2080	146					109	2087	15	2014				

APPENDIX B

LEVEL OF SERVICE DEFINITIONS

UNSIGNALIZED INTERSECTIONS
LEVEL OF SERVICE DEFINITIONS

Level of service for unsignalized intersections is defined by the amount of delay of each minor movement that must stop or yield to other major movements at the intersection. Level of service is defined for each of the individual turning movements that experience delays, but is not defined as a whole for unsignalized intersections. Stop signs are generally used to control movement at unsignalized intersections, as described below.

Two-Way Stop Controlled Intersections

At two-way stop controlled intersections, the approaches that are stop-controlled are considered as the minor street approach. The major street through and right turn movements generally have the highest priority at an unsignalized intersection and are not controlled by stop signs. A three-leg T-intersection is categorized as a two-way stop control intersection if the minor street approach (the stem of the 'T' intersection) is controlled by a stop sign. The estimation of delay at unsignalized two-way stop intersections is related to the acceptance of gaps by a driver waiting to enter into or exit from a minor street approach. Table B-1 shows the level of service criteria for two-way stop intersections.

Table B-1

LEVEL OF SERVICE CRITERIA FOR TWO-WAY STOP CONTROLLED INTERSECTIONS

Level of Service	Average Control Delay (seconds per vehicle)
A	0 – 10
B	> 10 – 15
C	> 15 – 25
D	> 25 – 35
E	> 35 – 50
F	> 50

Source: Highway Capacity Manual 2000

SIGNALIZED INTERSECTIONS
LEVEL OF SERVICE DEFINITIONS

Level of service for signalized intersections is defined in terms of control delay, which is a measure of driver discomfort, frustration, fuel consumption and increased travel time. Control delay is the component of delay that results when a traffic control signal causes vehicles to reduce speed or to stop at intersection. Total delay is defined as the difference between the actual travel time and the reference travel time that would occur under ideal, base conditions (absent of traffic control, geometric delays, incidents, or presence of other vehicles).

Delay experienced by motorists is affected by a number of factors that relate to control, geometrics, traffic, and incidents. Analytically, control delay is a complex technical measure that considers the quality of progression, cycle length, green phase-to-total cycle ratio, and the volume-to-capacity (v/c) ratio for each lane group.

The v/c ratio provides an indication of the utilization of the lane group capacity. The critical v/c ratio is an approximate indicator of the overall sufficiency of an intersection and is affected by the critical lane flow rates and traffic signal phasing. The six levels of service for signalized intersections are described below and summarized in Table B-2.

Level of Service A describes operations with low control delay between 0 to 10 seconds per vehicle, where there is extremely favorable progression. Most vehicles arrive during the green phase and many vehicles do not stop at all. Short cycle lengths may tend to contribute to low delays.

Level of Service B describes operations with control delays greater than 10 and up to 20 seconds per vehicle. There is generally good progression with short cycle lengths and slightly more vehicles stopping than in Level of Service A.

Level of Service C describes operations with control delays greater than 20 and up to 35 seconds per vehicle. These higher delays may result from fair progression, longer cycle lengths or a combination of both conditions. Cycle failure and overflow begins to occur at this level when a green phase is unable to serve all of the queued vehicles. The number of vehicles stopping increases, although many vehicles are still able to pass through the intersection without stopping.

Level of Service D describes operations with control delays greater than 35 and up to 55 seconds per vehicle. At this level, congestion becomes more noticeable. A combination of unfavorable progression, long cycle lengths and high v/c ratios may result in longer delays. Individual cycle failures become noticeable and the vehicles stopping become significant, although many vehicles pass through the intersection without stopping.

Level of Service E describes operations with control delays greater than 55 and up to 80 seconds per vehicle. Individual cycle failures are frequent and the high delay values are usually an indicator of poor progression, long cycle lengths and high v/c ratios.

Level of Service F describes operation with control delays greater that 80 seconds per vehicle. This level is considered unacceptable to most drivers and oversaturated conditions occur when arrival flow rates are greater than capacity of the lane group. There are many individual cycle failures related to high v/c ratios, poor progression, long cycle lengths or long red phase. The designation of Level of Service F does not automatically imply that the intersection, approach, or lane group is over capacity. Also, a Level of Service better than E does not necessarily imply that unused capacity is available.

Table B-2

LEVEL OF SERVICE CRITERIA FOR SIGNALIZED INTERSECTIONS

Level of Service	Average Control Delay (seconds per vehicle)
A	≤ 10
B	> 10 – 20
C	> 20 – 35
D	> 35 – 55
E	> 55 – 80
F	> 80

Source: Highway Capacity Manual 2000

APPENDIX C

COMPARISON OF ITE TRIP RATES WITH DERIVED CEMETERY AND DERIVED RETIREMENT COMMUNITY TRIP RATES

COMPARISON OF ITE AND DERIVED PHARMACY TRIP RATES

The Institute of Transportation Engineers (ITE) trip rates are based on national data. Manual traffic counts during April 2007 were collected at the Hawaiian Memorial Park and Pohai Nani Retirement Community to determine local Hawaii trip rates. Table C-1 provides the ITE trip rates for cemetery and retirement community.

Table C-1
ITE Trip Rates for Cemetery and Retirement Community

	Cemetery (Land Use Code 566) Trips per Acre		Continuing Care Retirement Community (Land Use Code 255) Trips per Unit	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Enter	0.12	0.28	0.12	0.14
Exit	0.05	0.56	0.06	0.15
Total	0.17	0.84	0.18	0.29

Source: ITE, Trip Generation, Seventh Edition

The Hawaiian Memorial Park has 72 acres and the Hawaii State Veteran Cemetery has 122.5 acres, or a total of 194.5 acres. The Pohai Nani Retirement Community includes 184 senior apartments, 15 cottages, 10-resident care home and a 42-bed immediate and skilled nursing facility, or a combined total of 251 units/beds. Table C-2 presents the derived trip rates from the manual traffic counts. For the cemetery, the derived total morning peak hour trip rate of 0.68 is four times higher than the ITE rate of 0.17 and the derived afternoon peak hour trip rate of 0.83 is slightly less than the ITE rate of 0.84. For the retirement community, the derived total morning peak hour trip of 0.21 is about 17 percent higher than the ITE rate of 0.18. The afternoon derived total trip rate of 0.29 for the retirement community is the same as the ITE total

trip rate; however, the derived exit trip rate of 0.18 is slightly higher when compared to the ITE exit trip rate of 0.15.

Table C-2
Derived Trip Rates
(Based on Manual Counts at Hawaiian Memorial Park and Pohai Nani)

	Cemetery		Retirement Community	
	Trips per Acre		Trips per Unit	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Enter	0.46	0.29	0.15	0.11
Exit	0.22	0.54	0.06	0.18
Total	0.68	0.83	0.21	0.29

The trip rates selected for this traffic study are shown in Table C-3. The morning derived trip rates for the cemetery was selected since they significantly higher than the ITE rates; however, the afternoon ITE trip rates was utilized since the total trip rates was slightly higher than the derived trip rates. For the retirement community, the derived trip rates were for the morning and afternoon peak hours were selected for use in the traffic study

Table C-3
Selected Trip Rates
(Based on Manual Counts at Hawaiian Memorial Park and Pohai Nani)

	Cemetery		Retirement Community	
	Trips per Acre		Trips per Unit	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Enter	0.46	0.28	0.15	0.11
Exit	0.22	0.56	0.06	0.18
Total	0.68	0.84	0.21	0.29

APPENDIX D

LEVEL OF SERVICE PRINTOUTS

EXISTING TRAFFIC CONDITIONS

Unsignalized Intersection

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SU*	Intersection	*Kamehameha Hwy-HMP1-Halekou Rd*
Agency/Co.	*Perazim Consulting, LLC*	Jurisdiction	*Oahu*
Date Performed	*4/24/2008*	Analysis Year	*Existing Year 2007*
Analysis Time Period	*AM Peak Hour (7:15-8:15 am)*		

Project Description *Hawaiian Memorial Park Expansion*

East/West Street: *HMP Primary Drwy-Halekou Rd* | North/South Street: *Kamehameha Highway*

Intersection Orientation: *North-South* | Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*38*	*872*	*19*	*44*	*1058*	*46*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*38*	*872*	*19*	*44*	*1058*	*46*
Percent Heavy Vehicles	*2*	--	--	*2*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*1*	*2*	*0*
Configuration	*L*	*T*	*TR*	*L*	*T*	*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*42*	*2*	*84*	*9*	*0*	*23*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*42*	*2*	*84*	*9*	*0*	*23*
Percent Heavy Vehicles	*0*	*2*	*0*	*0*	*2*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*1*
Configuration		*LTR*		*LT*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*	*LT*		*R*		*LTR*	
v (veh/h)	*38*	*44*	*9*		*23*		*128*	
C (m) (veh/h)	*628*	*757*	*155*		*565*		*267*	
v/c	*0.06*	*0.06*	*0.06*		*0.04*		*0.48*	
95% queue length	*0.19*	*0.19*	*0.18*		*0.13*		*2.66*	
Control Delay (s/veh)	*11.1*	*10.0*	*29.7*		*11.6*		*30.7*	
LOS	*B*	*B*	*D*		*B*		*D*	
Approach Delay (s/veh)	--	--	*16.7*			*30.7*		
Approach LOS	--	--	*C*			*D*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SU*	Intersection	*Kamehameha Hwy-HMP1-Halekou Rd*
Agency/Co.	*Perazim Consulting, LLC*	Jurisdiction	*Oahu*
Date Performed	*4/24/2008*	Analysis Year	*Existing Year 2007*
Analysis Time Period	*PM Peak Hour (4:00-5:00 pm)*		

Project Description	*Hawaiian Memorial Park Expansion*
East/West Street:	*HMP Primary Dwy-Halekou Rd*
North/South Street:	*Kamehameha Highway*
Intersection Orientation:	*North-South*
Study Period (hrs):	*1.00*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*93*	*1410*	*21*	*14*	*996*	*53*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*93*	*1410*	*21*	*14*	*996*	*53*
Percent Heavy Vehicles	*2*	--	--	*2*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*1*	*2*	*0*
Configuration	*L*	*T*	*TR*	*L*	*T*	*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*36*	*2*	*52*	*30*	*0*	*41*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*36*	*2*	*52*	*30*	*0*	*41*
Percent Heavy Vehicles	*0*	*2*	*0*	*0*	*2*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*1*
Configuration		*LTR*		*LT*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*	*LT*		*R*		*LTR*	
v (veh/h)	*93*	*14*	*30*		*41*		*90*	
C (m) (veh/h)	*659*	*471*	*75*		*377*		*210*	
v/c	*0.14*	*0.03*	*0.40*		*0.11*		*0.43*	
95% queue length	*0.49*	*0.09*	*1.85*		*0.37*		*2.17*	
Control Delay (s/veh)	*11.4*	*12.9*	*84.1*		*15.7*		*34.8*	
LOS	*B*	*B*	*F*		*C*		*D*	
Approach Delay (s/veh)	--	--	*44.6*			*34.8*		
Approach LOS	--	--	*E*			*D*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SU*	Intersection	*Kamehameha Hwy-HMP2-Mahinui*
Agency/Co.	*Perazim Consulting, LLC*	Jurisdiction	*Oahu*
Date Performed	*4/24/2008*	Analysis Year	*Existing Year 2007*
Analysis Time Period	*AM Peak Hour (7:15-8:15 am)*		

Project Description	*Hawaiian Memorial Park Expansion*
East/West Street:	*HMP Secondary Dwy-Mahinui Rd*
North/South Street:	*Kamehameha Hwy*
Intersection Orientation:	*North-South*
Study Period (hrs):	*1.00*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*5*	*952*	*3*	*18*	*1226*	*25*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*5*	*952*	*3*	*18*	*1226*	*25*
Percent Heavy Vehicles	*2*	--	--	*2*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*0*	*2*	*0*
Configuration	*L*	*T*	*TR*	*LT*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*35*	*3*	*12*	*2*	*0*	*8*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*35*	*3*	*12*	*2*	*0*	*8*
Percent Heavy Vehicles	*0*	*2*	*0*	*0*	*2*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*1*
Configuration		*LTR*		*LT*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*LT*	*LT*		*R*		*LTR*	
v (veh/h)	*5*	*18*	*2*		*8*		*50*	
C (m) (veh/h)	*552*	*715*	*177*		*539*		*163*	
v/c	*0.01*	*0.03*	*0.01*		*0.01*		*0.31*	
95% queue length	*0.03*	*0.08*	*0.03*		*0.05*		*1.30*	
Control Delay (s/veh)	*11.6*	*10.2*	*25.6*		*11.8*		*36.8*	
LOS	*B*	*B*	*D*		*B*		*E*	
Approach Delay (s/veh)	--	--	*14.5*			*36.8*		
Approach LOS	--	--	*B*			*E*		

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Unsignalized Intersection

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SU	Intersection	Kamehameha Hwy-HMP2-Mahinui
Agency/Co.	Perazim Consulting, LLC	Jurisdiction	Oahu
Date Performed	4/24/2008	Analysis Year	Existing Year 2007
Analysis Time Period	PM Peak Hour (4:00-5:00 pm)		

Project Description: Hawaiian Memorial Park Expansion

East/West Street: HMP Secondary Dwy-Mahinui Rd | North/South Street: Kamehameha Hwy

Intersection Orientation: North-South | Study Period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	31	1454	2	17	1127	32
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	31	1454	2	17	1127	32
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type	Raised curb					
RT Channelized			0			0
Lanes	1	2	0	0	2	0
Configuration	L	T	TR	LT		TR
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	20	1	6	2	0	32
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	20	1	6	2	0	32
Percent Heavy Vehicles	0	2	0	0	2	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	1
Configuration		LTR		LT		R

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	LT	LT		R		LTR	
v (veh/h)	31	17	2		32		27	
C (m) (veh/h)	599	461	93		370		143	
v/c	0.05	0.04	0.02		0.09		0.19	
95% queue length	0.16	0.11	0.07		0.28		0.69	
Control Delay (s/veh)	11.3	13.1	44.6		15.7		36.0	
LOS	B	B	E		C		E	
Approach Delay (s/veh)	--	--	17.4			36.0		
Approach LOS	--	--	C			E		

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Exstg 2-PM

Unsignalized Intersection

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SU	Intersection	Kaneohe Bay Dr and Namoku St
Agency/Co.	Perazim Consulting, LLC	Jurisdiction	Oahu
Date Performed	4/24/2008	Analysis Year	Existing Year 2007
Analysis Time Period	AM Peak Hour (7:15-8:15 am)		

Project Description: Hawaiian Memorial Park Expansion

East/West Street: Kaneohe Bay Drive | North/South Street: Namoku Street

Intersection Orientation: East-West | Study Period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	0	787	7	43	894	0
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	0	787	7	43	894	0
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	7	1	58	0	0	2
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	7	1	58	0	0	2
Percent Heavy Vehicles	0	2	0	0	2	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	1	0	1	0
Configuration	LT		R		LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR	LT		R		LTR	
v (veh/h)	0	43	8		58		2	
C (m) (veh/h)	759	827	61		393		343	
v/c	0.00	0.05	0.13		0.15		0.01	
95% queue length	0.00	0.16	0.45		0.52		0.02	
Control Delay (s/veh)	9.7	9.6	72.9		15.7		15.6	
LOS	A	A	F		C		C	
Approach Delay (s/veh)	--	--	22.7			15.6		
Approach LOS	--	--	C			C		

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Exstg 3-AM

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SU	Intersection	Kaneohe Bay Dr and Namoku St
Agency/Co.	Perazim Consulting, LLC	Jurisdiction	Oahu
Date Performed	4/24/2008	Analysis Year	Existing Year 2007
Analysis Time Period	PM Peak Hour (4:15-5:15 pm)		

Project Description	Hawaiian Memorial Park Expansion
East/West Street:	Kaneohe Bay Drive
North/South Street:	Namoku Street
Intersection Orientation:	East-West
Study Period (hrs):	1.00

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	1	811	16	36	846	1
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	1	811	16	36	846	1
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	5	0	52	1	0	1
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	5	0	52	1	0	1
Percent Heavy Vehicles	0	2	0	0	2	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	1	0	1	0
Configuration	LT		R		LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR	LT		R		LTR	
v (veh/h)	1	36	5		52		2	
C (m) (veh/h)	790	804	64		379		93	
v/c	0.00	0.04	0.08		0.14		0.02	
95% queue length	0.00	0.14	0.25		0.48		0.07	
Control Delay (s/veh)	9.6	9.7	66.0		16.0		44.6	
LOS	A	A	F		C		E	
Approach Delay (s/veh)	--	--	20.4			44.6		
Approach LOS	--	--	C			E		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SU	Intersection	Mokulele Dr and Namoku St
Agency/Co.	Perazim Consulting, LLC	Jurisdiction	Oahu
Date Performed	4/24/2008	Analysis Year	Existing Year 2007
Analysis Time Period	AM Peak Hour (7:15-8:15 am)		

Project Description	Hawaiian Memorial Park Expansion
East/West Street:	Mokulele Drive
North/South Street:	Namoku Street
Intersection Orientation:	North-South
Study Period (hrs):	1.00

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	15	73	34	3	127	49
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	15	73	34	3	127	49
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	34	48	28	40	46	14
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	34	48	28	40	46	14
Percent Heavy Vehicles	0	2	0	0	2	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (veh/h)	15	3		100			110	
C (m) (veh/h)	1412	1497		625			658	
v/c	0.01	0.00		0.16			0.17	
95% queue length	0.03	0.01		0.57			0.60	
Control Delay (s/veh)	7.6	7.4		11.9			11.6	
LOS	A	A		B			B	
Approach Delay (s/veh)	--	--	11.9			11.6		
Approach LOS	--	--	B			B		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SU*	Intersection	*Mokulele Dr and Namoku St*
Agency/Co.	*Perazim Consulting, LLC*	Jurisdiction	*Oahu*
Date Performed	*4/24/2008*	Analysis Year	*Existing Year 2007*
Analysis Time Period	*PM Peak Hour (4:00-5:00 pm)*		

Project Description *Hawaiian Memorial Park Expansion*

East/West Street: *Mokulele Drive* | North/South Street: *Namoku Street*

Intersection Orientation: *North-South* | Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*16*	*77*	*56*	*9*	*51*	*29*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*16*	*77*	*56*	*9*	*51*	*29*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*40*	*61*	*54*	*42*	*31*	*3*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*40*	*61*	*54*	*42*	*31*	*3*
Percent Heavy Vehicles	*0*	*2*	*0*	*0*	*2*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*16*	*9*		*76*			*155*	
C (m) (veh/h)	*1531*	*1464*		*622*			*747*	
v/c	*0.01*	*0.01*		*0.12*			*0.21*	
95% queue length	*0.03*	*0.02*		*0.42*			*0.78*	
Control Delay (s/veh)	*7.4*	*7.5*		*11.6*			*11.1*	
LOS	*A*	*A*		*B*			*B*	
Approach Delay (s/veh)	--	--	*11.6*			*11.1*		
Approach LOS	--	--	*B*			*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SU*	Intersection	*Namoku St and Lipalu St*
Agency/Co.	*Perazim Consulting, LLC*	Jurisdiction	*Oahu*
Date Performed	*4/24/2008*	Analysis Year	*Existing Year 2007*
Analysis Time Period	*AM Peak Hour (7:15-8:15 am)*		

Project Description *Hawaiian Memorial Park Expansion*

East/West Street: *Namoku Street* | North/South Street: *Lipalu Street*

Intersection Orientation: *East-West* | Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*82*	*4*	*2*	*80*	
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*82*	*4*	*2*	*80*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*16*		*1*			
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*16*	*0*	*1*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*		*LR*				
v (veh/h)		*2*		*17*				
C (m) (veh/h)		*1523*		*834*				
v/c		*0.00*		*0.02*				
95% queue length		*0.00*		*0.06*				
Control Delay (s/veh)		*7.4*		*9.4*				
LOS		*A*		*A*				
Approach Delay (s/veh)	--	--	*9.4*					
Approach LOS	--	--	*A*					

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Unsignalized Intersection

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SU*	Intersection	*Namoku St and Lipalu St*
Agency/Co.	*Perazim Consulting, LLC*	Jurisdiction	*Oahu*
Date Performed	*4/24/2008*	Analysis Year	*Existing Year 2007*
Analysis Time Period	*PM Peak Hour (4:00-5:00 pm)*		

Project Description *Hawaiian Memorial Park Expansion*

East/West Street: *Namoku Street* | North/South Street: *Lipalu Street*

Intersection Orientation: *East-West* | Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*111*	*10*	*8*	*59*	
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*111*	*10*	*8*	*59*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*10*		*3*			
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*10*	*0*	*3*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*		*LR*				
v (veh/h)		*8*		*13*				
C (m) (veh/h)		*1479*		*828*				
v/c		*0.01*		*0.02*				
95% queue length		*0.02*		*0.05*				
Control Delay (s/veh)		*7.4*		*9.4*				
LOS		*A*		*A*				
Approach Delay (s/veh)	--	--	*9.4*					
Approach LOS	--	--	*A*					

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Signalized Intersection

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*SU*	Intersection	*Kamehameha Hwy and Mokulele Dr*
Agency or Co.	*Perazim Consulting, LLC*	Area Type	*All other areas*
Date Performed	*4/24/2008*	Jurisdiction	*Oahu*
Time Period	*AM Peak Hour (7:15-8:15 am)*	Analysis Year	*Existing Year 2007*
		Project ID	*Hawaiian Memorial Park Expansion*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	*0*	*1*	*1*	*0*	*1*	*1*	*1*	*2*	*1*	*1*	*2*	*0*
Lane Group		*LT*	*R*		*LT*	*R*	*L*	*T*	*R*	*L*	*TR*	
Volume, V (vph)	*78*	*14*	*22*	*215*	*16*	*147*	*6*	*917*	*72*	*61*	*1032*	*33*
% Heavy Vehicles, %HV	*0*	*2*	*0*	*0*	*2*	*0*	*0*	*2*	*0*	*0*	*2*	*0*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Pretimed (P) or Actuated (A)	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
Start-up Lost Time, l_1		*2.0*	*2.0*		*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	
Extension of Effective Green, e		*2.0*	*2.0*		*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	
Arrival Type, AT		*3*	*3*		*3*	*3*	*3*	*3*	*3*	*3*	*3*	
Unit Extension, UE		*3.0*	*3.0*		*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	
Filtering/Metering, I		*1.000*	*1.000*		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	
Initial Unmet Demand, Q_b		*0.0*	*0.0*		*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	
Ped / Bike / RTOR Volumes	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width		*12.0*	*12.0*		*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B		*0*	*0*		*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Min. Time for Pedestrians, G_p		*3.2*			*3.2*			*3.2*			*3.2*	

Phasing	EW Perm	02	03	04	Excl. Left	SB Only	Thru & RT	08
Timing	G = *24.0*	G =	G =	G =	G = *6.0*	G = *10.0*	G = *48.0*	G =
	Y = *6*	Y =	Y =	Y =	Y =	Y = *6*	Y =	Y =

Duration of Analysis, T = *1.00* | Cycle Length, C = *100.0*

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		*103*	*24*		*257*	*163*	*7*	*1019*	*80*	*68*	*1184*	
Lane Group Capacity, c		*196*	*388*		*304*	*388*	*108*	*1703*	*775*	*289*	*2049*	
v/c Ratio, X		*0.53*	*0.06*		*0.85*	*0.42*	*0.06*	*0.60*	*0.10*	*0.24*	*0.58*	
Total Green Ratio, g/C		*0.24*	*0.24*		*0.24*	*0.24*	*0.06*	*0.48*	*0.48*	*0.16*	*0.58*	
Uniform Delay, d_1		*33.0*	*29.3*		*36.2*	*32.1*	*44.4*	*19.0*	*14.2*	*36.7*	*13.3*	
Progression Factor, PF		*1.000*	*1.000*		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	
Delay Calibration, k		*0.13*	*0.11*		*0.38*	*0.11*	*0.11*	*0.19*	*0.11*	*0.11*	*0.17*	
Incremental Delay, d_2		*2.6*	*0.1*		*22.7*	*0.7*	*0.3*	*0.6*	*0.1*	*0.4*	*0.4*	
Initial Queue Delay, d_3		*0.0*	*0.0*		*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	
Control Delay		*35.7*	*29.4*		*58.9*	*32.9*	*44.6*	*19.6*	*14.3*	*37.1*	*13.7*	
Lane Group LOS		*D*	*C*		*E*	*C*	*D*	*B*	*B*	*D*	*B*	
Approach Delay	*34.5*			*48.8*			*19.3*			*14.9*		
Approach LOS	*C*			*D*			*B*			*B*		
Intersection Delay	*22.4*			X_c = *0.62*			Intersection LOS			*C*		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	SU	Intersection	Kamehameha Dr and Mokulele Dr
Agency or Co.	Perazim Consulting, LLC	Area Type	All other areas
Date Performed	4/24/2008	Jurisdiction	Oahu
Time Period	PM Peak Hour (4:00-5:00 pm)	Analysis Year	Existing Year 2007
		Project ID	Hawaiian Memorial Park Expansion

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	0	1	1	0	1	1	1	2	1	1	2	0
Lane Group		LT	R		LT	R	L	T	R	L	TR	
Volume, V (vph)	60	12	13	127	23	78	13	1314	179	115	1036	52
% Heavy Vehicles, %HV	0	2	0	0	2	0	0	2	0	0	2	0
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Extension of Effective Green, e		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Arrival Type, AT		3	3		3	3	3	3	3	3	3	
Unit Extension, UE		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Filtering/Metering, I		1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	
Initial Unmet Demand, Q_b		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B		0	0		0	0	0	0	0	0	0	
Min. Time for Pedestrians, G_p		3.2			3.2			3.2			3.2	

Phasing	EW Perm	02	03	04	Excl. Left	SB Only	Thru & RT	08
Timing	G = 20.0	G =	G =	G =	G = 8.0	G = 7.0	G = 66.0	G =
	Y = 6	Y =	Y =	Y =	Y =	Y = 6	Y = 7	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 120.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		80	14		167	87	14	1460	199	128	1209	
Lane Group Capacity, c		162	269		222	269	120	1951	888	226	2320	
v/c Ratio, X		0.49	0.05		0.75	0.32	0.12	0.75	0.22	0.57	0.52	
Total Green Ratio, g/C		0.17	0.17		0.17	0.17	0.07	0.55	0.55	0.13	0.66	
Uniform Delay, d_1		45.4	42.0		47.6	44.0	52.7	20.6	13.9	49.4	10.7	
Progression Factor, PF		1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	
Delay Calibration, k		0.11	0.11		0.31	0.11	0.11	0.30	0.11	0.16	0.13	
Incremental Delay, d_2		2.4	0.1		14.6	0.7	0.4	1.7	0.1	3.4	0.2	
Initial Queue Delay, d_3		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Control Delay		47.8	42.1		62.3	44.7	53.1	22.3	14.0	52.8	10.9	
Lane Group LOS		D	D		E	D	D	C	B	D	B	
Approach Delay	46.9			56.3			21.6			14.9		
Approach LOS	D			E			C			B		
Intersection Delay	22.2			X_c = 0.72			Intersection LOS			C		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	SU	Intersection	Kaneohe Bay Dr and Mokulele Dr
Agency or Co.	Perazim Consulting, LLC	Area Type	All other areas
Date Performed	4/24/2008	Jurisdiction	Oahu
Time Period	AM Peak Hour (7:15-8:15 am)	Analysis Year	Existing Year 2007
		Project ID	Hawaiian Memorial Park Expansion

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	1	1	1	1	0	1	1	0	0	1	0
Lane Group	L	T	R	L	TR		L	TR			LTR	
Volume, V (vph)	15	742	192	47	843	6	207	2	59	0	2	7
% Heavy Vehicles, %HV	0	2	0	0	2	0	0	2	0	0	2	0
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	
Extension of Effective Green, e	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	
Arrival Type, AT	3	3	3	3	3		3	3			3	
Unit Extension, UE	3.0	3.0	3.0	3.0	3.0		3.0	3.0			3.0	
Filtering/Metering, I	1.000	1.000	1.000	1.000	1.000		1.000	1.000			1.000	
Initial Unmet Demand, Q_b	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0	12.0	12.0	12.0		12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0	0	0	0		0	0			0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	Excl. Left	WB Only	Thru & RT	04	NS Perm	06	07	08
Timing	G = 3.0	G = 4.0	G = 60.0	G =	G = 21.0	G =	G =	G =
	Y =	Y =	Y = 6	Y =	Y = 6	Y =	Y =	Y =
Duration of Analysis, T = 0.25						Cycle Length, C = 100.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	17	824	213	52	944		230	68			10	
Lane Group Capacity, c	54	1118	969	126	1191		300	341			354	
v/c Ratio, X	0.31	0.74	0.22	0.41	0.79		0.77	0.20			0.03	
Total Green Ratio, g/C	0.03	0.60	0.60	0.07	0.64		0.21	0.21			0.21	
Uniform Delay, d_1	47.5	14.3	9.2	44.5	13.2		37.2	32.6			31.4	
Progression Factor, PF	1.000	1.000	1.000	1.000	1.000		1.000	1.000			1.000	
Delay Calibration, k	0.11	0.29	0.11	0.11	0.34		0.32	0.11			0.11	
Incremental Delay, d_2	3.3	2.6	0.1	2.2	3.8		11.3	0.3			0.0	
Initial Queue Delay, d_3	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Control Delay	50.8	16.9	9.3	46.7	16.9		48.5	32.9			31.4	
Lane Group LOS	D	B	A	D	B		D	C			C	
Approach Delay	16.0			18.5			44.9			31.4		
Approach LOS	B			B			D			C		
Intersection Delay	20.7			X_c = 0.77			Intersection LOS			C		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	SU	Intersection	Kaneohe Bay Dr and Mokulele Dr
Agency or Co.	Perazim Consulting, LLC	Area Type	All other areas
Date Performed	4/24/2008	Jurisdiction	Oahu
Time Period	PM Peak Hour (4:15-5:15 pm)	Analysis Year	Existing Year 2007
		Project ID	Hawaiian Memorial Park Expansion

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	1	1	1	1	0	1	1	0	0	1	0
Lane Group	L	T	R	L	TR		L	TR			LTR	
Volume, V (vph)	16	736	132	35	823	3	119	5	42	5	4	21
% Heavy Vehicles, %HV	0	2	0	0	2	0	0	2	0	0	2	0
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	
Extension of Effective Green, e	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	
Arrival Type, AT	3	3	3	3	3		3	3			3	
Unit Extension, UE	3.0	3.0	3.0	3.0	3.0		3.0	3.0			3.0	
Filtering/Metering, I	1.000	1.000	1.000	1.000	1.000		1.000	1.000			1.000	
Initial Unmet Demand, Q_b	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0	12.0	12.0	12.0		12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0	0	0	0		0	0			0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EB Only	WB Only	Thru & RT	04	NS Perm	06	07	08
Timing	G = 6.0	G = 10.0	G = 52.0	G =	G = 19.0	G =	G =	G =
	Y =	Y =	Y = 7	Y =	Y = 6	Y =	Y =	Y =

Duration of Analysis, T = 0.25 — Cycle Length, C = 100.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	18	818	147	39	917		132	53			33	
Lane Group Capacity, c	108	969	840	181	1154		266	312			313	
v/c Ratio, X	0.17	0.84	0.17	0.22	0.79		0.50	0.17			0.11	
Total Green Ratio, g/C	0.06	0.52	0.52	0.10	0.62		0.19	0.19			0.19	
Uniform Delay, d_1	44.6	20.5	12.7	41.4	14.2		36.2	33.9			33.5	
Progression Factor, PF	1.000	1.000	1.000	1.000	1.000		1.000	1.000			1.000	
Delay Calibration, k	0.11	0.38	0.11	0.11	0.34		0.11	0.11			0.11	
Incremental Delay, d_2	0.7	6.9	0.1	0.6	3.9		1.5	0.3			0.1	
Initial Queue Delay, d_3	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Control Delay	45.4	27.5	12.8	42.0	18.2		37.7	34.2			33.6	
Lane Group LOS	D	C	B	D	B		D	C			C	
Approach Delay	25.6			19.1			36.7			33.6		
Approach LOS	C			B			D			C		
Intersection Delay	23.8			X_c = 0.69			Intersection LOS			C		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	SU	Intersection	Kamehameha Hwy-HMP1-Halekou Rd
Agency or Co.	Perazim Consulting, LLC	Area Type	All other areas
Date Performed	4/24/2008	Jurisdiction	Oahu
Time Period	AM Peak Hour (7:15-8:15 am)	Analysis Year	Existing Year 2007-Mitigation
		Project ID	Hawaiian Memorial Park Expansion

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	0	1	0	0	1	1	1	2	0	1	2	0
Lane Group		LTR			LT	R	L	TR		L	TR	
Volume, V (vph)	42	2	84	9	0	23	38	872	19	44	1058	46
% Heavy Vehicles, %HV	0	2	0	0	2	0	0	2	0	0	2	0
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1		2.0			2.0	2.0	2.0	2.0		2.0	2.0	
Extension of Effective Green, e		2.0			2.0	2.0	2.0	2.0		2.0	2.0	
Arrival Type, AT		3			3	3	3	3		3	3	
Unit Extension, UE		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Filtering/Metering, I		1.000			1.000	1.000	1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0			12.0	12.0	12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B		0			0	0	0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	Excl. Left	SB Only	Thru & RT	08
Timing	G = 24.0	G =	G =	G =	G = 6.0	G = 10.0	G = 48.0	G =
	Y = 6	Y =	Y =	Y =	Y =	Y =	Y = 6	Y =

Duration of Analysis, T = 1.00 — Cycle Length, C = 100.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		128			9	23	38	891		44	1104	
Lane Group Capacity, c		374			364	388	108	1698		289	2046	
v/c Ratio, X		0.34			0.02	0.06	0.35	0.52		0.15	0.54	
Total Green Ratio, g/C		0.24			0.24	0.24	0.06	0.48		0.16	0.58	
Uniform Delay, d_1		31.5			29.1	29.3	45.1	18.1		36.2	12.8	
Progression Factor, PF		1.000			1.000	1.000	1.000	1.000		1.000	1.000	
Delay Calibration, k		0.11			0.11	0.11	0.11	0.13		0.11	0.14	
Incremental Delay, d_2		0.6			0.0	0.1	2.0	0.3		0.2	0.3	
Initial Queue Delay, d_3		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay		32.0			29.1	29.4	47.1	18.4		36.4	13.1	
Lane Group LOS		C			C	C	D	B		D	B	
Approach Delay	32.0			29.3			19.6			14.0		
Approach LOS	C			C			B			B		
Intersection Delay	17.6			X_c = 0.47			Intersection LOS			B		

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Signalized Intersection

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	SU	Intersection	Kamehameha Hwy-HMP1-Halekou Rd
Agency or Co.	Perazim Consulting, LLC	Area Type	All other areas
Date Performed	4/24/2008	Jurisdiction	Oahu
Time Period	PM Peak Hour (4:00-5:00 pm)	Analysis Year	Existing Year 2007-Mitigation
		Project ID	Hawaiian Memorial Park Expansion

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	0	1	0	0	1	1	1	2	0	1	2	0
Lane Group		LTR			LT	R	L	TR		L	TR	
Volume, V (vph)	36	2	52	30	0	41	93	1410	21	14	996	53
% Heavy Vehicles, %HV	0	2	0	0	2	0	0	2	0	0	2	0
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1		2.0			2.0	2.0	2.0	2.0		2.0	2.0	
Extension of Effective Green, e		2.0			2.0	2.0	2.0	2.0		2.0	2.0	
Arrival Type, AT		3			3	3	3	3		3	3	
Unit Extension, UE		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Filtering/Metering, I		1.000			1.000	1.000	1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0			12.0	12.0	12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B		0			0	0	0	0		0	0	
Min. Time for Pedestrians, G_p		3.2			3.2			3.2			3.2	

Phasing	EW Perm	02	03	04	Excl. Left	NB Only	Thru & RT	08
Timing	G = 19.0	G =	G =	G =	G = 6.0	G = 10.0	G = 52.0	G =
	Y = 6	Y =	Y =	Y =	Y =	Y =	Y = 7	Y =
Duration of Analysis, T = 1.00					Cycle Length, C = 100.0			

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		90			30	41	93	1431		14	1049	
Lane Group Capacity, c		290			257	307	289	2195		108	1832	
v/c Ratio, X		0.31			0.12	0.13	0.32	0.65		0.13	0.57	
Total Green Ratio, g/C		0.19			0.19	0.19	0.16	0.62		0.06	0.52	
Uniform Delay, d_1		34.9			33.5	33.7	37.2	12.1		44.5	16.4	
Progression Factor, PF		1.000			1.000	1.000	1.000	1.000		1.000	1.000	
Delay Calibration, k		0.11			0.11	0.11	0.11	0.23		0.11	0.17	
Incremental Delay, d_2		0.6			0.2	0.2	0.6	0.7		0.5	0.4	
Initial Queue Delay, d_3		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay		35.5			33.8	33.9	37.8	12.8		45.1	16.8	
Lane Group LOS		D			C	C	D	B		D	B	
Approach Delay	35.5			33.8			14.3			17.2		
Approach LOS	D			C			B			B		
Intersection Delay	16.7			X_c = 0.54			Intersection LOS			B		

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Exstg 8-PM

FUTURE TRAFFIC CONDITIONS
WITHOUT PROJECT

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SU*	Intersection	*Kamehameha Hwy-HMP1-Halekou Rd*
Agency/Co.	*Perazim Consulting, LLC*	Jurisdiction	*Oahu*
Date Performed	*4/24/2008*	Analysis Year	*Future Year without Project*
Analysis Time Period	*AM Peak Hour*		

Project Description *Hawaiian Memorial Park Expansion*

East/West Street: *HMP Primary Drwy-Halekou Rd* | North/South Street: *Kamehameha Highway*

Intersection Orientation: *North-South* | Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*38*	*937*	*19*	*44*	*1122*	*46*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*38*	*937*	*19*	*44*	*1122*	*46*
Percent Heavy Vehicles	*2*	--	--	*2*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*1*	*2*	*0*
Configuration	*L*	*T*	*TR*	*L*	*T*	*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*42*	*2*	*84*	*9*	*0*	*23*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*42*	*2*	*84*	*9*	*0*	*23*
Percent Heavy Vehicles	*0*	*2*	*0*	*0*	*2*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*1*
Configuration		*LTR*		*LT*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*	*LT*		*R*		*LTR*	
v (veh/h)	*38*	*44*	*9*		*23*		*128*	
C (m) (veh/h)	*594*	*715*	*141*		*539*		*245*	
v/c	*0.06*	*0.06*	*0.06*		*0.04*		*0.52*	
95% queue length	*0.20*	*0.20*	*0.20*		*0.13*		*3.12*	
Control Delay (s/veh)	*11.5*	*10.4*	*32.3*		*12.0*		*35.5*	
LOS	*B*	*B*	*D*		*B*		*E*	
Approach Delay (s/veh)	--	--	*17.7*			*35.5*		
Approach LOS	--	--	*C*			*E*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SU*	Intersection	*Kamehameha Hwy-HMP1-Halekou Rd*
Agency/Co.	*Perazim Consulting, LLC*	Jurisdiction	*Oahu*
Date Performed	*4/24/2008*	Analysis Year	*Future Year without Project*
Analysis Time Period	*PM Peak Hour*		

Project Description *Hawaiian Memorial Park Expansion*

East/West Street: *HMP Primary Dwy-Halekou Rd* | North/South Street: *Kamehameha Highway*

Intersection Orientation: *North-South* | Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*93*	*1492*	*21*	*14*	*1064*	*53*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*93*	*1492*	*21*	*14*	*1064*	*53*
Percent Heavy Vehicles	*2*	--	--	*2*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*1*	*2*	*0*
Configuration	*L*	*T*	*TR*	*L*	*T*	*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*36*	*2*	*52*	*30*	*0*	*41*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*36*	*2*	*52*	*30*	*0*	*41*
Percent Heavy Vehicles	*0*	*2*	*0*	*0*	*2*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*1*
Configuration		*LTR*		*LT*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*	*LT*		*R*		*LTR*	
v (veh/h)	*93*	*14*	*30*		*41*		*90*	
C (m) (veh/h)	*621*	*438*	*66*		*355*		*192*	
v/c	*0.15*	*0.03*	*0.45*		*0.12*		*0.47*	
95% queue length	*0.53*	*0.10*	*2.22*		*0.39*		*2.52*	
Control Delay (s/veh)	*11.8*	*13.5*	*103.1*		*16.5*		*40.0*	
LOS	*B*	*B*	*F*		*C*		*E*	
Approach Delay (s/veh)	--	--	*53.1*			*40.0*		
Approach LOS	--	--	*F*			*E*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SU	Intersection	Kamehameha Hwy-HMP2-Mahinui
Agency/Co.	Perazim Consulting, LLC	Jurisdiction	Oahu
Date Performed	4/24/2008	Analysis Year	Future Year without Project
Analysis Time Period	AM Peak Hour		

Project Description: Hawaiian Memorial Park Expansion

East/West Street: HMP Secondary Dwy-Mahinui Rd | North/South Street: Kamehameha Hwy

Intersection Orientation: North-South | Study Period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	5	1017	3	18	1290	25
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	5	1017	3	18	1290	25
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type	Raised curb					
RT Channelized			0			0
Lanes	1	2	0	0	2	0
Configuration	L	T	TR	LT		TR
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	35	3	12	2	0	8
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	35	3	12	2	0	8
Percent Heavy Vehicles	0	2	0	0	2	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	1
Configuration		LTR		LT		R

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	LT	LT		R		LTR	
v (veh/h)	5	18	2		8		50	
C (m) (veh/h)	522	676	162		514		149	
v/c	0.01	0.03	0.01		0.02		0.34	
95% queue length	0.03	0.08	0.04		0.05		1.47	
Control Delay (s/veh)	12.0	10.5	27.5		12.1		41.2	
LOS	B	B	D		B		E	
Approach Delay (s/veh)	--	--	15.2			41.2		
Approach LOS	--	--	C			E		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SU	Intersection	Kamehameha Hwy-HMP2-Mahinui
Agency/Co.	Perazim Consulting, LLC	Jurisdiction	Oahu
Date Performed	4/24/2008	Analysis Year	Future Year without Project
Analysis Time Period	PM Peak Hour		

Project Description: Hawaiian Memorial Park Expansion

East/West Street: HMP Secondary Dwy-Mahinui Rd | North/South Street: Kamehameha Hwy

Intersection Orientation: North-South | Study Period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	31	1536	2	17	1195	32
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	31	1536	2	17	1195	32
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type	Raised curb					
RT Channelized			0			0
Lanes	1	2	0	0	2	0
Configuration	L	T	TR	LT		TR
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	20	1	6	2	0	32
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	20	1	6	2	0	32
Percent Heavy Vehicles	0	2	0	0	2	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	1
Configuration		LTR		LT		R

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	LT	LT		R		LTR	
v (veh/h)	31	17	2		32		27	
C (m) (veh/h)	564	428	83		348		130	
v/c	0.05	0.04	0.02		0.09		0.21	
95% queue length	0.17	0.12	0.07		0.30		0.77	
Control Delay (s/veh)	11.8	13.8	49.4		16.4		39.9	
LOS	B	B	E		C		E	
Approach Delay (s/veh)	--	--	18.3			39.9		
Approach LOS	--	--	C			E		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SU	Intersection	Kaneohe Bay Dr and Namoku St
Agency/Co.	Perazim Consulting, LLC	Jurisdiction	Oahu
Date Performed	4/24/2008	Analysis Year	Future Year without Project
Analysis Time Period	AM Peak Hour		

Project Description: Hawaiian Memorial Park Expansion

East/West Street: Kaneohe Bay Drive | North/South Street: Namoku Street

Intersection Orientation: East-West | Study Period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	3	811	7	43	921	1
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	3	811	7	43	921	1
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	8	1	58	1	1	13
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	8	1	58	1	1	13
Percent Heavy Vehicles	0	2	0	0	2	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	1	0	1	0
Configuration	LT		R		LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR	LT		R		LTR	
v (veh/h)	3	43	9		58		15	
C (m) (veh/h)	741	810	52		381		193	
v/c	0.00	0.05	0.17		0.15		0.08	
95% queue length	0.01	0.17	0.61		0.54		0.25	
Control Delay (s/veh)	9.9	9.7	88.6		16.1		25.2	
LOS	A	A	F		C		D	
Approach Delay (s/veh)	--	--	25.9			25.2		
Approach LOS	--	--	D			D		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SU	Intersection	Kaneohe Bay Dr and Namoku St
Agency/Co.	Perazim Consulting, LLC	Jurisdiction	Oahu
Date Performed	4/24/2008	Analysis Year	Future Year without Project
Analysis Time Period	PM Peak Hour		

Project Description: Hawaiian Memorial Park Expansion

East/West Street: Kaneohe Bay Drive | North/South Street: Namoku Street

Intersection Orientation: East-West | Study Period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	15	834	17	36	871	2
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	15	834	17	36	871	2
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	6	0	52	1	1	8
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	6	0	52	1	1	8
Percent Heavy Vehicles	0	2	0	0	2	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	1	0	1	0
Configuration	LT		R		LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR	LT		R		LTR	
v (veh/h)	15	36	6		52		10	
C (m) (veh/h)	773	788	53		367		167	
v/c	0.02	0.05	0.11		0.14		0.06	
95% queue length	0.06	0.14	0.38		0.49		0.19	
Control Delay (s/veh)	9.7	9.8	81.5		16.4		27.9	
LOS	A	A	F		C		D	
Approach Delay (s/veh)	--	--	23.2			27.9		
Approach LOS	--	--	C			D		

 HCS+™ Version 5.21

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SU	Intersection	Mokulele Dr and Namoku St
Agency/Co.	Perazim Consulting, LLC	Jurisdiction	Oahu
Date Performed	4/24/2008	Analysis Year	Future Year without Project
Analysis Time Period	AM Peak Hour		

Project Description: Hawaiian Memorial Park Expansion

East/West Street: Mokulele Drive | North/South Street: Namoku Street

Intersection Orientation: North-South | Study Period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	15	74	34	3	129	51
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	15	74	34	3	129	51
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	35	48	28	40	46	14
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	35	48	28	40	46	14
Percent Heavy Vehicles	0	2	0	0	2	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (veh/h)	15	3		100			111	
C (m) (veh/h)	1408	1495		622			655	
v/c	0.01	0.00		0.16			0.17	
95% queue length	0.03	0.01		0.57			0.61	
Control Delay (s/veh)	7.6	7.4		11.9			11.6	
LOS	A	A		B			B	
Approach Delay (s/veh)	--	--	11.9			11.6		
Approach LOS	--	--	B			B		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SU	Intersection	Mokulele Dr and Namoku St
Agency/Co.	Perazim Consulting, LLC	Jurisdiction	Oahu
Date Performed	3/24/2008	Analysis Year	Future Year without Project
Analysis Time Period	PM Peak Hour		

Project Description: Hawaiian Memorial Park Expansion

East/West Street: Mokulele Drive | North/South Street: Namoku Street

Intersection Orientation: North-South | Study Period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	16	78	56	9	53	30
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	16	78	56	9	53	30
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	41	61	54	42	31	3
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	41	61	54	42	31	3
Percent Heavy Vehicles	0	2	0	0	2	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (veh/h)	16	9		76			156	
C (m) (veh/h)	1527	1463		618			744	
v/c	0.01	0.01		0.12			0.21	
95% queue length	0.03	0.02		0.42			0.79	
Control Delay (s/veh)	7.4	7.5		11.6			11.1	
LOS	A	A		B			B	
Approach Delay (s/veh)	--	--	11.6			11.1		
Approach LOS	--	--	B			B		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SU	Intersection	Namoku St and Lipalu St
Agency/Co.	Perazim Consulting, LLC	Jurisdiction	Oahu
Date Performed	4/24/2008	Analysis Year	Future Year without Project
Analysis Time Period	AM Peak Hour		

Project Description: Hawaiian Memorial Park Expansion

East/West Street: Namoku Street | North/South Street: Lipalu Street

Intersection Orientation: East-West | Study Period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		82	4	2	80	
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	0	82	4	2	80	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration			TR	LT		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	16		1			
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	16	0	1	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT		LR				
v (veh/h)		2		17				
C (m) (veh/h)		1523		834				
v/c		0.00		0.02				
95% queue length		0.00		0.06				
Control Delay (s/veh)		7.4		9.4				
LOS		A		A				
Approach Delay (s/veh)	--	--	9.4					
Approach LOS	--	--	A					

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SU	Intersection	Namoku St and Lipalu St
Agency/Co.	Perazim Consulting, LLC	Jurisdiction	Oahu
Date Performed	4/24/2008	Analysis Year	Future Year without Project
Analysis Time Period	PM Peak Hour		

Project Description: Hawaiian Memorial Park Expansion

East/West Street: Namoku Street | North/South Street: Lipalu Street

Intersection Orientation: East-West | Study Period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		111	10	8	59	
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	0	111	10	8	59	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration			TR	LT		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	10		3			
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	10	0	3	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT		LR				
v (veh/h)		8		13				
C (m) (veh/h)		1479		828				
v/c		0.01		0.02				
95% queue length		0.02		0.05				
Control Delay (s/veh)		7.4		9.4				
LOS		A		A				
Approach Delay (s/veh)	--	--	9.4					
Approach LOS	--	--	A					

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	SU	Intersection	Kamehameha Dr and Mokulele Dr
Agency or Co.	Perazim Consulting, LLC	Area Type	All other areas
Date Performed	4/24/2008	Jurisdiction	Oahu
Time Period	AM Peak Hour	Analysis Year	Future Year without Project
		Project ID	Hawaiian Memorial Park Expansion

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	0	1	1	0	1	1	1	2	1	1	2	0
Lane Group		LT	R		LT	R	L	T	R	L	TR	
Volume, V (vph)	78	14	22	216	16	148	6	981	73	61	1095	33
% Heavy Vehicles, %HV	0	2	0	0	2	0	0	2	0	0	2	0
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Extension of Effective Green, e		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Arrival Type, AT		3	3		3	3	3	3	3	3	3	
Unit Extension, UE		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Filtering/Metering, I		1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	
Initial Unmet Demand, Q_b		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B		0	0		0	0	0	0	0	0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	Excl. Left	SB Only	Thru & RT	08
Timing	G = 24.0	G =	G =	G =	G = 6.0	G = 10.0	G = 48.0	G =
	Y = 6	Y =	Y =	Y =	Y =	Y = 6	Y =	Y =

Duration of Analysis, T = 1.00 — Cycle Length, C = 100.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		103	24		258	164	7	1090	81	68	1254	
Lane Group Capacity, c		195	388		304	388	108	1703	775	289	2049	
v/c Ratio, X		0.53	0.06		0.85	0.42	0.06	0.64	0.10	0.24	0.61	
Total Green Ratio, g/C		0.24	0.24		0.24	0.24	0.06	0.48	0.48	0.16	0.58	
Uniform Delay, d_1		33.1	29.3		36.3	32.1	44.4	19.5	14.2	36.7	13.7	
Progression Factor, PF		1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	
Delay Calibration, k		0.13	0.11		0.38	0.11	0.11	0.22	0.11	0.11	0.20	
Incremental Delay, d_2		2.7	0.1		23.4	0.7	0.3	0.8	0.1	0.4	0.5	
Initial Queue Delay, d_3		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Control Delay		35.8	29.4		59.6	32.9	44.6	20.3	14.3	37.1	14.2	
Lane Group LOS		D	C		E	C	D	C	B	D	B	
Approach Delay	34.6			49.2			20.1			15.4		
Approach LOS	C			D			C			B		
Intersection Delay	22.7			X_c = 0.64			Intersection LOS			C		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	SU	Intersection	Kamehameha Dr and Mokulele Dr
Agency or Co.	Perazim Consulting, LLC	Area Type	All other areas
Date Performed	4/24/2008	Jurisdiction	Oahu
Time Period	PM Peak Hour	Analysis Year	Future Year without Project
		Project ID	Hawaiian Memorial Park Expansion

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	0	1	1	0	1	1	1	2	1	1	2	0
Lane Group		LT	R		LT	R	L	T	R	L	TR	
Volume, V (vph)	60	12	13	128	23	79	13	1395	180	115	1103	52
% Heavy Vehicles, %HV	0	2	0	0	2	0	0	2	0	0	2	0
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Extension of Effective Green, e		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Arrival Type, AT		3	3		3	3	3	3	3	3	3	
Unit Extension, UE		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Filtering/Metering, I		1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	
Initial Unmet Demand, Q_b		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B		0	0		0	0	0	0	0	0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	Excl. Left	SB Only	Thru & RT	08
Timing	G = 20.0	G =	G =	G =	G = 8.0	G = 7.0	G = 66.0	G =
	Y = 6	Y =	Y =	Y =	Y =	Y = 6	Y = 7	Y =

Duration of Analysis, T = 1.00 — Cycle Length, C = 120.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		80	14		168	88	14	1550	200	128	1284	
Lane Group Capacity, c		161	269		222	269	120	1951	888	226	2321	
v/c Ratio, X		0.50	0.05		0.76	0.33	0.12	0.79	0.23	0.57	0.55	
Total Green Ratio, g/C		0.17	0.17		0.17	0.17	0.07	0.55	0.55	0.13	0.66	
Uniform Delay, d_1		45.4	42.0		47.7	44.1	52.7	21.6	13.9	49.4	11.0	
Progression Factor, PF		1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	
Delay Calibration, k		0.11	0.11		0.31	0.11	0.11	0.34	0.11	0.16	0.15	
Incremental Delay, d_2		2.4	0.1		15.1	0.7	0.4	2.4	0.1	3.4	0.3	
Initial Queue Delay, d_3		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Control Delay		47.9	42.1		62.8	44.8	53.1	24.0	14.0	52.8	11.3	
Lane Group LOS		D	D		E	D	D	C	B	D	B	
Approach Delay	47.0			56.6			23.1			15.1		
Approach LOS	D			E			C			B		
Intersection Delay	22.9			X_c = 0.75			Intersection LOS			C		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	SU	Intersection	Kaneohe Bay Dr and Mokulele Dr
Agency or Co.	Perazim Consulting, LLC	Area Type	All other areas
Date Performed	4/24/2008	Jurisdiction	Oahu
Time Period	AM Peak Hour	Analysis Year	Future Year without Project
		Project ID	Hawaiian Memorial Park Expansion

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	1	1	1	1	0	1	1	0	0	1	0
Lane Group	L	T	R	L	TR		L	TR			LTR	
Volume, V (vph)	15	767	192	51	878	6	207	2	61	0	2	7
% Heavy Vehicles, %HV	0	2	0	0	2	0	0	2	0	0	2	0
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	
Extension of Effective Green, e	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	
Arrival Type, AT	3	3	3	3	3		3	3			3	
Unit Extension, UE	3.0	3.0	3.0	3.0	3.0		3.0	3.0			3.0	
Filtering/Metering, I	1.000	1.000	1.000	1.000	1.000		1.000	1.000			1.000	
Initial Unmet Demand, Q_b	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0	12.0	12.0	12.0		12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0	0	0	0		0	0			0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	Excl. Left	WB Only	Thru & RT	04	NS Perm	06	07	08
Timing	G = 3.0	G = 4.0	G = 60.0	G =	G = 21.0	G =	G =	G =
	Y =	Y =	Y = 6	Y =	Y = 6	Y =	Y =	Y =

Duration of Analysis, T = 1.00 — Cycle Length, C = 100.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	17	852	213	57	983		230	70			10	
Lane Group Capacity, c	54	1118	969	126	1191		300	341			354	
v/c Ratio, X	0.31	0.76	0.22	0.45	0.83		0.77	0.21			0.03	
Total Green Ratio, g/C	0.03	0.60	0.60	0.07	0.64		0.21	0.21			0.21	
Uniform Delay, d_1	47.5	14.7	9.2	44.7	13.7		37.2	32.6			31.4	
Progression Factor, PF	1.000	1.000	1.000	1.000	1.000		1.000	1.000			1.000	
Delay Calibration, k	0.11	0.31	0.11	0.11	0.36		0.32	0.11			0.11	
Incremental Delay, d_2	3.4	3.2	0.1	2.6	5.1		12.2	0.3			0.0	
Initial Queue Delay, d_3	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Control Delay	50.9	18.0	9.3	47.2	18.8		49.4	32.9			31.4	
Lane Group LOS	D	B	A	D	B		D	C			C	
Approach Delay	16.8			20.4			45.5			31.4		
Approach LOS	B			C			D			C		
Intersection Delay	21.9			X_C = 0.79			Intersection LOS			C		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	SU	Intersection	Kaneohe Bay Dr and Mokulele Dr
Agency or Co.	Perazim Consulting, LLC	Area Type	All other areas
Date Performed	4/24/2008	Jurisdiction	Oahu
Time Period	PM Peak Hour	Analysis Year	Future Year without Project
		Project ID	Hawaiian Memorial Park Expansion

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	1	1	1	1	0	1	1	0	0	1	0
Lane Group	L	T	R	L	TR		L	TR			LTR	
Volume, V (vph)	16	772	132	38	853	3	119	5	44	5	4	21
% Heavy Vehicles, %HV	0	2	0	0	2	0	0	2	0	0	2	0
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	
Extension of Effective Green, e	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	
Arrival Type, AT	3	3	3	3	3		3	3			3	
Unit Extension, UE	3.0	3.0	3.0	3.0	3.0		3.0	3.0			3.0	
Filtering/Metering, I	1.000	1.000	1.000	1.000	1.000		1.000	1.000			1.000	
Initial Unmet Demand, Q_b	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0	12.0	12.0	12.0		12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0	0	0	0		0	0			0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EB Only	WB Only	Thru & RT	04	NS Perm	06	07	08
Timing	G = 6.0	G = 10.0	G = 52.0	G =	G = 19.0	G =	G =	G =
	Y =	Y =	Y = 7	Y =	Y = 6	Y =	Y =	Y =

Duration of Analysis, T = 1.00 — Cycle Length, C = 100.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	18	858	147	42	951		132	55			33	
Lane Group Capacity, c	108	969	840	181	1154		266	312			313	
v/c Ratio, X	0.17	0.89	0.17	0.23	0.82		0.50	0.18			0.11	
Total Green Ratio, g/C	0.06	0.52	0.52	0.10	0.62		0.19	0.19			0.19	
Uniform Delay, d_1	44.6	21.4	12.7	41.5	14.8		36.2	33.9			33.5	
Progression Factor, PF	1.000	1.000	1.000	1.000	1.000		1.000	1.000			1.000	
Delay Calibration, k	0.11	0.41	0.11	0.11	0.36		0.11	0.11			0.11	
Incremental Delay, d_2	0.7	11.2	0.1	0.7	5.2		1.5	0.3			0.1	
Initial Queue Delay, d_3	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Control Delay	45.4	32.5	12.8	42.1	20.0		37.7	34.2			33.6	
Lane Group LOS	D	C	B	D	B		D	C			C	
Approach Delay	29.9			20.9			36.7			33.6		
Approach LOS	C			C			D			C		
Intersection Delay	26.5			X_C = 0.71			Intersection LOS			C		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	SU	Intersection	Kamehameha Hwy-HMP1-Halekou Rd
Agency or Co.	Perazim Consulting, LLC	Area Type	All other areas
Date Performed	4/24/2008	Jurisdiction	Oahu
Time Period	AM Peak Hour	Analysis Year	Future Year without Project
		Project ID	Hawaiian Memorial Park Expansion

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	0	1	0	0	1	1	1	2	0	1	2	0
Lane Group		LTR			LT	R	L	TR		L	TR	
Volume, V (vph)	42	2	84	9	0	23	38	937	19	44	1122	46
% Heavy Vehicles, %HV	0	2	0	0	2	0	0	2	0	0	2	0
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1		2.0			2.0	2.0	2.0	2.0		2.0	2.0	
Extension of Effective Green, e		2.0			2.0	2.0	2.0	2.0		2.0	2.0	
Arrival Type, AT		3			3	3	3	3		3	3	
Unit Extension, UE		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Filtering/Metering, I		1.000			1.000	1.000	1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0			12.0	12.0	12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B		0			0	0	0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	Excl. Left	SB Only	Thru & RT	08
Timing	G = 24.0	G =	G =	G =	G = 6.0	G = 10.0	G = 48.0	G =
	Y = 6	Y =	Y =	Y =	Y =	Y = 6	Y =	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 100.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		128			9	23	38	956		44	1168	
Lane Group Capacity, c		374			364	388	108	1698		289	2046	
v/c Ratio, X		0.34			0.02	0.06	0.35	0.56		0.15	0.57	
Total Green Ratio, g/C		0.24			0.24	0.24	0.06	0.48		0.16	0.58	
Uniform Delay, d_1		31.5			29.1	29.3	45.1	18.5		36.2	13.2	
Progression Factor, PF		1.000			1.000	1.000	1.000	1.000		1.000	1.000	
Delay Calibration, k		0.11			0.11	0.11	0.11	0.16		0.11	0.17	
Incremental Delay, d_2		0.6			0.0	0.1	2.0	0.4		0.2	0.4	
Initial Queue Delay, d_3		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay		32.0			29.1	29.4	47.1	19.0		36.4	13.6	
Lane Group LOS		C			C	C	D	B		D	B	
Approach Delay	32.0			29.3			20.0			14.4		
Approach LOS	C			C			C			B		
Intersection Delay	17.9			X_c = 0.49			Intersection LOS			B		

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	SU	Intersection	Kamehameha Hwy-HMP1-Halekou Rd
Agency or Co.	Perazim Consulting, LLC	Area Type	All other areas
Date Performed	4/24/2008	Jurisdiction	Oahu
Time Period	PM Peak Hour	Analysis Year	Future Year without Project
		Project ID	Hawaiian Memorial Park Expansion

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	0	1	0	0	1	1	1	2	0	1	2	0
Lane Group		LTR			LT	R	L	TR		L	TR	
Volume, V (vph)	36	2	52	30	1	41	93	1492	21	14	1064	53
% Heavy Vehicles, %HV	0	2	0	0	2	0	0	2	0	0	2	0
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1		2.0			2.0	2.0	2.0	2.0		2.0	2.0	
Extension of Effective Green, e		2.0			2.0	2.0	2.0	2.0		2.0	2.0	
Arrival Type, AT		3			3	3	3	3		3	3	
Unit Extension, UE		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Filtering/Metering, I		1.000			1.000	1.000	1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0			12.0	12.0	12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B		0			0	0	0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	Excl. Left	NB Only	Thru & RT	08
Timing	G = 19.0	G =	G =	G =	G = 6.0	G = 10.0	G = 52.0	G =
	Y = 6	Y =	Y =	Y =	Y =	Y =	Y = 7	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 100.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		90			31	41	93	1513		14	1117	
Lane Group Capacity, c		289			259	307	289	2195		108	1833	
v/c Ratio, X		0.31			0.12	0.13	0.32	0.69		0.13	0.61	
Total Green Ratio, g/C		0.19			0.19	0.19	0.16	0.62		0.06	0.52	
Uniform Delay, d_1		34.9			33.6	33.7	37.2	12.6		44.5	16.9	
Progression Factor, PF		1.000			1.000	1.000	1.000	1.000		1.000	1.000	
Delay Calibration, k		0.11			0.11	0.11	0.11	0.26		0.11	0.20	
Incremental Delay, d_2		0.6			0.2	0.2	0.6	0.9		0.5	0.6	
Initial Queue Delay, d_3		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay		35.5			33.8	33.9	37.8	13.5		45.1	17.5	
Lane Group LOS		D			C	C	D	B		D	B	
Approach Delay	35.5			33.8			15.0			17.8		
Approach LOS	D			C			B			B		
Intersection Delay	17.2			X_c = 0.57			Intersection LOS			B		

FUTURE TRAFFIC CONDITIONS WITH ALTERNATIVE A

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SU*	Intersection	*Kamehameha Hwy-HMP1-Halekou Rd*
Agency/Co.	*Perazim Consulting, LLC*	Jurisdiction	*Oahu*
Date Performed	*4/24/2008*	Analysis Year	*Future Yr with Alternative A*
Analysis Time Period	*AM Peak Hour*		

Project Description *Hawaiian Memorial Park Expansion*

East/West Street: *HMP Primary Drwy-Halekou Rd* | North/South Street: *Kamehameha Highway*

Intersection Orientation: *North-South* | Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*38*	*939*	*22*	*51*	*1124*	*46*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*38*	*939*	*22*	*51*	*1124*	*46*
Percent Heavy Vehicles	*2*	--	--	*2*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*1*	*2*	*0*
Configuration	*L*	*T*	*TR*	*L*	*T*	*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*42*	*3*	*84*	*10*	*0*	*27*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*42*	*3*	*84*	*10*	*0*	*27*
Percent Heavy Vehicles	*0*	*2*	*0*	*0*	*2*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*1*
Configuration		*LTR*		*LT*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*	*LT*		*R*		*LTR*	
v (veh/h)	*38*	*51*	*10*		*27*		*129*	
C (m) (veh/h)	*593*	*712*	*137*		*537*		*238*	
v/c	*0.06*	*0.07*	*0.07*		*0.05*		*0.54*	
95% queue length	*0.21*	*0.23*	*0.24*		*0.16*		*3.35*	
Control Delay (s/veh)	*11.5*	*10.4*	*33.3*		*12.1*		*37.7*	
LOS	*B*	*B*	*D*		*B*		*E*	
Approach Delay (s/veh)	--	--	*17.8*			*37.7*		
Approach LOS	--	--	*C*			*E*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SU*	Intersection	*Kamehameha Hwy-HMP1-Halekou Rd*
Agency/Co.	*Perazim Consulting, LLC*	Jurisdiction	*Oahu*
Date Performed	*4/24/2008*	Analysis Year	*Future Yr with Alternative A*
Analysis Time Period	*AM Peak Hour*		

Project Description *Hawaiian Memorial Park Expansion*

East/West Street: *HMP Primary Dwy-Halekou Rd* | North/South Street: *Kamehameha Highway*

Intersection Orientation: *North-South* | Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*93*	*1495*	*24*	*16*	*1066*	*53*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*93*	*1495*	*24*	*16*	*1066*	*53*
Percent Heavy Vehicles	*2*	--	--	*2*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*1*	*2*	*0*
Configuration	*L*	*T*	*TR*	*L*	*T*	*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*36*	*2*	*52*	*35*	*0*	*47*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*36*	*2*	*52*	*35*	*0*	*47*
Percent Heavy Vehicles	*0*	*2*	*0*	*0*	*2*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*1*
Configuration		*LTR*		*LT*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*	*LT*		*R*		*LTR*	
v (veh/h)	*93*	*16*	*35*		*47*		*90*	
C (m) (veh/h)	*620*	*435*	*66*		*353*		*188*	
v/c	*0.15*	*0.04*	*0.53*		*0.13*		*0.48*	
95% queue length	*0.53*	*0.11*	*2.86*		*0.46*		*2.62*	
Control Delay (s/veh)	*11.8*	*13.6*	*117.2*		*16.8*		*41.4*	
LOS	*B*	*B*	*F*		*C*		*E*	
Approach Delay (s/veh)	--	--	*59.6*			*41.4*		
Approach LOS	--	--	*F*			*E*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SU*	Intersection	*Kamehameha Hwy-HMP2-Mahinui*
Agency/Co.	*Perazim Consulting, LLC*	Jurisdiction	*Oahu*
Date Performed	*4/24/2008*	Analysis Year	*Future Yr with Altenative A*
Analysis Time Period	*AM Peak Hour*		

Project Description *Hawaiian Memorial Park Expansion*

East/West Street: *HMP Secondary Dwy-Mahinui Rd* | North/South Street: *Kamehameha Hwy*

Intersection Orientation: *North-South* | Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*5*	*1022*	*4*	*20*	*1299*	*25*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*5*	*1022*	*4*	*20*	*1299*	*25*
Percent Heavy Vehicles	*2*	--	--	*2*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*0*	*2*	*0*
Configuration	*L*	*T*	*TR*	*LT*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*35*	*3*	*12*	*2*	*0*	*10*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*35*	*3*	*12*	*2*	*0*	*10*
Percent Heavy Vehicles	*0*	*2*	*0*	*0*	*2*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*1*
Configuration		*LTR*		*LT*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*LT*	*LT*		*R*		*LTR*	
v (veh/h)	*5*	*20*	*2*		*10*		*50*	
C (m) (veh/h)	*518*	*673*	*160*		*512*		*146*	
v/c	*0.01*	*0.03*	*0.01*		*0.02*		*0.34*	
95% queue length	*0.03*	*0.09*	*0.04*		*0.06*		*1.51*	
Control Delay (s/veh)	*12.0*	*10.5*	*27.8*		*12.2*		*42.4*	
LOS	*B*	*B*	*D*		*B*		*E*	
Approach Delay (s/veh)	--	--	*14.8*			*42.4*		
Approach LOS	--	--	*B*			*E*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SU	Intersection	Kamehameha Hwy-HMP2-Mahinui
Agency/Co.	Perazim Consulting, LLC	Jurisdiction	Oahu
Date Performed	4/24/2008	Analysis Year	Future Yr with Alternative A
Analysis Time Period	PM Peak Hour		

Project Description: Hawaiian Memorial Park Expansion

East/West Street: HMP Secondary Dwy-Mahinui Rd | North/South Street: Kamehameha Hwy

Intersection Orientation: North-South | Study Period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	31	1545	2	20	1199	32
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	31	1545	2	20	1199	32
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type	Raised curb					
RT Channelized			0			0
Lanes	1	2	0	0	2	0
Configuration	L	T	TR	LT		TR
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	20	1	6	2	0	38
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	20	1	6	2	0	38
Percent Heavy Vehicles	0	2	0	0	2	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	1
Configuration		LTR		LT		R

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	LT	LT		R		LTR	
v (veh/h)	31	20	2		38		27	
C (m) (veh/h)	562	425	82		346		127	
v/c	0.06	0.05	0.02		0.11		0.21	
95% queue length	0.18	0.15	0.07		0.37		0.80	
Control Delay (s/veh)	11.8	13.9	50.0		16.7		41.0	
LOS	B	B	E		C		E	
Approach Delay (s/veh)	--	--	18.4			41.0		
Approach LOS	--	--	C			E		

 HCS+™ Version 5.21

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SU	Intersection	Kaneohe Bay Dr and Namoku St
Agency/Co.	Perazim Consulting, LLC	Jurisdiction	Oahu
Date Performed	4/24/2008	Analysis Year	Future Yr with Alternative A
Analysis Time Period	AM Peak Hour		

Project Description: Hawaiian Memorial Park Expansion

East/West Street: Kaneohe Bay Drive | North/South Street: Namoku Street

Intersection Orientation: East-West | Study Period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	3	812	7	44	922	1
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	3	812	7	44	922	1
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	8	1	59	1	1	13
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	8	1	59	1	1	13
Percent Heavy Vehicles	0	2	0	0	2	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	1	0	1	0
Configuration	LT		R		LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR	LT		R		LTR	
v (veh/h)	3	44	9		59		15	
C (m) (veh/h)	740	810	52		380		193	
v/c	0.00	0.05	0.17		0.16		0.08	
95% queue length	0.01	0.17	0.61		0.55		0.25	
Control Delay (s/veh)	9.9	9.7	88.6		16.2		25.2	
LOS	A	A	F		C		D	
Approach Delay (s/veh)	--	--	25.8			25.2		
Approach LOS	--	--	D			D		

 HCS+™ Version 5.21

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SU	Intersection	Kaneohe Bay Dr and Namoku St
Agency/Co.	Perazim Consulting, LLC	Jurisdiction	Oahu
Date Performed	4/24/2008	Analysis Year	Future Yr with Alternative A
Analysis Time Period	PM Peak Hour		

Project Description: Hawaiian Memorial Park Expansion

East/West Street: Kaneohe Bay Drive | North/South Street: Namoku Street

Intersection Orientation: East-West | Study Period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	15	835	17	39	872	2
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	15	835	17	39	872	2
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	6	0	53	1	1	8
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	6	0	53	1	1	8
Percent Heavy Vehicles	0	2	0	0	2	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	1	0	1	0
Configuration	LT		R		LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR	LT		R		LTR	
v (veh/h)	15	39	6		53		10	
C (m) (veh/h)	772	787	52		366		165	
v/c	0.02	0.05	0.12		0.14		0.06	
95% queue length	0.06	0.16	0.38		0.51		0.19	
Control Delay (s/veh)	9.8	9.8	83.2		16.5		28.2	
LOS	A	A	F		C		D	
Approach Delay (s/veh)	--	--	23.3			28.2		
Approach LOS	--	--	C			D		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SU	Intersection	Mokulele Dr and Namoku St
Agency/Co.	Perazim Consulting, LLC	Jurisdiction	Oahu
Date Performed	4/24/2008	Analysis Year	Future Yr with Alternative A
Analysis Time Period	AM Peak Hour		

Project Description: Hawaiian Memorial Park Expansion

East/West Street: Mokulele Drive | North/South Street: Namoku Street

Intersection Orientation: North-South | Study Period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	15	75	35	4	130	51
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	15	75	35	4	130	51
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	35	49	28	44	51	15
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	35	49	28	44	51	15
Percent Heavy Vehicles	2	0	0	2	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (veh/h)	15	4		110			112	
C (m) (veh/h)	1407	1493		616			647	
v/c	0.01	0.00		0.18			0.17	
95% queue length	0.03	0.01		0.65			0.63	
Control Delay (s/veh)	7.6	7.4		12.1			11.7	
LOS	A	A		B			B	
Approach Delay (s/veh)	--	--	12.1			11.7		
Approach LOS	--	--	B			B		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SU*	Intersection	*Mokulele Dr and Namoku St*
Agency/Co.	*Perazim Consulting, LLC*	Jurisdiction	*Oahu*
Date Performed	*4/24/2008*	Analysis Year	*Future Yr with Alternative A*
Analysis Time Period	*PM Peak Hour*		

Project Description *Hawaiian Memorial Park Expansion*

East/West Street: *Mokulele Drive* | North/South Street: *Namoku Street*

Intersection Orientation: *North-South* | Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*16*	*79*	*61*	*11*	*54*	*30*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*16*	*79*	*61*	*11*	*54*	*30*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*41*	*64*	*54*	*45*	*33*	*4*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*41*	*64*	*54*	*45*	*33*	*4*
Percent Heavy Vehicles	*2*	*0*	*0*	*2*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*16*	*11*		*82*			*159*	
C (m) (veh/h)	*1526*	*1456*		*609*			*733*	
v/c	*0.01*	*0.01*		*0.13*			*0.22*	
95% queue length	*0.03*	*0.02*		*0.47*			*0.83*	
Control Delay (s/veh)	*7.4*	*7.5*		*11.8*			*11.3*	
LOS	*A*	*A*		*B*			*B*	
Approach Delay (s/veh)	--	--	*11.8*			*11.3*		
Approach LOS	--	--	*B*			*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SU*	Intersection	*Namoku St and Lipalu St*
Agency/Co.	*Perazim Consulting, LLC*	Jurisdiction	*Oahu*
Date Performed	*4/24/2008*	Analysis Year	*Future Yr with Alternative A*
Analysis Time Period	*AM Peak Hour*		

Project Description *Hawaiian Memorial Park Expansion*

East/West Street: *Namoku Street* | North/South Street: *Lipalu Street*

Intersection Orientation: *East-West* | Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*82*	*7*	*3*	*80*	
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*82*	*7*	*3*	*80*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*26*		*2*			
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*26*	*0*	*2*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*		*LR*				
v (veh/h)		*3*		*28*				
C (m) (veh/h)		*1519*		*831*				
v/c		*0.00*		*0.03*				
95% queue length		*0.01*		*0.10*				
Control Delay (s/veh)		*7.4*		*9.5*				
LOS		*A*		*A*				
Approach Delay (s/veh)	--	--	*9.5*					
Approach LOS	--	--	*A*					

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Unsignalized Intersection

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SU*	Intersection	*Namoku St and Lipalu St*
Agency/Co.	*Perazim Consulting, LLC*	Jurisdiction	*Oahu*
Date Performed	*4/24/2008*	Analysis Year	*Future Yr with Alternative A*
Analysis Time Period	*PM Peak Hour*		

Project Description *Hawaiian Memorial Park Expansion*

East/West Street: *Namoku Street* | North/South Street: *Lipalu Street*

Intersection Orientation: *East-West* | Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*111*	*20*	*11*	*59*	
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*111*	*20*	*11*	*59*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*16*		*4*			
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*16*	*0*	*4*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*		*LR*				
v (veh/h)		*11*		*20*				
C (m) (veh/h)		*1467*		*811*				
v/c		*0.01*		*0.02*				
95% queue length		*0.02*		*0.08*				
Control Delay (s/veh)		*7.5*		*9.6*				
LOS		*A*		*A*				
Approach Delay (s/veh)	--	--	*9.6*					
Approach LOS	--	--	*A*					

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FwithAltA 5-PM

Signalized Intersection

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*SU*	Intersection	*Kamehameha Dr and Mokulele Dr*
Agency or Co.	*Perazim Consulting, LLC*	Area Type	*All other areas*
Date Performed	*4/24/2008*	Jurisdiction	*Oahu*
Time Period	*AM Peak Hour*	Analysis Year	*Future Yr with Alternative A*
		Project ID	*Hawaiian Memorial Park Expansion*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	*0*	*1*	*1*	*0*	*1*	*1*	*1*	*2*	*1*	*1*	*2*	*0*
Lane Group		*LT*	*R*		*LT*	*R*	*L*	*T*	*R*	*L*	*TR*	
Volume, V (vph)	*78*	*14*	*22*	*219*	*16*	*150*	*6*	*986*	*75*	*61*	*1103*	*33*
% Heavy Vehicles, %HV	*0*	*2*	*0*	*0*	*2*	*0*	*0*	*2*	*0*	*0*	*2*	*0*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Pretimed (P) or Actuated (A)	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
Start-up Lost Time, l_1		*2.0*	*2.0*		*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	
Extension of Effective Green, e		*2.0*	*2.0*		*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	
Arrival Type, AT		*3*	*3*		*3*	*3*	*3*	*3*	*3*	*3*	*3*	
Unit Extension, UE		*3.0*	*3.0*		*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	
Filtering/Metering, I		*1.000*	*1.000*		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	
Initial Unmet Demand, Q_b		*0.0*	*0.0*		*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	
Ped / Bike / RTOR Volumes	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width		*12.0*	*12.0*		*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B		*0*	*0*		*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Min. Time for Pedestrians, G_p		*3.2*			*3.2*			*3.2*			*3.2*	

Phasing	EW Perm	02	03	04	Excl. Left	SB Only	Thru & RT	08
Timing	G = *24.0*	G =	G =	G =	G = *6.0*	G = *10.0*	G = *48.0*	G =
	Y = *6*	Y =	Y =	Y =	Y =	Y =	Y = *6*	Y =

Duration of Analysis, T = *1.00* | Cycle Length, C = *100.0*

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		*103*	*24*		*261*	*167*	*7*	*1096*	*83*	*68*	*1263*	
Lane Group Capacity, c		*193*	*388*		*304*	*388*	*108*	*1703*	*775*	*289*	*2049*	
v/c Ratio, X		*0.53*	*0.06*		*0.86*	*0.43*	*0.06*	*0.64*	*0.11*	*0.24*	*0.62*	
Total Green Ratio, g/C		*0.24*	*0.24*		*0.24*	*0.24*	*0.06*	*0.48*	*0.48*	*0.16*	*0.58*	
Uniform Delay, d_1		*33.1*	*29.3*		*36.4*	*32.2*	*44.4*	*19.6*	*14.3*	*36.7*	*13.7*	
Progression Factor, PF		*1.000*	*1.000*		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	
Delay Calibration, k		*0.14*	*0.11*		*0.39*	*0.11*	*0.11*	*0.22*	*0.11*	*0.11*	*0.20*	
Incremental Delay, d_2		*2.9*	*0.1*		*25.5*	*0.8*	*0.3*	*0.8*	*0.1*	*0.4*	*0.6*	
Initial Queue Delay, d_3		*0.0*	*0.0*		*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	
Control Delay		*36.0*	*29.4*		*61.8*	*33.0*	*44.6*	*20.4*	*14.3*	*37.1*	*14.3*	
Lane Group LOS		*D*	*C*		*E*	*C*	*D*	*C*	*B*	*D*	*B*	
Approach Delay	*34.8*			*50.6*			*20.1*			*15.5*		
Approach LOS	*C*			*D*			*C*			*B*		
Intersection Delay	*23.0*			X_c = *0.64*			Intersection LOS			*C*		

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FwithAltA 6-AM

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	SU	Intersection	Kamehameha Dr and Mokulele Dr
Agency or Co.	Perazim Consulting, LLC	Area Type	All other areas
Date Performed	4/24/2008	Jurisdiction	Oahu
Time Period	PM Peak Hour	Analysis Year	Future Yr with Alternative A
		Project ID	Hawaiian Memorial Park Expansion

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	0	1	1	0	1	1	1	2	1	1	2	0
Lane Group		LT	R		LT	R	L	T	R	L	TR	
Volume, V (vph)	60	12	13	131	23	80	13	1406	184	119	1107	52
% Heavy Vehicles, %HV	0	2	0	0	2	0	0	2	0	0	2	0
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Extension of Effective Green, e		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Arrival Type, AT		3	3		3	3	3	3	3	3	3	
Unit Extension, UE		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Filtering/Metering, I		1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	
Initial Unmet Demand, Q_b		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B		0	0		0	0	0	0	0	0	0	
Min. Time for Pedestrians, G_p		3.2			3.2			3.2			3.2	

Phasing	EW Perm	02	03	04	Excl. Left	SB Only	Thru & RT	08
Timing	G = 20.0	G =	G =	G =	G = 8.0	G = 7.0	G = 66.0	G =
	Y = 6	Y =	Y =	Y =	Y =	Y = 6	Y = 7	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 120.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		80	14		172	89	14	1562	204	132	1288	
Lane Group Capacity, c		158	269		222	269	120	1951	888	226	2321	
v/c Ratio, X		0.51	0.05		0.77	0.33	0.12	0.80	0.23	0.58	0.55	
Total Green Ratio, g/C		0.17	0.17		0.17	0.17	0.07	0.55	0.55	0.13	0.66	
Uniform Delay, d_1		45.5	42.0		47.8	44.1	52.7	21.7	13.9	49.6	11.0	
Progression Factor, PF		1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	
Delay Calibration, k		0.11	0.11		0.32	0.11	0.11	0.34	0.11	0.18	0.15	
Incremental Delay, d_2		2.7	0.1		17.3	0.7	0.4	2.5	0.1	3.9	0.3	
Initial Queue Delay, d_3		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Control Delay		48.2	42.1		65.2	44.8	53.1	24.2	14.0	53.5	11.3	
Lane Group LOS		D	D		E	D	D	C	B	D	B	
Approach Delay	47.3			58.2			23.3			15.2		
Approach LOS	D			E			C			B		
Intersection Delay	23.3			X_c = 0.76			Intersection LOS			C		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	SU	Intersection	Kaneohe Bay Dr and Mokulele Dr
Agency or Co.	Perazim Consulting, LLC	Area Type	All other areas
Date Performed	4/24/2008	Jurisdiction	Oahu
Time Period	AM Peak Hour	Analysis Year	Future Yr with Alternative A
		Project ID	Hawaiian Memorial Park Expansion

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	1	1	1	1	0	1	1	0	0	1	0
Lane Group	L	T	R	L	TR		L	TR			LTR	
Volume, V (vph)	15	767	193	52	878	6	207	2	62	0	2	7
% Heavy Vehicles, %HV	0	2	0	0	2	0	0	2	0	0	2	0
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	
Extension of Effective Green, e	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	
Arrival Type, AT	3	3	3	3	3		3	3			3	
Unit Extension, UE	3.0	3.0	3.0	3.0	3.0		3.0	3.0			3.0	
Filtering/Metering, I	1.000	1.000	1.000	1.000	1.000		1.000	1.000			1.000	
Initial Unmet Demand, Q_b	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0	12.0	12.0	12.0		12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0	0	0	0		0	0			0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	Excl. Left	WB Only	Thru & RT	04	NS Perm	06	07	08
Timing	G = 3.0	G = 4.0	G = 60.0	G =	G = 21.0	G =	G =	G =
	Y =	Y =	Y = 6	Y =	Y = 6	Y =	Y =	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 100.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	17	852	214	58	983		230	71			10	
Lane Group Capacity, c	54	1118	969	126	1191		300	341			354	
v/c Ratio, X	0.31	0.76	0.22	0.46	0.83		0.77	0.21			0.03	
Total Green Ratio, g/C	0.03	0.60	0.60	0.07	0.64		0.21	0.21			0.21	
Uniform Delay, d_1	47.5	14.7	9.2	44.7	13.7		37.2	32.6			31.4	
Progression Factor, PF	1.000	1.000	1.000	1.000	1.000		1.000	1.000			1.000	
Delay Calibration, k	0.11	0.31	0.11	0.11	0.36		0.32	0.11			0.11	
Incremental Delay, d_2	3.4	3.2	0.1	2.7	5.1		12.2	0.3			0.0	
Initial Queue Delay, d_3	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Control Delay	50.9	18.0	9.3	47.4	18.8		49.4	32.9			31.4	
Lane Group LOS	D	B	A	D	B		D	C			C	
Approach Delay	16.8			20.4			45.5			31.4		
Approach LOS	B			C			D			C		
Intersection Delay	21.9			X_c = 0.79			Intersection LOS			C		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	SU	Intersection	Kaneohe Bay Dr and Mokulele Dr
Agency or Co.	Perazim Consulting, LLC	Area Type	All other areas
Date Performed	4/24/2008	Jurisdiction	Oahu
Time Period	PM Peak Hour	Analysis Year	Future Yr with Alternative A
		Project ID	Hawaiian Memorial Park Expansion

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	1	1	1	1	0	1	1	0	0	1	0
Lane Group	L	T	R	L	TR		L	TR			LTR	
Volume, V (vph)	16	772	134	39	853	3	119	5	45	5	4	21
% Heavy Vehicles, %HV	0	2	0	0	2	0	0	2	0	0	2	0
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	
Extension of Effective Green, e	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	
Arrival Type, AT	3	3	3	3	3		3	3			3	
Unit Extension, UE	3.0	3.0	3.0	3.0	3.0		3.0	3.0			3.0	
Filtering/Metering, I	1.000	1.000	1.000	1.000	1.000		1.000	1.000			1.000	
Initial Unmet Demand, Q_b	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0	12.0	12.0	12.0		12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0	0	0	0		0	0			0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EB Only	WB Only	Thru & RT	04	NS Perm	06	07	08
Timing	G = 6.0	G = 10.0	G = 52.0	G =	G = 19.0	G =	G =	G =
	Y =	Y =	Y = 7	Y =	Y = 6	Y =	Y =	Y =

Duration of Analysis, T = 0.25 — Cycle Length, C = 100.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	18	858	149	43	951		132	56			33	
Lane Group Capacity, c	108	969	840	181	1154		266	312			313	
v/c Ratio, X	0.17	0.89	0.18	0.24	0.82		0.50	0.18			0.11	
Total Green Ratio, g/C	0.06	0.52	0.52	0.10	0.62		0.19	0.19			0.19	
Uniform Delay, d_1	44.6	21.4	12.7	41.5	14.8		36.2	34.0			33.5	
Progression Factor, PF	1.000	1.000	1.000	1.000	1.000		1.000	1.000			1.000	
Delay Calibration, k	0.11	0.41	0.11	0.11	0.36		0.11	0.11			0.11	
Incremental Delay, d_2	0.7	9.9	0.1	0.7	5.0		1.5	0.3			0.1	
Initial Queue Delay, d_3	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Control Delay	45.4	31.2	12.8	42.2	19.8		37.7	34.2			33.6	
Lane Group LOS	D	C	B	D	B		D	C			C	
Approach Delay	28.8			20.7			36.7			33.6		
Approach LOS	C			C			D			C		
Intersection Delay	25.9			X_c = 0.71			Intersection LOS			C		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	SU	Intersection	Kamehameha Hwy-HMP1-Halekou Rd
Agency or Co.	Perazim Consulting, LLC	Area Type	All other areas
Date Performed	4/24/2008	Jurisdiction	Oahu
Time Period	AM Peak Hour	Analysis Year	Future Yr with Alt A & Mitigtn
		Project ID	Hawaiian Memorial Park Expansion

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	0	1	0	0	1	1	1	2	0	1	2	0
Lane Group		LTR			LT	R	L	TR		L	TR	
Volume, V (vph)	42	3	84	10	0	27	38	939	22	51	1124	46
% Heavy Vehicles, %HV	0	2	0	0	2	0	0	2	0	0	2	0
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1		2.0			2.0	2.0	2.0	2.0		2.0	2.0	
Extension of Effective Green, e		2.0			2.0	2.0	2.0	2.0		2.0	2.0	
Arrival Type, AT		3			3	3	3	3		3	3	
Unit Extension, UE		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Filtering/Metering, I		1.000			1.000	1.000	1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0			12.0	12.0	12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B		0			0	0	0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	Excl. Left	SB Only	Thru & RT	08
Timing	G = 24.0	G =	G =	G =	G = 6.0	G = 10.0	G = 48.0	G =
	Y = 6	Y =	Y =	Y =	Y =	Y =	Y = 6	Y =

Duration of Analysis, T = 1.00 — Cycle Length, C = 100.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		129			10	27	38	961		51	1170	
Lane Group Capacity, c		375			361	388	108	1697		289	2046	
v/c Ratio, X		0.34			0.03	0.07	0.35	0.57		0.18	0.57	
Total Green Ratio, g/C		0.24			0.24	0.24	0.06	0.48		0.16	0.58	
Uniform Delay, d_1		31.5			29.1	29.4	45.1	18.6		36.3	13.2	
Progression Factor, PF		1.000			1.000	1.000	1.000	1.000		1.000	1.000	
Delay Calibration, k		0.11			0.11	0.11	0.11	0.16		0.11	0.17	
Incremental Delay, d_2		0.6			0.0	0.1	2.0	0.4		0.3	0.4	
Initial Queue Delay, d_3		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay		32.0			29.1	29.4	47.1	19.0		36.6	13.6	
Lane Group LOS		C			C	C	D	B		D	B	
Approach Delay	32.0			29.4			20.1			14.5		
Approach LOS	C			C			C			B		
Intersection Delay	18.0			X_c = 0.49			Intersection LOS			B		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	SU	Intersection	Kamehameha Hwy-HMP1-Halekou Rd
Agency or Co.	Perazim Consulting, LLC	Area Type	All other areas
Date Performed	4/24/2008	Jurisdiction	Oahu
Time Period	PM Peak Hour	Analysis Year	Future Yr with Alt A & Mitigtn
		Project ID	Hawaiian Memorial Park Expansion

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	0	1	0	0	1	1	1	2	0	1	2	0
Lane Group		LTR			LT	R	L	TR		L	TR	
Volume, V (vph)	36	2	52	35	0	47	93	1495	24	16	1066	53
% Heavy Vehicles, %HV	0	2	0	0	2	0	0	2	0	0	2	0
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1		2.0			2.0	2.0	2.0	2.0		2.0	2.0	
Extension of Effective Green, e		2.0			2.0	2.0	2.0	2.0		2.0	2.0	
Arrival Type, AT		3			3	3	3	3		3	3	
Unit Extension, UE		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Filtering/Metering, I		1.000			1.000	1.000	1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0			12.0	12.0	12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B		0			0	0	0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	Excl. Left	NB Only	Thru & RT	08
Timing	G = 19.0	G =	G =	G =	G = 6.0	G = 10.0	G = 52.0	G =
	Y = 6	Y =	Y =	Y =	Y =	Y =	Y = 7	Y =
Duration of Analysis, T = 1.00					Cycle Length, C = 100.0			

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		90			35	47	93	1519		16	1119	
Lane Group Capacity, c		289			253	307	289	2194		108	1833	
v/c Ratio, X		0.31			0.14	0.15	0.32	0.69		0.15	0.61	
Total Green Ratio, g/C		0.19			0.19	0.19	0.16	0.62		0.06	0.52	
Uniform Delay, d_1		34.9			33.7	33.8	37.2	12.7		44.6	16.9	
Progression Factor, PF		1.000			1.000	1.000	1.000	1.000		1.000	1.000	
Delay Calibration, k		0.11			0.11	0.11	0.11	0.26		0.11	0.20	
Incremental Delay, d_2		0.6			0.3	0.2	0.6	1.0		0.6	0.6	
Initial Queue Delay, d_3		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay		35.5			33.9	34.0	37.8	13.6		45.2	17.5	
Lane Group LOS		D			C	C	D	B		D	B	
Approach Delay	35.5			34.0			15.0			17.9		
Approach LOS	D			C			B			B		
Intersection Delay	17.3			X_c = 0.57			Intersection LOS			B		

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FUTURE TRAFFIC CONDITIONS WITH ALTERNATIVE B

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SU*	Intersection	*Kamehameha Hwy-HMP1-Halekou Rd*
Agency/Co.	*Perazim Consulting, LLC*	Jurisdiction	*Oahu*
Date Performed	*4/24/2008*	Analysis Year	*Future Yr with Alternative B*
Analysis Time Period	*AM Peak Hour*		

Project Description *Hawaiian Memorial Park Expansion*

East/West Street: *HMP Primary Drwy-Halekou Rd* | North/South Street: *Kamehameha Highway*

Intersection Orientation: *North-South* | Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*38*	*945*	*22*	*51*	*1124*	*46*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*38*	*945*	*22*	*51*	*1124*	*46*
Percent Heavy Vehicles	*2*	--	--	*2*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*1*	*2*	*0*
Configuration	*L*	*T*	*TR*	*L*	*T*	*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*42*	*3*	*84*	*10*	*0*	*27*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*42*	*3*	*84*	*10*	*0*	*27*
Percent Heavy Vehicles	*0*	*2*	*0*	*0*	*2*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*1*
Configuration		*LTR*		*LT*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*	*LT*		*R*		*LTR*	
v (veh/h)	*38*	*51*	*10*		*27*		*129*	
C (m) (veh/h)	*593*	*708*	*136*		*534*		*238*	
v/c	*0.06*	*0.07*	*0.07*		*0.05*		*0.54*	
95% queue length	*0.21*	*0.23*	*0.24*		*0.16*		*3.35*	
Control Delay (s/veh)	*11.5*	*10.5*	*33.6*		*12.1*		*37.7*	
LOS	*B*	*B*	*D*		*B*		*E*	
Approach Delay (s/veh)	--	--	*17.9*			*37.7*		
Approach LOS	--	--	*C*			*E*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SU*	Intersection	*Kamehameha Hwy-HMP1-Halekou Rd*
Agency/Co.	*Perazim Consulting, LLC*	Jurisdiction	*Oahu*
Date Performed	*4/24/2008*	Analysis Year	*Future Yr with Alternative B*
Analysis Time Period	*AM Peak Hour*		

Project Description *Hawaiian Memorial Park Expansion*

East/West Street: *HMP Primary Dwy-Halekou Rd* | North/South Street: *Kamehameha Highway*

Intersection Orientation: *North-South* | Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*93*	*1496*	*24*	*16*	*1071*	*53*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*93*	*1496*	*24*	*16*	*1071*	*53*
Percent Heavy Vehicles	*2*	--	--	*2*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*1*	*2*	*0*
Configuration	*L*	*T*	*TR*	*L*	*T*	*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*36*	*2*	*52*	*35*	*0*	*47*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*36*	*2*	*52*	*35*	*0*	*47*
Percent Heavy Vehicles	*0*	*2*	*0*	*0*	*2*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*1*
Configuration		*LTR*		*LT*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*	*LT*		*R*		*LTR*	
v (veh/h)	*93*	*16*	*35*		*47*		*90*	
C (m) (veh/h)	*617*	*435*	*65*		*353*		*187*	
v/c	*0.15*	*0.04*	*0.54*		*0.13*		*0.48*	
95% queue length	*0.53*	*0.11*	*2.93*		*0.46*		*2.64*	
Control Delay (s/veh)	*11.9*	*13.6*	*120.6*		*16.8*		*41.8*	
LOS	*B*	*B*	*F*		*C*		*E*	
Approach Delay (s/veh)	--	--	*61.1*			*41.8*		
Approach LOS	--	--	*F*			*E*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SU*	Intersection	*Kamehameha Hwy-HMP2-Mahinui*
Agency/Co.	*Perazim Consulting, LLC*	Jurisdiction	*Oahu*
Date Performed	*4/24/2008*	Analysis Year	*Future Yr with Altenative B*
Analysis Time Period	*AM Peak Hour*		

Project Description *Hawaiian Memorial Park Expansion*

East/West Street: *HMP Secondary Dwy-Mahinui Rd* | North/South Street: *Kamehameha Hwy*

Intersection Orientation: *North-South* | Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*5*	*1028*	*4*	*20*	*1299*	*25*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*5*	*1028*	*4*	*20*	*1299*	*25*
Percent Heavy Vehicles	*2*	--	--	*2*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*0*	*2*	*0*
Configuration	*L*	*T*	*TR*	*LT*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*35*	*3*	*12*	*2*	*0*	*10*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*35*	*3*	*12*	*2*	*0*	*10*
Percent Heavy Vehicles	*0*	*2*	*0*	*0*	*2*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*1*
Configuration		*LTR*		*LT*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*LT*	*LT*		*R*		*LTR*	
v (veh/h)	*5*	*20*	*2*		*10*		*50*	
C (m) (veh/h)	*518*	*669*	*159*		*509*		*146*	
v/c	*0.01*	*0.03*	*0.01*		*0.02*		*0.34*	
95% queue length	*0.03*	*0.09*	*0.04*		*0.06*		*1.51*	
Control Delay (s/veh)	*12.0*	*10.5*	*27.9*		*12.2*		*42.4*	
LOS	*B*	*B*	*D*		*B*		*E*	
Approach Delay (s/veh)	--	--	*14.8*			*42.4*		
Approach LOS	--	--	*B*			*E*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SU*	Intersection	*Kamehameha Hwy-HMP2-Mahinui*
Agency/Co.	*Perazim Consulting, LLC*	Jurisdiction	*Oahu*
Date Performed	*4/24/2008*	Analysis Year	*Future Yr with Alternative C*
Analysis Time Period	*PM Peak Hour*		

Project Description *Hawaiian Memorial Park Expansion*

East/West Street: *HMP Secondary Dwy-Mahinui Rd* | North/South Street: *Kamehameha Hwy*

Intersection Orientation: *North-South* | Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*31*	*1542*	*2*	*20*	*1198*	*32*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*31*	*1542*	*2*	*20*	*1198*	*32*
Percent Heavy Vehicles	*2*	--	--	*2*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*0*	*2*	*0*
Configuration	*L*	*T*	*TR*	*LT*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*20*	*1*	*6*	*2*	*0*	*39*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*20*	*1*	*6*	*2*	*0*	*39*
Percent Heavy Vehicles	*0*	*2*	*0*	*0*	*2*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*1*
Configuration		*LTR*		*LT*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*LT*	*LT*		*R*		*LTR*	
v (veh/h)	*31*	*20*	*2*		*39*		*27*	
C (m) (veh/h)	*562*	*426*	*82*		*347*		*127*	
v/c	*0.06*	*0.05*	*0.02*		*0.11*		*0.21*	
95% queue length	*0.18*	*0.15*	*0.07*		*0.38*		*0.80*	
Control Delay (s/veh)	*11.8*	*13.9*	*50.0*		*16.7*		*41.0*	
LOS	*B*	*B*	*E*		*C*		*E*	
Approach Delay (s/veh)	--	--	*18.3*			*41.0*		
Approach LOS	--	--	*C*			*E*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SU*	Intersection	*Kaneohe Bay Dr and Namoku St*
Agency/Co.	*Perazim Consulting, LLC*	Jurisdiction	*Oahu*
Date Performed	*4/24/2008*	Analysis Year	*Future Yr with Alternative B*
Analysis Time Period	*AM Peak Hour*		

Project Description *Hawaiian Memorial Park Expansion*

East/West Street: *Kaneohe Bay Drive* | North/South Street: *Namoku Street*

Intersection Orientation: *East-West* | Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*3*	*812*	*7*	*45*	*922*	*1*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*3*	*812*	*7*	*45*	*922*	*1*
Percent Heavy Vehicles	*2*	--	--	*2*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*8*	*1*	*59*	*1*	*1*	*13*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*8*	*1*	*59*	*1*	*1*	*13*
Percent Heavy Vehicles	*0*	*2*	*0*	*0*	*2*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*1*	*0*	*1*	*0*
Configuration	*LT*		*R*		*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*	*LT*		*R*		*LTR*	
v (veh/h)	*3*	*45*	*9*		*59*		*15*	
C (m) (veh/h)	*740*	*810*	*51*		*380*		*191*	
v/c	*0.00*	*0.06*	*0.18*		*0.16*		*0.08*	
95% queue length	*0.01*	*0.18*	*0.62*		*0.55*		*0.25*	
Control Delay (s/veh)	*9.9*	*9.7*	*90.6*		*16.2*		*25.5*	
LOS	*A*	*A*	*F*		*C*		*D*	
Approach Delay (s/veh)	--	--	*26.1*			*25.5*		
Approach LOS	--	--	*D*			*D*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SU*	Intersection	*Kaneohe Bay Dr and Namoku St*
Agency/Co.	*Perazim Consulting, LLC*	Jurisdiction	*Oahu*
Date Performed	*4/24/2008*	Analysis Year	*Future Yr with Alternative B*
Analysis Time Period	*PM Peak Hour*		

Project Description *Hawaiian Memorial Park Expansion*

East/West Street: *Kaneohe Bay Drive* | North/South Street: *Namoku Street*

Intersection Orientation: *East-West* | Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*15*	*835*	*17*	*38*	*872*	*2*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*15*	*835*	*17*	*38*	*872*	*2*
Percent Heavy Vehicles	*2*	--	--	*2*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*6*	*0*	*57*	*1*	*1*	*8*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*6*	*0*	*57*	*1*	*1*	*8*
Percent Heavy Vehicles	*0*	*2*	*0*	*0*	*2*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*1*	*0*	*1*	*0*
Configuration	*LT*		*R*		*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*	*LT*		*R*		*LTR*	
v (veh/h)	*15*	*38*	*6*		*57*		*10*	
C (m) (veh/h)	*772*	*787*	*52*		*366*		*165*	
v/c	*0.02*	*0.05*	*0.12*		*0.16*		*0.06*	
95% queue length	*0.06*	*0.15*	*0.38*		*0.55*		*0.19*	
Control Delay (s/veh)	*9.8*	*9.8*	*83.2*		*16.6*		*28.2*	
LOS	*A*	*A*	*F*		*C*		*D*	
Approach Delay (s/veh)	--	--	*23.0*			*28.2*		
Approach LOS	--	--	*C*			*D*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SU*	Intersection	*Mokulele Dr and Namoku St*
Agency/Co.	*Perazim Consulting, LLC*	Jurisdiction	*Oahu*
Date Performed	*4/24/2008*	Analysis Year	
Analysis Time Period	*AM Peak Hour*		

Project Description *Hawaiian Memorial Park Expansion*

East/West Street: *Mokulele Drive* | North/South Street: *Namoku Street*

Intersection Orientation: *North-South* | Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*15*	*75*	*44*	*8*	*130*	*51*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*15*	*75*	*44*	*8*	*130*	*51*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*35*	*50*	*28*	*43*	*47*	*16*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*35*	*50*	*28*	*43*	*47*	*16*
Percent Heavy Vehicles	*0*	*2*	*0*	*0*	*2*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*15*	*8*		*106*			*113*	
C (m) (veh/h)	*1407*	*1482*		*607*			*635*	
v/c	*0.01*	*0.01*		*0.17*			*0.18*	
95% queue length	*0.03*	*0.02*		*0.63*			*0.65*	
Control Delay (s/veh)	*7.6*	*7.4*		*12.2*			*11.9*	
LOS	*A*	*A*		*B*			*B*	
Approach Delay (s/veh)	--	--	*12.2*			*11.9*		
Approach LOS	--	--	*B*			*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SU*	Intersection	*Mokulele Dr and Namoku St*
Agency/Co.	*Perazim Consulting, LLC*	Jurisdiction	*Oahu*
Date Performed	*4/24/2008*	Analysis Year	*Future Yr with Alternative B*
Analysis Time Period	*PM Peak Hour*		

Project Description *Hawaiian Memorial Park Expansion*

East/West Street: *Mokulele Drive* | North/South Street: *Namoku Street*

Intersection Orientation: *North-South* | Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*16*	*79*	*62*	*11*	*54*	*30*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*16*	*79*	*62*	*11*	*54*	*30*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*41*	*64*	*54*	*52*	*35*	*7*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*41*	*64*	*54*	*52*	*35*	*7*
Percent Heavy Vehicles	*0*	*2*	*0*	*0*	*2*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (veh/h)	*16*	*11*		*94*			*159*	
C (m) (veh/h)	*1526*	*1455*		*615*			*729*	
v/c	*0.01*	*0.01*		*0.15*			*0.22*	
95% queue length	*0.03*	*0.02*		*0.54*			*0.83*	
Control Delay (s/veh)	*7.4*	*7.5*		*11.9*			*11.3*	
LOS	*A*	*A*		*B*			*B*	
Approach Delay (s/veh)	--	--	*11.9*			*11.3*		
Approach LOS	--	--	*B*			*B*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SU	Intersection	Namoku St and Lipalu St
Agency/Co.	Perazim Consulting, LLC	Jurisdiction	Oahu
Date Performed	4/24/2008	Analysis Year	Future Yr with Alternative B
Analysis Time Period	AM Peak Hour		

Project Description: Hawaiian Memorial Park Expansion

East/West Street: Namoku Street | North/South Street: Lipalu Street

Intersection Orientation: East-West | Study Period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		82	21	4	80	
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	0	82	21	4	80	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration			TR	LT		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	22		2			
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	22	0	2	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT		LR				
v (veh/h)		4		24				
C (m) (veh/h)		1502		823				
v/c		0.00		0.03				
95% queue length		0.01		0.09				
Control Delay (s/veh)		7.4		9.5				
LOS		A		A				
Approach Delay (s/veh)	--	--	9.5					
Approach LOS	--	--	A					

 HCS+™ Version 5.21

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SU	Intersection	Namoku St and Lipalu St
Agency/Co.	Perazim Consulting, LLC	Jurisdiction	Oahu
Date Performed	4/24/2008	Analysis Year	Future Yr with Alternative B
Analysis Time Period	PM Peak Hour		

Project Description: Hawaiian Memorial Park Expansion

East/West Street: Namoku Street | North/South Street: Lipalu Street

Intersection Orientation: East-West | Study Period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		111	21	10	59	
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	0	111	21	10	59	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration			TR	LT		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	28		8			
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	28	0	8	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT		LR				
v (veh/h)		10		36				
C (m) (veh/h)		1466		816				
v/c		0.01		0.04				
95% queue length		0.02		0.14				
Control Delay (s/veh)		7.5		9.6				
LOS		A		A				
Approach Delay (s/veh)	--	--	9.6					
Approach LOS	--	--	A					

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	SU	Intersection	Kamehameha Dr and Mokulele Dr
Agency or Co.	Perazim Consulting, LLC	Area Type	All other areas
Date Performed	4/24/2008	Jurisdiction	Oahu
Time Period	AM Peak Hour	Analysis Year	Future Yr with Alternative B
		Project ID	Hawaiian Memorial Park Expansion

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	0	1	1	0	1	1	1	2	1	1	2	0
Lane Group		LT	R		LT	R	L	T	R	L	TR	
Volume, V (vph)	78	14	22	219	16	149	6	986	81	64	1103	33
% Heavy Vehicles, %HV	0	2	0	0	2	0	0	2	0	0	2	0
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Extension of Effective Green, e		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Arrival Type, AT		3	3		3	3	3	3	3	3	3	
Unit Extension, UE		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Filtering/Metering, I		1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	
Initial Unmet Demand, Q_b		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B		0	0		0	0	0	0	0	0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	Excl. Left	SB Only	Thru & RT	08
Timing	G = 24.0	G =	G =	G =	G = 6.0	G = 10.0	G = 48.0	G =
	Y = 6	Y =	Y =	Y =	Y =	Y = 6	Y =	Y =

Duration of Analysis, T = 1.00 — Cycle Length, C = 100.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		103	24		261	166	7	1096	90	71	1263	
Lane Group Capacity, c		193	388		304	388	108	1703	775	289	2049	
v/c Ratio, X		0.53	0.06		0.86	0.43	0.06	0.64	0.12	0.25	0.62	
Total Green Ratio, g/C		0.24	0.24		0.24	0.24	0.06	0.48	0.48	0.16	0.58	
Uniform Delay, d_1		33.1	29.3		36.4	32.2	44.4	19.6	14.3	36.7	13.7	
Progression Factor, PF		1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	
Delay Calibration, k		0.14	0.11		0.39	0.11	0.11	0.22	0.11	0.11	0.20	
Incremental Delay, d_2		2.9	0.1		25.5	0.8	0.3	0.8	0.1	0.4	0.6	
Initial Queue Delay, d_3		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Control Delay		36.0	29.4		61.8	32.9	44.6	20.4	14.4	37.2	14.3	
Lane Group LOS		D	C		E	C	D	C	B	D	B	
Approach Delay	34.8			50.6			20.1			15.5		
Approach LOS	C			D			C			B		
Intersection Delay	22.9			X_c = 0.64			Intersection LOS			C		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	SU	Intersection	Kamehameha Dr and Mokulele Dr
Agency or Co.	Perazim Consulting, LLC	Area Type	All other areas
Date Performed	4/24/2008	Jurisdiction	Oahu
Time Period	PM Peak Hour	Analysis Year	Future Yr with Alternative B
		Project ID	Hawaiian Memorial Park Expansion

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	0	1	1	0	1	1	1	2	1	1	2	0
Lane Group		LT	R		LT	R	L	T	R	L	TR	
Volume, V (vph)	60	12	13	136	23	82	13	1406	185	119	1107	52
% Heavy Vehicles, %HV	0	2	0	0	2	0	0	2	0	0	2	0
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Extension of Effective Green, e		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Arrival Type, AT		3	3		3	3	3	3	3	3	3	
Unit Extension, UE		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Filtering/Metering, I		1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	
Initial Unmet Demand, Q_b		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B		0	0		0	0	0	0	0	0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	Excl. Left	SB Only	Thru & RT	08
Timing	G = 20.0	G =	G =	G =	G = 8.0	G = 7.0	G = 66.0	G =
	Y = 6	Y =	Y =	Y =	Y =	Y = 6	Y = 7	Y =

Duration of Analysis, T = 1.00 — Cycle Length, C = 120.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		80	14		177	91	14	1562	206	132	1288	
Lane Group Capacity, c		154	269		222	269	120	1951	888	226	2321	
v/c Ratio, X		0.52	0.05		0.80	0.34	0.12	0.80	0.23	0.58	0.55	
Total Green Ratio, g/C		0.17	0.17		0.17	0.17	0.07	0.55	0.55	0.13	0.66	
Uniform Delay, d_1		45.6	42.0		48.1	44.2	52.7	21.7	13.9	49.6	11.0	
Progression Factor, PF		1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	
Delay Calibration, k		0.13	0.11		0.34	0.11	0.11	0.34	0.11	0.18	0.15	
Incremental Delay, d_2		3.2	0.1		20.6	0.8	0.4	2.5	0.1	3.9	0.3	
Initial Queue Delay, d_3		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Control Delay		48.8	42.1		68.7	44.9	53.1	24.2	14.1	53.5	11.3	
Lane Group LOS		D	D		E	D	D	C	B	D	B	
Approach Delay	47.8			60.6			23.3			15.2		
Approach LOS	D			E			C			B		
Intersection Delay	23.5			X_c = 0.77			Intersection LOS			C		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	SU	Intersection	Kaneohe Bay Dr and Mokulele Dr
Agency or Co.	Perazim Consulting, LLC	Area Type	All other areas
Date Performed	4/24/2008	Jurisdiction	Oahu
Time Period	AM Peak Hour	Analysis Year	Future Yr with Alternative B
		Project ID	Hawaiian Memorial Park Expansion

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	1	1	1	1	0	1	1	0	0	1	0
Lane Group	L	T	R	L	TR		L	TR			LTR	
Volume, V (vph)	15	767	197	52	878	6	209	2	62	0	2	7
% Heavy Vehicles, %HV	0	2	0	0	2	0	0	2	0	0	2	0
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	
Extension of Effective Green, e	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	
Arrival Type, AT	3	3	3	3	3		3	3			3	
Unit Extension, UE	3.0	3.0	3.0	3.0	3.0		3.0	3.0			3.0	
Filtering/Metering, I	1.000	1.000	1.000	1.000	1.000		1.000	1.000			1.000	
Initial Unmet Demand, Q_b	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0	12.0	12.0	12.0		12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0	0	0	0		0	0			0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	Excl. Left	WB Only	Thru & RT	04	NS Perm	06	07	08
Timing	G = 3.0	G = 4.0	G = 60.0	G =	G = 21.0	G =	G =	G =
	Y =	Y =	Y = 6	Y =	Y = 6	Y =	Y =	Y =

Duration of Analysis, T = 1.00 — Cycle Length, C = 100.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	17	852	219	58	983		232	71			10	
Lane Group Capacity, c	54	1118	969	126	1191		300	341			354	
v/c Ratio, X	0.31	0.76	0.23	0.46	0.83		0.77	0.21			0.03	
Total Green Ratio, g/C	0.03	0.60	0.60	0.07	0.64		0.21	0.21			0.21	
Uniform Delay, d_1	47.5	14.7	9.3	44.7	13.7		37.3	32.6			31.4	
Progression Factor, PF	1.000	1.000	1.000	1.000	1.000		1.000	1.000			1.000	
Delay Calibration, k	0.11	0.31	0.11	0.11	0.36		0.32	0.11			0.11	
Incremental Delay, d_2	3.4	3.2	0.1	2.7	5.1		12.8	0.3			0.0	
Initial Queue Delay, d_3	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Control Delay	50.9	18.0	9.4	47.4	18.8		50.1	32.9			31.4	
Lane Group LOS	D	B	A	D	B		D	C			C	
Approach Delay	16.7			20.4			46.1			31.4		
Approach LOS	B			C			D			C		
Intersection Delay	22.0			X_C = 0.80			Intersection LOS			C		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	SU	Intersection	Kaneohe Bay Dr and Mokulele Dr
Agency or Co.	Perazim Consulting, LLC	Area Type	All other areas
Date Performed	4/24/2008	Jurisdiction	Oahu
Time Period	PM Peak Hour	Analysis Year	Future Yr with Alternative B
		Project ID	Hawaiian Memorial Park Expansion

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	1	1	1	1	0	1	1	0	0	1	0
Lane Group	L	T	R	L	TR		L	TR			LTR	
Volume, V (vph)	16	772	134	39	853	3	123	5	45	5	4	21
% Heavy Vehicles, %HV	0	2	0	0	2	0	0	2	0	0	2	0
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	
Extension of Effective Green, e	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	
Arrival Type, AT	3	3	3	3	3		3	3			3	
Unit Extension, UE	3.0	3.0	3.0	3.0	3.0		3.0	3.0			3.0	
Filtering/Metering, I	1.000	1.000	1.000	1.000	1.000		1.000	1.000			1.000	
Initial Unmet Demand, Q_b	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0	12.0	12.0	12.0		12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0	0	0	0		0	0			0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EB Only	WB Only	Thru & RT	04	NS Perm	06	07	08
Timing	G = 6.0	G = 10.0	G = 52.0	G =	G = 19.0	G =	G =	G =
	Y =	Y =	Y = 7	Y =	Y = 6	Y =	Y =	Y =

Duration of Analysis, T = 1.00 — Cycle Length, C = 100.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	18	858	149	43	951		137	56			33	
Lane Group Capacity, c	108	969	840	181	1154		266	312			313	
v/c Ratio, X	0.17	0.89	0.18	0.24	0.82		0.52	0.18			0.11	
Total Green Ratio, g/C	0.06	0.52	0.52	0.10	0.62		0.19	0.19			0.19	
Uniform Delay, d_1	44.6	21.4	12.7	41.5	14.8		36.4	34.0			33.5	
Progression Factor, PF	1.000	1.000	1.000	1.000	1.000		1.000	1.000			1.000	
Delay Calibration, k	0.11	0.41	0.11	0.11	0.36		0.12	0.11			0.11	
Incremental Delay, d_2	0.7	11.2	0.1	0.7	5.2		1.7	0.3			0.1	
Initial Queue Delay, d_3	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Control Delay	45.4	32.5	12.8	42.2	20.0		38.1	34.2			33.6	
Lane Group LOS	D	C	B	D	B		D	C			C	
Approach Delay	29.9			20.9			37.0			33.6		
Approach LOS	C			C			D			C		
Intersection Delay	26.6			X_C = 0.71			Intersection LOS			C		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	SU	Intersection	Kamehameha Hwy-HMP1-Halekou Rd
Agency or Co.	Perazim Consulting, LLC	Area Type	All other areas
Date Performed	4/24/2008	Jurisdiction	Oahu
Time Period	AM Peak Hour	Analysis Year	Future Yr with Alt B & Mitigtn
		Project ID	Hawaiian Memorial Park Expansion

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	0	1	0	0	1	1	1	2	0	1	2	0
Lane Group		LTR			LT	R	L	TR		L	TR	
Volume, V (vph)	42	3	84	10	0	27	38	945	22	51	1124	46
% Heavy Vehicles, %HV	0	2	0	0	2	0	0	2	0	0	2	0
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1		2.0			2.0	2.0	2.0	2.0		2.0	2.0	
Extension of Effective Green, e		2.0			2.0	2.0	2.0	2.0		2.0	2.0	
Arrival Type, AT		3			3	3	3	3		3	3	
Unit Extension, UE		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Filtering/Metering, I		1.000			1.000	1.000	1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0			12.0	12.0	12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B		0			0	0	0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	Excl. Left	SB Only	Thru & RT	08
Timing	G = 24.0	G =	G =	G =	G = 6.0	G = 10.0	G = 48.0	G =
	Y = 6	Y =	Y =	Y =	Y =	Y = 6	Y =	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 100.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		129			10	27	38	967		51	1170	
Lane Group Capacity, c		375			361	388	108	1697		289	2046	
v/c Ratio, X		0.34			0.03	0.07	0.35	0.57		0.18	0.57	
Total Green Ratio, g/C		0.24			0.24	0.24	0.06	0.48		0.16	0.58	
Uniform Delay, d_1		31.5			29.1	29.4	45.1	18.6		36.3	13.2	
Progression Factor, PF		1.000			1.000	1.000	1.000	1.000		1.000	1.000	
Delay Calibration, k		0.11			0.11	0.11	0.11	0.16		0.11	0.17	
Incremental Delay, d_2		0.6			0.0	0.1	2.0	0.5		0.3	0.4	
Initial Queue Delay, d_3		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay		32.0			29.1	29.4	47.1	19.1		36.6	13.6	
Lane Group LOS		C			C	C	D	B		D	B	
Approach Delay	32.0			29.4			20.1			14.5		
Approach LOS	C			C			C			B		
Intersection Delay	18.1			X_c = 0.49			Intersection LOS			B		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	SU	Intersection	Kamehameha Hwy-HMP1-Halekou Rd
Agency or Co.	Perazim Consulting, LLC	Area Type	All other areas
Date Performed	4/24/2008	Jurisdiction	Oahu
Time Period	PM Peak Hour	Analysis Year	Future Yr with Alt B & Mitigtn
		Project ID	Hawaiian Memorial Park Expansion

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	0	1	0	0	1	1	1	2	0	1	2	0
Lane Group		LTR			LT	R	L	TR		L	TR	
Volume, V (vph)	36	2	52	35	0	47	93	1496	24	16	1071	53
% Heavy Vehicles, %HV	0	2	0	0	2	0	0	2	0	0	2	0
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1		2.0			2.0	2.0	2.0	2.0		2.0	2.0	
Extension of Effective Green, e		2.0			2.0	2.0	2.0	2.0		2.0	2.0	
Arrival Type, AT		3			3	3	3	3		3	3	
Unit Extension, UE		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Filtering/Metering, I		1.000			1.000	1.000	1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0			12.0	12.0	12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B		0			0	0	0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	Excl. Left	NB Only	Thru & RT	08
Timing	G = 19.0	G =	G =	G =	G = 6.0	G = 10.0	G = 52.0	G =
	Y = 6	Y =	Y =	Y =	Y =	Y =	Y = 7	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 100.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		90			35	47	93	1520		16	1124	
Lane Group Capacity, c		289			253	307	289	2194		108	1833	
v/c Ratio, X		0.31			0.14	0.15	0.32	0.69		0.15	0.61	
Total Green Ratio, g/C		0.19			0.19	0.19	0.16	0.62		0.06	0.52	
Uniform Delay, d_1		34.9			33.7	33.8	37.2	12.7		44.6	16.9	
Progression Factor, PF		1.000			1.000	1.000	1.000	1.000		1.000	1.000	
Delay Calibration, k		0.11			0.11	0.11	0.11	0.26		0.11	0.20	
Incremental Delay, d_2		0.6			0.3	0.2	0.6	1.0		0.6	0.6	
Initial Queue Delay, d_3		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay		35.5			33.9	34.0	37.8	13.6		45.2	17.5	
Lane Group LOS		D			C	C	D	B		D	B	
Approach Delay	35.5			34.0			15.0			17.9		
Approach LOS	D			C			B			B		
Intersection Delay	17.3			X_c = 0.57			Intersection LOS			B		

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FUTURE TRAFFIC CONDITIONS WITH ALTERNATIVE C

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SU*	Intersection	*Kamehameha Hwy-HMP1-Halekou Rd*
Agency/Co.	*Perazim Consulting, LLC*	Jurisdiction	*Oahu*
Date Performed	*4/24/2008*	Analysis Year	*Future Yr with Alternative C*
Analysis Time Period	*AM Peak Hour*		

Project Description *Hawaiian Memorial Park Expansion*

East/West Street: *HMP Primary Drwy-Halekou Rd* | North/South Street: *Kamehameha Highway*

Intersection Orientation: *North-South* | Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*38*	*938*	*22*	*52*	*1122*	*46*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*38*	*938*	*22*	*52*	*1122*	*46*
Percent Heavy Vehicles	*2*	--	--	*2*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*1*	*2*	*0*
Configuration	*L*	*T*	*TR*	*L*	*T*	*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*42*	*3*	*84*	*10*	*0*	*27*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*42*	*3*	*84*	*10*	*0*	*27*
Percent Heavy Vehicles	*0*	*2*	*0*	*0*	*2*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*1*
Configuration		*LTR*		*LT*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*	*LT*		*R*		*LTR*	
v (veh/h)	*38*	*52*	*10*		*27*		*129*	
C (m) (veh/h)	*594*	*712*	*137*		*537*		*237*	
v/c	*0.06*	*0.07*	*0.07*		*0.05*		*0.54*	
95% queue length	*0.20*	*0.24*	*0.24*		*0.16*		*3.37*	
Control Delay (s/veh)	*11.5*	*10.5*	*33.3*		*12.1*		*37.9*	
LOS	*B*	*B*	*D*		*B*		*E*	
Approach Delay (s/veh)	--	--	*17.8*			*37.9*		
Approach LOS	--	--	*C*			*E*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SU*	Intersection	*Kamehameha Hwy-HMP1-Halekou Rd*
Agency/Co.	*Perazim Consulting, LLC*	Jurisdiction	*Oahu*
Date Performed	*4/24/2008*	Analysis Year	*Future Yr with Alternative C*
Analysis Time Period	*PM Peak Hour*		

Project Description *Hawaiian Memorial Park Expansion*

East/West Street: *HMP Primary Dwy-Halekou Rd* | North/South Street: *Kamehameha Highway*

Intersection Orientation: *North-South* | Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*93*	*1492*	*25*	*17*	*1064*	*53*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*93*	*1492*	*25*	*17*	*1064*	*53*
Percent Heavy Vehicles	*2*	--	--	*2*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*1*	*2*	*0*
Configuration	*L*	*T*	*TR*	*L*	*T*	*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*36*	*2*	*52*	*36*	*0*	*47*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*36*	*2*	*52*	*36*	*0*	*47*
Percent Heavy Vehicles	*0*	*2*	*0*	*0*	*2*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*1*
Configuration		*LTR*		*LT*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*L*	*LT*		*R*		*LTR*	
v (veh/h)	*93*	*17*	*36*		*47*		*90*	
C (m) (veh/h)	*621*	*436*	*65*		*354*		*188*	
v/c	*0.15*	*0.04*	*0.55*		*0.13*		*0.48*	
95% queue length	*0.53*	*0.12*	*3.07*		*0.46*		*2.62*	
Control Delay (s/veh)	*11.8*	*13.6*	*124.1*		*16.7*		*41.4*	
LOS	*B*	*B*	*F*		*C*		*E*	
Approach Delay (s/veh)	--	--	*63.3*			*41.4*		
Approach LOS	--	--	*F*			*E*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SU*	Intersection	*Kamehameha Hwy-HMP2-Mahinui*
Agency/Co.	*Perazim Consulting, LLC*	Jurisdiction	*Oahu*
Date Performed	*4/24/2008*	Analysis Year	*Future Yr with Altenative C*
Analysis Time Period	*AM Peak Hour*		

Project Description *Hawaiian Memorial Park Expansion*

East/West Street: *HMP Secondary Dwy-Mahinui Rd* | North/South Street: *Kamehameha Hwy*

Intersection Orientation: *North-South* | Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*5*	*1021*	*4*	*21*	*1298*	*25*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*5*	*1021*	*4*	*21*	*1298*	*25*
Percent Heavy Vehicles	*2*	--	--	*2*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*0*	*2*	*0*
Configuration	*L*	*T*	*TR*	*LT*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*35*	*3*	*12*	*2*	*0*	*10*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*35*	*3*	*12*	*2*	*0*	*10*
Percent Heavy Vehicles	*0*	*2*	*0*	*2*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*1*
Configuration		*LTR*		*LT*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*LT*	*LT*		*R*		*LTR*	
v (veh/h)	*5*	*21*	*2*		*10*		*50*	
C (m) (veh/h)	*518*	*673*	*158*		*512*		*146*	
v/c	*0.01*	*0.03*	*0.01*		*0.02*		*0.34*	
95% queue length	*0.03*	*0.10*	*0.04*		*0.06*		*1.51*	
Control Delay (s/veh)	*12.0*	*10.5*	*28.1*		*12.2*		*42.4*	
LOS	*B*	*B*	*D*		*B*		*E*	
Approach Delay (s/veh)	--	--	*14.8*			*42.4*		
Approach LOS	--	--	*B*			*E*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SU*	Intersection	*Kamehameha Hwy-HMP2-Mahinui*
Agency/Co.	*Perazim Consulting, LLC*	Jurisdiction	*Oahu*
Date Performed	*4/24/2008*	Analysis Year	*Future Yr with Alternative C*
Analysis Time Period	*PM Peak Hour*		

Project Description *Hawaiian Memorial Park Expansion*

East/West Street: *HMP Secondary Dwy-Mahinui Rd* | North/South Street: *Kamehameha Hwy*

Intersection Orientation: *North-South* | Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*31*	*1542*	*2*	*20*	*1198*	*32*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*31*	*1542*	*2*	*20*	*1198*	*32*
Percent Heavy Vehicles	*2*	--	--	*2*	--	--
Median Type	*Raised curb*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*0*	*2*	*0*
Configuration	*L*	*T*	*TR*	*LT*		*TR*
Upstream Signal		*0*			*0*	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*20*	*1*	*6*	*2*	*0*	*39*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*20*	*1*	*6*	*2*	*0*	*39*
Percent Heavy Vehicles	*0*	*2*	*0*	*0*	*2*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*1*
Configuration		*LTR*		*LT*		*R*

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*	*LT*	*LT*		*R*		*LTR*	
v (veh/h)	*31*	*20*	*2*		*39*		*27*	
C (m) (veh/h)	*562*	*426*	*82*		*347*		*127*	
v/c	*0.06*	*0.05*	*0.02*		*0.11*		*0.21*	
95% queue length	*0.18*	*0.15*	*0.07*		*0.38*		*0.80*	
Control Delay (s/veh)	*11.8*	*13.9*	*50.0*		*16.7*		*41.0*	
LOS	*B*	*B*	*E*		*C*		*E*	
Approach Delay (s/veh)	--	--	*18.3*			*41.0*		
Approach LOS	--	--	*C*			*E*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SU*	Intersection	*Kaneohe Bay Dr and Namoku St*
Agency/Co.	*Perazim Consulting, LLC*	Jurisdiction	*Oahu*
Date Performed	*4/24/2008*	Analysis Year	
Analysis Time Period	*AM Peak Hour*		

Project Description *Hawaiian Memorial Park Expansion*

East/West Street: *Kaneohe Bay Drive* | North/South Street: *Namoku Street*

Intersection Orientation: *East-West* | Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*3*	*812*	*7*	*43*	*922*	*1*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*3*	*812*	*7*	*43*	*922*	*1*
Percent Heavy Vehicles	*2*	--	--	*2*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*8*	*1*	*58*	*1*	*1*	*13*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*8*	*1*	*58*	*1*	*1*	*13*
Percent Heavy Vehicles	*0*	*2*	*0*	*0*	*2*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*1*	*0*	*1*	*0*
Configuration	*LT*		*R*		*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*	*LT*		*R*		*LTR*	
v (veh/h)	*3*	*43*	*9*		*58*		*15*	
C (m) (veh/h)	*740*	*810*	*52*		*380*		*193*	
v/c	*0.00*	*0.05*	*0.17*		*0.15*		*0.08*	
95% queue length	*0.01*	*0.17*	*0.61*		*0.54*		*0.25*	
Control Delay (s/veh)	*9.9*	*9.7*	*88.6*		*16.2*		*25.2*	
LOS	*A*	*A*	*F*		*C*		*D*	
Approach Delay (s/veh)	--	--	*25.9*			*25.2*		
Approach LOS	--	--	*D*			*D*		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SU	Intersection	Kaneohe Bay Dr and Namoku St
Agency/Co.	Perazim Consulting, LLC	Jurisdiction	Oahu
Date Performed	4/24/2008	Analysis Year	Future Yr with Alternative C
Analysis Time Period	PM Peak Hour		

Project Description: Hawaiian Memorial Park Expansion

East/West Street: Kaneohe Bay Drive | North/South Street: Namoku Street

Intersection Orientation: East-West | Study Period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	15	835	17	36	872	2
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	15	835	17	36	872	2
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	6	0	52	1	1	8
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	6	0	52	1	1	8
Percent Heavy Vehicles	0	2	0	0	2	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	1	0	1	0
Configuration	LT		R		LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR	LT		R		LTR	
v (veh/h)	15	36	6		52		10	
C (m) (veh/h)	772	787	52		366		167	
v/c	0.02	0.05	0.12		0.14		0.06	
95% queue length	0.06	0.14	0.38		0.50		0.19	
Control Delay (s/veh)	9.8	9.8	83.2		16.5		27.9	
LOS	A	A	F		C		D	
Approach Delay (s/veh)	--	--	23.4			27.9		
Approach LOS	--	--	C			D		

 HCS+™ Version 5.21

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SU	Intersection	Mokulele Dr and Namoku St
Agency/Co.	Perazim Consulting, LLC	Jurisdiction	Oahu
Date Performed	4/24/2008	Analysis Year	Future Yr with Alternative C
Analysis Time Period	AM Peak Hour		

Project Description: Hawaiian Memorial Park Expansion

East/West Street: Mokulele Drive | North/South Street: Namoku Street

Intersection Orientation: North-South | Study Period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	15	75	34	3	130	51
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	15	75	34	3	130	51
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	35	58	28	40	46	14
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	35	58	28	40	46	14
Percent Heavy Vehicles	0	2	0	0	2	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (veh/h)	15	3		100			121	
C (m) (veh/h)	1407	1494		614			648	
v/c	0.01	0.00		0.16			0.19	
95% queue length	0.03	0.01		0.58			0.69	
Control Delay (s/veh)	7.6	7.4		12.0			11.8	
LOS	A	A		B			B	
Approach Delay (s/veh)	--	--	12.0			11.8		
Approach LOS	--	--	B			B		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SU	Intersection	Mokulele Dr and Namoku St
Agency/Co.	Perazim Consulting, LLC	Jurisdiction	Oahu
Date Performed	4/24/2008	Analysis Year	Future Yr with Alternative C
Analysis Time Period	PM Peak Hour		

Project Description: Hawaiian Memorial Park Expansion

East/West Street: Mokulele Drive | North/South Street: Namoku Street

Intersection Orientation: North-South | Study Period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	16	79	56	9	54	30
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	16	79	56	9	54	30
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	41	61	54	42	31	3
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	41	61	54	42	31	3
Percent Heavy Vehicles	0	2	0	0	2	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (veh/h)	16	9		76			156	
C (m) (veh/h)	1526	1462		617			742	
v/c	0.01	0.01		0.12			0.21	
95% queue length	0.03	0.02		0.42			0.80	
Control Delay (s/veh)	7.4	7.5		11.7			11.1	
LOS	A	A		B			B	
Approach Delay (s/veh)	--	--	11.7			11.1		
Approach LOS	--	--	B			B		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	SU	Intersection	Namoku St and Lipalu St
Agency/Co.	Perazim Consulting, LLC	Jurisdiction	Oahu
Date Performed	4/24/2008	Analysis Year	Future Yr with Alternative C
Analysis Time Period	AM Peak Hour		

Project Description: Hawaiian Memorial Park Expansion

East/West Street: Namoku Street | North/South Street: Lipalu Street

Intersection Orientation: East-West | Study Period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		82	4	2	80	
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	0	82	4	2	80	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration			TR	LT		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	16		1			
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	16	0	1	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT		LR				
v (veh/h)		2		17				
C (m) (veh/h)		1523		834				
v/c		0.00		0.02				
95% queue length		0.00		0.06				
Control Delay (s/veh)		7.4		9.4				
LOS		A		A				
Approach Delay (s/veh)	--	--	9.4					
Approach LOS	--	--	A					

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Unsignalized Intersection

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*SU*	Intersection	*Namoku St and Lipalu St*
Agency/Co.	*Perazim Consulting, LLC*	Jurisdiction	*Oahu*
Date Performed	*4/24/2008*	Analysis Year	*Future Yr with Alternative C*
Analysis Time Period	*PM Peak Hour*		

Project Description *Hawaiian Memorial Park Expansion*

East/West Street: *Namoku Street* | North/South Street: *Lipalu Street*

Intersection Orientation: *East-West* | Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*111*	*10*	*8*	*59*	
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*111*	*10*	*8*	*59*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration			*TR*	*LT*		
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*10*		*3*			
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*10*	*0*	*3*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration		*LR*				

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*		*LR*				
v (veh/h)		*8*		*13*				
C (m) (veh/h)		*1479*		*828*				
v/c		*0.01*		*0.02*				
95% queue length		*0.02*		*0.05*				
Control Delay (s/veh)		*7.4*		*9.4*				
LOS		*A*		*A*				
Approach Delay (s/veh)	--	--	*9.4*					
Approach LOS	--	--	*A*					

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FwithAltC 5-PM

Signalized Intersection

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	*SU*	Intersection	*Kamehameha Dr and Mokulele Dr*
Agency or Co.	*Perazim Consulting, LLC*	Area Type	*All other areas*
Date Performed	*4/24/2008*	Jurisdiction	*Oahu*
Time Period	*AM Peak Hour*	Analysis Year	*Future Yr with Alternative C*
		Project ID	*Hawaiian Memorial Park Expansion*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	*0*	*1*	*1*	*0*	*1*	*1*	*1*	*2*	*1*	*1*	*2*	*0*
Lane Group		*LT*	*R*		*LT*	*R*	*L*	*T*	*R*	*L*	*TR*	
Volume, V (vph)	*78*	*14*	*22*	*217*	*16*	*148*	*6*	*986*	*74*	*61*	*1105*	*33*
% Heavy Vehicles, %HV	*0*	*2*	*0*	*0*	*2*	*0*	*0*	*2*	*0*	*0*	*2*	*0*
Peak-Hour Factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Pretimed (P) or Actuated (A)	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
Start-up Lost Time, l_1		*2.0*	*2.0*		*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	
Extension of Effective Green, e		*2.0*	*2.0*		*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	*2.0*	
Arrival Type, AT		*3*	*3*		*3*	*3*	*3*	*3*	*3*	*3*	*3*	
Unit Extension, UE		*3.0*	*3.0*		*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	*3.0*	
Filtering/Metering, I		*1.000*	*1.000*		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	
Initial Unmet Demand, Q_b		*0.0*	*0.0*		*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	
Ped / Bike / RTOR Volumes	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width		*12.0*	*12.0*		*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	*12.0*	
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B		*0*	*0*		*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Min. Time for Pedestrians, G_p		*3.2*			*3.2*			*3.2*			*3.2*	

Phasing	EW Perm	02	03	04	Excl. Left	SB Only	Thru & RT	08
Timing	G = *24.0*	G =	G =	G =	G = *6.0*	G = *10.0*	G = *48.0*	G =
	Y = *6*	Y =	Y =	Y =	Y =	Y = *6*	Y =	Y =

Duration of Analysis, T = *1.00* | Cycle Length, C = *100.0*

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		*103*	*24*		*259*	*164*	*7*	*1096*	*82*	*68*	*1265*	
Lane Group Capacity, c		*194*	*388*		*304*	*388*	*108*	*1703*	*775*	*289*	*2049*	
v/c Ratio, X		*0.53*	*0.06*		*0.85*	*0.42*	*0.06*	*0.64*	*0.11*	*0.24*	*0.62*	
Total Green Ratio, g/C		*0.24*	*0.24*		*0.24*	*0.24*	*0.06*	*0.48*	*0.48*	*0.16*	*0.58*	
Uniform Delay, d_1		*33.1*	*29.3*		*36.3*	*32.1*	*44.4*	*19.6*	*14.2*	*36.7*	*13.7*	
Progression Factor, PF		*1.000*	*1.000*		*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	
Delay Calibration, k		*0.13*	*0.11*		*0.38*	*0.11*	*0.11*	*0.22*	*0.11*	*0.11*	*0.20*	
Incremental Delay, d_2		*2.8*	*0.1*		*24.0*	*0.7*	*0.3*	*0.8*	*0.1*	*0.4*	*0.6*	
Initial Queue Delay, d_3		*0.0*	*0.0*		*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	
Control Delay		*35.9*	*29.4*		*60.3*	*32.9*	*44.6*	*20.4*	*14.3*	*37.1*	*14.3*	
Lane Group LOS		*D*	*C*		*E*	*C*	*D*	*C*	*B*	*D*	*B*	
Approach Delay	*34.7*			*49.7*			*20.1*			*15.5*		
Approach LOS	*C*			*D*			*C*			*B*		
Intersection Delay	*22.8*			X_c = *0.64*			Intersection LOS			*C*		

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FwithAltC 6-AM

HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	SU	Intersection	Kamehameha Dr and Mokulele Dr
Agency or Co.	Perazim Consulting, LLC	Area Type	All other areas
Date Performed	4/24/2008	Jurisdiction	Oahu
Time Period	PM Peak Hour	Analysis Year	Future Yr with Alternative C
		Project ID	Hawaiian Memorial Park Expansion

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	0	1	1	0	1	1	1	2	1	1	2	0
Lane Group		LT	R		LT	R	L	T	R	L	TR	
Volume, V (vph)	60	12	13	129	23	79	13	1407	181	117	1108	52
% Heavy Vehicles, %HV	0	2	0	0	2	0	0	2	0	0	2	0
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Extension of Effective Green, e		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Arrival Type, AT		3	3		3	3	3	3	3	3	3	
Unit Extension, UE		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Filtering/Metering, I		1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	
Initial Unmet Demand, Q_b		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0	12.0		12.0	12.0	12.0	12.0	12.0	12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B		0	0		0	0	0	0	0	0	0	
Min. Time for Pedestrians, G_p		3.2			3.2			3.2			3.2	

Phasing	EW Perm	02	03	04	Excl. Left	SB Only	Thru & RT	08
Timing	G = 20.0	G =	G =	G =	G = 8.0	G = 7.0	G = 66.0	G =
	Y = 6	Y =	Y =	Y =	Y =	Y = 6	Y = 7	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 120.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		80	14		169	88	14	1563	201	130	1289	
Lane Group Capacity, c		160	269		222	269	120	1951	888	226	2321	
v/c Ratio, X		0.50	0.05		0.76	0.33	0.12	0.80	0.23	0.58	0.56	
Total Green Ratio, g/C		0.17	0.17		0.17	0.17	0.07	0.55	0.55	0.13	0.66	
Uniform Delay, d_1		45.5	42.0		47.7	44.1	52.7	21.7	13.9	49.5	11.0	
Progression Factor, PF		1.000	1.000		1.000	1.000	1.000	1.000	1.000	1.000	1.000	
Delay Calibration, k		0.11	0.11		0.31	0.11	0.11	0.34	0.11	0.17	0.15	
Incremental Delay, d_2		2.5	0.1		15.7	0.7	0.4	2.5	0.1	3.6	0.3	
Initial Queue Delay, d_3		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Control Delay		47.9	42.1		63.4	44.8	53.1	24.3	14.0	53.1	11.3	
Lane Group LOS		D	D		E	D	D	C	B	D	B	
Approach Delay	47.1			57.0			23.3			15.2		
Approach LOS	D			E			C			B		
Intersection Delay	23.1			X_c = 0.76			Intersection LOS			C		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	SU	Intersection	Kaneohe Bay Dr and Mokulele Dr
Agency or Co.	Perazim Consulting, LLC	Area Type	All other areas
Date Performed	4/24/2008	Jurisdiction	Oahu
Time Period	AM Peak Hour	Analysis Year	Future Yr with Alternative C
		Project ID	Hawaiian Memorial Park Expansion

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	1	1	1	1	0	1	1	0	0	1	0
Lane Group	L	T	R	L	TR		L	TR			LTR	
Volume, V (vph)	15	767	192	52	878	6	207	2	62	0	2	7
% Heavy Vehicles, %HV	0	2	0	0	2	0	0	2	0	0	2	0
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	
Extension of Effective Green, e	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	
Arrival Type, AT	3	3	3	3	3		3	3			3	
Unit Extension, UE	3.0	3.0	3.0	3.0	3.0		3.0	3.0			3.0	
Filtering/Metering, I	1.000	1.000	1.000	1.000	1.000		1.000	1.000			1.000	
Initial Unmet Demand, Q_b	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0	12.0	12.0	12.0		12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0	0	0	0		0	0			0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	Excl. Left	WB Only	Thru & RT	04	NS Perm	06	07	08
Timing	G = 3.0	G = 4.0	G = 60.0	G =	G = 21.0	G =	G =	G =
	Y =	Y =	Y = 6	Y =	Y = 6	Y =	Y =	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 100.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	17	852	213	58	983		230	71			10	
Lane Group Capacity, c	54	1118	969	126	1191		300	341			354	
v/c Ratio, X	0.31	0.76	0.22	0.46	0.83		0.77	0.21			0.03	
Total Green Ratio, g/C	0.03	0.60	0.60	0.07	0.64		0.21	0.21			0.21	
Uniform Delay, d_1	47.5	14.7	9.2	44.7	13.7		37.2	32.6			31.4	
Progression Factor, PF	1.000	1.000	1.000	1.000	1.000		1.000	1.000			1.000	
Delay Calibration, k	0.11	0.31	0.11	0.11	0.36		0.32	0.11			0.11	
Incremental Delay, d_2	3.4	3.2	0.1	2.7	5.1		12.2	0.3			0.0	
Initial Queue Delay, d_3	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Control Delay	50.9	18.0	9.3	47.4	18.8		49.4	32.9			31.4	
Lane Group LOS	D	B	A	D	B		D	C			C	
Approach Delay	16.8			20.4			45.5			31.4		
Approach LOS	B			C			D			C		
Intersection Delay	22.0			X_c = 0.79			Intersection LOS			C		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	SU	Intersection	Kaneohe Bay Dr and Mokulele Dr
Agency or Co.	Perazim Consulting, LLC	Area Type	All other areas
Date Performed	4/24/2008	Jurisdiction	Oahu
Time Period	PM Peak Hour	Analysis Year	Future Yr with Alternative C
		Project ID	Hawaiian Memorial Park Expansion

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	1	1	1	1	1	0	1	1	0	0	1	0
Lane Group	L	T	R	L	TR		L	TR			LTR	
Volume, V (vph)	16	772	132	39	853	3	119	5	45	5	4	21
% Heavy Vehicles, %HV	0	2	0	0	2	0	0	2	0	0	2	0
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	
Extension of Effective Green, e	2.0	2.0	2.0	2.0	2.0		2.0	2.0			2.0	
Arrival Type, AT	3	3	3	3	3		3	3			3	
Unit Extension, UE	3.0	3.0	3.0	3.0	3.0		3.0	3.0			3.0	
Filtering/Metering, I	1.000	1.000	1.000	1.000	1.000		1.000	1.000			1.000	
Initial Unmet Demand, Q_b	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0	12.0	12.0	12.0		12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B	0	0	0	0	0		0	0			0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EB Only	WB Only	Thru & RT	04	NS Perm	06	07	08
Timing	G = 6.0	G = 10.0	G = 52.0	G =	G = 19.0	G =	G =	G =
	Y =	Y =	Y = 7	Y =	Y = 6	Y =	Y =	Y =

Duration of Analysis, T = 1.00 — Cycle Length, C = 100.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v	18	858	147	43	951		132	56			33	
Lane Group Capacity, c	108	969	840	181	1154		266	312			313	
v/c Ratio, X	0.17	0.89	0.17	0.24	0.82		0.50	0.18			0.11	
Total Green Ratio, g/C	0.06	0.52	0.52	0.10	0.62		0.19	0.19			0.19	
Uniform Delay, d_1	44.6	21.4	12.7	41.5	14.8		36.2	34.0			33.5	
Progression Factor, PF	1.000	1.000	1.000	1.000	1.000		1.000	1.000			1.000	
Delay Calibration, k	0.11	0.41	0.11	0.11	0.36		0.11	0.11			0.11	
Incremental Delay, d_2	0.7	11.2	0.1	0.7	5.2		1.5	0.3			0.1	
Initial Queue Delay, d_3	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Control Delay	45.4	32.5	12.8	42.2	20.0		37.7	34.2			33.6	
Lane Group LOS	D	C	B	D	B		D	C			C	
Approach Delay	29.9			20.9			36.7			33.6		
Approach LOS	C			C			D			C		
Intersection Delay	26.6			X_c = 0.71			Intersection LOS			C		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	SU	Intersection	Kamehameha Hwy-HMP1-Halekou Rd
Agency or Co.	Perazim Consulting, LLC	Area Type	All other areas
Date Performed	4/24/2008	Jurisdiction	Oahu
Time Period	AM Peak Hour	Analysis Year	Future Yr with Alt C & Mitigtn
		Project ID	Hawaiian Memorial Park Expansion

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	0	1	0	0	1	1	1	2	0	1	2	0
Lane Group		LTR			LT	R	L	TR		L	TR	
Volume, V (vph)	42	3	84	10	0	27	38	938	22	52	1122	46
% Heavy Vehicles, %HV	0	2	0	0	2	0	0	2	0	0	2	0
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1		2.0			2.0	2.0	2.0	2.0		2.0	2.0	
Extension of Effective Green, e		2.0			2.0	2.0	2.0	2.0		2.0	2.0	
Arrival Type, AT		3			3	3	3	3		3	3	
Unit Extension, UE		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Filtering/Metering, I		1.000			1.000	1.000	1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0			12.0	12.0	12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B		0			0	0	0	0		0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	Excl. Left	SB Only	Thru & RT	08
Timing	G = 24.0	G =	G =	G =	G = 6.0	G = 10.0	G = 48.0	G =
	Y = 6	Y =	Y =	Y =	Y =	Y =	Y = 6	Y =

Duration of Analysis, T = 1.00 — Cycle Length, C = 100.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		129			10	27	38	960		52	1168	
Lane Group Capacity, c		375			361	388	108	1697		289	2046	
v/c Ratio, X		0.34			0.03	0.07	0.35	0.57		0.18	0.57	
Total Green Ratio, g/C		0.24			0.24	0.24	0.06	0.48		0.16	0.58	
Uniform Delay, d_1		31.5			29.1	29.4	45.1	18.6		36.3	13.2	
Progression Factor, PF		1.000			1.000	1.000	1.000	1.000		1.000	1.000	
Delay Calibration, k		0.11			0.11	0.11	0.11	0.16		0.11	0.17	
Incremental Delay, d_2		0.6			0.0	0.1	2.0	0.4		0.3	0.4	
Initial Queue Delay, d_3		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay		32.0			29.1	29.4	47.1	19.0		36.6	13.6	
Lane Group LOS		C			C	C	D	B		D	B	
Approach Delay	32.0			29.4			20.1			14.6		
Approach LOS	C			C			C			B		
Intersection Delay	18.0			X_c = 0.49			Intersection LOS			B		

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HCS+™ DETAILED REPORT

General Information		Site Information	
Analyst	SU	Intersection	Kamehameha Hwy-HMP1-Halekou Rd
Agency or Co.	Perazim Consulting, LLC	Area Type	All other areas
Date Performed	4/24/2008	Jurisdiction	Oahu
Time Period	PM Peak Hour	Analysis Year	Future with Alt C & Mitigtn
		Project ID	Hawaiian Memorial Park Expansion

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1	0	1	0	0	1	1	1	2	0	1	2	0
Lane Group		LTR			LT	R	L	TR		L	TR	
Volume, V (vph)	36	2	52	36	0	47	93	1492	25	17	1064	53
% Heavy Vehicles, %HV	0	2	0	0	2	0	0	2	0	0	2	0
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Pretimed (P) or Actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up Lost Time, l_1		2.0			2.0	2.0	2.0	2.0		2.0	2.0	
Extension of Effective Green, e		2.0			2.0	2.0	2.0	2.0		2.0	2.0	
Arrival Type, AT		3			3	3	3	3		3	3	
Unit Extension, UE		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Filtering/Metering, I		1.000			1.000	1.000	1.000	1.000		1.000	1.000	
Initial Unmet Demand, Q_b		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Ped / Bike / RTOR Volumes	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0			12.0	12.0	12.0	12.0		12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B		0			0	0	0	0		0	0	
Min. Time for Pedestrians, G_p		3.2			3.2			3.2			3.2	

Phasing	EW Perm	02	03	04	Excl. Left	NB Only	Thru & RT	08
Timing	G = 19.0	G =	G =	G =	G = 6.0	G = 10.0	G = 52.0	G =
	Y = 6	Y =	Y =	Y =	Y =	Y =	Y = 7	Y =

Duration of Analysis, T = 1.00 — Cycle Length, C = 100.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v		90			36	47	93	1517		17	1117	
Lane Group Capacity, c		289			252	307	289	2194		108	1833	
v/c Ratio, X		0.31			0.14	0.15	0.32	0.69		0.16	0.61	
Total Green Ratio, g/C		0.19			0.19	0.19	0.16	0.62		0.06	0.52	
Uniform Delay, d_1		34.9			33.7	33.8	37.2	12.6		44.6	16.9	
Progression Factor, PF		1.000			1.000	1.000	1.000	1.000		1.000	1.000	
Delay Calibration, k		0.11			0.11	0.11	0.11	0.26		0.11	0.20	
Incremental Delay, d_2		0.6			0.3	0.2	0.6	1.0		0.7	0.6	
Initial Queue Delay, d_3		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Control Delay		35.5			34.0	34.0	37.8	13.6		45.3	17.5	
Lane Group LOS		D			C	C	D	B		D	B	
Approach Delay	35.5			34.0			15.0			17.9		
Approach LOS	D			C			B			B		
Intersection Delay	17.3			X_c = 0.57			Intersection LOS			B		

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L. TMDL Analysis Report

(Element Environmental, LLC)

TMDL Analysis Report

Kawa Stream TMDL Analysis for Hawaiian Memorial Park Expansion
Kaneohe, Oahu, Hawaii

Prepared for:

Helber Hastert & Fee, Planners, Inc.

Helber Hastert & Fee
PLANNERS

Prepared by:

element environmental
62-180 Emerson Road
Haleiwa, HI 96712

September 2008

Question to Answer: Since the proposed cemetery development is located within an impaired water body (Kawa Stream) for which TMDLs have been developed, we are asked to demonstrate how the proposed project will contribute to the achievement of the pollutant load reductions suggested in the Kawa Stream TMDL technical studies (Oceanit, 2002; DOH, 2005).

Response to Question: We use the DOH TMDL methodology (DOH, 2005) to calculate the incremental change in TSS, TN and TP load to Kawa Stream resulting from the proposed expansion of the Hawaiian Memorial Cemetery. The salient facts with respect to the proposed development include:

- The proposed 56.6-acre development will contain 25.8 acres of cemetery, 15.3 acres of vegetative buffer, 9.5 acres of cultural preserve, 4.8 acres of impervious land (mausoleums, roadways, etc.) and 1.2 acres of retention features.
- A total of 4.8 acres, or about 8.5%, of the proposed development is considered impervious for the purposes of calculating runoff in the TMDL analysis.
- The developer is required to capture the excess runoff generated from the proposed development area by the 10 year, one-hour duration storm event (2.5 inches/hour).
- The required on-site retention volume to capture this excess runoff is calculated to be 78,772 cubic feet (589,215 gallons).
- The retention areas will consist of 1.20-acres of depressed turf or grassy planted areas with a maximum depth of 18 inches that are scattered throughout the cemetery.
- The soils on the project site have permeability rates that range from 2.0 to 6.3 inches/hour (Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii Soil Conservation Service), resulting in an estimated time of between 2.86 to 9 hours for the retained runoff to percolate into the soil from a filled retention basin.

The revised TMDL document (DOH, 2005) allocated the calculated stormwater runoff volume to the various land-uses and sub-basins present within the Kawa watershed. The vast majority of the proposed cemetery expansion will be located within Basin 4 of the watershed. Basin 4 is comprised in part of 135.25 acres of forest land (Table 3.1; DOH, 2005), from which 1.15 million cubic feet (~8.6 million gallons) of storm runoff is generated (Table 4.3). The proposed development will convert 56.6 acres (~42%) of the existing forest land within the Basin 4 watershed into cemetery and associated vegetative buffer and preserve lands. The runoff volume calculated in the original TMDL analysis for the 56.6 acres of land to undergo conversion was 0.481 million cubic feet (~3.6 million gallons/13.63 million liters). The mass of nutrients calculated by the original TMDL analysis to originate from the 56.6 area to be developed was calculated by multiplying the estimated runoff volume by the runoff concentration (Table 5.1; DOH, 2005) associated with forest land for the "Storm Runoff Sources" scenario (Table 1 below).

Table 1: Estimated Mass of TSS and Nutrients Entering Kawa Stream from 56.6-Acres of Forest Land Under Existing Conditions

Land Use	Runoff Concentrations (mg/L)			Estimated Runoff from	Mass in Runoff (Kg)		
	TSS	Total N	Total P	56.6 acres land (liters)	TSS	Total N	Total P
Forest Land	10	0.5	0.1	13,630,000	136.3	6.815	1.363

The runoff to Kawa stream resulting from the proposed development was calculated using the same methodology used in the revised TMDL analysis (DOH, 2005). The daily rainfall record from rainfall station 838.1 from November 1999 to October 2000 was used to calculate runoff on a daily basis for the proposed 56.6-acre development. In order to adjust the daily rainfall collected at the reference station (838.1, elevation 50 feet) to the estimated value of rainfall for Basin 4, with an estimated average elevation of 600 feet, the daily reference station rainfall was multiplied by the following relation [1]:

[1] Adjusted Basin Rainfall (inches) = [rainfall*(1 + 0.000864*600 ft)/(1 + 0.000864*50 ft] = 1.456*reference station daily rainfall

The TMDL analysis used the following rational formula runoff expression that is used for determination of pollutant loads in the City and County of Honolulu MS4 permit application:

[2] $R = (P) * (p_r) * (R_v) * A$

[3] $R_v = 0.05 + 0.9f_I$

where:

R = Runoff volume

P = Adjusted Daily Basin Rainfall (ft)

p_r = Fraction of rainfall that produces runoff (0.9 used by Honolulu)

R_v = Mean runoff coefficient

A = Area of Proposed Development (56.6 acres)

f_I = Fraction of area that is effectively impervious.

The fraction impervious area (f_I) in equation 3 for the proposed development is 0.085, which leads to a mean runoff coefficient (R_v) value for the development of 0.1265. No carryover of stored water was assumed during consecutive days of rainfall since the retention basins are designed to completely infiltrate their contents in less than 10 hours. The total volume of runoff produced by the 56.6 acre cemetery expansion was calculated on a daily basis and compared to the volume of retention designed for the proposed development (Appendix). This analysis shows that the proposed retention system, which was developed to satisfy the City and County of Honolulu's design 10-year one-hour duration (2.5 inches/hour) storm event, will capture all of the runoff generated by the daily rainfall events used to generate the Kawa watershed TMDLs. The maximum adjusted daily rainfall for the TMDL period occurred on 9/28/00 (3.01 inches) which generated 518,060 gallons of runoff from the 56.6-acre proposed development area. This runoff volume is less than the designed storage volume (589,215 gallons) of the retention systems that will be constructed within the proposed cemetery expansion area. It is interesting to note that the designed retention system will also capture all of the runoff associated with the Wet Season 2% Rainfall Event (2.30 inches) that was used to calculate runoff and pollutant load contributions in the recently completed TMDL analysis for the adjacent Kaneohe Stream watershed (DOH, 2008). Since no runoff will reach Kawa stream according to these TMDL-based calculations, a net reduction of 136.3 kg TSS, 6.82 kg total N, and 1.363 kg will result from the proposed cemetery expansion.

Table 2 summarizes the reductions required from all of the nonpoint sources (including the existing Hawaiian Memorial Park) located within the Kawa watershed in the TMDL study (DOH, 2005). The proposed development achieves approximately 27.5% of the net reduction in TSS, 17.5% of the net reduction in total nitrogen, and 17% of the net reduction in total phosphorus required for all nonpoint source areas located within the Kawa watershed by the TMDL study.

Table 2: Comparison of Load Reductions Achieved by Proposed Project to Total Reductions Required by TMDL

Load Allocations to Nonpoint Sources in Kawa Watershed

Scenario	Existing Loads (Kg)			Reductions Required by TMDL (Kg)		
	TSS	TN	TP	TSS	TN	TP
Annual Storm Runoff	1,286	59	15	496	39	8
Net Mass TSS and Nutrients Reduced Entering Kawa Stream- 10 Year Retention Basin Design				136.3	6.82	1.363
Percentage of the Total Reduction Required by TMDL Achieved by the Proposed Project				27.5%	17.5%	17.0%

In order to evaluate potential changes to dry and wet season baseflow water quality resulting from the proposed development, baseline monitoring will be initiated at Station 16 (DOH's Monitoring Station 6). This proposed monitoring station is located in the upper portion of the Kawa watershed that receives baseflow from sub-basin 4 of the TMDL analysis (the area directly impacted by the proposed expansion) (Figure 1).

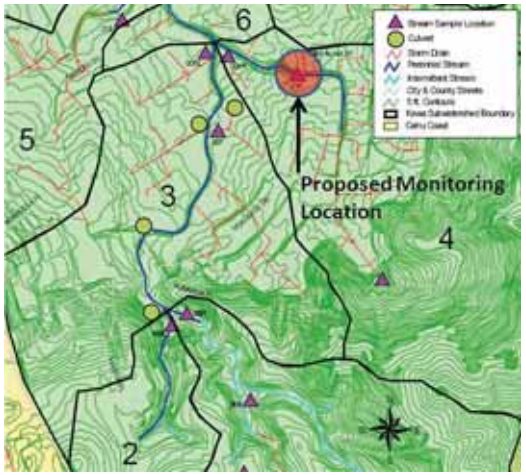

FIGURE 1: Proposed Stream Monitoring Location

In order to re-establish the baseline (pre-construction) water quality conditions at this sampling location, a minimum of four rounds of sampling should be conducted prior to the initiation of construction. In addition, quarterly groundwater monitoring will be conducted during construction activities and for the first three years of operation of the expanded cemetery. The streamflow volume will be measured at the time of sampling. The stream samples will be analyzed for the following field parameters: pH, temperature, salinity, and conductivity. The samples will be submitted to an analytical laboratory for analysis of the following constituents: total nitrogen, nitrate + nitrite nitrogen, total phosphorous and total suspended sediment. The data collected will be compared to the dry and wet season baseline water quality data collected by DOH and Oceanit between 1999 and 2000.

References:

Hawaii Department of Health, Environmental Planning Office 2005. Allocations of Total Maximum Daily Loads of Total Suspended Solids, Nitrogen and Phosphorus for Kawa Stream Kaneohe, Hawaii. Report dated June 2005.

Hawaii Department of Health, Environmental Planning Office 2008. Total Maximum Daily Loads (TMDLs) for Total Suspended Solids, Nitrogen and Phosphorus in Kaneohe Stream, Kaneohe, Hawaii. Report dated August 2008.

Oceanit, 2002. Total Maximum Daily Loads of Total Suspended Solids, Nitrogen and Phosphorus for Kawa Stream, Kaneohe, Hawaii. Report dated March 2002.

Kawa Stream TMDL Analysis for Hawaiian Memorial Park Cemetery Expansion *9-15-08*

APPENDIX A

Date	Reference Rainfall (Stn 838.1)	Adjusted Rainfall for Basin 4	Volume of Rainfall on 56.6 Acre Development (gallon)	Estimated Runoff with 8.5% Impermeable Surface (gallon)	On-Development Retention Storage Volume (10-Year Design Storm) (gallon)	Net Runoff to Kawa Stream from Development
11/1/1999	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
11/2/1999	0.04	0.06	87,930	10,011	589,215	NO RUNOFF
11/3/1999	0.13	0.19	285,772	32,535	589,215	NO RUNOFF
11/4/1999	0.22	0.32	483,615	55,060	589,215	NO RUNOFF
11/5/1999	0.12	0.17	263,790	30,032	589,215	NO RUNOFF
11/6/1999	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
11/7/1999	0.04	0.06	87,930	10,011	589,215	NO RUNOFF
11/8/1999	0.05	0.07	109,912	12,514	589,215	NO RUNOFF
11/9/1999	0.05	0.07	109,912	12,514	589,215	NO RUNOFF
11/10/1999	0.08	0.12	175,860	20,022	589,215	NO RUNOFF
11/11/1999	0.07	0.10	153,877	17,519	589,215	NO RUNOFF
11/12/1999	0.10	0.15	219,825	25,027	589,215	NO RUNOFF
11/13/1999	0.00	0.00	0	0	589,215	NO RUNOFF
11/14/1999	0.07	0.10	153,877	17,519	589,215	NO RUNOFF
11/15/1999	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
11/16/1999	0.00	0.00	0	0	589,215	NO RUNOFF
11/17/1999	0.00	0.00	0	0	589,215	NO RUNOFF
11/18/1999	0.11	0.16	241,807	27,530	589,215	NO RUNOFF
11/19/1999	0.05	0.07	109,912	12,514	589,215	NO RUNOFF
11/20/1999	0.07	0.10	153,877	17,519	589,215	NO RUNOFF
11/21/1999	0.04	0.06	87,930	10,011	589,215	NO RUNOFF
11/22/1999	0.00	0.00	0	0	589,215	NO RUNOFF
11/23/1999	0.00	0.00	0	0	589,215	NO RUNOFF
11/24/1999	0.00	0.00	0	0	589,215	NO RUNOFF
11/25/1999	0.00	0.00	0	0	589,215	NO RUNOFF
11/26/1999	0.08	0.12	175,860	20,022	589,215	NO RUNOFF
11/27/1999	0.00	0.00	0	0	589,215	NO RUNOFF
11/28/1999	0.05	0.07	109,912	12,514	589,215	NO RUNOFF
11/29/1999	0.03	0.04	65,947	7,508	589,215	NO RUNOFF
11/30/1999	0.00	0.00	0	0	589,215	NO RUNOFF
12/1/1999	0.45	0.66	989,212	112,622	589,215	NO RUNOFF
12/2/1999	0.57	0.83	1,253,002	142,654	589,215	NO RUNOFF
12/3/1999	0.01	0.01	21,982	2,503	589,215	NO RUNOFF
12/4/1999	0.01	0.01	21,982	2,503	589,215	NO RUNOFF
12/5/1999	0.21	0.31	461,632	52,557	589,215	NO RUNOFF

Date	Reference Rainfall (Stn 838.1)	Adjusted Rainfall for Basin 4	Volume of Rainfall on 56.6 Acre Development (gallon)	Estimated Runoff with 8.5% Impermeable Surface (gallon)	On-Development Retention Storage Volume (10-Year Design Storm) (gallon)	Net Runoff to Kawa Stream from Development
12/6/1999	0.04	0.06	87,930	10,011	589,215	NO RUNOFF
12/7/1999	0.04	0.06	87,930	10,011	589,215	NO RUNOFF
12/8/1999	0.00	0.00	0	0	589,215	NO RUNOFF
12/9/1999	0.06	0.09	131,895	15,016	589,215	NO RUNOFF
12/10/1999	0.03	0.04	65,947	7,508	589,215	NO RUNOFF
12/11/1999	2.02	2.94	4,440,465	505,547	589,215	NO RUNOFF
12/12/1999	0.54	0.79	1,187,055	135,146	589,215	NO RUNOFF
12/13/1999	0.12	0.17	263,790	30,032	589,215	NO RUNOFF
12/14/1999	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
12/15/1999	0.39	0.57	857,317	97,606	589,215	NO RUNOFF
12/16/1999	0.00	0.00	0	0	589,215	NO RUNOFF
12/17/1999	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
12/18/1999	0.60	0.87	1,318,950	150,162	589,215	NO RUNOFF
12/19/1999	0.05	0.07	109,912	12,514	589,215	NO RUNOFF
12/20/1999	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
12/21/1999	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
12/22/1999	0.04	0.06	87,930	10,011	589,215	NO RUNOFF
12/23/1999	0.50	0.73	1,099,125	125,135	589,215	NO RUNOFF
12/24/1999	0.15	0.22	329,737	37,541	589,215	NO RUNOFF
12/25/1999	0.00	0.00	0	0	589,215	NO RUNOFF
12/26/1999	0.10	0.15	219,825	25,027	589,215	NO RUNOFF
12/27/1999	0.46	0.67	1,011,195	115,125	589,215	NO RUNOFF
12/28/1999	0.00	0.00	0	0	589,215	NO RUNOFF
12/29/1999	0.01	0.01	21,982	2,503	589,215	NO RUNOFF
12/30/1999	0.20	0.29	439,650	50,054	589,215	NO RUNOFF
12/31/1999	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
1/1/2000	0.00	0.00	0	0	589,215	NO RUNOFF
1/2/2000	0.00	0.00	0	0	589,215	NO RUNOFF
1/3/2000	0.00	0.00	0	0	589,215	NO RUNOFF
1/4/2000	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
1/5/2000	0.00	0.00	0	0	589,215	NO RUNOFF
1/6/2000	0.12	0.17	263,790	30,032	589,215	NO RUNOFF
1/7/2000	0.06	0.09	131,895	15,016	589,215	NO RUNOFF
1/8/2000	0.00	0.00	0	0	589,215	NO RUNOFF
1/9/2000	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
1/10/2000	0.11	0.16	241,807	27,530	589,215	NO RUNOFF
1/11/2000	0.01	0.01	21,982	2,503	589,215	NO RUNOFF
1/12/2000	0.11	0.16	241,807	27,530	589,215	NO RUNOFF
1/13/2000	0.05	0.07	109,912	12,514	589,215	NO RUNOFF

Date	Reference Rainfall (Stn 838.1)	Adjusted Rainfall for Basin 4	Volume of Rainfall on 56.6 Acre Development (gallon)	Estimated Runoff with 8.5% Impermeable Surface (gallon)	On-Development Retention Storage Volume (10-Year Design Storm) (gallon)	Net Runoff to Kawa Stream from Development
1/14/2000	0.64	0.93	1,406,880	160,173	589,215	NO RUNOFF
1/15/2000	0.23	0.33	505,597	57,562	589,215	NO RUNOFF
1/16/2000	0.17	0.25	373,702	42,546	589,215	NO RUNOFF
1/17/2000	0.01	0.01	21,982	2,503	589,215	NO RUNOFF
1/18/2000	0.13	0.19	285,772	32,535	589,215	NO RUNOFF
1/19/2000	0.16	0.23	351,720	40,043	589,215	NO RUNOFF
1/20/2000	1.74	2.53	3,824,955	435,471	589,215	NO RUNOFF
1/21/2000	0.45	0.66	989,212	112,622	589,215	NO RUNOFF
1/22/2000	0.05	0.07	109,912	12,514	589,215	NO RUNOFF
1/23/2000	0.00	0.00	0	0	589,215	NO RUNOFF
1/24/2000	0.00	0.00	0	0	589,215	NO RUNOFF
1/25/2000	0.00	0.00	0	0	589,215	NO RUNOFF
1/26/2000	0.00	0.00	0	0	589,215	NO RUNOFF
1/27/2000	0.41	0.60	901,282	102,611	589,215	NO RUNOFF
1/28/2000	0.00	0.00	0	0	589,215	NO RUNOFF
1/29/2000	0.00	0.00	0	0	589,215	NO RUNOFF
1/30/2000	0.00	0.00	0	0	589,215	NO RUNOFF
1/31/2000	0.00	0.00	0	0	589,215	NO RUNOFF
2/1/2000	0.17	0.25	373,702	42,546	589,215	NO RUNOFF
2/2/2000	0.00	0.00	0	0	589,215	NO RUNOFF
2/3/2000	0.00	0.00	0	0	589,215	NO RUNOFF
2/4/2000	0.00	0.00	0	0	589,215	NO RUNOFF
2/5/2000	0.00	0.00	0	0	589,215	NO RUNOFF
2/6/2000	0.00	0.00	0	0	589,215	NO RUNOFF
2/7/2000	0.00	0.00	0	0	589,215	NO RUNOFF
2/8/2000	0.00	0.00	0	0	589,215	NO RUNOFF
2/9/2000	0.00	0.00	0	0	589,215	NO RUNOFF
2/10/2000	0.00	0.00	0	0	589,215	NO RUNOFF
2/11/2000	0.00	0.00	0	0	589,215	NO RUNOFF
2/12/2000	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
2/13/2000	0.00	0.00	0	0	589,215	NO RUNOFF
2/14/2000	0.00	0.00	0	0	589,215	NO RUNOFF
2/15/2000	0.00	0.00	0	0	589,215	NO RUNOFF
2/16/2000	0.00	0.00	0	0	589,215	NO RUNOFF
2/17/2000	0.00	0.00	0	0	589,215	NO RUNOFF
2/18/2000	0.00	0.00	0	0	589,215	NO RUNOFF
2/19/2000	0.04	0.06	87,930	10,011	589,215	NO RUNOFF
2/20/2000	0.00	0.00	0	0	589,215	NO RUNOFF
2/21/2000	0.00	0.00	0	0	589,215	NO RUNOFF

Date	Reference Rainfall (Stn 838.1)	Adjusted Rainfall for Basin 4	Volume of Rainfall on 56.6 Acre Development (gallon)	Estimated Runoff with 8.5% Impermeable Surface (gallon)	On-Development Retention Storage Volume (10-Year Design Storm) (gallon)	Net Runoff to Kawa Stream from Development
2/22/2000	0.08	0.12	175,860	20,022	589,215	NO RUNOFF
2/23/2000	0.00	0.00	0	0	589,215	NO RUNOFF
2/24/2000	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
2/25/2000	0.00	0.00	0	0	589,215	NO RUNOFF
2/26/2000	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
2/27/2000	0.03	0.04	65,947	7,508	589,215	NO RUNOFF
2/28/2000	0.01	0.01	21,982	2,503	589,215	NO RUNOFF
2/29/2000	0.00	0.00	0	0	589,215	NO RUNOFF
3/1/2000	0.03	0.04	65,947	7,508	589,215	NO RUNOFF
3/2/2000	0.00	0.00	0	0	589,215	NO RUNOFF
3/3/2000	0.00	0.00	0	0	589,215	NO RUNOFF
3/4/2000	0.00	0.00	0	0	589,215	NO RUNOFF
3/5/2000	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
3/6/2000	0.00	0.00	0	0	589,215	NO RUNOFF
3/7/2000	0.00	0.00	0	0	589,215	NO RUNOFF
3/8/2000	0.00	0.00	0	0	589,215	NO RUNOFF
3/9/2000	0.00	0.00	0	0	589,215	NO RUNOFF
3/10/2000	0.00	0.00	0	0	589,215	NO RUNOFF
3/11/2000	0.00	0.00	0	0	589,215	NO RUNOFF
3/12/2000	0.00	0.00	0	0	589,215	NO RUNOFF
3/13/2000	0.00	0.00	0	0	589,215	NO RUNOFF
3/14/2000	0.00	0.00	0	0	589,215	NO RUNOFF
3/15/2000	0.03	0.04	65,947	7,508	589,215	NO RUNOFF
3/16/2000	0.01	0.01	21,982	2,503	589,215	NO RUNOFF
3/17/2000	0.00	0.00	0	0	589,215	NO RUNOFF
3/18/2000	0.03	0.04	65,947	7,508	589,215	NO RUNOFF
3/19/2000	0.03	0.04	65,947	7,508	589,215	NO RUNOFF
3/20/2000	0.00	0.00	0	0	589,215	NO RUNOFF
3/21/2000	0.00	0.00	0	0	589,215	NO RUNOFF
3/22/2000	0.06	0.09	131,895	15,016	589,215	NO RUNOFF
3/23/2000	0.10	0.15	219,825	25,027	589,215	NO RUNOFF
3/24/2000	0.04	0.06	87,930	10,011	589,215	NO RUNOFF
3/25/2000	0.09	0.13	197,842	22,524	589,215	NO RUNOFF
3/26/2000	0.23	0.33	505,597	57,562	589,215	NO RUNOFF
3/27/2000	0.48	0.70	1,055,160	120,130	589,215	NO RUNOFF
3/28/2000	0.20	0.29	439,650	50,054	589,215	NO RUNOFF
3/29/2000	0.05	0.07	109,912	12,514	589,215	NO RUNOFF
3/30/2000	0.27	0.39	593,527	67,573	589,215	NO RUNOFF
3/31/2000	0.44	0.64	967,230	110,119	589,215	NO RUNOFF

Date	Reference Rainfall (Stn 838.1)	Adjusted Rainfall for Basin 4	Volume of Rainfall on 56.6 Acre Development (gallon)	Estimated Runoff with 8.5% Impermeable Surface (gallon)	On-Development Retention Storage Volume (10-Year Design Storm) (gallon)	Net Runoff to Kawa Stream from Development
4/1/2000	1.31	1.91	2,879,707	327,855	589,215	NO RUNOFF
4/2/2000	0.19	0.28	417,667	47,551	589,215	NO RUNOFF
4/3/2000	0.67	0.98	1,472,827	167,681	589,215	NO RUNOFF
4/4/2000	0.05	0.07	109,912	12,514	589,215	NO RUNOFF
4/5/2000	0.08	0.12	175,860	20,022	589,215	NO RUNOFF
4/6/2000	0.01	0.01	21,982	2,503	589,215	NO RUNOFF
4/7/2000	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
4/8/2000	0.03	0.04	65,947	7,508	589,215	NO RUNOFF
4/9/2000	0.36	0.52	791,370	90,097	589,215	NO RUNOFF
4/10/2000	0.06	0.09	131,895	15,016	589,215	NO RUNOFF
4/11/2000	0.01	0.01	21,982	2,503	589,215	NO RUNOFF
4/12/2000	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
4/13/2000	0.03	0.04	65,947	7,508	589,215	NO RUNOFF
4/14/2000	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
4/15/2000	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
4/16/2000	0.00	0.00	0	0	589,215	NO RUNOFF
4/17/2000	0.10	0.15	219,825	25,027	589,215	NO RUNOFF
4/18/2000	0.07	0.10	153,877	17,519	589,215	NO RUNOFF
4/19/2000	0.01	0.01	21,982	2,503	589,215	NO RUNOFF
4/20/2000	0.01	0.01	21,982	2,503	589,215	NO RUNOFF
4/21/2000	0.10	0.15	219,825	25,027	589,215	NO RUNOFF
4/22/2000	0.00	0.00	0	0	589,215	NO RUNOFF
4/23/2000	0.04	0.06	87,930	10,011	589,215	NO RUNOFF
4/24/2000	0.03	0.04	65,947	7,508	589,215	NO RUNOFF
4/25/2000	0.06	0.09	131,895	15,016	589,215	NO RUNOFF
4/26/2000	0.03	0.04	65,947	7,508	589,215	NO RUNOFF
4/27/2000	0.07	0.10	153,877	17,519	589,215	NO RUNOFF
4/28/2000	0.00	0.00	0	0	589,215	NO RUNOFF
4/29/2000	0.00	0.00	0	0	589,215	NO RUNOFF
4/30/2000	0.00	0.00	0	0	589,215	NO RUNOFF
5/1/2000	0.00	0.00	0	0	589,215	NO RUNOFF
5/2/2000	0.00	0.00	0	0	589,215	NO RUNOFF
5/3/2000	0.03	0.04	65,947	7,508	589,215	NO RUNOFF
5/4/2000	0.00	0.00	0	0	589,215	NO RUNOFF
5/5/2000	0.00	0.00	0	0	589,215	NO RUNOFF
5/6/2000	0.04	0.06	87,930	10,011	589,215	NO RUNOFF
5/7/2000	0.09	0.13	197,842	22,524	589,215	NO RUNOFF
5/8/2000	0.00	0.00	0	0	589,215	NO RUNOFF
5/9/2000	0.00	0.00	0	0	589,215	NO RUNOFF

Date	Reference Rainfall (Stn 838.1)	Adjusted Rainfall for Basin 4	Volume of Rainfall on 56.6 Acre Development (gallon)	Estimated Runoff with 8.5% Impermeable Surface (gallon)	On-Development Retention Storage Volume (10-Year Design Storm) (gallon)	Net Runoff to Kawa Stream from Development
5/10/2000	0.00	0.00	0	0	589,215	NO RUNOFF
5/11/2000	0.05	0.07	109,912	12,514	589,215	NO RUNOFF
5/12/2000	0.25	0.36	549,562	62,568	589,215	NO RUNOFF
5/13/2000	0.07	0.10	153,877	17,519	589,215	NO RUNOFF
5/14/2000	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
5/15/2000	0.00	0.00	0	0	589,215	NO RUNOFF
5/16/2000	0.00	0.00	0	0	589,215	NO RUNOFF
5/17/2000	0.61	0.89	1,340,932	152,665	589,215	NO RUNOFF
5/18/2000	0.00	0.00	0	0	589,215	NO RUNOFF
5/19/2000	0.04	0.06	87,930	10,011	589,215	NO RUNOFF
5/20/2000	0.01	0.01	21,982	2,503	589,215	NO RUNOFF
5/21/2000	0.04	0.06	87,930	10,011	589,215	NO RUNOFF
5/22/2000	0.03	0.04	65,947	7,508	589,215	NO RUNOFF
5/23/2000	0.03	0.04	65,947	7,508	589,215	NO RUNOFF
5/24/2000	0.01	0.01	21,982	2,503	589,215	NO RUNOFF
5/25/2000	0.01	0.01	21,982	2,503	589,215	NO RUNOFF
5/26/2000	0.00	0.00	0	0	589,215	NO RUNOFF
5/27/2000	0.03	0.04	65,947	7,508	589,215	NO RUNOFF
5/28/2000	0.03	0.04	65,947	7,508	589,215	NO RUNOFF
5/29/2000	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
5/30/2000	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
5/31/2000	0.05	0.07	109,912	12,514	589,215	NO RUNOFF
6/1/2000	0.06	0.09	131,895	15,016	589,215	NO RUNOFF
6/2/2000	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
6/3/2000	0.00	0.00	0	0	589,215	NO RUNOFF
6/4/2000	0.00	0.00	0	0	589,215	NO RUNOFF
6/5/2000	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
6/6/2000	0.03	0.04	65,947	7,508	589,215	NO RUNOFF
6/7/2000	0.20	0.29	439,650	50,054	589,215	NO RUNOFF
6/8/2000	0.18	0.26	395,685	45,049	589,215	NO RUNOFF
6/9/2000	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
6/10/2000	0.00	0.00	0	0	589,215	NO RUNOFF
6/11/2000	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
6/12/2000	0.00	0.00	0	0	589,215	NO RUNOFF
6/13/2000	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
6/14/2000	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
6/15/2000	0.00	0.00	0	0	589,215	NO RUNOFF
6/16/2000	0.00	0.00	0	0	589,215	NO RUNOFF
6/17/2000	0.07	0.10	153,877	17,519	589,215	NO RUNOFF

Date	Reference Rainfall (Stn 838.1)	Adjusted Rainfall for Basin 4	Volume of Rainfall on 56.6 Acre Development (gallon)	Estimated Runoff with 8.5% Impermeable Surface (gallon)	On-Development Retention Storage Volume (10-Year Design Storm) (gallon)	Net Runoff to Kawa Stream from Development
6/18/2000	0.04	0.06	87,930	10,011	589,215	NO RUNOFF
6/19/2000	0.00	0.00	0	0	589,215	NO RUNOFF
6/20/2000	0.00	0.00	0	0	589,215	NO RUNOFF
6/21/2000	0.08	0.12	175,860	20,022	589,215	NO RUNOFF
6/22/2000	0.05	0.07	109,912	12,514	589,215	NO RUNOFF
6/23/2000	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
6/24/2000	0.03	0.04	65,947	7,508	589,215	NO RUNOFF
6/25/2000	0.07	0.10	153,877	17,519	589,215	NO RUNOFF
6/26/2000	0.06	0.09	131,895	15,016	589,215	NO RUNOFF
6/27/2000	0.00	0.00	0	0	589,215	NO RUNOFF
6/28/2000	0.15	0.22	329,737	37,541	589,215	NO RUNOFF
6/29/2000	0.05	0.07	109,912	12,514	589,215	NO RUNOFF
6/30/2000	0.07	0.10	153,877	17,519	589,215	NO RUNOFF
7/1/2000	0.13	0.19	285,772	32,535	589,215	NO RUNOFF
7/2/2000	0.31	0.45	681,457	77,584	589,215	NO RUNOFF
7/3/2000	0.05	0.07	109,912	12,514	589,215	NO RUNOFF
7/4/2000	0.05	0.07	109,912	12,514	589,215	NO RUNOFF
7/5/2000	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
7/6/2000	0.04	0.06	87,930	10,011	589,215	NO RUNOFF
7/7/2000	0.00	0.00	0	0	589,215	NO RUNOFF
7/8/2000	0.00	0.00	0	0	589,215	NO RUNOFF
7/9/2000	0.00	0.00	0	0	589,215	NO RUNOFF
7/10/2000	0.00	0.00	0	0	589,215	NO RUNOFF
7/11/2000	0.10	0.15	219,825	25,027	589,215	NO RUNOFF
7/12/2000	0.01	0.01	21,982	2,503	589,215	NO RUNOFF
7/13/2000	0.00	0.00	0	0	589,215	NO RUNOFF
7/14/2000	0.04	0.06	87,930	10,011	589,215	NO RUNOFF
7/15/2000	0.20	0.29	439,650	50,054	589,215	NO RUNOFF
7/16/2000	0.04	0.06	87,930	10,011	589,215	NO RUNOFF
7/17/2000	0.04	0.06	87,930	10,011	589,215	NO RUNOFF
7/18/2000	0.04	0.06	87,930	10,011	589,215	NO RUNOFF
7/19/2000	0.00	0.00	0	0	589,215	NO RUNOFF
7/20/2000	0.04	0.06	87,930	10,011	589,215	NO RUNOFF
7/21/2000	0.38	0.55	835,335	95,103	589,215	NO RUNOFF
7/22/2000	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
7/23/2000	0.01	0.01	21,982	2,503	589,215	NO RUNOFF
7/24/2000	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
7/25/2000	0.04	0.06	87,930	10,011	589,215	NO RUNOFF
7/26/2000	0.10	0.15	219,825	25,027	589,215	NO RUNOFF

Date	Reference Rainfall (Stn 838.1)	Adjusted Rainfall for Basin 4	Volume of Rainfall on 56.6 Acre Development (gallon)	Estimated Runoff with 8.5% Impermeable Surface (gallon)	On-Development Retention Storage Volume (10-Year Design Storm) (gallon)	Net Runoff to Kawa Stream from Development
7/27/2000	0.05	0.07	109,912	12,514	589,215	NO RUNOFF
7/28/2000	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
7/29/2000	0.03	0.04	65,947	7,508	589,215	NO RUNOFF
7/30/2000	0.00	0.00	0	0	589,215	NO RUNOFF
7/31/2000	0.03	0.04	65,947	7,508	589,215	NO RUNOFF
8/1/2000	0.14	0.20	307,755	35,038	589,215	NO RUNOFF
8/2/2000	0.10	0.15	219,825	25,027	589,215	NO RUNOFF
8/3/2000	0.03	0.04	65,947	7,508	589,215	NO RUNOFF
8/4/2000	0.00	0.00	0	0	589,215	NO RUNOFF
8/5/2000	0.15	0.22	329,737	37,541	589,215	NO RUNOFF
8/6/2000	0.00	0.00	0	0	589,215	NO RUNOFF
8/7/2000	0.00	0.00	0	0	589,215	NO RUNOFF
8/8/2000	0.00	0.00	0	0	589,215	NO RUNOFF
8/9/2000	0.00	0.00	0	0	589,215	NO RUNOFF
8/10/2000	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
8/11/2000	0.00	0.00	0	0	589,215	NO RUNOFF
8/12/2000	0.01	0.01	21,982	2,503	589,215	NO RUNOFF
8/13/2000	0.00	0.00	0	0	589,215	NO RUNOFF
8/14/2000	0.00	0.00	0	0	589,215	NO RUNOFF
8/15/2000	0.00	0.00	0	0	589,215	NO RUNOFF
8/16/2000	0.00	0.00	0	0	589,215	NO RUNOFF
8/17/2000	0.20	0.29	439,650	50,054	589,215	NO RUNOFF
8/18/2000	0.27	0.39	593,527	67,573	589,215	NO RUNOFF
8/19/2000	0.00	0.00	0	0	589,215	NO RUNOFF
8/20/2000	0.10	0.15	219,825	25,027	589,215	NO RUNOFF
8/21/2000	1.50	2.18	3,297,375	375,406	589,215	NO RUNOFF
8/22/2000	0.01	0.01	21,982	2,503	589,215	NO RUNOFF
8/23/2000	0.00	0.00	0	0	589,215	NO RUNOFF
8/24/2000	0.03	0.04	65,947	7,508	589,215	NO RUNOFF
8/25/2000	0.00	0.00	0	0	589,215	NO RUNOFF
8/26/2000	0.00	0.00	0	0	589,215	NO RUNOFF
8/27/2000	0.11	0.16	241,807	27,530	589,215	NO RUNOFF
8/28/2000	0.14	0.20	307,755	35,038	589,215	NO RUNOFF
8/29/2000	0.19	0.28	417,667	47,551	589,215	NO RUNOFF
8/30/2000	0.01	0.01	21,982	2,503	589,215	NO RUNOFF
8/31/2000	0.00	0.00	0	0	589,215	NO RUNOFF
9/1/2000	0.01	0.01	21,982	2,503	589,215	NO RUNOFF
9/2/2000	0.00	0.00	0	0	589,215	NO RUNOFF
9/3/2000	0.01	0.01	21,982	2,503	589,215	NO RUNOFF

Date	Reference Rainfall (Stn 838.1)	Adjusted Rainfall for Basin 4	Volume of Rainfall on 56.6 Acre Development (gallon)	Estimated Runoff with 8.5% Impermeable Surface (gallon)	On-Development Retention Storage Volume (10-Year Design Storm) (gallon)	Net Runoff to Kawa Stream from Development
9/4/2000	0.00	0.00	0	0	589,215	NO RUNOFF
9/5/2000	0.19	0.28	417,667	47,551	589,215	NO RUNOFF
9/6/2000	0.44	0.64	967,230	110,119	589,215	NO RUNOFF
9/7/2000	0.05	0.07	109,912	12,514	589,215	NO RUNOFF
9/8/2000	0.14	0.20	307,755	35,038	589,215	NO RUNOFF
9/9/2000	0.01	0.01	21,982	2,503	589,215	NO RUNOFF
9/10/2000	0.00	0.00	0	0	589,215	NO RUNOFF
9/11/2000	0.03	0.04	65,947	7,508	589,215	NO RUNOFF
9/12/2000	0.09	0.13	197,842	22,524	589,215	NO RUNOFF
9/13/2000	0.04	0.06	87,930	10,011	589,215	NO RUNOFF
9/14/2000	1.29	1.88	2,835,742	322,849	589,215	NO RUNOFF
9/15/2000	0.05	0.07	109,912	12,514	589,215	NO RUNOFF
9/16/2000	0.00	0.00	0	0	589,215	NO RUNOFF
9/17/2000	0.00	0.00	0	0	589,215	NO RUNOFF
9/18/2000	0.14	0.20	307,755	35,038	589,215	NO RUNOFF
9/19/2000	0.00	0.00	0	0	589,215	NO RUNOFF
9/20/2000	0.25	0.36	549,562	62,568	589,215	NO RUNOFF
9/21/2000	0.21	0.31	461,632	52,557	589,215	NO RUNOFF
9/22/2000	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
9/23/2000	0.00	0.00	0	0	589,215	NO RUNOFF
9/24/2000	0.00	0.00	0	0	589,215	NO RUNOFF
9/25/2000	0.00	0.00	0	0	589,215	NO RUNOFF
9/26/2000	0.01	0.01	21,982	2,503	589,215	NO RUNOFF
9/27/2000	0.30	0.44	659,475	75,081	589,215	NO RUNOFF
9/28/2000	2.07	3.01	4,550,377	518,060	589,215	NO RUNOFF
9/29/2000	0.20	0.29	439,650	50,054	589,215	NO RUNOFF
9/30/2000	0.01	0.01	21,982	2,503	589,215	NO RUNOFF
10/1/2000	0.00	0.00	0	0	589,215	NO RUNOFF
10/2/2000	0.00	0.00	0	0	589,215	NO RUNOFF
10/3/2000	0.00	0.00	0	0	589,215	NO RUNOFF
10/4/2000	0.00	0.00	0	0	589,215	NO RUNOFF
10/5/2000	0.10	0.15	219,825	25,027	589,215	NO RUNOFF
10/6/2000	0.00	0.00	0	0	589,215	NO RUNOFF
10/7/2000	0.00	0.00	0	0	589,215	NO RUNOFF
10/8/2000	0.00	0.00	0	0	589,215	NO RUNOFF
10/9/2000	0.06	0.09	131,895	15,016	589,215	NO RUNOFF
10/10/2000	0.00	0.00	0	0	589,215	NO RUNOFF
10/11/2000	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
10/12/2000	0.09	0.13	197,842	22,524	589,215	NO RUNOFF

Date	Reference Rainfall (Stn 838.1)	Adjusted Rainfall for Basin 4	Volume of Rainfall on 56.6 Acre Development (gallon)	Estimated Runoff with 8.5% Impermeable Surface (gallon)	On-Development Retention Storage Volume (10-Year Design Storm) (gallon)	Net Runoff to Kawa Stream from Development
10/13/2000	0.00	0.00	0	0	589,215	NO RUNOFF
10/14/2000	0.23	0.33	505,597	57,562	589,215	NO RUNOFF
10/15/2000	0.00	0.00	0	0	589,215	NO RUNOFF
10/16/2000	0.04	0.06	87,930	10,011	589,215	NO RUNOFF
10/17/2000	0.01	0.01	21,982	2,503	589,215	NO RUNOFF
10/18/2000	0.01	0.01	21,982	2,503	589,215	NO RUNOFF
10/19/2000	0.30	0.44	659,475	75,081	589,215	NO RUNOFF
10/20/2000	0.02	0.03	43,965	5,005	589,215	NO RUNOFF
10/21/2000	0.00	0.00	0	0	589,215	NO RUNOFF
10/22/2000	0.00	0.00	0	0	589,215	NO RUNOFF
10/23/2000	0.00	0.00	0	0	589,215	NO RUNOFF
10/24/2000	0.09	0.13	197,842	22,524	589,215	NO RUNOFF
10/25/2000	0.09	0.13	197,842	22,524	589,215	NO RUNOFF
10/26/2000	0.07	0.10	153,877	17,519	589,215	NO RUNOFF
10/27/2000	0.00	0.00	0	0	589,215	NO RUNOFF
10/28/2000	0.00	0.00	0	0	589,215	NO RUNOFF
10/29/2000	0.38	0.55	835,335	95,103	589,215	NO RUNOFF
10/30/2000	1.33	1.94	2,923,672	332,860	589,215	NO RUNOFF
10/31/2000	0.09	0.13	197,842	22,524	589,215	NO RUNOFF