Draft Environmental Assessment

Wahiawa Transit Center & Park and Ride
TMK: 7-4-006:002 & portion of 7-4-006:012
956 California Avenue, Wahiawa, O`ahu, Hawai`i

Prepared by:

AM Partners, Inc.
1100 Alakea Street, Suite 800
Honolulu, Hawai`i 96813

December 2008

DEPARTMENT OF TRANSPORTATION SERVICES

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET, 3RD FLOOR
HONOLULU, HAWAII 96813
Phone: (808) 768-8305 • Fax: (808) 768-4730 • Internet: www.co@honolulu.gov

MUFI HANNEMANN
MAYOR

WAYNE Y. YOSHIOKA
DIRECTOR

RICHARD F. TORRES
DEPUTY DIRECTOR

December 26, 2008

Ms. Katherine Puana Kealoha, Director
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawai`i 96813

Dear Ms. Kealoha:

Subject: Draft Environmental Assessment (DEA) for the Wahiawa Transit Center & Park and Ride, TMK: 7-4-06:002 and 7-4-06: por. 012, Wahiawa, Hawai`i

The City and County of Honolulu Department of Transportation Services has reviewed the draft environmental assessment for the subject project and anticipates a Finding of No Significant Impact (FONSI) determination. We are writing to request that you publish a notice of availability for this project in the next available OEQC Environmental Notice.

We have enclosed a completed OEQC Publication Form and Project Summary, two hard copies of the draft EA and one copy on disk of the draft EA in PDF format.

If you have any questions regarding this submittal, please call Mr. Akira Fujita at 768-8367.

Very truly yours,

WAYNE Y. YOSHIOKA
Director

Wahiawa Transit Center & Park and Ride

Proposed Action	Construct an 8-bus bay transit center on the ground floor of a two-story parking structure in Wahiawa Town
Proposing Agency and Accepting Authority	Department of Transportation Services (DTS) City and County of Honolulu 650 South King Street, 3rd Floor Honolulu, Hawai`i 96813 Contact: Akira Fujita Phone: (808) 768-8367 Fax: (808) 596-2380
Agent	AM Partners, Inc. 1100 Alakea Street, Suite 800 Honolulu, Hawai`i 96813 Contact: Roland Libby Phone: (808) 526-2828 ext. 248 Fax: (808) 538-0027
Tax Map Key	7-4-60:002 and portion of 7-4-06:012
Address	956 California Avenue, Wahiawa, Oahu, Hawai`i
Land Area	17,500 SF at 7-4-006:002 (entire parcel) 10,250 SF at 7-4-006:012 (portion of 75,100 SF-parcel) 27,750 SF Total
Land Ownership	State of Hawai`i
Existing Use	Parking lot
State Land Use District	Urban district
Sustainable Communities Plan Land Use Designation	Public and quasi public
Zoning Designation	R-5 Residential District
Special Management Area (SMA)	Not within the SMA
FEMA FIRM Zone	FIRM Zone D; Areas of undetermined flood
Anticipated Determination	Finding of No Significant Impact (FONSI)

TABLE OF CONTENTS

List of Exhibits

Appendices

Section 1.0 Introduction

1.1 Purpose and Objectives

The applicant, the Department of Transportation Services (DTS) of the City and County of Honolulu, proposes to develop a transit center /park and ride facility to accommodate express, trunk and circulator bus services. The ground level of the two-story structure will house eight (8) bus bays, a passenger waiting area, single use restroom, and storage closet. The second level will contain 58 parking stalls.

This Environmental Assessment (EA) is prepared pursuant to and in accordance with the requirements of Chapter 343 Hawaii Revised Statutes, and Chapter 200 of Title 11, Department of Health Administrative Rules. The action that triggers this assessment is the use of City & County funds in the planning, design and construction of the facility. In addition, the structure will be located on State owned lands. Federal funds will be used to implement this project. However, a Categorical Exclusion (CE) was granted for this project under 23 CFR 771.117(d)(10) which exempts the construction of bus transfer facilities in commercial or high activity centers with adequate street capacity, as described in relevant provisions of the National Environmental Policy Act (NEPA).

A Draft Environmental Statement (DEA) for the two-level design concept was first prepared in 2005. Availability of this DEA and notice of the 30-day comment period was published in “The Environmental Notice “ on November 8, 2005 by Hawaii State’s Office of Environmental Quality Control.

This document represents a modification of the DEA published in 2005 and expands more fully the lease terms between the State of Hawaii and the City & County of Honolulu. This document also contains an updated TIAR (replaces the TIAR prepared in 2002) and an Arborist Report. The design concept as presented in the 2005 DEA remains relatively unchanged except for the decrease in the height of the clock tower.

1.2 Project Location

The subject property is on TMK 7-4-006:02 at 17,500 square feet and a portion of TMK 7-4-006:012, where approximately 10.250 square feet will be utilized for this project. The total land area used for the project will be 27,750 SF. Both parcels are located in the heart of Wahiawa Town, 20 miles north of downtown Honolulu, on the central plain of the Island of Oahu, Hawaii. (<u>Exhibit 1</u>) The site is near the intersection of California Avenue and North Cane Street. It is bounded by Center Street to the northwest, a Jiffy Lube Store and an abandoned Union 76 Service Station to the northeast, California Avenue to the southeast, and the existing Wahiawa Civic Center to the southwest.

1.3 Land Ownership

The 17,500 SF parcel is owned by the State of Hawaii and is used for employee and public parking. It is adjacent to two privately owned parcels of land on the northeast boundary. It can be accessed by vehicular traffic on the northwest via Center Street and on the southeast via California Avenue. The land parcel with TMK 7-4-006:012, with an area of 75,100 square feet lies on the southwest border of the parking lot. Owned by the State of Hawaii, the property is the current site of the Wahiawa Civic Center. A portion of this parcel, approximately 10,250 square feet is being planned for inclusion in the proposed site for the Wahiawa Transit Center & Park and Ride facility. (Exhibit 2 & 3.)

1.4 Land Use and Site Description

The proposed site consists of two rectangular shaped open parking lots. On the western side of the site, 25 parking stalls are designated for the use of the Wahiawa Civic Center. The lot is also occupied by a small storage shed and two small gardens. The eastern side of the site appears to be used as unrestricted public parking and provides approximately 56 parking stalls. Both lots are paved with asphalt and both are in poor condition. The site is relatively level with existing ground elevations ranging from +920 feet Mean Sea Level (MSL) to +922 feet MSL.

1.5 Zoning Waivers

The subject parcels are within the block that is surrounded by California Avenue, Cane Street, Center Street and Lehua Street. All parcels within this block are zoned R-5, except for two parcels contiguous to Cane Street which are zoned B-2.

Since the two subject parcels TMK: 7-4-006:002 and 7-4-006:012 are zoned R-5, they are subject to the Residential Districts Development Standards. The project will require zoning waivers because the project deviates from the R-5 standards. Exhibit 3, referred to as the Land Use Reference, describes how the structure is sited on the two parcels and its impact on the zoning standards of the Land Use Ordinance (LUO). A list of the zoning waivers required for a two-level structure is summarized below

- allow a public parking/transit facility on the site.
- allow 5'-0" setback on the front yard; 30 feet setback is required
- allow 9'-6" setback on the side yard; 15 feet setback is required
- allow 82% of lot area for the building area; 50% of zoning lot is required
- allow a building height of more than 25'-0"; clock tower is 42'-5" in height

The City has entered into a Lease Agreement with the State (see Section 2.3 below for details) that allows the State to build additional levels of parking on the proposed structure. Should the State pursue that option, additional waivers will be needed.

Section 2.0 Project Background

2.1 Wahiawa and Public Transportation

Wahiawa is a major origin, transfer and destination point for people using public transportation. The community is currently served by a variety of bus routes: Express routes 83, 83A, and 98A, local or trunk routes 52 and 62, and shuttle route 72. All but route 98A converge in the Wahiawa Civic Center area that is bordered by California Avenue, Cane Street, Center Street and Lehua Street, which surrounds the site of the proposed community transit center. Route 98A operates on the edge of Wahiawa town along Wilikina Drive and does not enter the civic center area.

2.2 Development of a Suitable Facility to Enhance Transit Services for Wahiawa

The development of a suitable facility such as a park and ride / transit center on the proposed site would enhance the transit services for Wahiawa, which according to the Department of Transportation Services (DTS) has a daily ridership of 3,000 people. It will accommodate the transfer of passengers in a location that is in close walking proximity to nearby medical facilities, government offices, social services and commercial establishments. It will not only serve the current users, but also provide additional incentives for residents to utilize public transportation.

The site of the proposed center is located primarily on TMK 7-4-06:02 which is now used as a parking lot, and on approximately 10,250 square feet on portions of TMK 7-4-06:012 contiguous to TMK 7-4-06:02. These two parcels are part of five contiguous parcels owned by the State of Hawaii within the block that is surrounded by California Avenue, Cane Street, Center Street and Lehua Street. The State has plans to develop the area for a new Wahiawa Civic Center that would house State offices, Judiciary facilities and vehicular parking. *(Source: Wahiawa Civic Center, Conceptual Design Report dated April 1996; Wahiawa District Court, Project Development Report (PDR), dated November 1997; prepared for the Department of Accounting & General Services (DAGS) by Dennis T. Toyumura F.A.I.A.)* In the 1996 DAGS PDR, the recommended development plan for the Wahiawa Civic Center includes the construction of a two level parking structure on Center Street which is owned by the City & County of Honolulu.

2.3 Lease Agreement

Discussions are on-going between the State's Department of Accounting and General Services (DAGS) and the City's Department of Transportation Services (DTS). The City is requesting the right to use State owned land, and in return the City will provide a certain number of parking spaces that can be allocated for the proposed Judiciary and Civic Center. Such an exchange would also allow the State to pursue its plans to add more floors to the City's proposed parking structure. An agreement is being negotiated to arrive at a resolution that is mutually beneficial to both parties and to the residents of Wahiawa who stand to gain from the implementation of both the civic center/judiciary facilities and the transit center/park and ride on the proposed site.

A draft of the lease agreement was completed and is now being reviewed by all parties. The terms that are significant to the project are:

- The 44-year lease to begin on January 1, 2007 and terminate on December 31, 2050. The length and dates of the lease agreement are based on the approval by the Board of Land and Natural Resources dated December 8, 2006.

- The premises shall be used by the City to construct a transit center which will function as a bus staging area; City buses will load and unload passengers on the ground level. Bus passengers can park their vehicles on the second level that will house the "park and ride" stalls.

- The City will also construct a 58-stall parking structure above the ground level transit center; 25 stalls will be dedicated to staff and users of the State's Civic Center as replacement to the present usage by the Wahiawa Civic Center; the remaining (33 stalls) will be dedicated for park and ride users.

- The 58-stall parking structure shall be built to structurally accommodate further upward expansion. When the State expands the parking structure, the additional spaces constructed shall be dedicated for use by patrons and staff of the proposed Judiciary complex and office building which will replace the existing civic center.

- The City will retain ownership of the Transit Center and the 58-stall parking structure and will be responsible for all requirements for maintenance and security.

- The City will use Federal funds from the Federal Transit Administration (FTA), and as such the Federal government retains interest in both the transit center and the 58-stall parking structure. Accordingly, neither the State nor the City can execute any obligation that would affect the Federal interest.

- The City through its Department of Transportation Services (DTS) agrees to make good faith reasonable efforts to help the State in satisfying the parking requirements of the proposed State Judiciary Complex/ State Office Building that will be built on adjacent area bordered by California Avenue, Lehua Street and Center Street. The DTS will support the State's application for a zoning waiver to allow the parking structure to exceed the zoning height limit. The DTS will also support the State's application for all required permits, environmental clearances, funding and other third party contracts.

- The City through DTS will also support the State's request for a waiver of zoning requirements to allow a reduction in the number of off-street parking stalls to be provided by the proposed Judiciary Complex/ State Office Building.

- Upon the completion of the Judiciary Complex/State Office Building and the parking structure's expansion, the City through DTS agrees to assist the State in its efforts to designate 109 parking spaces as part of the Judiciary Complex/State Office Building parking count (or less if the State is successful in getting a waiver on its parking requirements) on Center Street, a City-owned roadway.

A Resolution to enter into an Intergovernmental Agreement (IGA) was approved by City Council and a documents-review by DAGS and the State's Attorney General, should be completed in the 4th quarter of 2008.

Section 3.0 Construction Activities

3.1 Proposed Structure

The transit center will be housed on the ground floor with parking provided on a second level. Although the building is only two stories, the structure will be designed to allow future construction of additional parking levels in a separate project by others. The ground level will house eight (8) bus bays, passenger-waiting area between the bus bays, and may include a unisex toilet for staff use, and storage closets. The second level will accommodate 58 parking stalls. The ground floor consists of approximately 23,086 square feet and the second level consists of approximately 23,086 square feet for a total floor area of approximately 46,172 square feet. The structure, with a footprint of 238 feet by 97 feet is approximately 33 feet high from the top of the second level railing to the lowest point on the site. A clock tower, 42 feet and five inches in height from the lowest point on site, will be located on the eastern corner of the structure at California Avenue. <u>Exhibit 4</u> contains the topographical survey and architectural drawings of the proposed structure.

The building is designed as a reinforced concrete structure supported on spread footings that may extend up to five feet below finished grade. The bus bays on the first level will be concrete slabs on grade while the second level parking deck will be poured-in-place post-tensioned concrete. Infill walls will be built with concrete and concrete masonry units.

Construction activities will be typical of a large concrete structure, and will require the use of heavy equipment.

3.2 Construction Schedule

The proposed structure will not require major grading of the site, which is relatively flat. The project will be built at one time and is expected to have a construction period of nine to 12 months, which includes grading, building construction and paving work. A Lease Agreement for the use of the site need to be endorsed by the State's DAGS before the City's DTS can solicit bids for the project. Construction will begin once all land use and ownership issues are resolved and all building permit requirements are granted. A construction start date of October 2009 is anticipated. The transit center is expected to be operational in November 2010**.**

3.3 Estimated Cost

The project cost is estimated at approximately $6 to $6.5 million, which includes planning, design and construction costs.

Section 4.0 Description of the Affected Environment

4.1 Physical Environment

4.1.1 Climate. Like the rest of Hawaii, the area's climate has a low day-to-day and month-to-month variability. The average temperatures are moderate ranging from 68.2 to 75.5 degrees Fahrenheit. The average annual precipitation is 40 inches. The proposed project will not have significant effect on the surrounding climate conditions.

4.1.2 Topography, Geology, Soils. The geologic formation of the site falls under the classification of Tkb--Koolau volcanic series according to H.T. Stearns and the U.S. Geologic Survey entitled "Geologic and Topographic Map, Island of Oahu," USGS, 1938. The U.S Soil Conservation Service "Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai and Lanai, State of Hawaii" dated August 1972 classifies the surface soils as WaA—Wahiawa silty clay. The Unified Soil Classification is MH and has low shrink-swell potential. The soil has low corrosivity for uncoated steel and moderate to low corrosivity for concrete. The area consists of well-drained soils on uplands on the Island of Oahu, and these soils developed in residium and old alluvium derived from basic igneous rock. Its permeability is moderately rapid; runoff is slow and the erosion hazard is no more than slight. The site is fairly level at 0 to 3% slope that generally slopes down gently in a southwesterly direction.

Based on soil borings conducted by the project's soil engineers, soils consisting of very stiff to hard clayey silts were encountered. These residual soils graded with depth to saprolite consisted of silty soils retaining the structure of the parent basaltic rock formation. Weathered basalt rock and remnant boulders were encountered in some borings at depths as shallow as about seven to 10 feet. In some borings, after penetrating these stony horizons, the borings encountered saprolitic materials again to the maximum depth explored of approximately 31.5 feet below the existing ground surface. Water was not noted in the borings during the field exploration.

The project site may be classified as a "Very Dense Soil and Soft Rock" site based on the average penetration resistance (N-values) and the undrained shear strength of the sub surface materials encountered below the foundation sub grade level and the geology of the area. The seismic design of the building structure at the site may be designed based on a Soil Profile Type Sc in accordance with Table 16-J of the Uniform Building Code (1997).

4.1.3 Hydrology. The closest fresh water feature is Lake Wilson, which is 2,640 feet eastward of the project site. Ground water for the area is basal water in sediments or floating in salt water and is not a source of domestic use.

No adverse impacts are expected on surface or ground water. Since the site is relatively flat, ground water run-off to the lake is not expected. In addition, surface drainage will be collected by drain inlets and directed to existing, underground municipal systems.

4.1.4 Terrestrial Flora and Fauna. Portions of the affected property contain trees and shrubbery introduced during the development of the site. The project site is urban and surrounded by commercial and public uses that are not conducive to habitat for rare and endangered flora and fauna.

Four trees will be impacted by the project. Monkeypod 1(Samanea Saman), growing adjacent to California Avenue, is the only tree located within the project limits. Hong Kong Orchid 2 (Bauhinia x Blakeana), a street tree immediately adjacent to the project site, is within the City right of way (ROW) on Center Street but is also directly impacted by the proposed construction. In addition, there are two monkeypod trees (Monkeypod 3 & Monkeypod 4) growing in the Wahiawa Civic Center landscaping that are sufficiently close to the proposed project site. Construction activities that will occur within their root zones may affect them adversely.

An Arborist Report (Appendix A) prepared by Carol Kwan Consulting LLC was completed in December 2008. The report recommends that Monkeypod 1 be removed from the site and replaced with two each (2 ea.) 4"-6" caliper Field Stock (F.S.) monkeypod trees at Kahi Kani Park on Whitmore Avenue in Wahiawa (Whitmore Village). The report also recommends that the Hong Kong Orchid 2, which has numerous defects and is not suitable for relocation, should be removed from the site. A new 25-gallon Hong Kong Orchid street tree will replace this tree, but will be replanted to where a street tree stump is now located on Center Street. The City departments that have jurisdiction over the new sites where the new trees will be planted have agreed to the replacements.

The report further recommends that Monkeypod 3 and Monkeypod 4 –both in good condition-- should be protected from construction damage. The preparation and implementation of a Tree Protection Plan is recommended and will be part of the project's specifications.

The report further states that many individuals and groups concerned with the disposition of the trees were contacted, particularly the Outdoor Circle, a non-profit organization whose mission includes tree advocacy.

4.1.5 Scenic and Visual Resources. No significant visual resources are in the vicinity. The proposed transit center will not significantly impact the surrounding areas.

4.1.6 Historical, Cultural and Archaeological Resources. The project site does not contain any known sites of historic or cultural significance and is not listed on either the Hawaii or National Registers of Historic Places. An archaeological and cultural impact evaluation for the proposed project is attached in Appendix B. This report notes that there will be no adverse impact to historical or cultural resources with the implementation of the project.

Should any unidentified archaeological resources be encountered during construction, all work will cease and the Historic Preservation Office will be contacted for review and approval of mitigation measures. The project will be designed to create an architectural character and quality compatible to the ambience of Wahiawa.

4.1.7 Noise Quality. Potential noise impacts are expected from construction activities and during the operational phase of the transit center. Construction impacts will be temporary and localized, and are the normal result of construction related activity. The State Department of Health administers rules and regulations relating to the hours during which construction is permitted and the noise levels permitted.

Noise generated during the operation of the facility is expected from increased traffic due to convergence of buses at the same time, and from the noise typically generated by people milling about in a public area. The peak activities at the transit center are expected to occur from 6:45 A.M. to 8:30 A.M. and from 3:45 P.M. to 5:30 P.M.

4.1.8 Air Quality. The major factor affecting air quality in the area is vehicular traffic. Emission levels will increase with the operations of the transit center. According to studies prepared for this project, the resulting increase in air pollution due to bus emission was found to be relatively smaller than the significant emission rates as defined in the Hawaii Administrative Rules. The study states that it is unlikely that any measurable impacts on air quality will occur. Implementing measures for long term impacts from the proposed project is unnecessary and unwarranted. Please refer to Appendix C -- Air Quality Environmental Assessment Final Report dated June 2002.

4.1.9 Water Quality and Water Services. The property is located within the Board of Water (BWS) 1075 water system service zone, served by the 2.0 MG Glen Avenue Reservoir, maintained by the Board of Water Supply (BWS), in sizes suitable for delivering required quantity of water for domestic use and fire protection. The project will be served by new waterlines that will connect to an existing 12-inch waterline on California Avenue or to the 8-inch main along Center Street. The water source is groundwater, supplied by the BWS Walker Avenue wells and Wahiawa Well II (located near the intersection of California Avenue and Mahele Street). The estimated daily water usage is 150 gpd or less for the single compartment unisex toilet for staff use.

Fire Protection is provided by fire hydrants along California Avenue and Center Street. All water connectivity, fire apparatus accessibility and protection plans will be reviewed and approved by BWS, the Fire Department and DPP prior to construction.

The existing off-site water system is adequate to accommodate the proposed project. The BWS approved Reduced Pressure Principle Back Flow Prevention Assemblies will be installed where appropriate. No adverse impacts are anticipated on surface water or ground water since the project does not include injection wells or cesspools. Any runoff or wastewater disposal required for the project will be done in full compliance with County, State and Federal guidelines.

4.1.10 Wastewater. Wastewater from this site is transported along California Avenue to the Wahiawa Waste Water Treatment Plant (WWTP). The project's impact on the municipal waste water system is not significant. A sewer connection permit for the increase in wastewater flow is still necessary for the responsible City agency to allow the connection.

4.1.11 Hazardous Materials/Hazardous Waste. Hazardous materials or hazardous waste are not found within the premises of the site. The current uses of the site—as part of the Wahiawa Civic Center—preclude its use as storage for hazardous materials and waste.

4.2 Socio-Economic Environment

4.2.1 Population Data. The State Data Book 2000 lists the population of Wahiawa at 38,370 in 2000 or 25 percent of Central Oahu's total population of 149,000. This is expected to grow to 43,250 in 2025 when Central Oahu's population increases to 173,000. No significant change in the population size or mix is expected to occur due to this project.

4.2.2 Surrounding Land Use and Community Character. The site is surrounded by properties used for commercial uses and public facilities. The scale and feeling of Wahiawa as a small "country town" is clearly evident in the areas surrounding the subject property. Its plantation heritage and multi-cultural roots are reflected in the neighboring buildings surrounding the site. The location of the transit center at the proposed site enhances the immediate area as a town core and setting for social, civic and commercial interactions. The project is also being kept at a scale and design intended to complement surrounding structures.

4.3 Public Facilities and Services

4.3.1 Schools and Recreational Facilities. Wahiawa has both public and private schools. The students of these schools will benefit significantly from the introduction of a community transit center since this allows better mobility for students who generally rely on public transportation. The parks in close proximity to the project site are the Wahiawa Botanic Garden and the Wahiawa Freshwater Park. Public use and access to both parks are significantly enhanced by the development of the project.

4.3.2 Police and Fire Protection. Substations providing police and fire protection services are relatively near and are adequate to serve the transit center & park and ride facility.

4.3.3 Medical and Health Facilities. The Wahiawa General Hospital is located across Center Street. The project will not have adverse impacts on the facility, but provides the necessary public transport for residents to access its services.

4.3.4 Transportation Facilities and Accessibility. Wahiawa Town has experienced minimal growth with traffic demands in the general vicinity of the proposed project, remaining relatively stable in recent years. The existing roadway network impacted by the project consists of California Avenue, North Cane Street, Lehua Street and Center Street. California Avenue is a four-lane roadway with a right-of-way of 66 feet. It is fully improved with curb and gutter on both sides with a posted speed limit of 25 mph. North Cane Street is a two-lane roadway that dead-ends approximately two blocks away and has an approximate right of way of 80 feet. It has a posted speed limit of 25 mph. Lehua Street is a two-lane roadway parallel to the site on the west and has an approximate right-of-way of 70 feet and a posted speed limit of 25 mph. Center Street is a two-lane roadway that is parallel to California Avenue to the North, and is fully improved with curb and gutter. It has parallel parking on both sides of the street and an approximate right of way of 79 feet.

The first traffic study was prepared in 2002 and included as an appendix in the Draft Environmental Assessment published in November 2005. A second traffic study was initiated in 2008 to ascertain that traffic conditions have not significantly changed since 2002 when the first traffic study was conducted. This study also takes into account conditions imposed by the new design concept and the lease agreement between the City and DAGS. The report is attached as in Appendix D.

The new design concept consists of a transit center on the ground floor with parking provided on a second level. Vehicular ingress/egress to the bus bays on the ground level is via California Avenue and Center Street. Automobile entry and exit to the upper level parking area of 58 parking stalls are via ramps accessible only on Center Street.

The 2008 traffic study concludes that traffic volumes on the roadways surrounding the project site will increase as a result of the project. However, traffic operations of individual movements at intersections would operate adequately at LOS “C” or better conditions. Based on the analysis of the traffic data, the following are also recommended:

- Maintain sufficient sight distance for motorists to safely enter and exit all project driveways/roadways.

- Maintain adequate on-site loading and off-loading service area and prohibit off-site loading operations on public streets

- If applicable, maintain adequate turn-around area for service, delivery, and refuse collection vehicles to maneuver on the project site to avoid vehicle-reversing maneuvers into public roadways

- Maintain sufficient turning radii at all project driveways /roadways to avoid or minimize vehicle encroachments to oncoming traffic lanes by buses and passenger vehicles.

With the implementation of the recommendations listed above, the study reiterates that the proposed Wahiawa Transit Center and Park & Ride structures are not expected to have a significant impact on traffic operations in the project vicinity.

4.3.5 Water and Sewer. Water and sewer services are discussed under Section 4.1.9 and 4.1.10 respectively.

4.3.6 Ground Drainage. The site is flat, and any surface drainage will be collected by drain inlets and directed towards the California and Center Streets. The proposed drainage system will connect to existing, underground municipal systems on those two streets.

4.3.7 Solid Waste. No significant amounts of solid waste will be generated by the project once it becomes operational. Solid waste disposal from the site will be handled by the responsible City agency.

4.3.8 Electrical, Telephone and Cable Service. The Hawaiian Electric Company (HECO) distribution system in the vicinity consists of aerial 12 kv primary distribution and aerial secondary distribution system conductors. The aerial lines exist along the north or Wahiawa Hospital side of Center Drive and the north or project side of California Avenue. A power pole on California Avenue owned by HECO will need to be relocated to accommodate this project. The new pole location, cost and schedule for relocation is still under study by HECO.

The land based phone system (Hawaiian Telcom) in the area consists of aerial cables that are supported from joint poles—the same ones which support the electrical lines. Aerial CATV lines run parallel to the other utilities and are supported from the same poles.

Section 5.0 Relationship to Federal, State and City & County Land Use Plans and Policies

5.1 Federal

5.1.1 A Categorical Exclusion (CE) was granted for this project under 23 CFR 771.117(d)(10) which exempts the construction of bus transfer facilities in commercial or high activity centers with adequate street capacity as described in relevant provisions of the National Environmental Policy Act (NEPA).

5.1.2 The Americans with Disabilities Act (ADA) of 1990 provides guidelines for development of accessibility to buildings and facilities by individuals with disabilities. The proposed community transit center will apply these guidelines during the design and construction and operation of the center.

5.2 State of Hawaii

5.2.1 Hawaii State Plan. The Hawaii State Plan (Chapter 226, Hawaii Revised Statutes) provides a guide for the future of Hawaii by setting forth a broad range of goals, objectives, and policies. These serve as guidelines for growth and development of the State of Hawaii. The proposed project is consistent with the Hawaii State Plan.

Section 226-13: Physical Environment – Land, Air and Water Quality. The proposed transit center will achieve the objective of planning for the State's physical environment by pursuing development activities in a manner that is compatible to the surrounding Wahiawa community and consistent with the Federal, State and County regulations.

5.2.2 State Functional Plans. The Hawaii State Functional Plan (Chapter 226) provides a management program that allows judicious use of the State's natural resources to improve current conditions and attend to various societal issues and trends. The proposed project is generally consistent with the State Functional Plans.

5.2.3 State Land Use Law. The State Land Use Commission classifies the subject property as Urban. The proposed transit center conforms to the State Urban classification of Chapter 205, Hawaii Revised Statutes and State of Hawaii Land Use Commission Rules (Hawaii Revised Statutes, Chapter 205; Hawaii Administrative Rules, Title 15, Subtitle 3, Chapter 15).

5.2.4 Coastal Zone Management Act. The proposed transit center is not located on the coastline or shoreline and does not involve coastal resources. In any event, the facility will be designed in a manner that will not negatively impact the coastline, its resources and the surrounding community.

5.3 City and County of Honolulu

The City & County General Plan provides a statement of long range social, economic, environmental, and design objectives for the Island of Oahu. It also includes a statement of policies necessary to meet these objectives.

5.3.1 General Plan. The proposed Wahiawa Community Transit Center is consistent with, and supports the following objectives and policies of the General Plan:

Objective A "To create a transportation system which will enable people and goods to move safely, efficiently, and at a reasonable cost; serve all people, including the poor, the elderly, and the physically handicapped; and offer a variety of attractive and convenient modes of travel."

Policy 1: "Develop and maintain an integrated ground transportation system consisting of the following elements and their primary purposes."

Policy 3: "Provide transportation services outside Ewa, Central Oahu, and Pearl City-Hawaii Kai corridors primarily through a system of express and feeder buses as well as through the highway system with limited to moderate improvements sufficient to meet the needs of the communities being served."

Policy 9: "Promote programs to reduce the dependence on the use of automobiles."

5.3.2 Central Oahu Sustainable Communities Plan. One of the elements of the vision for Central Oahu is the creation of communities designed to reduce automobile usage by providing easy access to transit.

5.3.3 Wahiawa Town Master Plan. In 1994, the Wahiawa Town Plan that was accepted by the City Council as Resolution 94-269, includes a strategy to build a civic center to house state agencies, a satellite City Hall and Judiciary facilities. The intent was to build a civic center that could provide government services and thereby eliminate travel to Honolulu. The proposed transit center is envisioned to complement, and encourage access to the civic center via use of public transportation systems.

5.3.4 Wahiawa Urban Design Plan. A number of community meetings and workshops were held in 1996 and 1997, and by August 1998 the Wahiawa Urban Design Plan was transmitted to the City Council. Among the general policies drawn from this community-based planning process was to " enhance the town core as a setting for social, civic, and commercial transactions." Wahiawa's government offices have historically provided services to both upland Central Oahu and to North Shore communities. Its town core also played a role as a regional civic and shopping center. The consolidation of public services and the location of more social and community service organizations in the town will strengthen its civic center. Locating the transit center in close proximity to the civic center and commercial entities reinforces the community's vision for Wahiawa.

The proposed transit center project will retain existing street trees along California Avenue, Kilani Avenue and North Cane Street, and will also retain other trees on site when feasible. These landscaping features will be consistent with the following recommendations of the "Streetscapes of Wahiawa" section of the Wahiawa Urban Design Plan which was approved by the City Council as Resolution 98-262.

> "Provide streetscape improvements along the business-zoned frontages of Kamehameha Highway, California Avenue, Kilani Avenue, North Cane Street, and Wilikina Drive. Improvements could include street trees, theme street lighting, low walls, and enhanced sidewalk paving."

As described in Section 4.1.4 Terrestrial Flora and Fauna, there are four mature trees that will be impacted by the project. Two will need to be removed from their existing locations to make way for the structure. The other two will need pruning to provide sufficient clearance between their canopies and the structure. See the Arborist Report completed in December 2008 and attached as Appendix A.

Section 6.0 Alternatives to the Proposed Action

6.1 No Action

The No-Action alternative would result in lost opportunity to provide an efficient and viable system that encourages use of City buses for public transport.

6.2 Alternative Sites

The alternative site considered for the facility is Center Street, which is City owned. The site was deemed unacceptable by members of the Wahiawa community. The Wahiawa residents, through a series of community dialogues, have expressed a preference for the project site due to its accessibility to and from other community resources and facilities. The project site is also of walking distance to Wahiawa Botanical Gardens where meeting rooms for the use of the community have recently been completed.

6.3 Alternative Uses

The State of Hawaii has alternative plans for the site. The State has plans to develop the area for a new Wahiawa Civic Center that would house State offices, Judiciary facilities and vehicular parking. The design recommendation includes the construction of a two level parking structure on Center Street that is owned by the City & County of Honolulu. However, the State and City has reached an agreement for the use of TMK 7-4-06:02 and 10,250 SF portion of TMK 7-4-06:012 as the site of the transit center and park and ride facility which will allow the State to proceed with its plans to construct the Judiciary and other State offices on the same site.

6.4 Recommended Action

The recommended action is to proceed with the proposed structure on the site.

Section 7.0
Relationship Between Local Short-term Uses and the Maintenance and Enhancement of Long Term Productivity

No short-term exploitation of resources resulting from the proposed transit center will have long term adverse consequences. Major impacts such as the increased bus and pedestrian traffic to the site will increase noise and emission levels. However, recent studies show that no measurable negative impacts on air quality will occur with the proposed project.

Long-term gains will be the increased consumer use for the commercial entities surrounding the site. The convergence of different public services and commercial entities within walking distance to the site increases the accessibility of public services to the community, and the use of public transport is encouraged.

Section 8.0
Irreversible/Irretrievable Commitment of Resources by the Proposed Action

Development of the proposed facility will involve the irretrievable loss of certain environmental and fiscal resources. However the costs associated with the use of these resources should be evaluated in light of the long term benefits to Wahiawa Town, the City & County of Honolulu and the State.

Section 9.0
Summary of Impacts

9.1 Summary of Impacts

9.1.1 Physical Impacts. No long term negative physical impacts are anticipated with the implementation of the proposed action. Short-term construction related impacts are anticipated but should be adequately mitigated through the use of sound construction practices.

A Traffic Management Plan will be provided for each aspect of the construction that will determine which adjacent streets will be closed off, and the mitigation measures to reduce the impacts. The Traffic Management Plan will also provide mitigation measures to minimize impacts on pedestrian traffic and will also include provisions that will allow the uninterrupted use of the existing cross walks.

Beneficial impacts include the provision of efficient and logical routing and scheduling of public bus transport which encourages less dependence on the personal automobile.

9.1.2 Impacts on Public Facilities and Services. The proposed project will allow greater public accessibility to all public facilities and services.

9.1.3 Socio Economic Impacts. No long-term negative impacts are anticipated to the socio-economic environment as a result of the proposed action. A short-term benefit of the project is the creation of employment in the planning, design and construction industries. The long-term benefits are the provision of a community transit center that encourages the use of public transport and reduces the residents' dependence on the automobile.

9.2 Need for an Environmental Impact Statement (EIS)

Because no long-term adverse impacts are anticipated to the proposed project, it is expected that an Environmental Impact Statement is not required.

9.3 Significance

According to the Department of Health Rules (Chapter 11-200-12), an applicant must determine whether an action may have a significant impact on the environment. These would include (1) all phases of the project; (2) its expected primary and secondary consequences; (3) its cumulative impact with other projects; and (4) its short and long-term effects. The Rules establish a Significance Criterion to be used as a basis for identifying whether significant environmental impact will occur. According to the Rules, an action shall be determined to have a significant impact on the environment if it meets any of the following criteria.

1. *Involves an irrevocable commitment to loss or destruction of any natural or cultural resource.* The project will not require the loss or destruction of any natural or cultural resource, but will encourage conservation of a non-renewal resource such as oil-based fuel.

2. *Curtails the range of beneficial uses of the environment.* The project will be built on previously developed land. Therefore, it will not negatively impact other beneficial uses.

3. *Conflicts with the state's long term-environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders.* The project does not conflict with any long term environmental policies, goals and guidelines.

4. *Substantially affects the economic or social welfare of the community or State*. The project could have a significant positive effect on the economic welfare of the community by reducing the residents' use of non-renewable fuel sources.

5. *Substantially affects public health*. The project will improve public health by encouraging use of public transport--thus reducing use of private automobiles and the resulting air emissions generated. It will also encourage residents to access public services located around the transit center on foot—which will contribute to a healthier and active lifestyle.

6. *Involves substantially secondary impacts, such as population changes or effects on public facilities.* The project will not have significant adverse secondary impacts on public facilities.

7. *Involves a substantial degradation of environmental quality*. The project will not substantially degrade the environmental quality. Existing trees (2) will be removed and new trees will be planted near the Civic Center site or on City parks whenever feasible.

8. *Is individually limited but cumulatively has considerable effect on the environment, or involves a commitment for larger actions.* The project is part of a statewide system of transit centers, however, the development will not have a considerable negative impact on the environment.

9. *Substantially affect a rare, threatened or endangered species or its habitat*. The project will not affect rare or threatened species or habitat.

10. *Detrimentally affects air or water quality or ambient noise levels.* The project will not detrimentally impact air or water quality.

11. *Affects or is likely to suffer damage by being located in an environmentally sensitive area such as flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, freshwater or coastal waters*. The project will not be developed in an environmentally sensitive area.

12. *Substantially affects vistas and view planes identified in County or State plans or studies*. The project will not impact any scenic or view planes.

13. *Requires substantial energy consumption*. The project will not require substantial amounts of energy to complete. In fact, when in operation, the project will reduce the consumption of non-renewal fuel sources typically used by automobiles.

14. *Adheres to the concepts of environmental justice*. The project will not displace any ethnic groups or populations.

Section 10.0
Necessary Permits and Approvals

10.1 Federal

No Federal permits are required. A Categorical Exclusion (CE) was granted for this project under 23 CFR 771.117(d)(10) which exempts the construction of bus transfer facilities in commercial or high activity centers with adequate street capacity, as described in relevant provisions of the National Environmental Policy Act (NEPA).

10.2 State of Hawaii

The State requires the preparation of an Environmental Assessment. If the State provisions are addressed, the applicant can determine that an Environmental Impact Statement (EIS) will not be required, and can then issue a FONSI (Finding of No Significant Impact) for this project.

A Lease Agreement for the use of the site need to be endorsed by the State's DAGS before the City's DTS can solicit bids and initiate construction.

10.3 City & County of Honolulu

Prior to obtaining the building permit, it will be necessary to secure all applicable reviews and approvals from regulating agencies. Approvals for construction plans affecting City streets will also be required. The applicant has not sought approval for the following permits since the Lease Agreement for the use of the site is still under discussion with the State's DAGS.

- Zoning Waivers as discussed in Section 1.5
- Conditional Use Permit (Minor) for Joint Development of Two Adjacent Zoning Lots
- Grading, Grubbing, and Stockpiling
- Permit to Excavate Public Right of Way
- Sewer Connection
- Connection to the City's Storm Sewer System
- Building Permits for Building, Electrical, Plumbing, Sidewalk/Driveway
- Certificate of Occupancy
- Water Connection/Facilities Charges

Section 11.0 References

Geolabs, Inc. GEOTECHNICAL ENGINEERING EXPLORATION, WAHIAWA TRANSIT CENTER PROJECT, WAHIAWA, OAHU, HAWAI`I. SEPTEMBER 2005

Hawai`i Department of Business, Economic Development & Tourism. THE STATE OF HAWAI`I DATA BOOK 2000. Honolulu, 2001.

Honolulu Department of Planning and Permitting. CENTRAL OAHU SUSTAINABLE COMMUNITIES PLAN. Honolulu, February 2002.

Honolulu Department of Transportation Services. OAHU TRANS 2K, ISLANDWIDE MOBILITY CONCEPT PLAN. Reprinted with updates August 2001.

Juvik, Sonia P. and James O., eds. ATLAS OF HAWAII. 3d ed. Honolulu: University of Hawaii Press, 1998.

Park, Gerald. FINAL ENVIRONMENTAL ASSESSEMENT WAHIAWA SATELLITE CITY HALL RELOCATION. Honolulu: City Building Department, May 1996.

Toyomura, Dennis T. WAHIAWA CIVIC CENTER CONCEPTUAL DESIGN REPORT. Honolulu: State Division of Public Works, April 1996.

Section 12.0
Preparation of the Draft Environmental Assessment: Pre-Consultation Responses

The following agencies and individuals responded to the project's letter of consultation sent out in 2005. The list of agencies and individuals who were recipients of the letter, and copies of the responses are enclosed in Appendix E.

Federal Agencies
U.S. Department of Interior

State Agencies
Hawaii Department of Accounting and General Services
Hawaii Department of Business, Economic Development and Tourism
Hawaii Department of Education
Hawaii Department of Hawaiian Home Lands
Hawaii Department of Health
Hawaii Department of Transportation
Office of Hawaiian Affairs

City & County Agencies
C&C Department of Parks & Recreation
C&C Department of Planning & Permitting
C&C Honolulu Fire Department
C&C Board of Water Supply
C&C Police Department

Section 13.0
Responses to the DEA Published in 2005

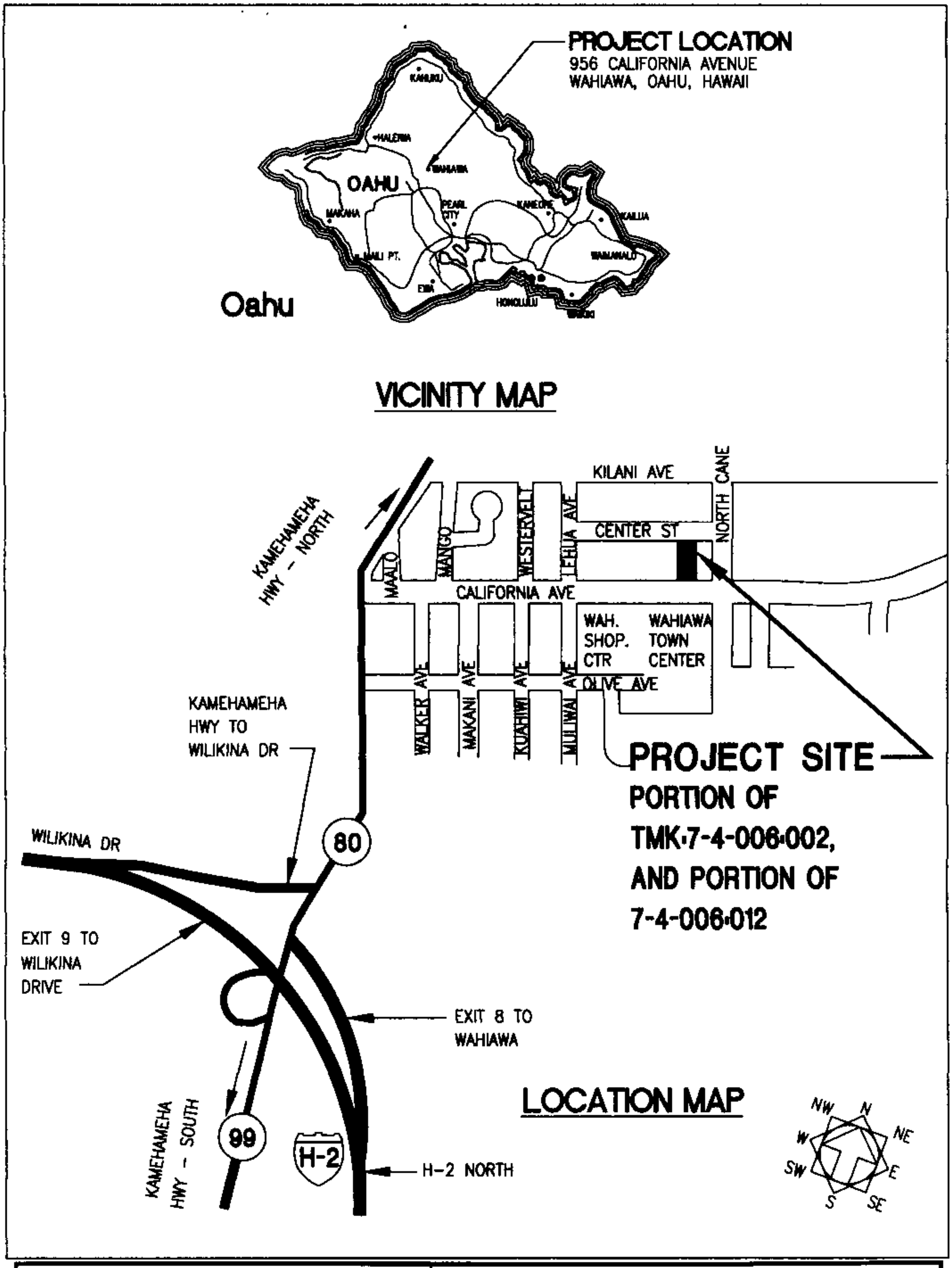
The following agencies responded to the project's Draft Environmental Assessment (DEA) published in November 2005. Copies of the letters are enclosed in Appendix F.

Office of Environmental Quality Control, State of Hawaii
Department of Accounting and General Services, State of Hawaii

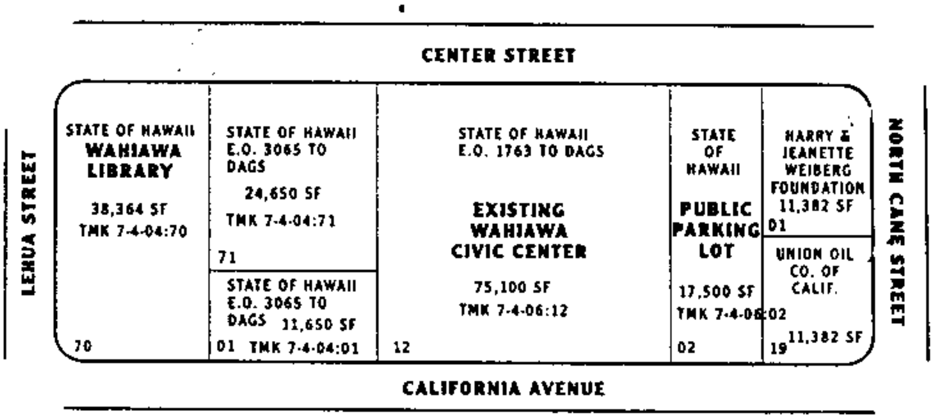
Compilation of
EXHIBITS

Environmental Assessment

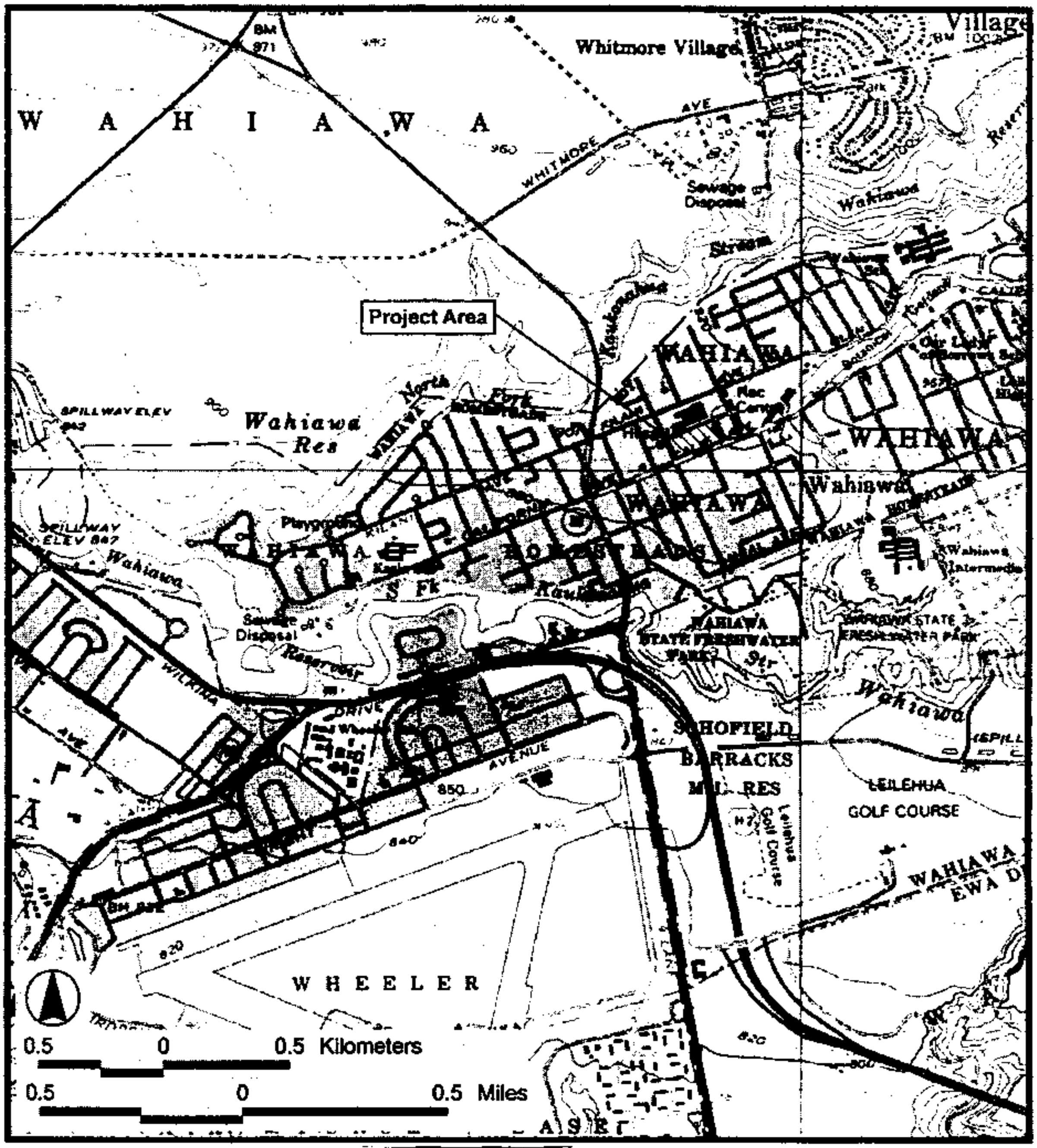
Wahiawa Transit Center & Park and Ride
TMK: 7-4-006:002 & portion of 7-4-006:012
956 California Avenue, Wahiawa, O`ahu, Hawai`i



WAHIAWA TRANSIT CENTER & PARK AND RIDE TMK:7-4-006: 002 & 7-4-006: 012	**Exhibit 1**: Project Location and Vicinity Map



Source: *Wahiawa Civic Center, Conceptual Design Report dated April 1996; Wahiawa District Court, Project Development Report (PDR), dated November 1997; prepared for the Department of Accounting & General Services (DAGS) by Dennis T. Toyumura F.A.I.A.*



WAHIAWA TRANSIT CENTER & PARK AND RIDE TMK:7-4-006: 002 & 7-4-006: 012	**Exhibit 2**: Portion of USGS 7.5 Minute Series Topographic Map and Tax Map Key and Ownership of Affected Parcels

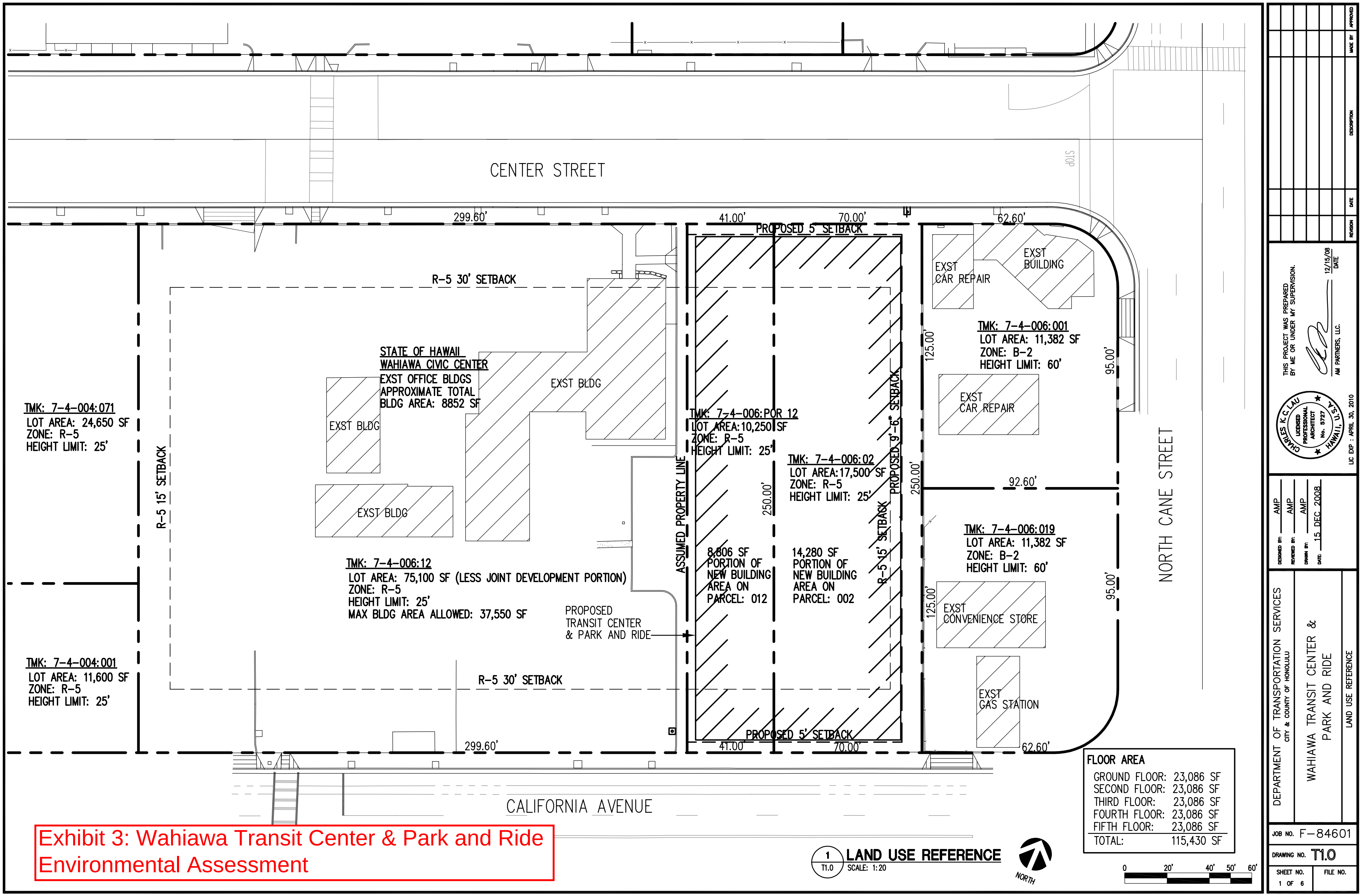


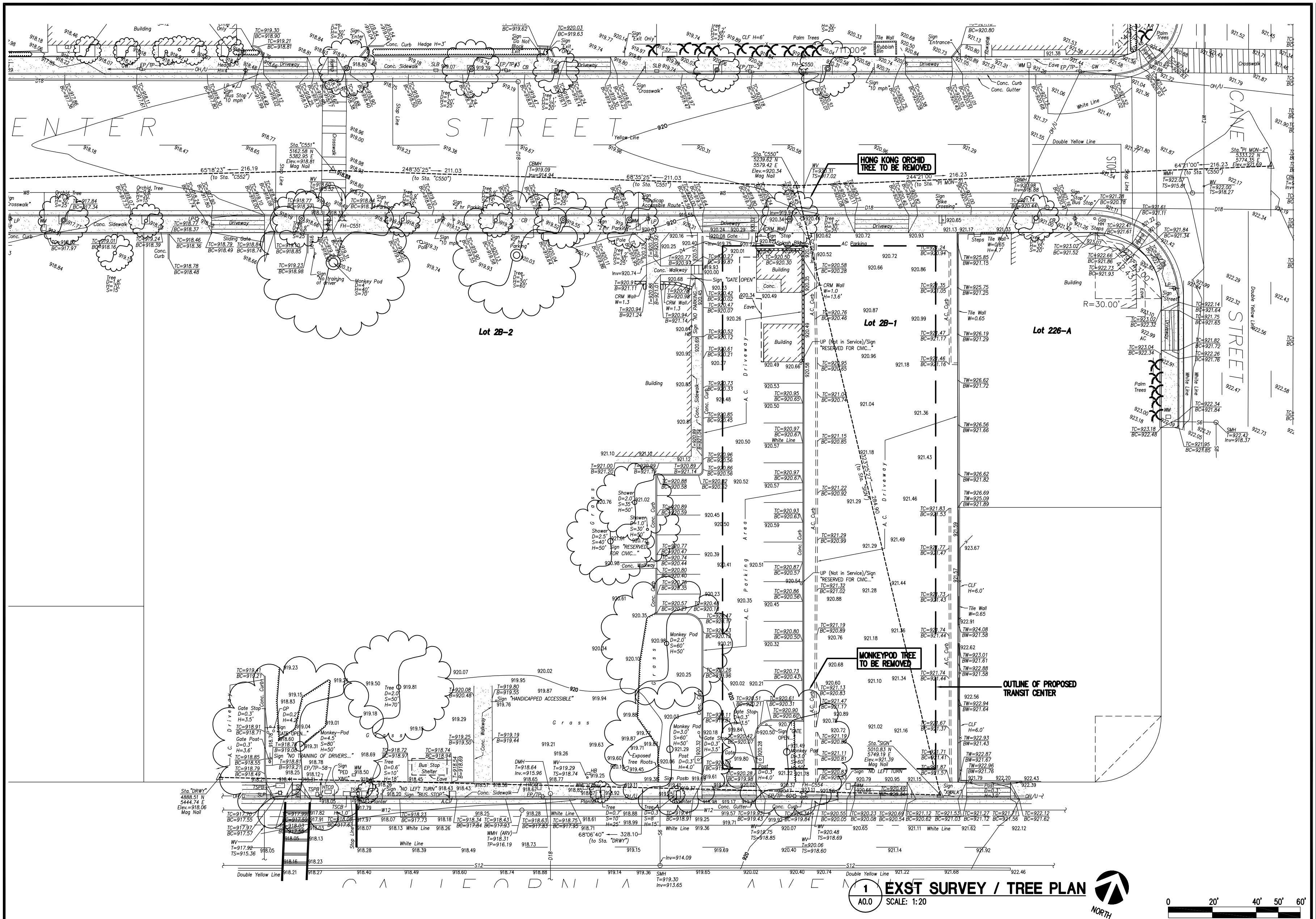
Exhibit 3: Wahiawa Transit Center & Park and Ride Environmental Assessment

Exhibit 4

Topographical Survey and Architectural Drawings

Environmental Assessment

Wahiawa Transit Center & Park and Ride
TMK: 7-4-006:002 & portion of 7-4-006:012
956 California Avenue, Wahiawa, O`ahu, Hawai`i



1 EXST SURVEY / TREE PLAN
A0.0 SCALE: 1:20

REVISION	DATE	DESCRIPTION	MADE BY	APPROVED

THIS PROJECT WAS PREPARED BY ME OR UNDER MY SUPERVISION.

????? DATE

AM PARTNERS, INC.

LIC EXP: APRIL 30, 2010

DESIGNED BY: AMP
REVIEWED BY: AMP
DRAWN BY: AMP
DATE: 15 DEC 2008

DEPARTMENT OF TRANSPORTATION SERVICES
CITY & COUNTY OF HONOLULU

WAHIAWA TRANSIT CENTER & PARK AND RIDE

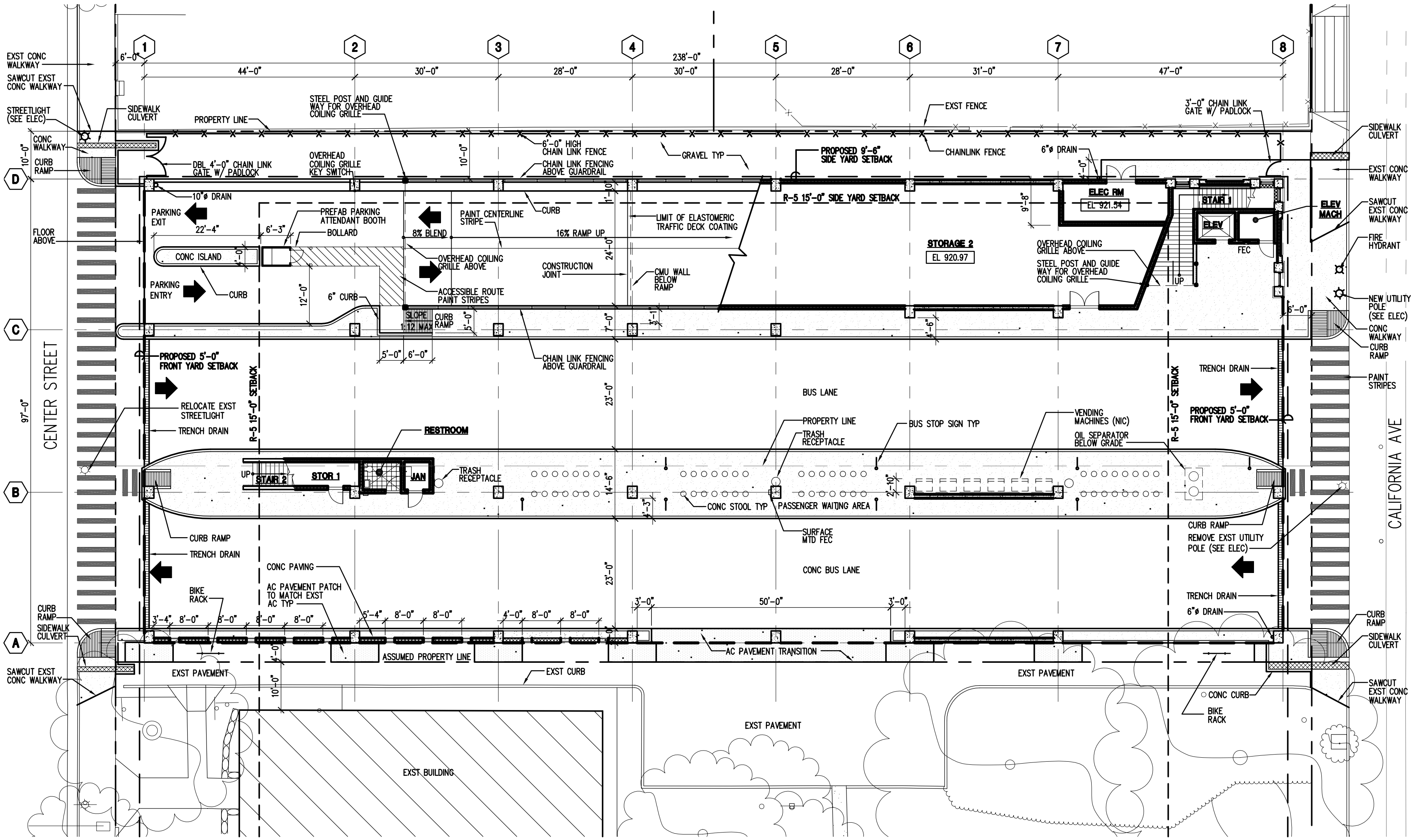
EXSTING SURVEY/TREE PLAN

JOB NO. F-84601

DRAWING NO. A0.0

SHEET NO. 2 OF 6

FILE NO.



NOTES:

1. SEE A4.0 FOR FLOOR FINISHES

1 A1.1 **SITE PLAN / GROUND FLOOR PLAN**
SCALE: 1:10

NORTH

0 10' 20' 25' 30'

REVISION	DATE	DESCRIPTION	MADE BY	APPROVED

THIS PROJECT WAS PREPARED BY ME OR UNDER MY SUPERVISION.

????? DATE

AM PARTNERS, INC.

LIC EXP : APRIL 30, 2010

DESIGNED BY: AMP
REVIEWED BY: AMP
DRAWN BY: AMP
DATE: 15 DEC 2008

DEPARTMENT OF TRANSPORTATION SERVICES
CITY & COUNTY OF HONOLULU

WAHIAWA TRANSIT CENTER & PARK AND RIDE

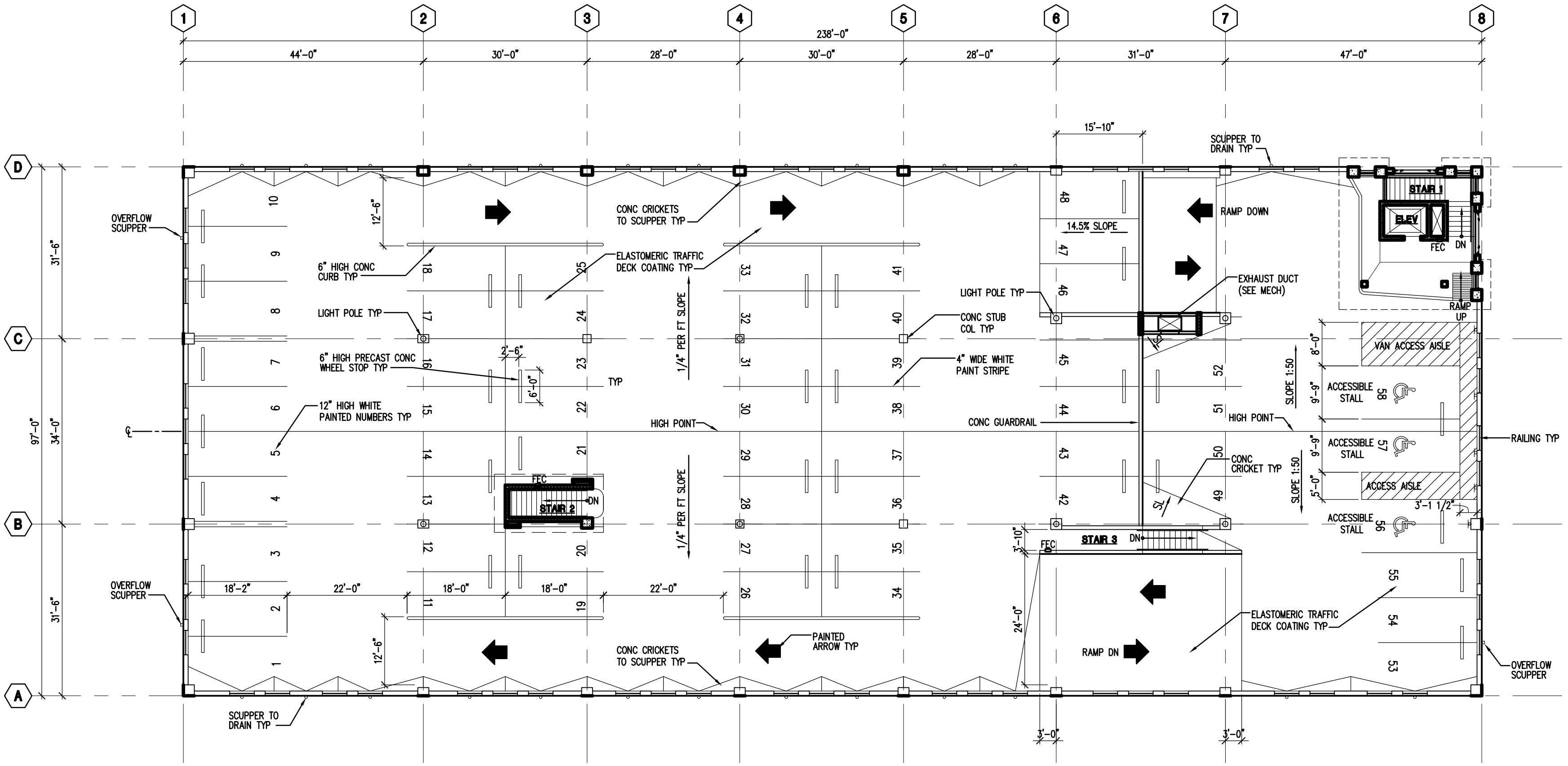
SITE PLAN / GROUND FLOOR PLAN

JOB NO. F-84601

DRAWING NO. A1.0

SHEET NO. 3 OF 6

FILE NO.



1 A2.0 **SECOND FLOOR PLAN**
SCALE: 1:10

REVISION	DATE	DESCRIPTION	MADE BY	APPROVED

THIS PROJECT WAS PREPARED BY ME OR UNDER MY SUPERVISION.
12/15/08 DATE
AM PARTNERS, LLC.
LIC EXP : APRIL 30, 2010

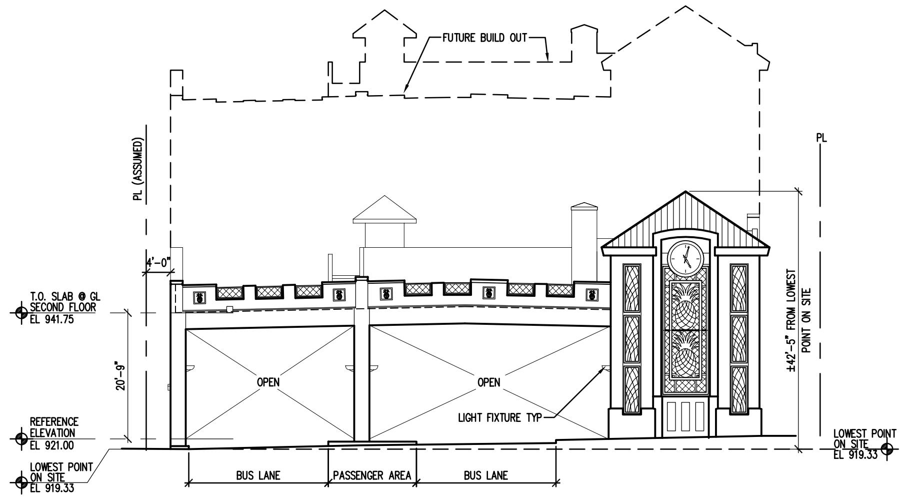
DESIGNED BY: AMP
REVIEWED BY: AMP
DRAWN BY: AMP
DATE: 15 DEC 2008

DEPARTMENT OF TRANSPORTATION SERVICES
CITY & COUNTY OF HONOLULU

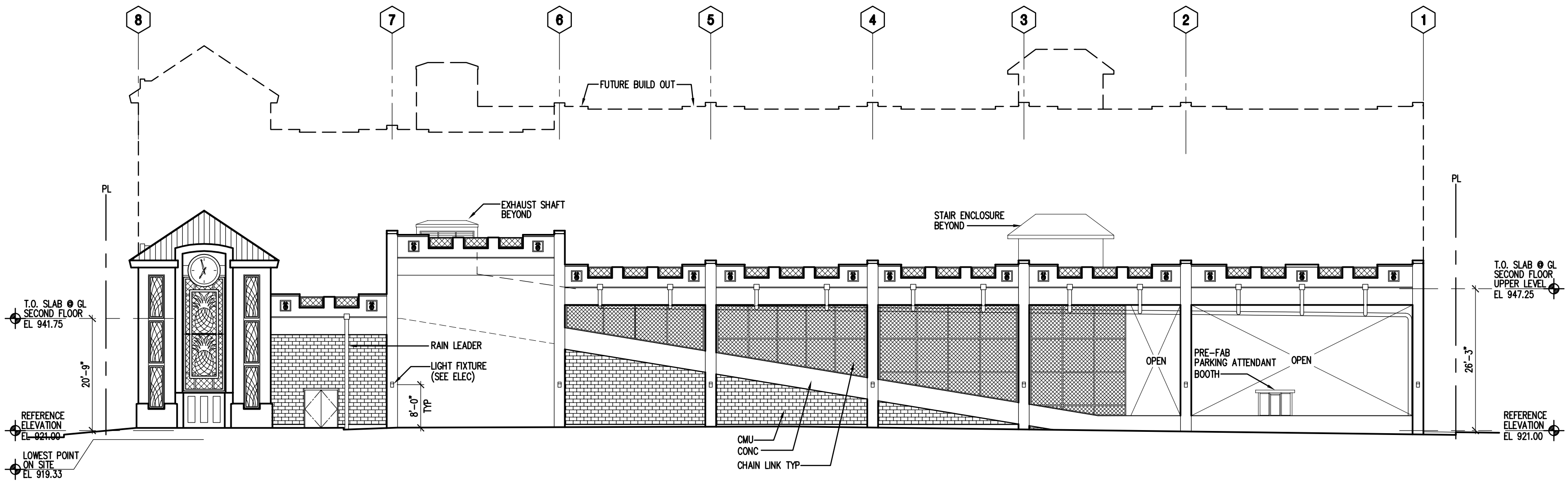
WAHIAWA TRANSIT CENTER & PARK AND RIDE

SECOND FLOOR PLAN

JOB NO. F-84601
DRAWING NO. A2.0
SHEET NO. 4 OF 6
FILE NO.



1 A3.0 **CALIFORNIA AVENUE (SOUTH) ELEVATION**
SCALE: 1:10



2 A3.0 **EAST ELEVATION**
SCALE: 1:10

0 10' 20' 25' 30'

REVISION	DATE	DESCRIPTION	MADE BY	APPROVED

THIS PROJECT WAS PREPARED BY ME OR UNDER MY SUPERVISION.
12/15/08
DATE
AM PARTNERS, LLC.

CHARLES K.C. LAU
LICENSED PROFESSIONAL ARCHITECT
No. 5727
HAWAII, U.S.A.
LIC EXP : APRIL 30, 2010

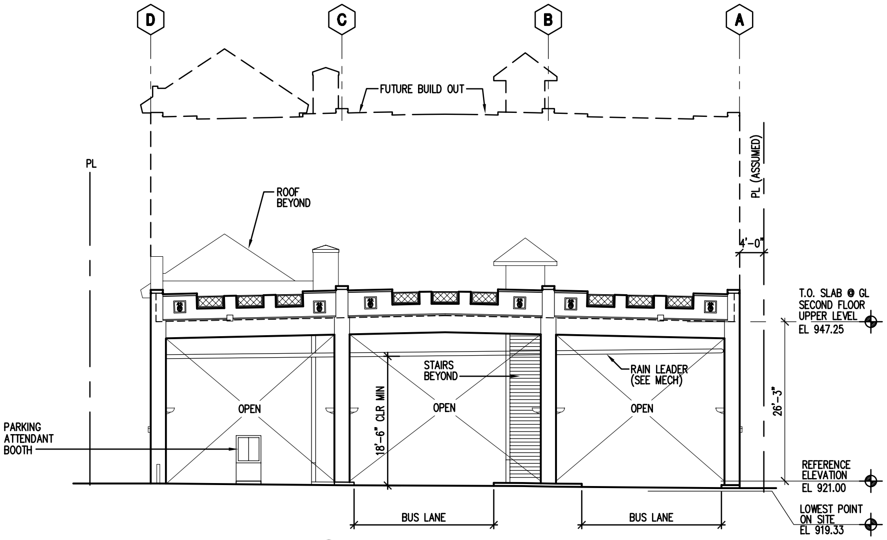
DESIGNED BY: AMP
REVIEWED BY: AMP
DRAWN BY: AMP
DATE: 15 DEC 2008

DEPARTMENT OF TRANSPORTATION SERVICES
CITY & COUNTY OF HONOLULU

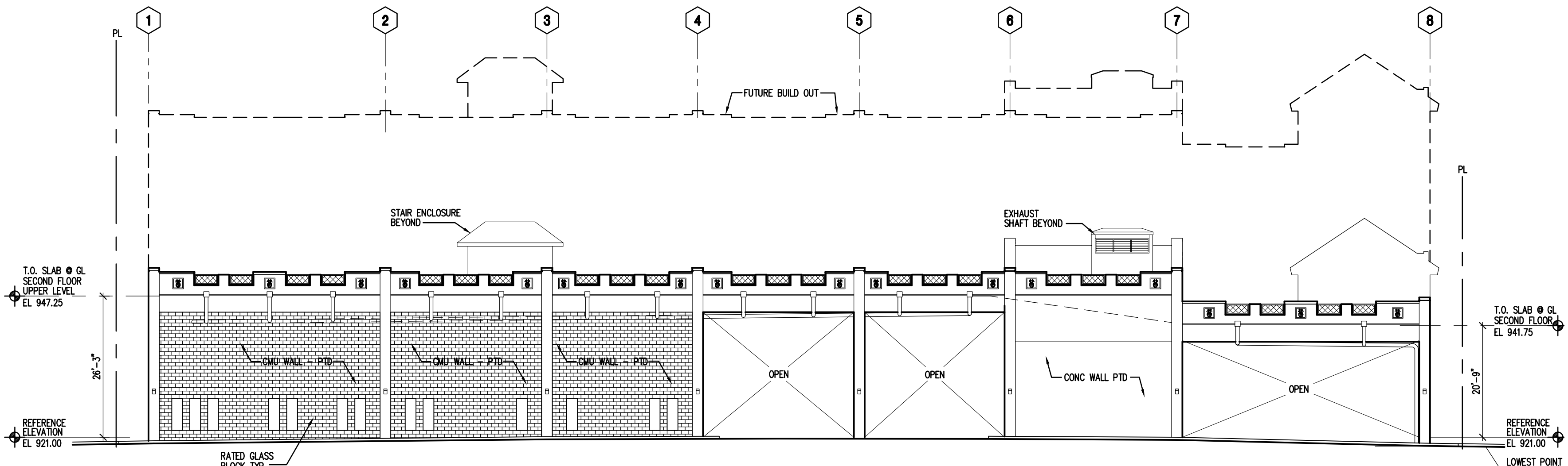
WAHIAWA TRANSIT CENTER & PARK AND RIDE

EXTERIOR ELEVATIONS

JOB NO. F-84601
DRAWING NO. A3.0
SHEET NO. 5 OF 6
FILE NO.



1 A4.0 **CENTER STREET (NORTH) ELEVATION**
SCALE: 1:10



2 A4.0 **WEST ELEVATION**
SCALE: 1:10

REVISION	DATE	DESCRIPTION	MADE BY	APPROVED

THIS PROJECT WAS PREPARED BY ME OR UNDER MY SUPERVISION.
AM PARTNERS, LLC.
12/15/08
DATE

CHARLES K.C. LAU
LICENSED PROFESSIONAL ARCHITECT
No. 5727
HAWAII, U.S.A.
LIC EXP : APRIL 30, 2010

DESIGNED BY: AMP
REVIEWED BY: AMP
DRAWN BY: AMP
DATE: 15 DEC 2008

DEPARTMENT OF TRANSPORTATION SERVICES
CITY & COUNTY OF HONOLULU
WAHIAWA TRANSIT CENTER & PARK AND RIDE
EXTERIOR ELEVATIONS

JOB NO. F-84601
DRAWING NO. A4.0
SHEET NO. 6 OF 6
FILE NO.

Appendix A

Certified Arborist Report

December 15, 2008

Environmental Assessment

Wahiawa Transit Center & Park and Ride
TMK: 7-4-006:002 & portion of 7-4-006:012
956 California Avenue, Wahiawa, O`ahu, Hawai`i

Wahiawa Transit Center & Park and Ride

CERTIFIED ARBORIST REPORT

prepared for

AM Partners LLC
&
The City and County of Honolulu
Department of Transportation Services

December 15, 2008

prepared by

CAROL KWAN
CONSULTING LLC

P.O. Box 893953
Mililani, Hawaii 96789-0953
381-1342, fax 625-4287
ckwan@hawaii.rr.com

Mr. Roland Libby
AM Partners LLC
1100 Alakea Street, Suite 800
Honolulu, Hawaii 96813

Dear Mr. Libby:

Subject: Wahiawa Transit Center & Park and Ride
Certified Arborist Report

As requested, I have inspected the four trees located on or adjacent to the proposed Wahiawa Transit Center & Park and Ride project. My visual inspections were conducted during the period of December 3, 2008 through December 12, 2008. This letter constitutes my findings and recommendations for the Draft Environmental Assessment and includes Tree Assessment Reports as required by the City and County of Honolulu (City) *Guidelines and Standards for Trees in Urban Areas*.

Background

The proposed project will construct a transit center including a park and ride adjacent to the Wahiawa Civic Center between California Avenue and Center Street (TMK 7-4-006:002 and portion of 7-4-006:012). See Figure 1 for a location map and Figure 2 for an aerial photo of the project location. When the project was first proposed to the Wahiawa community, there were many individuals concerned about the disposition of the monkeypod trees *(Samanea saman*. The Outdoor Circle (TOC), a non-profit organization whose mission includes tree advocacy, was contacted by these individuals and became interested in the trees in and around the project. I advised TOC of my recommendations for the trees during the assessment process.

Four trees will be impacted by the project. Monkeypod 1, growing adjacent to California Avenue, is the only tree located within the project limits. Hong Kong Orchid 2 *(Bauhinia* x *blakeana),* a street tree immediately adjacent to the project site, is within the City right-of-way (ROW) on Center Street and is also directly impacted by the proposed construction. In addition there are two monkeypod trees growing in the Wahiawa Civic Center landscaping that are sufficiently close to the proposed project site that construction will occur within their root zones and may affect them adversely. These are Monkeypod 3 and Monkeypod 4. See Figure 3 for a Tree Location Plan.

Overview photos of the site are shown in Figures 4 and 5. Detailed Tree Assessment Report forms and sketches are provided in Appendix A.

Recommendations

1. Monkeypod 1 is located inside of the project site and there is no feasible way to accommodate or protect the tree in place. It is in good condition but is too large to relocate. See Figures 6 through 19 inclusive for photos. It should be removed from the site and replaced with two each (2 ea.) 4”-6” caliper Field Stock (F.S.) monkeypod trees at Kahi Kani Park on Whitmore Avenue in Wahiawa (Whitmore Village). Mr. Dexter Liu of the City Department of Parks and Recreation (DPR) Park Maintenance & Recreational Services has confirmed that this park has suitable planting sites and will be able to accommodate the replacement trees.

2. Hong Kong Orchid 2 is a City street tree abutting the proposed project along Center Street. Due to changes to be made within the ROW with three driveways to be constructed in the limited frontage available, there is no feasible way to accommodate or protect the tree in place. It is in fair condition with numerous defects and is not suitable for relocation. It should be removed from the site. See Figures 20 through 31 inclusive for photos. There is a street tree stump on Center Street towards Lehua Street from Hong Kong Orchid 2. See Figure 32. The stump should be removed and a new 25 gal Hong Kong orchid street tree should be provided at this location as a replacement street tree for Hong Kong Orchid 2. The proposed replacement location has been reviewed by Mr. David Kumasaka of the City’s DPR Division of Urban Forestry (DUF) who has verbally indicated that the replacement location appears to be acceptable subject to review of the project plans.

3. Monkeypod 3 is located within the Wahiawa Civic Center landscaping beyond the construction limits for the proposed project. However, a significant percentage of its root zone is within the project area. It is in good condition and should be protected from construction damage. See Figures 8 and 33 through 43 inclusive for photos. A Tree Protection Plan should be prepared and implemented including fencing to prevent unnecessary entry into the area around the tree, pruning, root pruning, mulching, and temporary irrigation.

4. Monkeypod 4 is located within the Wahiawa Civic Center landscaping beyond the construction limits for the proposed project. However, a significant percentage of its root zone is within the project area. It is in fair condition and should be protected from construction damage. See Figures 35 and 44 through 54 inclusive for photos. A Tree Protection Plan should be prepared and implemented including fencing to prevent unnecessary entry into the area around the tree, pruning, root pruning, mulching, removal of Philodendron for a five foot radius around the trunk, and temporary irrigation.

This report has been prepared by Carol Kwan Consulting LLC (“Consultant”) for the exclusive use of AM Partners LLC and The City and County of Honolulu Department of Transportation Services (Client) regarding **Wahiawa Transit Center & Park and Ride** and at its discretion, other agents hired by Client to perform work related to Wahiawa Transit Center & Park and Ride. In the completion of the investigation and the preparation of this report, Consultant strived to perform services in a manner consistent with that level of care and skill ordinarily exercised by members of the arborist profession practicing under similar conditions in Hawaii. No warranty, either expressed or implied, is made. This report shall not be reproduced or relied upon except by Client or with the express written consent of Consultant.

Thank you for the opportunity to be of assistance. Should you have any questions regarding this report, please feel free to contact me at (808) 381-1342 or via e-mail at ckwan@hawaii.rr.com.

Respectfully submitted,

CAROL KWAN CONSULTING LLC

Carol L Kwan

Carol L Kwan
President and Certified Arborist

Enclosures:
Figures
Appendix A – Tree Assessment Report Forms and Sketches

Wahiawa Transit Center & Park and Ride
Certified Arborist Report
Figures

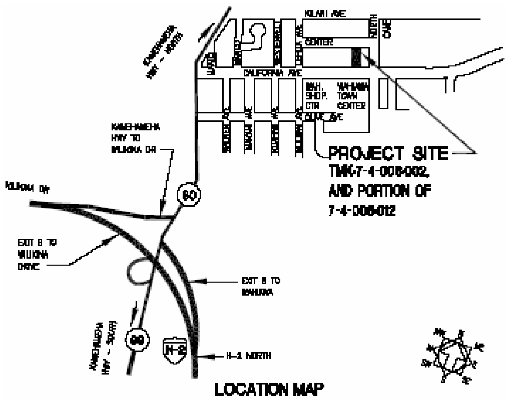


Figure 1

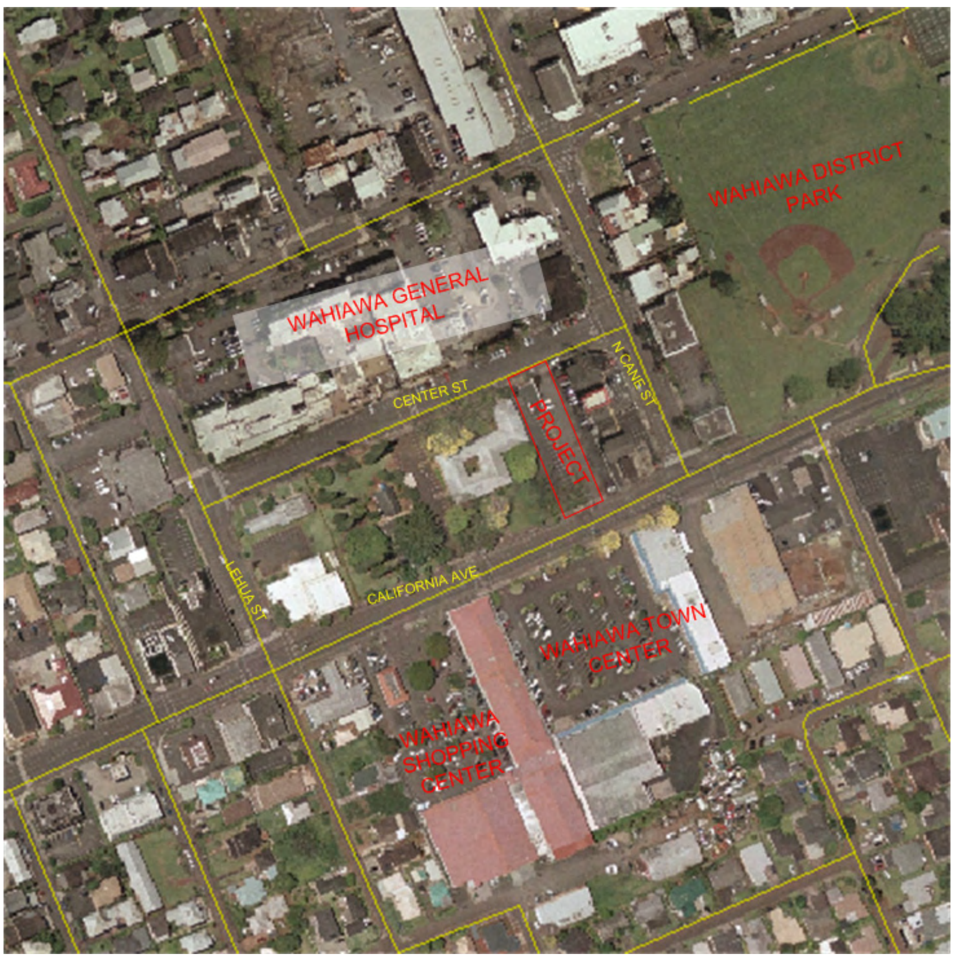


Figure 2

Project location. Base photo courtesy of NASA.

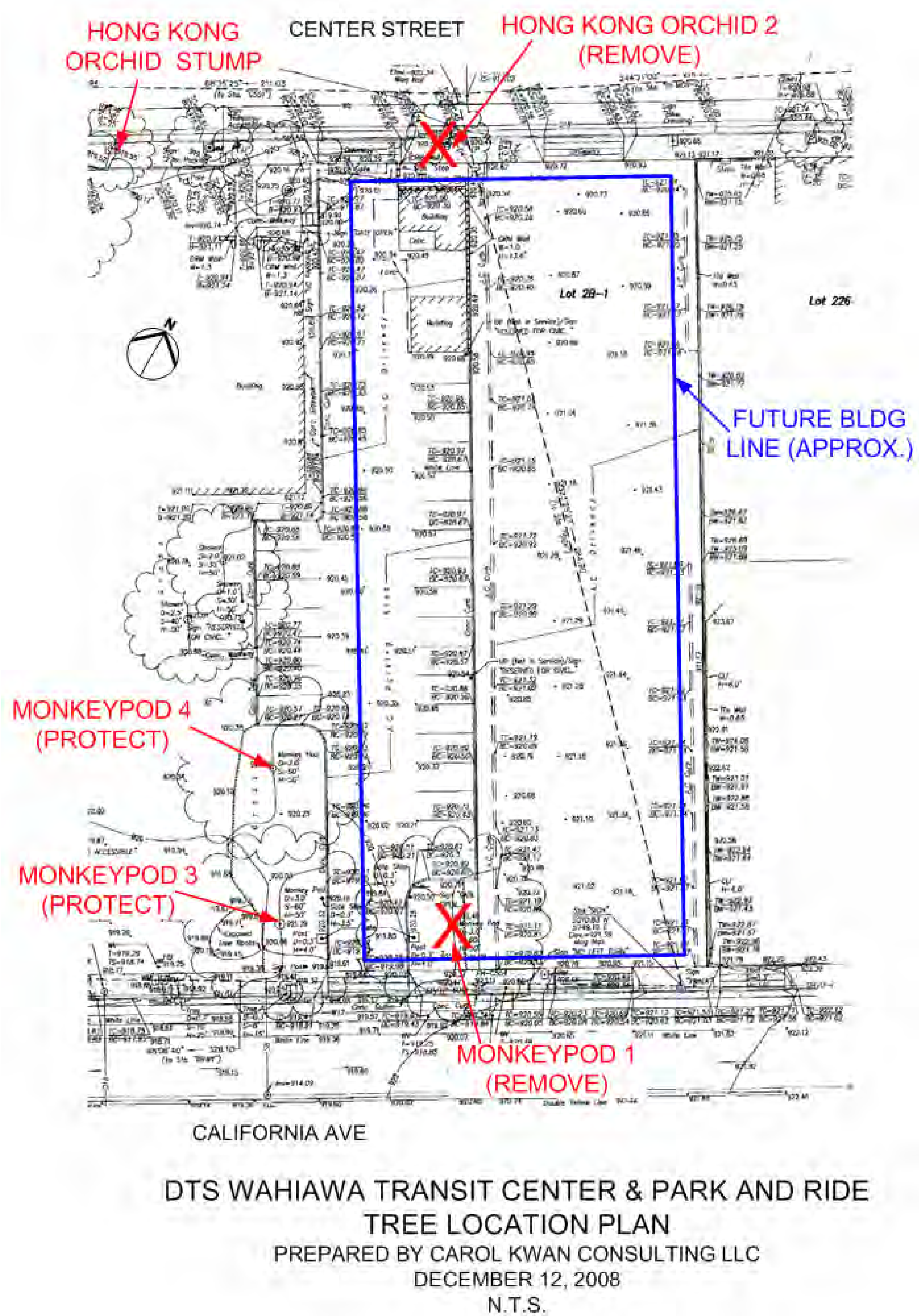

HONG KONG ORCHID STUMP
CENTER STREET
HONG KONG ORCHID 2 (REMOVE)
Lot 28-1
Lot 226
FUTURE BLDG LINE (APPROX.)
MONKEYPOD 4 (PROTECT)
MONKEYPOD 3 (PROTECT)
MONKEYPOD 1 (REMOVE)
CALIFORNIA AVE
DTS WAHIAWA TRANSIT CENTER & PARK AND RIDE
TREE LOCATION PLAN
PREPARED BY CAROL KWAN CONSULTING LLC
DECEMBER 12, 2008
N.T.S.

Figure 3

Figure 4

View from Wahiawa Shopping Center of Monkeypod 4 (center left), Monkeypod 3 (center right) and Monkeypod 1 (right) at future Wahiawa Transit Center project. Monkeypod 1 is scheduled to be removed prior to construction while Monkeypods 3 and 4 will be protected. View facing north.

Figure 5

View from Center Street facing towards California Avenue (southeast). Monkeypod 1 (to be removed) is on the left, Monkeypod 4 is on the right foreground, and Monkeypod 3 is on the right background. Monkeypods 3 and 4 should be protected from construction damage.

Figure 22

Hong Kong Orchid 2. View facing Lehua Street (southwest)


Figure 32

Hong Kong orchid stump to be removed. The replacement Hong Kong orchid street tree will be planted at this location. View facing Lehua Street (southwest)

Monkeypod 3


Figure 33

Monkeypod 3. View facing Center Street (northwest)

TREE ASSESSMENT REPORT FORMS AND SKETCHES
APPENDIX A

TREE ASSESSMENT REPORT (TAR)
MONKEYPOD 1

Prepared by: **Carol L Kwan**

ISA Arborist Certification No. **WE-6803A** **Expires:** **12/31/2009** **OR**

ASCA Registered Consulting Arborist No. ____________**N/A**_________ **Expires:** ____**N/A**____

Company: **Carol Kwan Consulting LLC**

Address: **P.O. Box 893953**

________**Mililani, HI 96789**____

Phone: **381-1342** **Fax:** **625-4287**

Date of Assessment: 12/4/2008

Project Name: Wahiawa Transit Center

Tree Number: 1 (see annotated site plan attached for tree location)

Tree Species Botanical/Common Name: *Samanea saman*/Monkeypod

Diameter Standard Height (DSH) (4.5' above flat, 4.5' above upslope side on slope): 40"

Diameter Root Trunk Flare (see sketch attached for extent): excluded from data

Tree Height: 44'

Tree Crown Size (see sketch attached for extent): See sketch

Tree Health: ☒ Good ☐ Fair ☐ Poor ☐ Very Poor

Condition Assessment: ☒ Good Form ☐ Fungi ☐ Insect Pests ☐ Disease

☐ Weed Trimmer Damage ☒ Foliage Color green ☐ Wound(s) ☐ Decay Pockets ☐ Cavity

☒Codominant Branches ☐ Girdling Roots ☐ Decline ☐ Overmature ☐Compartmentalization,

☐Soil Compaction ☒ Other codominant stems have grafted in trunk ~4' above ground. Epiphytes.

Comments: Asymmetry due to pruning to clear overhead utility lines along California Avenue

Growing Location/Size: ☐ 2' Wide Grass Planting Strip between Curb/Sidewalk

☐ 4'X4' Tree Well with Metal Cover ☐ 10' Wide Grassed Median ☐ 20' Wide Grassed Median

☐ Raised Planter ☐ Container ☐ Open Park Space ☐ Private Property ☒ Other see sketch

Comments: ____

Tree No. 1

Potential Targets: ☒ Vehicular Traffic ☒ Pedestrian Traffic ☐ Playground ☐ School

☐ Picnic Table ☐ Bus Stop ☐ Streetlight ☐ Traffic Sign ☒ Other parking, overhead utilities

Comments: ____

Site Constraints/Problems: ☒ Roots Uplifting Walkway/Curbs/Gutters/Roadway ☐ Growing Too Close to Building/Walls ☐ Too Close to Utilities ☐ Too Close/Blocking Sign

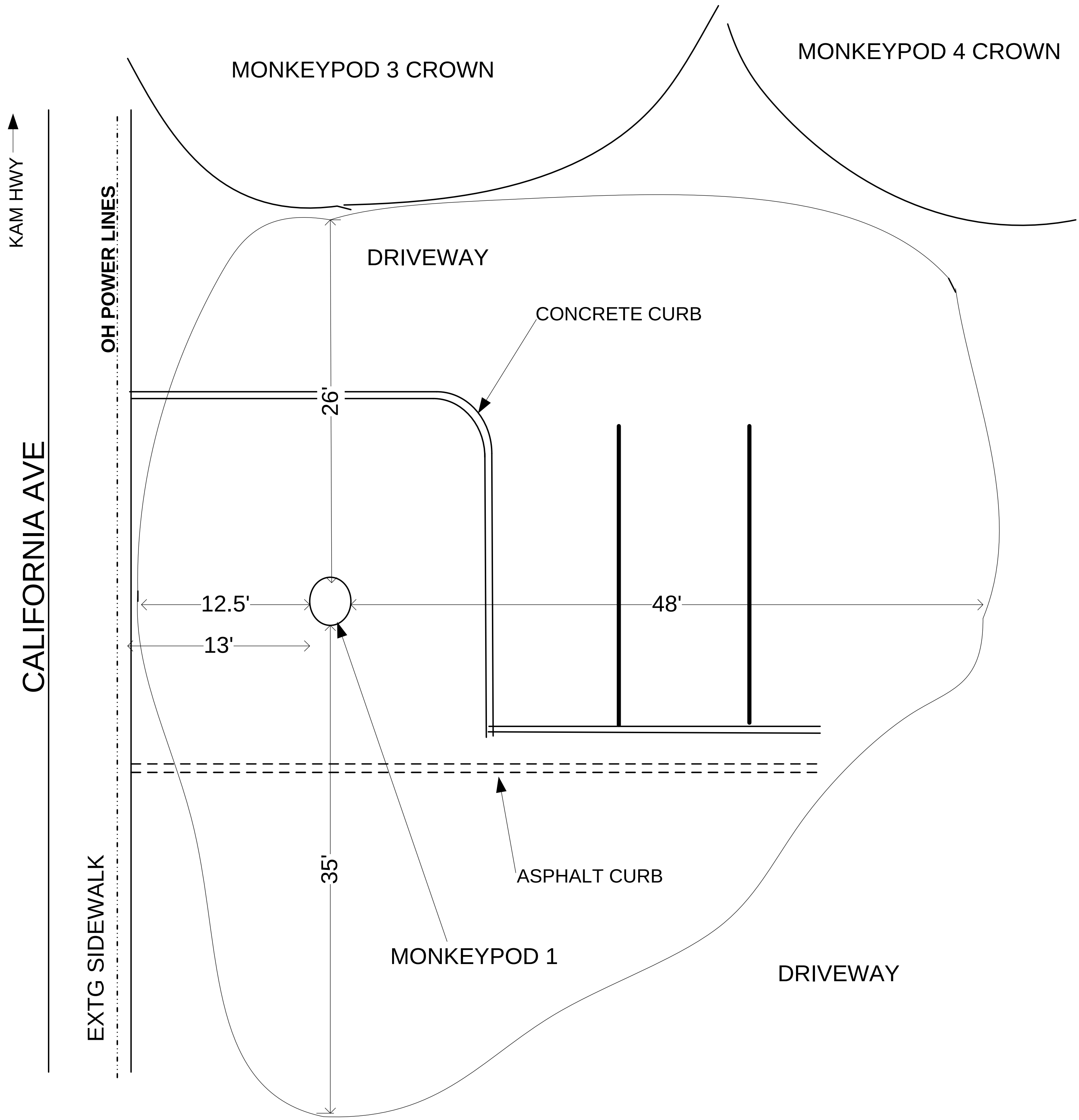
Recommendations/Remarks: ☐ Monitor ☒ Remove ☐ Relocate ☒ Replace ☐ Prune

☐ Remove Targets ☐ Other ______________________________

Comments: Project cannot be built with tree in place. There is no feasible way to accommodate or protect the tree within the project. Tree is too large to relocate. Recommend replacement with two F.S. monkeypod trees on City property in the vicinity.

Other Pertinent Information: With the protection of Monkeypods 3 and 4 during construction, their crowns should grow into some of the space presently occupied by the crown of Monkeypod 1

Submit two sets of TAR to DUF at 3902 Paki Avenue, Honolulu, HI 96815 for approval prior to start of construction. TAR may be transmitted via e-mail, compact disk, and/or letter.



DTS WAHIAWA TRANSIT CENTER & PARK AND RIDE
TREE ASSESSMENT REPORT SKETCH 1
MONKEYPOD 1

PREPARED BY CAROL KWAN CONSULTING LLC
DECEMBER 12, 2008
SCALE 1" - 10'

TREE ASSESSMENT REPORT (TAR)
HONG KONG ORCHID 2

Prepared by: **Carol L Kwan**

ISA Arborist Certification No. **WE-6803A** **Expires:** **12/31/2009** **OR**

ASCA Registered Consulting Arborist No. ____________**N/A**_________ **Expires:** ____**N/A**____

Company: **Carol Kwan Consulting LLC**

Address: **P.O. Box 893953**

________**Mililani, HI 96789**____

Phone: **381-1342** **Fax:** **625-4287**

Date of Assessment: 12/10/2008

Project Name: Wahiawa Transit Center

Tree Number: 2 (see annotated site plan attached for tree location)

Tree Species Botanical/Common Name: __*Bauhinia x blakeana*

Diameter Standard Height (DSH) (4.5' above flat, 4.5' above upslope side on slope): 14"

Diameter Root Trunk Flare (see sketch attached for extent): 32.5"

Tree Height: 32.5'

Tree Crown Size (see sketch attached for extent): See sketch

Tree Health: ☐ Good ☒ Fair ☐ Poor ☐ Very Poor

Condition Assessment: ☒ Good Form ☐ Fungi ☐ Insect Pests ☐ Disease

☐ Weed Trimmer Damage ☒ Foliage Color green ☒ Wound(s) ☒ Decay Pockets ☐ Cavity

☐Codominant Branches ☐ Girdling Roots ☐ Decline ☐ Overmature ☐Compartmentalization,

☐Soil Compaction ☒ Other _Limited root zone, decaying branch stubs

Comments: Bark tears

Growing Location/Size: ☐ 2' Wide Grass Planting Strip between Curb/Sidewalk

☐ 4'X4' Tree Well with Metal Cover ☐ 10' Wide Grassed Median ☐ 20' Wide Grassed Median

☐ Raised Planter ☐ Container ☐ Open Park Space ☐ Private Property ☒ Other 3'2" x 2'8" planter in concrete sidewalk

Comments: Street tree located between two driveways

Potential Targets: ☒ Vehicular Traffic ☒ Pedestrian Traffic ☐ Playground ☐ School

☐ Picnic Table ☐ Bus Stop ☒ Streetlight ☒ Traffic Sign ☐ Other ___________________

Comments: ____

____

____

Site Constraints/Problems: ☐ Roots Uplifting Walkway/Curbs/Gutters/Roadway ☐ Growing Too Close to Building/Walls ☐ Too Close to Utilities ☐ Too Close/Blocking Sign

Recommendations/Remarks: ☐ Monitor ☒ Remove ☐ Relocate ☒ Replace ☐ Prune

☐ Remove Targets ☐ Other ____

Comments: Project cannot be built with tree in place. There is no feasible way to accommodate or protect the tree within the project. Tree is too large to relocate and has too many defects. Recommend replacement with one 25 gal Hong Kong orchid street tree on the same side of Center Street beyond the project site (towards Lehua Street) at street tree well with 5' stump.

Other Pertinent Information:

____

____

____

____

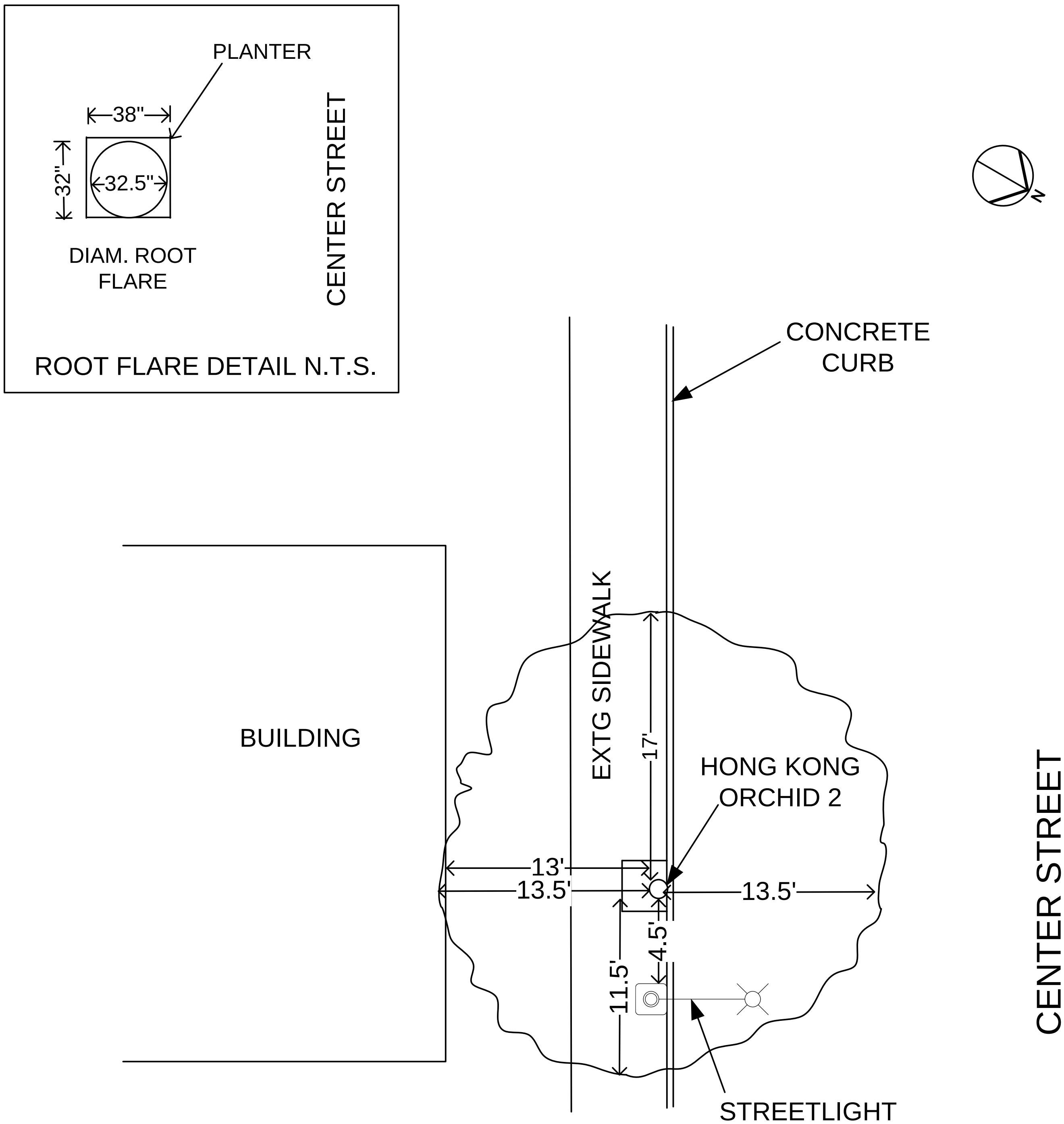
____

____

____

____

Submit two sets of TAR to DUF at 3902 Paki Avenue, Honolulu, HI 96815 for approval prior to start of construction. TAR may be transmitted via e-mail, compact disk, and/or letter.



DTS WAHIAWA TRANSIT CENTER & PARK AND RIDE
TREE ASSESSMENT REPORT SKETCH 2
HONG KONG ORCHID 2

PREPARED BY CAROL KWAN CONSULTING LLC
DECEMBER 12, 2008
SCALE 1" - 10'

TREE ASSESSMENT REPORT (TAR)
MONKEYPOD 3

Prepared by: **Carol L Kwan**

ISA Arborist Certification No. **WE-6803A** **Expires:** **12/31/2009** **OR**

ASCA Registered Consulting Arborist No. ____________**N/A**_________ **Expires:** ____**N/A**____

Company: **Carol Kwan Consulting LLC**

Address: **P.O. Box 893953**

________**Mililani, HI 96789**____

Phone: **381-1342** **Fax:** **625-4287**

Date of Assessment: 12/4/2008

Project Name: Wahiawa Transit Center

Tree Number: 3 (see annotated site plan attached for tree location)

Tree Species Botanical/Common Name: *Samanea saman*/Monkeypod

Diameter Standard Height (DSH) (4.5' above flat, 4.5' above upslope side on slope): 42"

Diameter Root Trunk Flare (see sketch attached for extent): 47"

Tree Height: 54'

Tree Crown Size (see sketch attached for extent): See sketch

Tree Health: ☒ Good ☐ Fair ☐ Poor ☐ Very Poor

Condition Assessment: ☒ Good Form ☐ Fungi ☐ Insect Pests ☐ Disease

☐ Weed Trimmer Damage ☒ Foliage Color green ☐ Wound(s) ☐ Decay Pockets ☐ Cavity

☒Codominant Branches ☐ Girdling Roots ☐ Decline ☐ Overmature ☐Compartmentalization,

☐Soil Compaction ☒ Other Invasive vines. Minor dieback.

Comments: Codominant stems are widely attached. Asymmetry due to pruning to clear overhead utility lines along California Avenue.

Growing Location/Size: ☐ 2' Wide Grass Planting Strip between Curb/Sidewalk

☐ 4'X4' Tree Well with Metal Cover ☐ 10' Wide Grassed Median ☐ 20' Wide Grassed Median

☐ Raised Planter ☐ Container ☒ Open Park Space ☐ Private Property ☒ Other see sketch

Comments: Driveway on one side, sidewalk on one side, lawn/groundcover/shrubs on two sides

Potential Targets: ☒ Vehicular Traffic ☒ Pedestrian Traffic ☐ Playground ☐ School

☐ Picnic Table ☐ Bus Stop ☐ Streetlight ☐ Traffic Sign ☒ Other parking, overhead utilities

Comments: ____

Site Constraints/Problems: ☐ Roots Uplifting Walkway/Curbs/Gutters/Roadway ☐ Growing Too Close to Building/Walls ☐ Too Close to Utilities ☐ Too Close/Blocking Sign

Recommendations/Remarks: ☐ Monitor ☐ Remove ☐ Relocate ☐ Replace ☒ Prune

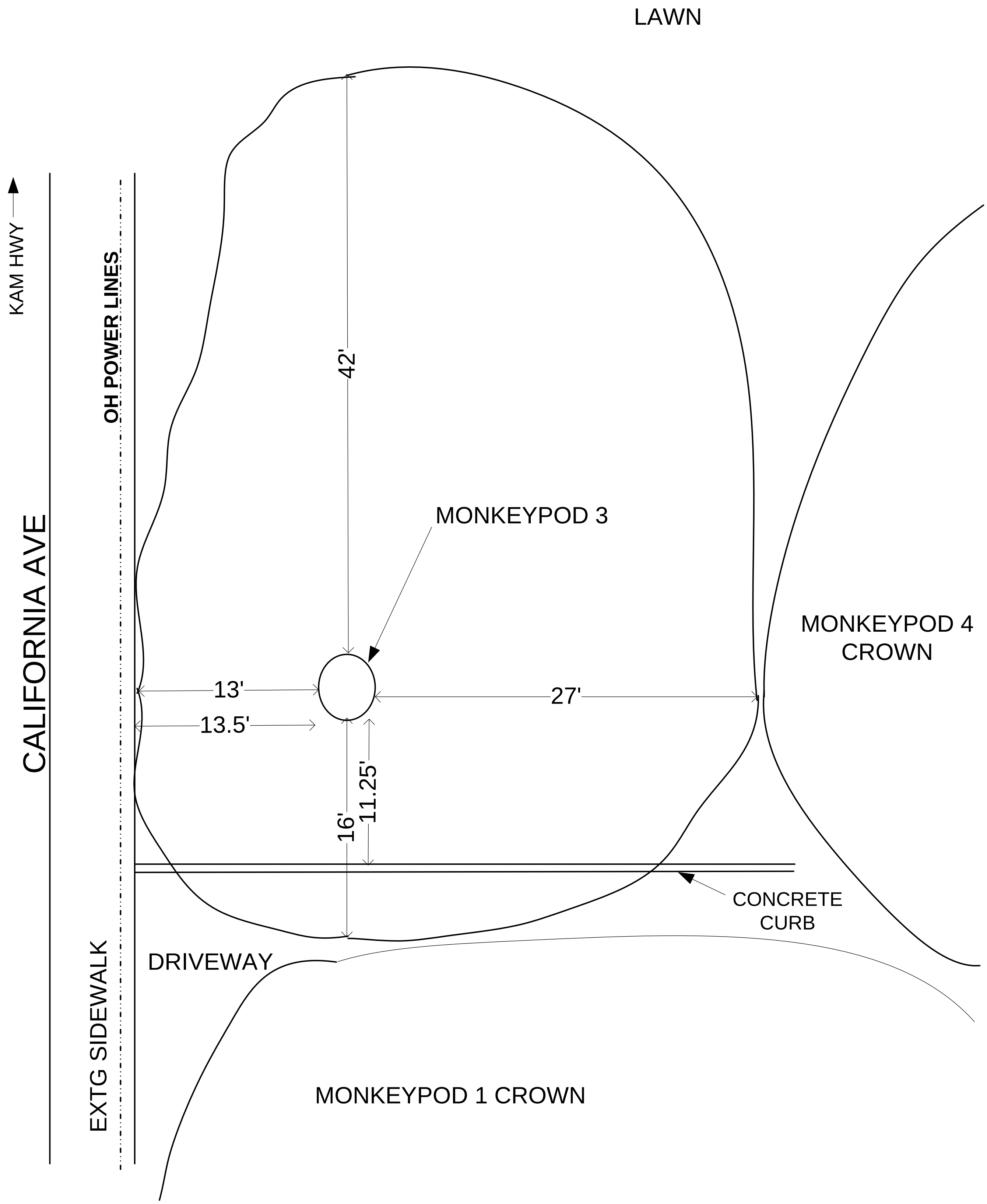
☐ Remove Targets ☒ Other root prune

Comments: Remove invasive vines – Syngonium, other. Clean crown – minor deadwood. Crown has sufficient clear height (19') to allow for construction underneath in paved areas. See Tree Protection Plan for additional recommendations.

Other Pertinent Information:

Large roots growing mostly into lawn and towards California Avenue. One large surface root growing towards driveway. Root pruning should be minor.

Submit two sets of TAR to DUF at 3902 Paki Avenue, Honolulu, HI 96815 for approval prior to start of construction. TAR may be transmitted via e-mail, compact disk, and/or letter.



DTS WAHIAWA TRANSIT CENTER & PARK AND RIDE
TREE ASSESSMENT REPORT SKETCH 3
MONKEYPOD 3

PREPARED BY CAROL KWAN CONSULTING LLC
DECEMBER 12, 2008
SCALE 1'' - 10'

TREE ASSESSMENT REPORT (TAR)
MONKEYPOD 4

Prepared by: **Carol L Kwan**

ISA Arborist Certification No. **WE-6803A** **Expires:** **12/31/2009** **OR**

ASCA Registered Consulting Arborist No. ____________**N/A**_________ **Expires:** ____**N/A**____

Company: **Carol Kwan Consulting LLC**

Address: **P.O. Box 893953**

________**Mililani, HI 96789**____

Phone: **381-1342** **Fax:** **625-4287**

Date of Assessment: 12/4/2008

Project Name: Wahiawa Transit Center

Tree Number: 4 (see annotated site plan attached for tree location)

Tree Species Botanical/Common Name: *Samanea saman*/Monkeypod

Diameter Standard Height (DSH) (4.5' above flat, 4.5' above upslope side on slope): 39.5" (2 stems)

Diameter Root Trunk Flare (see sketch attached for extent): 41"

Tree Height: 47.5'

Tree Crown Size (see sketch attached for extent): See sketch

Tree Health: ☐ Good ☒ Fair ☐ Poor ☐ Very Poor

Condition Assessment: ☒ Good Form ☐ Fungi ☐ Insect Pests ☐ Disease

☐ Weed Trimmer Damage ☒ Foliage Color green ☐ Wound(s) ☐ Decay Pockets ☐ Cavity

☒Codominant Branches ☐ Girdling Roots ☒ Decline ☐ Overmature ☐Compartmentalization,

☐Soil Compaction ☒ Other Girdling Philodendron and Syngonium roots. Dieback.

Comments: Codominant stems are widely attached. Dieback is caused by girdling roots.

Growing Location/Size: ☐ 2' Wide Grass Planting Strip between Curb/Sidewalk

☐ 4'X4' Tree Well with Metal Cover ☐ 10' Wide Grassed Median ☐ 20' Wide Grassed Median

☐ Raised Planter ☐ Container ☒ Open Park Space ☐ Private Property ☒ Other see sketch

Comments: Driveway on one side, parking on one side, lawn/groundcover/shrubs on two sides

Potential Targets: ☒ Vehicular Traffic ☒ Pedestrian Traffic ☐ Playground ☐ School

☐ Picnic Table ☐ Bus Stop ☐ Streetlight ☐ Traffic Sign ☒ Other parking

Comments: ____

____

____

Site Constraints/Problems: ☐ Roots Uplifting Walkway/Curbs/Gutters/Roadway ☐ Growing Too Close to Building/Walls ☐ Too Close to Utilities ☐ Too Close/Blocking Sign

Recommendations/Remarks: ☐ Monitor ☐ Remove ☐ Relocate ☐ Replace ☒ Prune

☐ Remove Targets ☒ Other root prune

Comments: Remove invasive vines – Philodendron, Syngonium, other. Remove Philodendron for 5' radius around trunk. Clean crown – deadwood. Crown has sufficient clear height (18') to allow for construction underneath in paved areas. See Tree Protection Plan for additional recommendations.

Other Pertinent Information:

Advised CTAHR personnel in adjacent DAGS building of girdling Philodendron, other plants and requested that these be removed urgently for tree health. At reinspection on 12/11/2008, girdling roots had been severed and pulled off. Most structural tree roots are growing towards lawn. Root pruning should be minor.

____

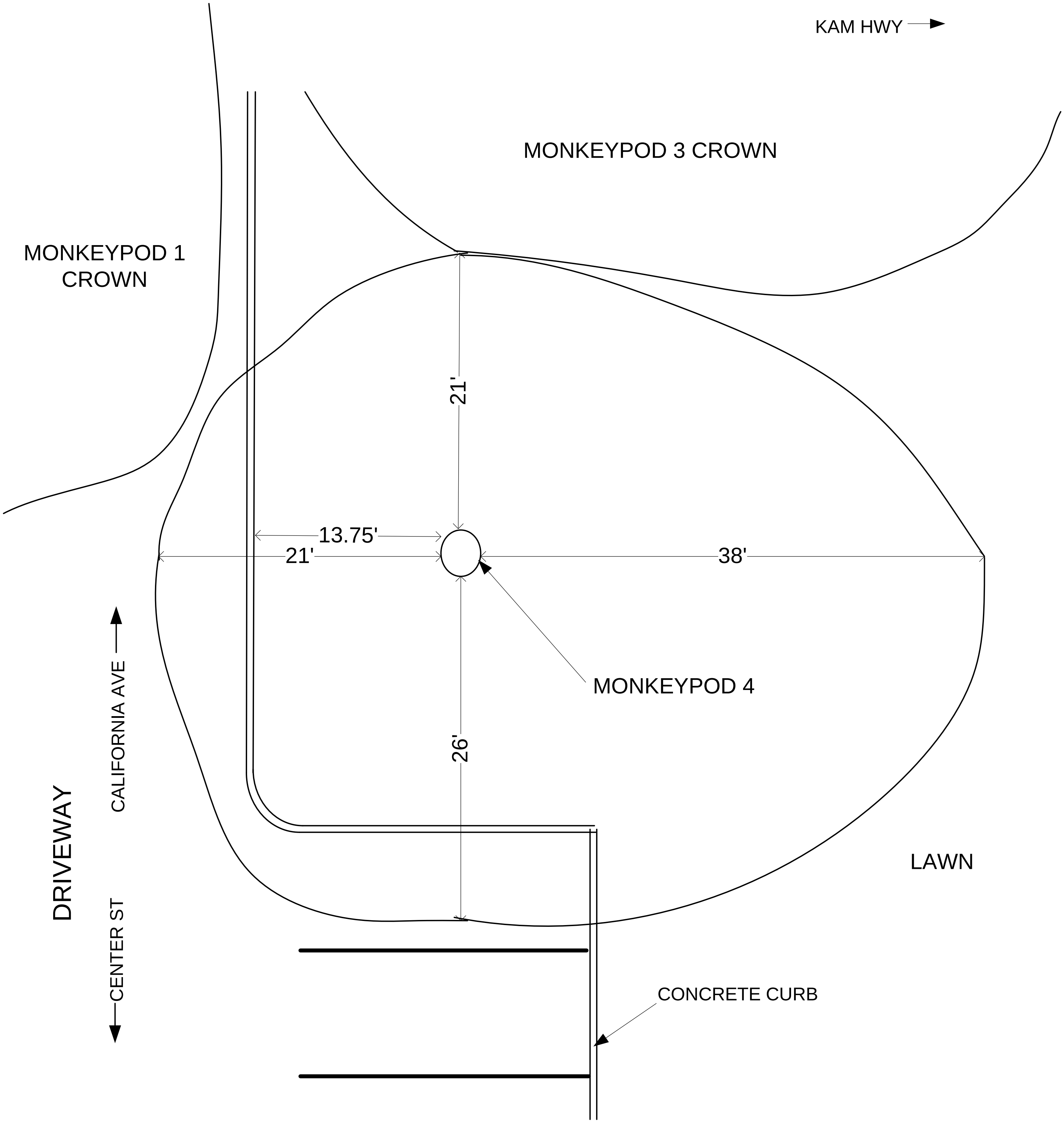
____

____

____

____

Submit two sets of TAR to DUF at 3902 Paki Avenue, Honolulu, HI 96815 for approval prior to start of construction. TAR may be transmitted via e-mail, compact disk, and/or letter.



DTS WAHIAWA TRANSIT CENTER & PARK AND RIDE
TREE ASSESSMENT REPORT SKETCH 4
MONKEYPOD 4

PREPARED BY CAROL KWAN CONSULTING LLC
DECEMBER 12, 2008
SCALE 1" - 10'

Appendix B

Archaeological and Cultural Impact Evaluation

May 2002

Environmental Assessment

Wahiawa Transit Center & Park and Ride
TMK: 7-4-006:002 & portion of 7-4-006:012
956 California Avenue, Wahiawa, O`ahu, Hawai`i

Return to list of appendices

An Archaeological and Cultural Impact Evaluation for the Proposed Wahiawā Community Transit Center, Wahiawā *Ahupua`a*, Wahiawā District, Island of O`ahu (TMK 7-4-06 por. 2 and por. 12)

by

Hallett H. Hammatt, Ph.D.
David W. Shideler, M. A.
and
Melanie M. Mann, B.A.

Prepared for

AM Partners, Inc.

Cultural Surveys Hawai`i, Inc.

May 2002

ABSTRACT

At the request of AM Partners, Inc., Cultural Surveys Hawaii, Inc. (CSH) has completed an archaeological assessment for the proposed Wahiawā Community Transit Center, Wahiawā *Ahupua`a*, Wahiawā District, Island of O`ahu (TMK 7-4-06 por. 2 and por 12). The archaeological assessment included a thorough historic overview and a field inspection of the project area.

Based on historic overviews, it is very evident that the majority of the activities that were occurring upon the project area began during the 1900s. However, many of these historic structures were long gone by the late 1940s and early 1960s in order to accommodate new urban developments.

The field inspection, which was completed on April 25, 2002, revealed no surface archaeological sites and no evidence of traditional Hawaiian activity, which further confirms the extensive development of the project area. It was very apparent during the assessment that continued modern development upon the project area over the last century has greatly impacted the land.

The area's history of urban development has distorted or terminated any native practices, if any, that formerly pertained to the project area parcel. There is no evidence of any native practices – including burials, trails, hunting, gathering, and cultural sites – formerly associated specifically with the parcel, nor is there evidence of any ongoing cultural practices.

Given the century-long history of modern developments of all portions of the Wahiawā Community Transit Center project area, the general absence of any archaeological findings adjacent to the project area, as well as results of the field inspection, there is little likelihood of encountering prehistoric and significant surface structures or subsurface archaeological remains during construction.

Based on the above findings, this study concludes that there will be no adverse impact to historical or cultural resources by the implementation of the transit center project.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF FIGURES (continued)

TABLES

I. INTRODUCTION

A. Project Background

At the request of AM Partners, Inc., Cultural Surveys Hawaii, Inc. (CSH) has completed an Archaeological Assessment for the proposed Wahiawā Community Transit Center, Wahiawā *Ahupua`a*, Wahiawā District, Island of O`ahu (TMK 7-4-06 por.2 and por. 12) (Figures 1-3). The project area is the west portion of a rectangular block, approximately 321,000 square feet, situated immediately south of the existing Wahiawā General Hospital facility. The parcel block is bounded by Lehua Street to the west, California Avenue to the south, North Cane Street to the east, and Center Street to the north. Based on conceptual drawings provided by AM Partners, Inc., the primary area of proposed impact is the state lands on the west side of the project area (Figure 4).

B. Project Area Description

The proposed Wahiawā Community Transit Center is situated upon the southwestern aspect of Wahiawā *Ahupua`a*, and is marked prominently by the formation of the Schofield Plateau and its subsequent erosion. The Schofield Plateau is the result of the younger Ko`olau volcanic basalt overflowing and banking against the older Wai`anae volcanic basalt. The Ko`olau and Wai`anae series were unaffected by the later Honolulu Series which is the only other volcanic series to occur on the island (MacDonald and Abbot 1974:352-354).

According to Foote *et al.*(1972), the soil type associated with the proposed Wahiawā Community Transit Center is exclusively Wahiawā Silty Clay, 0 to 3 percent slope:

> In a representative profile, the surface layer is very dusky red and dusky red silty clay about 12 inches thick. The subsoil, about 48 inches thick, is dark reddish-brown silty clay that has subangular blocky structure. The underlaying material is weathered basic igneous rock. The soil is medium acid in the surface layer and medium acid to neutral in the subsoil (Foote *et al* 1972: 124 to 125).

Permeability is moderately rapid, with runoff slow, and erosion hazards no more than slight. This soil type is generally used for sugarcane, pineapple, pasture and residential developments.

A significant portion of the project area consists of lawn landscape, with primarily introduced vegetation including various palm types, Hong Kong orchid tree (*Bauhinia blakeana*), mango (*Mangifera indica*), avocado (*Persea americana*), and Norfolk Island pine (*Araucaria excelsa*). The only indigenous plant observed within the project area was ti (*Cordyline fruticosa*).

C. Methodology

The proposed Wahiawā Community Transit Center was inspected on April 25, 2002 to identify possible surface historic properties. The inspection was documented by field notes and photographs.

Background research included a review of archaeological studies in the library of the State Historic Preservation Division; document searches at the Hawai`i State Archives; the Mission Houses Museum Library; the Hawai`i Public Library; the libraries of the University of Hawai`i-Mānoa; and the Archives of the Bishop Museum; and a study of maps at the Survey Office of the Department of Accounting and General Services.

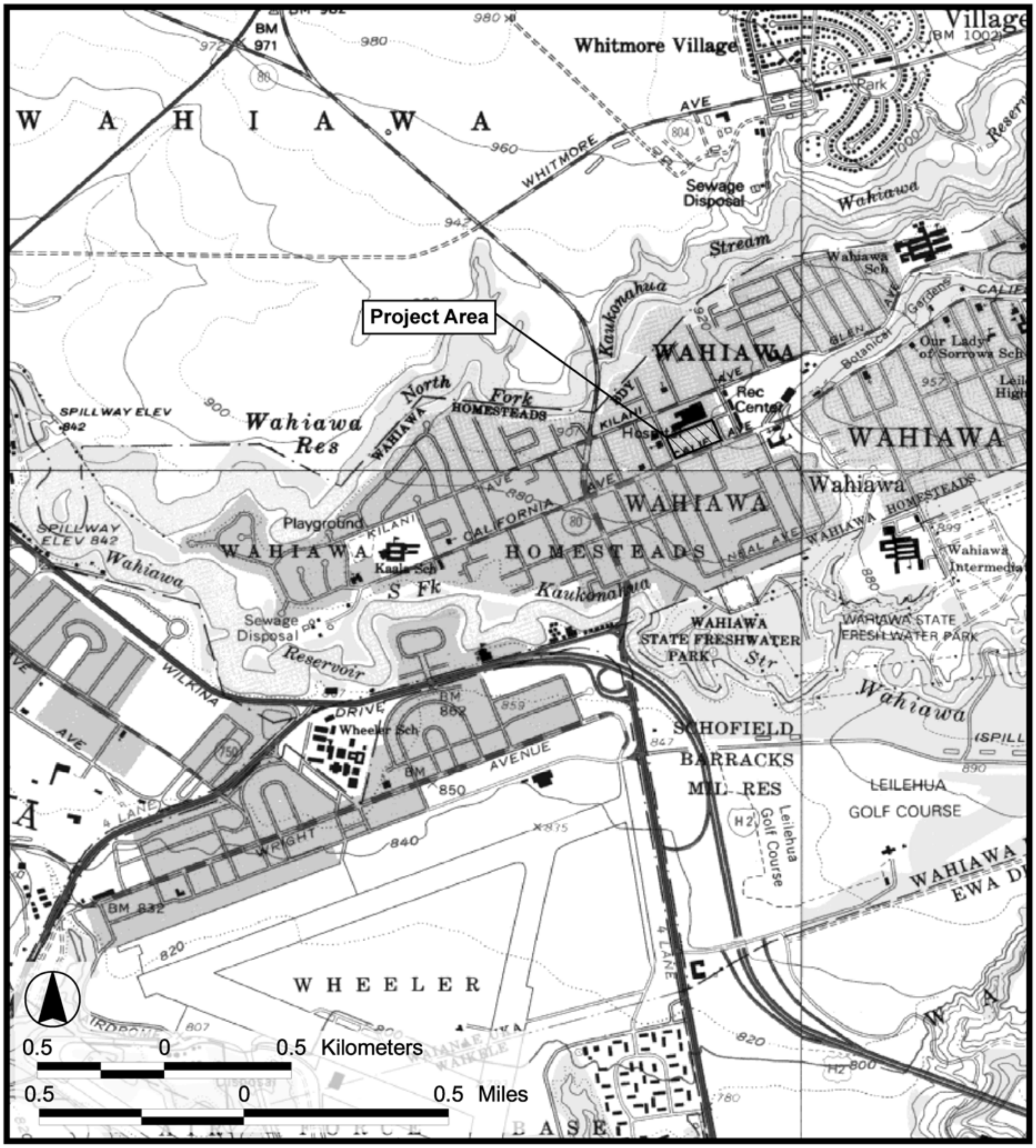


Figure 1 Portion of USGS 7.5 Minute Series Topographic Map, Schofield Barracks, Haleiwa, Hau`ula, and Waipahu Quadrangles, Showing Proposed Wahiawā Community Transit Center project area.

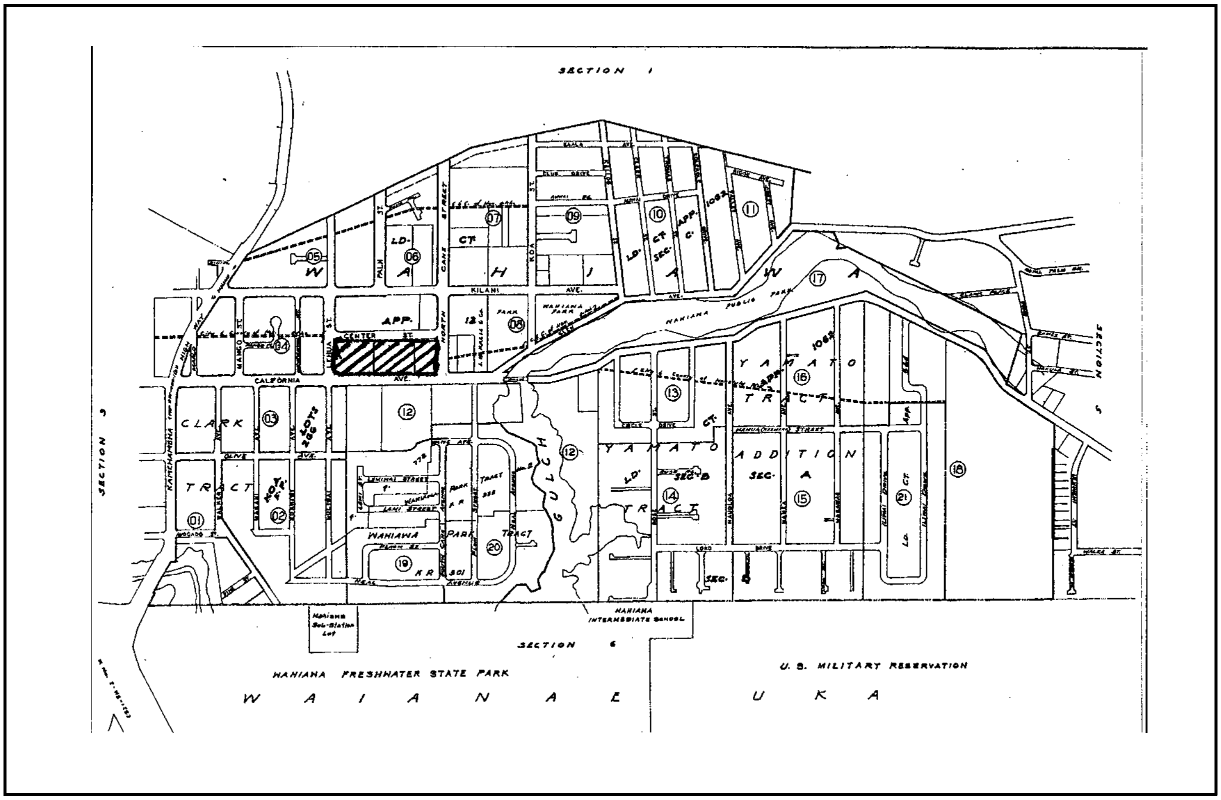


Figure 2 Tax Map Key (TMK 7-4) showing proposed Wahiawā Community Transit Center project area in hatching.

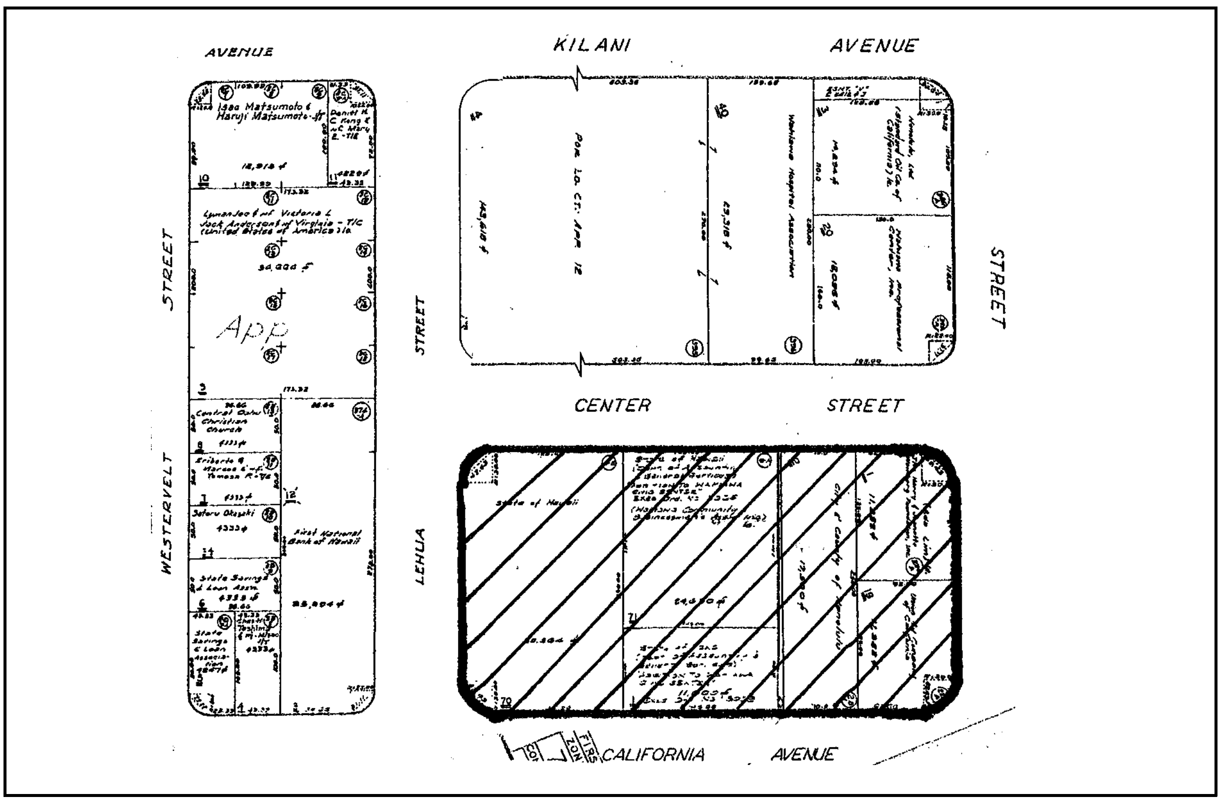


Figure 3 Composite of portions of Tax Map Key 7-4-04 and 7-4-06, showing proposed Wahiawā Community Transit Center project area and adjacent streets.

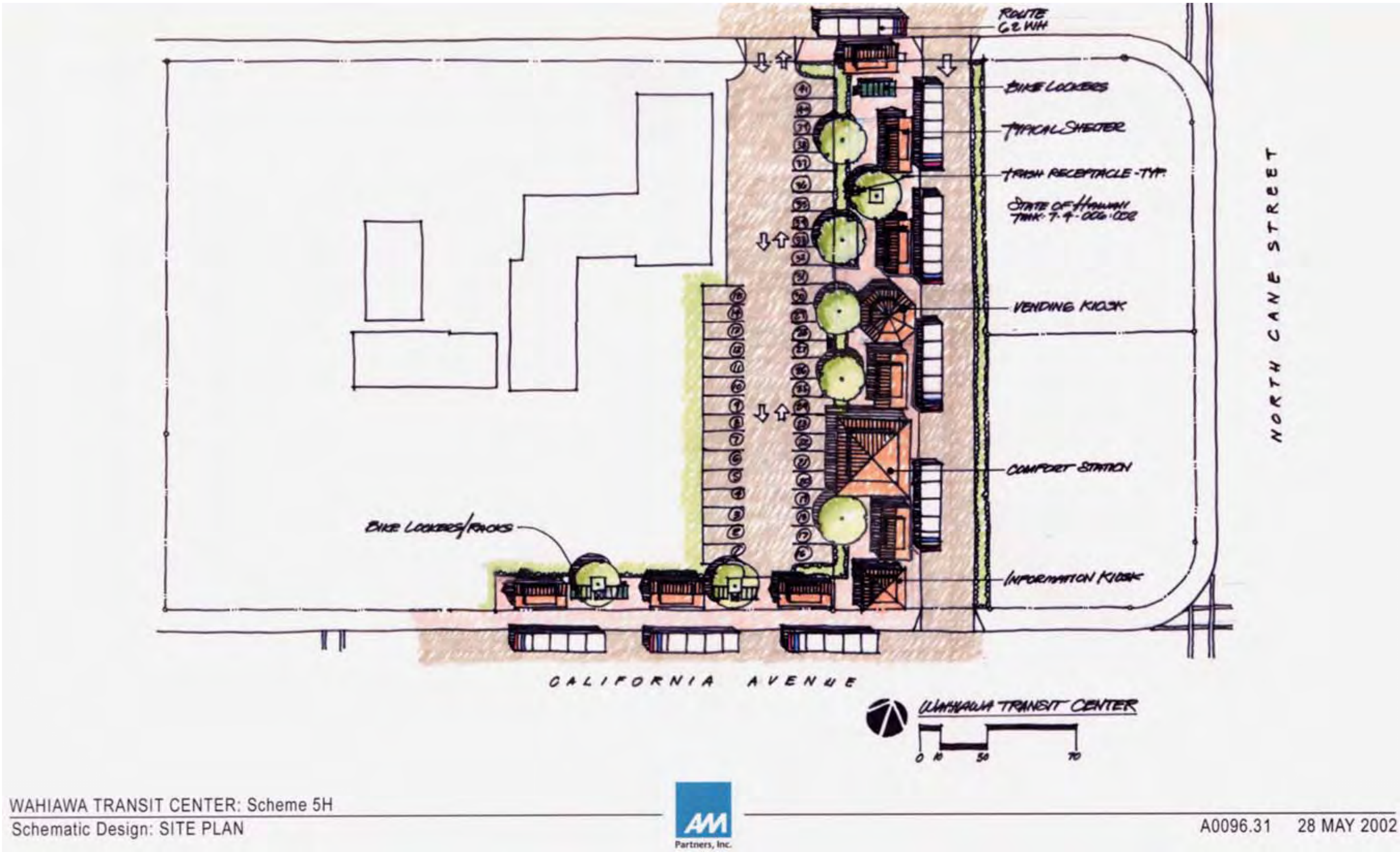


Figure 4 Conceptual drawing Showing Proposed Wahiawā Community Transit Center project site.

II. CULTURAL AND HISTORIC BACKGROUND

The proposed Wahiawā Community Transit Center is situated in the southwestern aspect of the *ahupua`a* of Wahiawā (Wahiawā is both a traditional place name and a modern district designation). This section presents a review of the available documentary evidence for the general character of the Wahiawā area as it had evolved in the years before western contact in the later 18th century. The development of Wahiawā lands adjacent to and including the present study area during the 19th century and into the early 20th century was recorded in increasingly detailed documentation — including government records and maps. Finally, during subsequent decades of the 20th century, abundant documentation of Wahiawā allows a more precise focus on the Wahiawā Community Transit Center project area.

A. Wahiawā in Pre-Contact O`ahu

According to E.S. Craighill Handy and Elizabeth Handy:

> Wahiawā was from very ancient times, identified with the ruling *ali`i* of Oahu. The name analyzed is *Wahi* (place), *a* (belonging to), *wa* (noise). Perhaps the name goes back to the time when Hi`iaka was in this general area and could see waves dashing against the coast afar off and hear the ocean's ceaseless roar... (Handy and Handy 1972: 465)

The Handys suggest that a "sizable population" filled the Wahiawā area in traditional Hawaiian times, based on the "various areas of *lo`i* northwest of the present town of Wahiawā..":

> There were extensive terraces that drew water from Wahiawā Stream, both above and below the present town. There were many small terrace areas along the sides of the valleys of all the streams of this general area. These streams tap the southwest slopes of the Ko`olau range where it begins to lose altitude but it is still very wet in the hinterland. The peculiarity of this area, apart from distance from the sea, is that it is the only extensive level area on [O`ahu] that is quite high. (Handy and Handy 1972: 465)

The pioneering Hawaiian historian Samuel M. Kamakau identifies Wahiawā with a specific chiefly degree:

> The chiefs of Lihue, Wahiawa, and Halemano on Oahu were called *Lo* chiefs, *po`e Lo Ali`i* ["people from whom to obtain a chief"], because they preserved their chiefly kapus...They lived in the mountains (*i kuahiwi*); and if the kingdom was without a chief, there in the mountains could be found a high chief (*ali`i nui*) for the kingdom. Or if a chief was without a wife, there one could be found — one from chiefly ancestors. (Kamakau 1964: 5)

One of the *Lo* chiefs was Kūkaniloko. Kūkaniloko is also the name of "one of the two famous places in the Hawaiian islands for the birth of children of tapu chiefs...Kūkaniloko is said to have been established by Nanakaoko and his wife Kahihiokalani, whose son, Kapwa, heads the list of the important *alii* born here" (McAllister 1933: 134, 135). It is located approximately 200 meters west of the intersection of Kamehameha Highway and Whitmore Road. Associated with — and located near — Kūkaniloko was Ho`olonopahu *heiau* where "were kept the sacred drums of Opaku and Hawea which announced the birth of an alii" (McAllister 1933: 147). Sacred sites like Kūkaniloko and Ho`olonopahu suggest the significant place of the Wahiawā area in the Hawaiian consciousness during pre-contact times.

B. Early Contact to mid-19th Century

Wahiawā enters the historical record in the sandalwood trade of the early 1800s. The Hawaiian Islands began exporting sandalwood to the Orient shortly after 1800 and the commerce flourished until the supply dwindled in the mid-1830s. Trade in sandalwood was the strict monopoly of the *ali`i* beginning with Kamehameha. At the height of the sandalwood boom, Kamehameha was buying foreign ships, including six vessels between 1816 and 1818, to transport his own wood to the Orient (Kuykendall 1965:87). According to Samuel Kamakau, Wahiawā was a prime source for the valuable wood, though harvesting it was not easy:

> ...Ka-lani-moku and all the chiefs went to work cutting sandalwood at Wahiawā, Halemano, Pu`ukapu, Kanewai, and the two Ko`olaus. The largest trees were at Wahiawā, and it was hard work dragging them to the beach. (Kamakau 1992: 207)

By the time the trade collapsed in the 1830s, its effects on the Hawaiian population and landscape had been devastating:

> The chiefs, old and young, went into the mountains with their retainers, accompanied by the king and his officials, to take charge of the cutting, and some of the commoners cut while others carried the wood to the ships at the various landings; none was allowed to remain behind. Many of them suffered from food; because of the green herbs they were obliged to eat they were called "Excreters of green herbs" (*Hilalele*), and many died and were buried there. The land was denuded of sandalwood by this means. (Kamakau 1992: 252)

Toward the mid-19th century, the Organic Acts of 1845 and 1846 initiated the process of the *Māhele* - the division of Hawaiian lands - which introduced private property into Hawaiian society. In 1848 the crown, the Hawaiian government, and the *ali`i* (royalty) received their land titles. No known LCAs were registered in the vicinity of the project area.

The lack of LCA claims may not however, indicate the absence of an indigenous Hawaiian population in the southwestern portion of the *ahupua`a* at mid-19th century. Discussing the growth of Hawaiian education during the reign of Kamehameha III — from 1824 to 1854 — Samuel Kamakau notes: "At Kahalepo`ai, Hauone, Kalakoa, Wahiawa, Halemano, and Kanewai there were larger villages with teachers and schoolhouses..." (Kamakau 1992: 424).

C. Latter 19th Century to Early 20th Century

What became of the "larger village" at Wahiawā during the second half of the 19th century is unrecorded. Further, there is no documentation of any continuing Hawaiian presence in the general area of the present proposed Wahiawā Community Transit Center in Wahiawā *ahupua`a*. However, towards the end of the 1800s, following the overthrow of the Hawaiian monarchy, western military, entrepreneurial and agricultural interests would transform the Wahiawā landscape. Following the annexation of the Hawaiian Islands by the United States in 1898, a presidential order of July 20, 1899 set aside Waianae Uka lands as the military reservation indicated on the map. Ten years later, in 1909, these lands would become the site of Schofield Barracks, named after Lt. General John M. Schofield.

Monsarrat's 1899 survey map of Wahiawā indicates no significant 19th century development within the immediate Wahiawā Community Transit Center project area (Figure 5). However, "Homesteads" in Wahiawā between the north and south forks of Kaukonahua Stream were beginning to take shape by the early 1900s.

In 1897 Byron Clark, a Californian, arrived in the Hawaiian Islands and became the Hawaiian Republic's commissioner of agriculture. Wanting to remain in the islands, Clark searched out land to purchase:

> But to buy or lease suitable land from private individuals proved too expensive. Searching for alternatives, Clark went to the government land office. He learned there was one piece of land, indeed the only one on the island of Oahu, that might be available for settlement. The tract was called Wahiawa. It had previously been leased to Oahu businessman James Robinson for cattle grazing. By the time of Clark's inquiry, the area had been designated homestead land by the Land Act of 1895. To receive title, each settler must live on and cultivate a portion of the land for three years. (Nedbalek 1984: 18)

Clark organized a group of families, mainly from California, who would join him in settling the whole tract of thirteen hundred acres — which became known as the Wahiawā Colony Tract. Having formed an agricultural cooperative called the Hawaiian Fruit and Plant Company, the homesteaders began formalizing and refining the physical organization of their Wahiawā settlement:

> Initially each settler lived in a house on his five-acre parcel in the town site and farmed his other land in the surrounding area. It was soon discovered, however, that each settler preferred to reside on his own farmstead, holding his town lot in reserve. The homesteaders abandoned the village plan and agreed that one man, Thomas Holloway, would live on their 145-acre central lot site. On 27 August 1902 a trust deed, often referred to as the Holloway

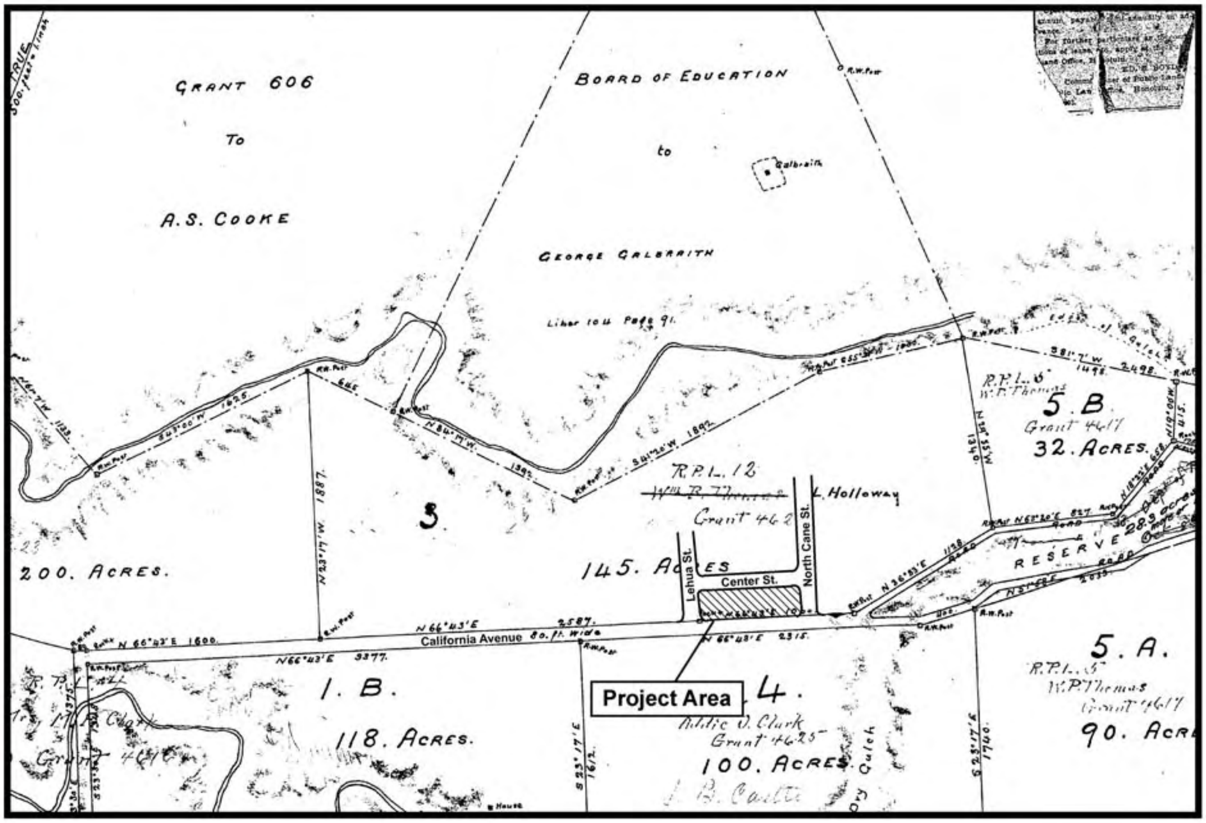


Figure 5 Portion of Government Land on Wahiawā map of 1899 (Monsarrat Surveyor), with the project area, California Avenue, Lehua Street, Center Street, and North Cane Street superimposed.

> Trust, formally set aside the central town lots for the use and benefit of the Wahiawa Settlement Association resident landowners. Within a few years most public facilities would be located there. (Nedbalek 1984: 20)

The layout of the homesteaders' settlement would develop, during subsequent decades of the 20th century, into Wahiawā Town. Some of the town's streets would be named for the early homesteaders — including Clark, Kellog, Thomas, and Eames streets.

Another homesteader was James D. Dole, who moved to Wahiawā in 1900 to attempt farming on 61-acres. Dole described Wahiawā at the beginning of the 20th century as "a park-like stretch of some 1,400-acres of third-class pasture land, dotted with shacks of 13 hopeful homesteaders for whom [the] general sentiment was merely pity" (in Nedbalek 1984: 26). Dole founded Hawaiian Pineapple Company in 1901. Within a few years pineapple production at Wahiawā had so increased that Dole planned a cannery at Iwilei, near the shipping facilities of Honolulu Harbor. In order to transport the pineapple from Wahiawā to Honolulu, Dole persuaded the Oahu Railway & Land Company to extend its rail line to Wahiawā. The line to Wahiawā was constructed in 1906.

A 1919 fire control map of O`ahu shows Wahiawā and the proposed Wahiawā Community Transit Center project area in the years following the developments detailed above (Figure 6). The plateau on the future Whitmore Village side of Kaukonahua Stream — northeast of the project area — is indicated to be planted in pineapple. On the opposite side of the stream — within the limits of the current project area — Wahiawā Town is taking shape in the grid of streets now forming across the former homestead tracts. Schofield Barracks is fully established and rail lines course through the pineapple fields and out of Wahiawā to Honolulu. According to the map, a section of the O.R. & L. railroad tracks appear to lie immediately adjacent to the east side of the proposed Wahiawā Community Transit Center project area.

Another feature indicated on the map is a body of water at the confluence of the north and south forks of Kaukonahua Stream. The stream was no longer a free-flowing water course after the first decade of the 20th century. Castle and Cooke had started the Wailua Agricultural Company, later known as Waialua Sugar Company, in 1889. Water was crucial to the plantation's survival and growth:

> The key to Waialua's irrigation was Wahiawā Dam and Reservoir. The 2.5-billion-gallon capacity reservoir was completed in two years, on 23 January 1906. It was the largest reservoir in Hawaii and the most economical as well. Later known as Lake Wilson, it provided 90 percent of Waialua Sugar Company's surface water...
>
> The dam itself, at 136 feet, is the highest earthen dam in Hawaii. Sited at the 1000 foot elevation, it measures 461 feet long and is 580 feet thick at the base. It created a 7-mile-long reservoir that took advantage of the natural stream beds and canyons located in the Kaukonahua gulch. (Wilcox 1996: 109-110)

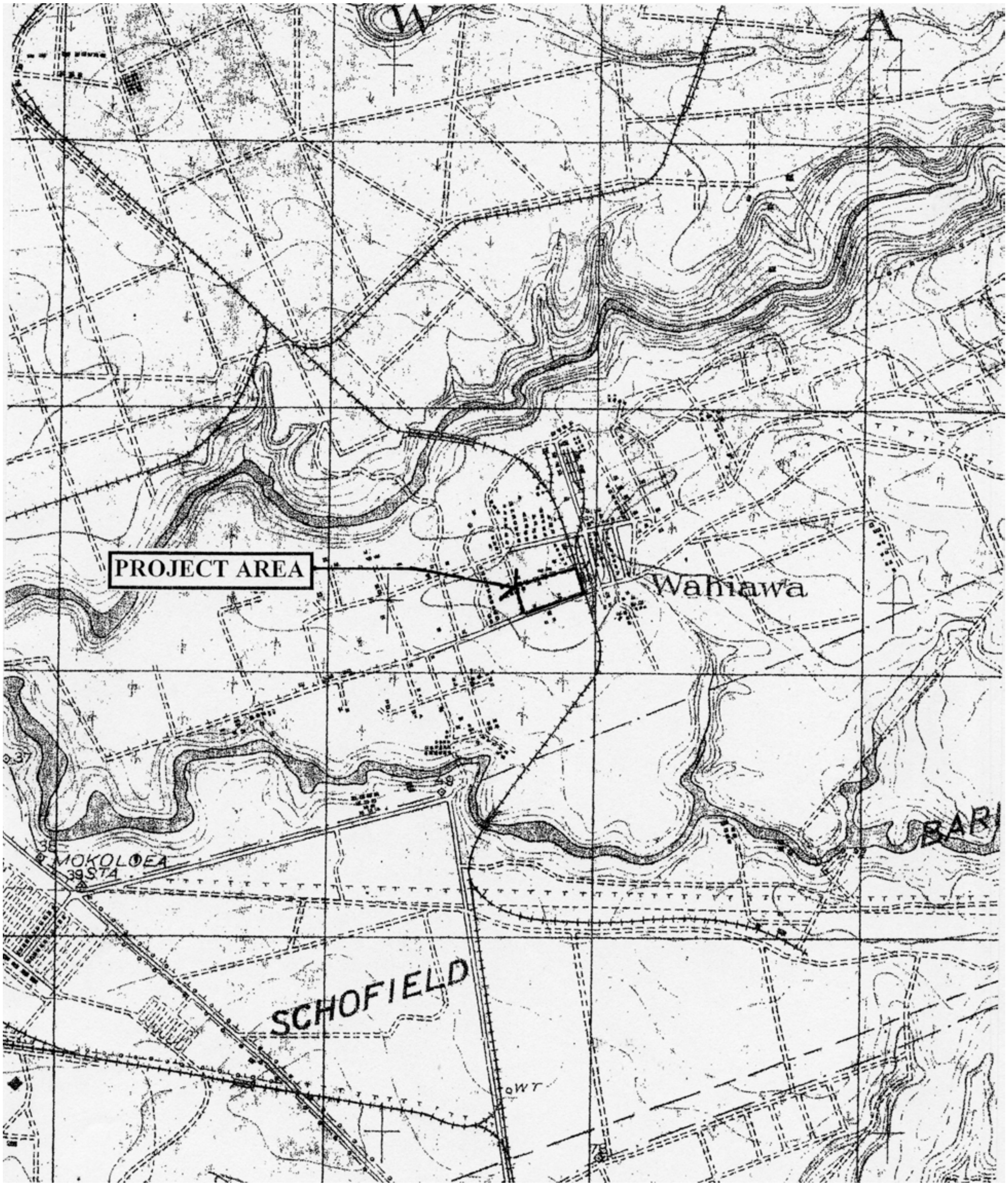


Figure 6 Portion of 1919 fire control map of O`ahu showing Wahiawā Town, Schofield Barracks and Wahiawā Reservoir–with proposed Wahiawā Community Transit Center indicated.

The Wahiawā Reservoir continues at present to aid in flood control and the storage of storm water.

Continued housing development within the immediate vicinity of the project area is further indicated on a 1928/1929 USGS Wahiawā quadrangle map. The map indicates two additional structures at the western most aspect of the current Wahiawā Community Transit Center project area (Figure 7). The map further indicates four new structures within the perimeters of the current project area, and a larger structure, (believed to be the old Wahiawā Elementary School), located immediately north of the project area.

Wahiawā Elementary School was originally located at the intersection of Center Street and Lehua Street, just north of the Wahiawā Community Transit Center project area. The school started in 1899 to educate children of farmers who were brought in from California. By 1924, the school had grown to accommodate a new six-room school building, office, teachers' cottages, kitchen, and shop.

A more recent map of Wahiawā in the 1940s shows substantial developments south of the project area, but no additional developments within the limits of the proposed Wahiawā Community Transit Center project area (Figure 8).

D. Post World War II to Present

The start of World War II further helped to accelerate developments within Wahiawā to accommodate the needs of the growing military population. Wahiawā Elementary School on Lehua Street soon closed their doors in the 1940s to become the new Wahiawā General Hospital (Figure 9). The Office of Civil Defense established a 42-bed wartime medical facility in the wood frame buildings formerly housing Wahiawā Elementary School. At the end of World War II, the facility continued to remain in operation under the leaders of the Wahiawā Hospital Association. The 72-bed acute care facility was dedicated in 1958, under the official name, Wahiawā General Hospital, which is currently situated north of the current project area.

At the corner of Lehua Street and California Avenue stood the old Wahiawā Hotel (Figure 10). The "cottages", as the hotel was referred to, was a carry-over from the old Wahiawā Elementary School, which was then located where Wahiawā General Hospital now stands. The old Wahiawā Hotel was operated by Mary Johnson until World War II, when it was formally taken over by the Army for nurses' quarters. Post World War II, the old Wahiawā Hotel had been used as living quarters for area school teachers. By the 1960s, Wahiawā teachers, who had been quartered at the teachers' cottages (as they referred to them), were forced to relocate as plans for the new Wahiawā Branch Library were in the making.

The existing Wahiawā branch library, located at the southeastern corner of the current project area, opened its doors on July 19, 1965 at the corner of California Avenue and Lehua Street. The library, located at the southwestern most corner of the proposed Wahiawā Community Transit Center project area, continues to remain in operation today. In more recent years, the state has used the surrounding areas as state, university and Department of Education offices.

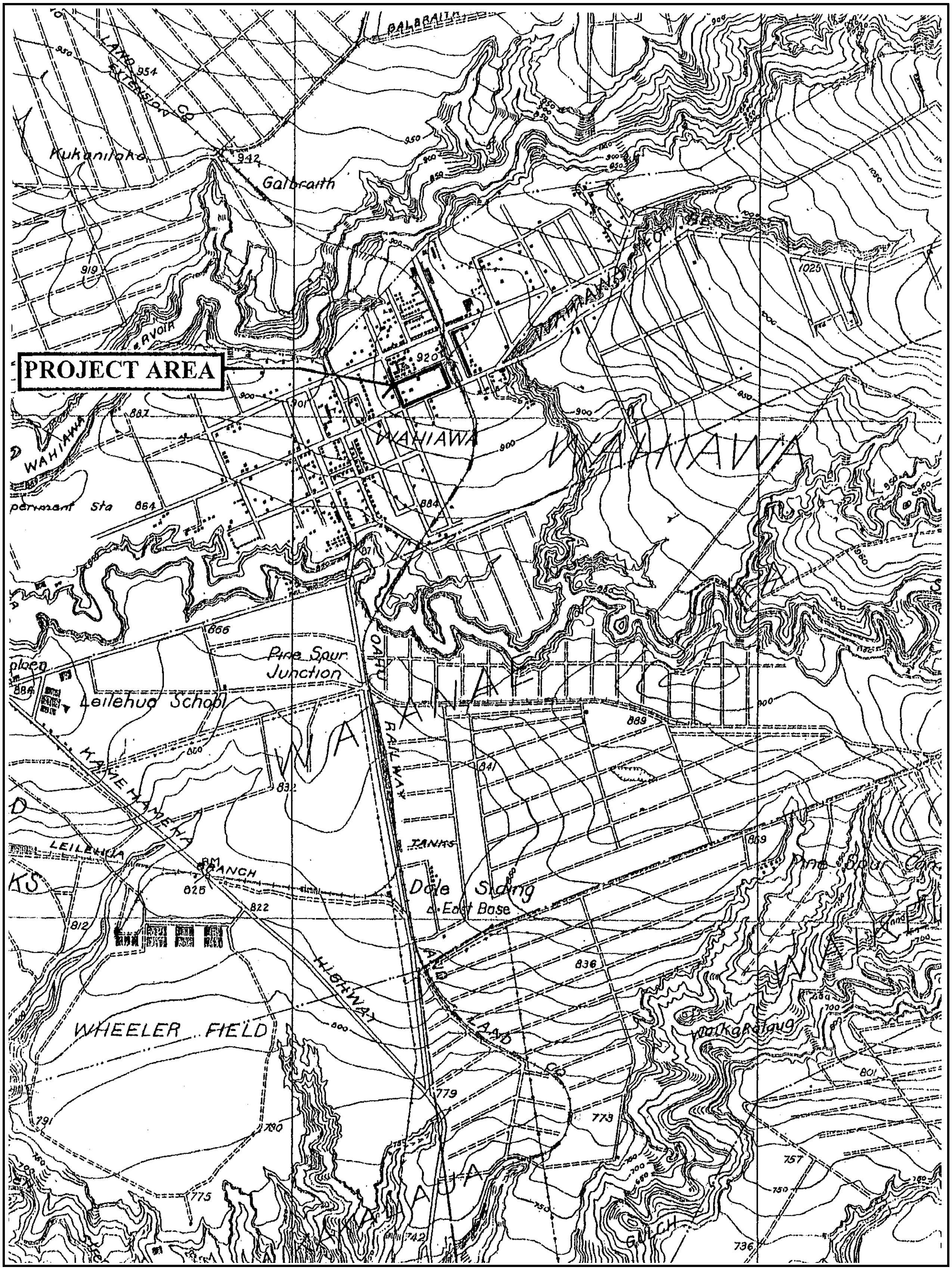


Figure 7 Portion of 1928/1929 USGS Wahiawā Quadrangle Map, showing project area and continued development in the greater Wahiawā area. Also noted is Wahiawā Elementary School immediately north of the project area.

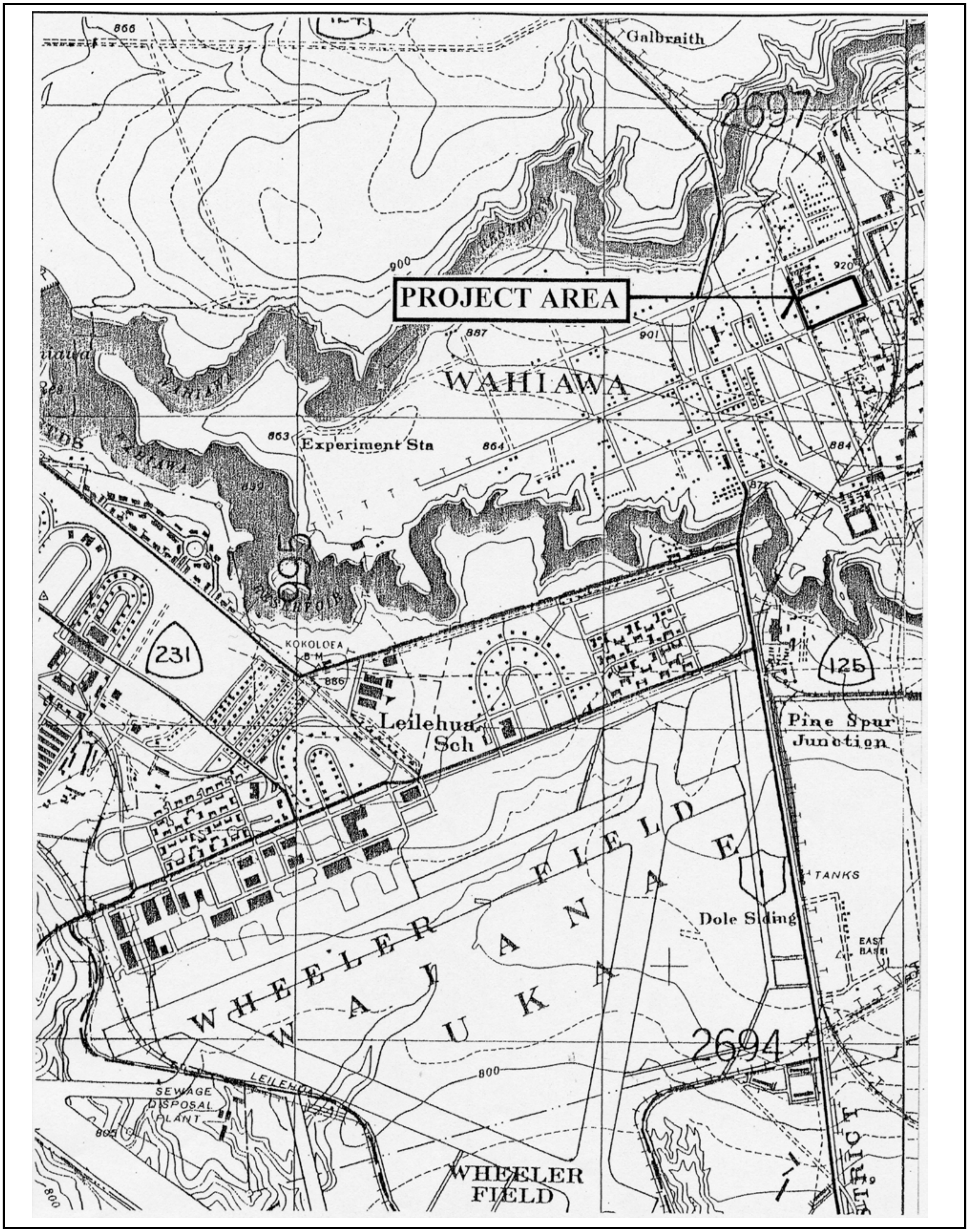


Figure 8 Portion of 1943 War Department Schofield and Kaukonahua Quadrangles, showing Wahiawā Community Transit Center project area and continued developments south of the project area.

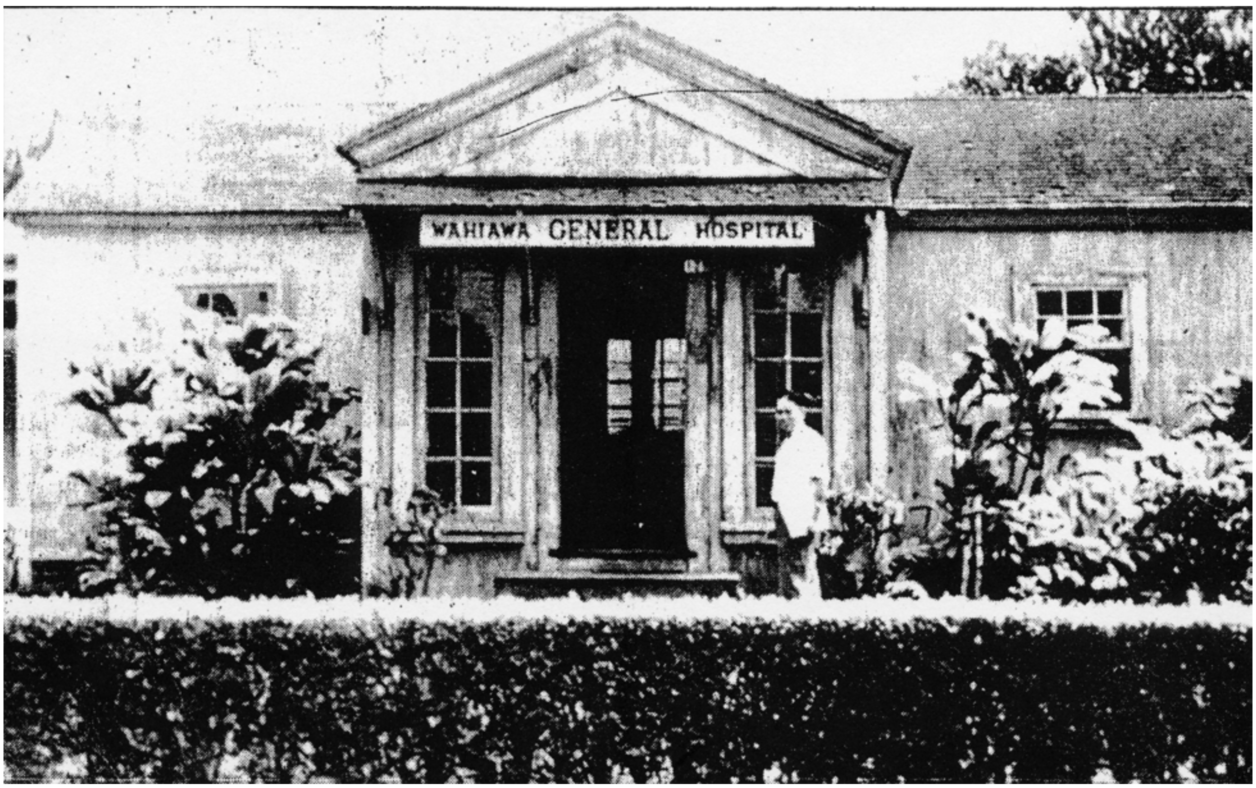


Figure 9 Photo taken of Wahiawā General Hospital, which was established in 1945 as an emergency facility for wartime injuries.

Figure 10 Early photo of the old Wahiawā Hotel, which was demolished in the 1960s to accommodate construction for the new Wahiawā Library, located at the southwestern corner of the proposed Wahiawā Community Transit Center project area.

III. PREVIOUS ARCHAEOLOGICAL STUDIES

Two archaeological sites in the general vicinity of the present study area were recorded during the first attempt at a comprehensive survey of sites on the island of O`ahu, which was accomplished by J. Gilbert McAllister of the Bishop Museum in 1930. Site 218 is Kūkaniloko which, as noted in the previous section, was "one of the two famous places in the Hawaiian islands for the birth of children of tapu chiefs" (McAllister 1933: 134). McAllister describes the site as it appeared in the early 1930s:

> There is now little to see at Kukaniloko. It is an inclosed [*sic*] area about one-half acre in size, with many large stones, some just visible, others protruding to a height of 3 to 4 feet, scattered about on a well-kept lawn. Tall trees border the site. To the old Hawaiians these stones were all named and represented alii, but now the only name remembered is Kahamaluihi, a flat stone near the center of the group. The old Hawaiians of today remember that in their childhood they were never allowed by their parents to approach even near the sacred birthplace, an indication of the great respect in which Kukaniloko was held, even a century after contact with Europeans and more than a half century after the coming of the missionaries. (McAllister 1933: 136)

Kūkaniloko is located approximately 200 meters west of the intersection of Kamehameha Highway and Whitmore Road.

McAllister recorded, adjacent to Kūkaniloko, Site 219: Ho`olonopahu *heiau*:

> Hoolonopahu was a heiau which functioned in connection with Kukaniloko ...Here were kept the sacred drums of Opuku and Hawea which announced the birth of an alii. Nothing now remains of the temple. The land is planted in pineapple. (McAllister 1933.: 137)

More recent archaeological studies has been completed in the vicinity of the current Wahiawā Community Transit Station.

Hommon and Ahlo (1983) completed an archaeological reconnaissance survey (immediately east of the current Wahiawā Community Transit Center project area) of a 12-acre parcel of land near the east end of California Avenue; no significant archaeological sites were documented.

An archaeological inventory survey was completed by Paul Rosendahl (PHRI) (Rosendahl 1992) of an approximate 2,000-acre area of the Galbraith Trust Lands, located northwest of the current Wahiawā Community Transit Center project area. During the survey, the Kūkaniloko birthstones (State Inventory of Historic Places Site 50-80-04-218) were relocated and a stacked stone wall (State Inventory of Historic Places Site 50-80-04-218) was recorded. Twelve shovel test units were excavated; no subsurface cultural deposits were encountered.

In 1995, BioSystems Analysis, Inc (McIntosh, Denham and Cleghorn 1995) conducted an archaeological inventory survey on select portions of Schofield Barracks Military Reservation and Wheeler Army Airfield, located south of the current project area. One historic site was documented: Building 1414 (State Site 50-80-08-5082), which was built in 1941. A large boulder with several facets was encountered, but given no significant recognition.

Northeast of the current Wahiawā Community Transit Center project area, Hammatt and Chiogioji (2000) completed an archaeological assessment of the proposed water line route between Whitmore Village and Wahiawā. At the completion of the field inspection, no surface archaeological sites were observed on any portion of the water line route. The report mentions significant human intrusions to the slopes and reservoir area, as evident by modern trash. Additionally, no evidence of traditional Hawaiian activities were observed on the grassy banks of the reservoir.

Table 1 (Figure 11) below lists additional archaeological investigations in the general Wahiawā area.

Table 1. Previous Archaeological Investigations in the vicinity of the proposed Wahiawā Community Transit Center.

Source	Type of Investigations	General Location	Findings
McAllister (1933)	Island Survey	O`ahu Island	Identifies Sites 218 (Kūkaniloko) and Site 219 (Ho`olonopahu *Heiau*).
Rosendahl (1977)	Archaeological inventory, assessment, and evaluation	U.S. Army Facilities	No sites were located on the 67-acre portion of Wheeler Army Airfield that was surveyed.
Griffin and Yent (1977)	Archaeological Survey	Wahiawā Fresh Water Park	Remains of a railway trestle and associated roadbed, and a small complex of four terraces and a rock alignment were documented. Broken concrete and coral blocks found in terrace complex, suggesting that the terrace had been historically constructed or was a prehistoric site that had been historically modified.
Hommon and Ahlo (1983)	Archaeological Reconnaissance Survey	Wahiawā (east end of California Avenue)	No significant archaeological sites documented.

Source	Type of Investigations	General Location	Findings
Powell (1984)	Walk-through Survey	Valley at the base of Mount Ka`ala	Notes 35 terraces, four small enclosures, and four irrigation canals.
Barrera 1985	Reconnaissance Survey	Mililani Town	No significant archaeological findings. Report concludes that pineapple cultivation has long since erased any such evidence of archaeological or historic remains.
Henry, Walker and Rosendahl 1992	Inventory Survey	Kamananui and Wahiawā (Galbraith Trust Lands)	Field work resulted in the relocation of Kūkaniloko birthstones (State Site 50-80-04-218), and the identification of a stacked stone wall (SIHP Site 4571).
Tomonari-Tuggle 1994	Cultural Resource Assessment	Wheeler Army Airfield	The study identifies five archaeological sites, but of these, only the Oahu Rail & Land Company Waipahu-toWahiawā line could be definitely evaluated as historically significant. The other four sites were suggested to be associated with military features. Based on the assessment, the Wheeler Army Airfield project area was divided into areas of low and medium historic preservation sensitivity with appropriate mitigation measures for each.
McIntosh, Denham, Cleghorn 1995	Archaeological Inventory Survey	Schofield Barracks and Wheeler Army Airfield	One historic site was encountered, Building 1414 (an abandoned bunker) at Wheeler Army Airfield and assigned State Site 50-80-08-5082.
Hammatt and Chiogioji 2000	Archaeological Assessment	Whitmore Village and Wahiawā	No surface archaeological sites or evidence of traditional Hawaiian activity were observed.

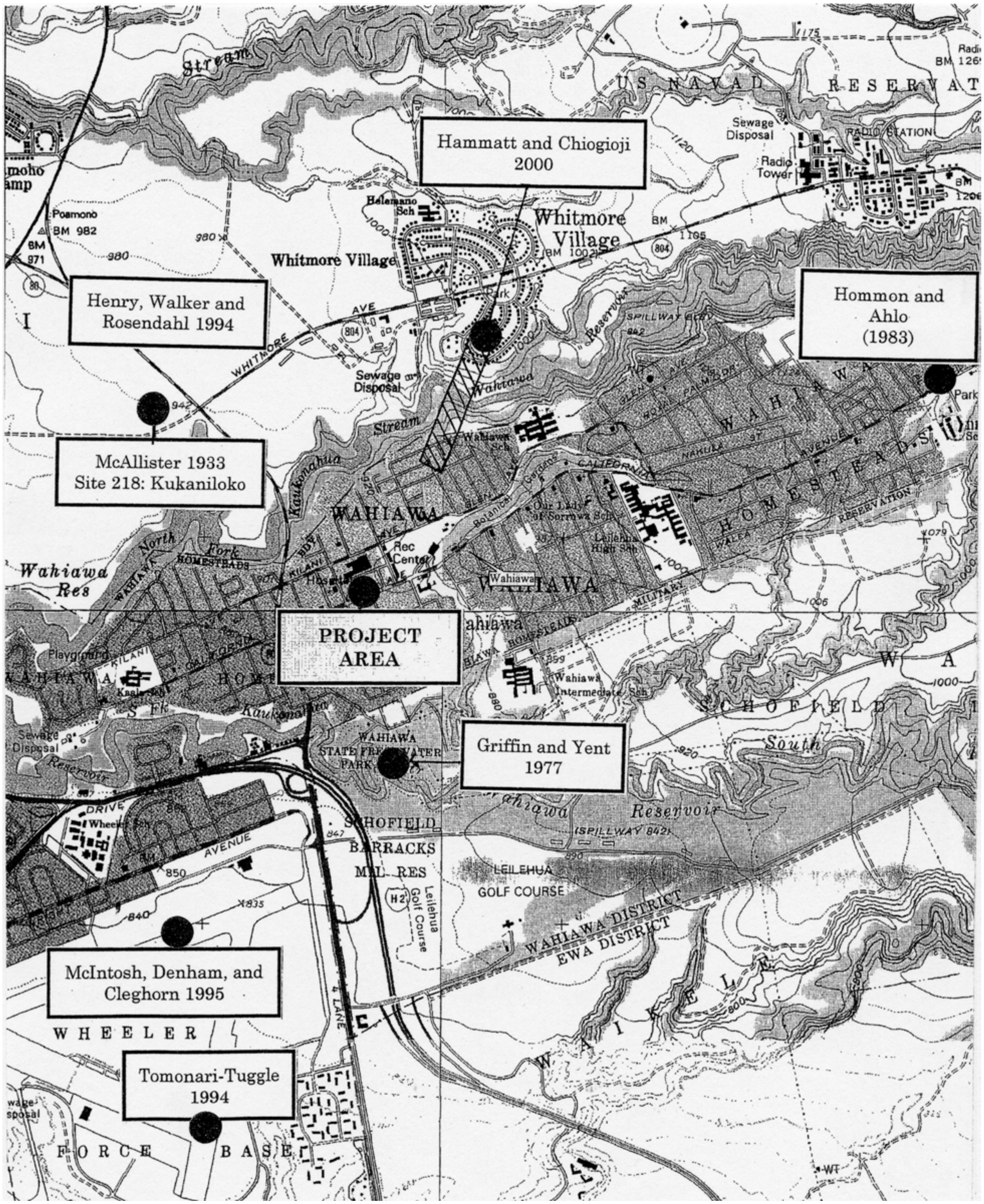


Figure 11 Portion of USGS 7.5 Minute Series Topographic Map, Schofield Barracks, Haleiwa, Hauula, and Waipahu quadrangles, showing Relevant Archaeological Investigation in the Wahiawā Community Transit Center project area.

IV. FIELD INSPECTION

Field inspection of the proposed Wahiawā Community Transit Center was accomplished on April 25, 2002. The entire project area was inspected on foot by CSH archaeologist David Shideler, M.A.

The eastern most aspect of the project area is privately owned and includes two separate businesses: the Flagship Fastlube (located at 961 Center Street) and the Union-76 Gas Station (which is currently closed and for sale). The remaining project area, which includes the central and western aspects, are currently owned by the State of Hawai`i.

An asphalt parking lot and access drive way, running north to south from California Avenue to Center Street, is further situated abutting the two privately owned businesses and the portable structures located at 910 California Avenue. Based on historic map documentation of the project area, this is also the approximate location of a section of the old Oahu Railway & Land Company Wahiawā route.

Further west of the asphalt parking lot, several portable structures are situated at the east-central aspect of the project area, located at 910 California Avenue. These portables include Public Health Nursing, University of Hawai`i Cooperative Extension Services, Family Planning, Clinical Health Department, and Wahiawā Counseling. West of the portable structures are four wooden State office buildings (numbered 1 through 4), and the Wahiawā Women and Children program, located at 830 California Avenue.

At the western most aspect of the project area stands the Wahiawā Public Library (at the southwestern most corner). North of the library, are several portable structures associated with the State of Hawaii, Department of Education (Figures 12 through 14).

The field inspection of the proposed Wahiawā Community Transit Center project area revealed no surface archaeological sites and no evidence of traditional Hawaiian activity. It was very apparent during the course of the assessment that continued modern developments upon the project area over the last century have greatly impacted the land, as evident by the graded landscape areas and existing structures.

Figure 12 View from midblock Center Street, showing Wahiawā Library (in the far distance) and portables associated with the Department of Education.

Figure 13 View of Department of Education portables from the corner of Lehua Street and Center Street.

Figure 14 View from midblock Lehua Street showing the existing parking lot and Department of Education portables.

V. NATIVE HAWAIIAN CUSTOMS PERTAINING TO THE PROJECT AREA AND POSSIBLE CULTURAL IMPACTS

A. Burials

There are no documented prehistoric or historic burials within or in the vicinity of the project area. The project area lies within a landscape that has been developed and urbanized throughout most of the 20th century. Additionally, soil type and geology within the project area make it unlikely that the area once served as a traditional Hawaiian burial place.

B. Hawaiian Trails

There is no documentation of any traditional trails running through the project area. In the 19th century memoirs of John Papa I`i, the traditional trails of O`ahu are recorded. I`i describes the trail through central O`ahu, connecting the north and south shores of the island; in the general area of Wahiawā, the trail ran to:

> ...Kukaniloko, the birthplace of chiefs. Just below the main trail was the descent to the stream of Kuaikua, where there was a diving place and a palce for travelers to rest. Beyond was Paka stream and the *maika* field of Kapalauauai, which lay beyond the pond belonging to the village. There the trail met with the one from Kolekole and continued on to the stream of Waikakalaua... (I`i 1959: 98-99)

Based on I`i's description, this trail ran well west of the present project area.

C. Native Hunting Practices

There is no direct evidence or documentation of any native hunting practices specifically associated with the present project area.

D. Native Gathering Practices for Plant Resources

As has been noted in this assessment, the project area has been a portion of the urban landscape of Wahiawā Town throughout most of the 20th century. No evidence of any former gathering of plant resources within the specific project area remains. Additionally, there is no evidence of any on-going gathering practices.

E. Cultural Sites

The decades-long urban development within the present project area has so disturbed and altered the original landscape that no surface cultural sites or properties are present.

VI. SUMMARY AND CONCLUSION

Historic documentation suggests that the Wahiawā area was highly significant in traditional Hawaiian times. It was associated with the Hawaiian royalty and is the location of Kūkaniloko, a birthing site considered one of the most sacred places on O`ahu, located northeast of the project area. Researchers have also noted the presence of extensive agricultural terraces in the area which could have supported a substantial population in pre-contact O`ahu. A large Hawaiian village continued to exist in Wahiawā at least up to the mid-19th century.

Toward the end of the 19th century, western entrepreneurial, agricultural and military interests began to focus on Wahiawā. Additionally, residential tracts were also simultaneously being built in the immediate vicinity of the project area.

Based on historic overviews, it is very evident that majority of the activities indicated within the immediate project area began to transform during the early 1900s. However, many of these historic structures were long gone by the late 1940s and early 1960s in order to accommodate new urban developments.

Germane to the project area is the historic presence of the old Wahiawā Hotel, located at the corner of Lehua Street and California Avenue. In subsequent years, the hotel, which was used primarily as housing facilities for nearby school teachers, would soon be demolished in the 1960s for the construction of the new Wahiawā Library. The library, located at the southwestern corner of the project area, at the intersection of Lehua Street and California Avenue, continues to remain in operation today.

The site of the former Wahiawā Elementary School, which is now Wahiawā General Hospital, is also of importance to the project area. During World War II, Wahiawā Elementary School would transform into a hospital facility for the war injured and remains in operation today.

Archaeological investigations further note several important studies in the general area of Wahiawā. A 1992 archaeological inventory survey of an approximately 2,000-acre parcel adjacent to — and north of — the proposed Wahiawā Community Transit Center documented only one previously-unrecorded site: a stacked stone wall. The survey encountered no archaeological materials within the Wahiawā Reservoir-Kaukonahua Stream gulch. Additionally, the archaeological reconnaissance survey completed by Hommon and Ahlo (1983) immediately east of the project area (on the east end of California Avenue) documented no significant archaeological findings.

During the field inspection, no surface archaeological sites and no evidence of traditional Hawaiian activities were observed. The absence of any surface remains further suggests the continued development of the project area within the last hundred year.

The area's history of urban development has distorted or terminated any native practices, if any, that formerly pertained to the project area parcel. There is no evidence of any native practices – including burials, trails, hunting, gathering, and cultural sites –

formerly associated specifically with the parcel, nor is there evidence of any ongoing cultural practices.

Given the century-long history of modern development of all portions of the proposed Wahiawā Community Transit Center, the general absence of findings in the adjacent archaeological study area, and the results of the field inspection, there is little likelihood of encountering prehistoric or significant post-contact surface structures or subsurface archaeological remains during construction. If any significant features are observed, they most likely postdate the early 1900s.

Based on the above findings, this study concludes that there will be no adverse impact to historical or cultural resources by the implementation of the transit project.

VII. REFERENCES

Armstrong, Warwick R.
1973 *Atlas of Hawaii.* University of Hawaii Press: Honolulu.

Barrera, William Jr.
1985 *Archaeological Reconnaissance Survey: Mililani Area, `Ewa, O`ahu.* Chiniago, Inc. Honolulu, HI.

Childs, Jan Wesner
1994 "Workers Recall Hosptial's Humble Beginnings: Wahiawā General was 'Wooded Shack' at its 1944 Opening". Sunpress. September 2, 1994.

Foote, Donald E., Elmer L. Hill, Sakuichi Nakamura, and Floyd Stephens
1972 *Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii*. Soil Conservation Service, United States Department of Agriculture.

Griffin, Agnes E. and Martha Yent
1977 *Results of the Archaeological Survey of Phase I of Wahiawā Fresh Water Park.* Department of Land and Natural Resources Division of State Parks. Honolulu, HI.

Hammatt, Hallett H. and Rodney Chiogioji
2000 *Archaeological Assessment of a Proposed Water Line Route Between Whitmore Village and Wahiawā, in the Mauka Portion of Kamananui Ahupua`a, Wahiawā District, Island of O`ahu (TMK 7-1-02)* Cultural Surveys Hawai`i, Kailua, HI

Hartwig, Boyd
1989 "Hospital Outgrows 'primitive' past". Sunpress. October 19, 1989.

Handy, E.S. Craighill and Elizabeth G. Handy
1972 *Native Planters of Old Hawaii: Their Life, Lore, and Environment.* Honolulu: Bishop Museum Press.

Henry, Jack D., Alan T. Walker, and Paul H. Rosendahl
1992 *Archaeological Inventory Survey, Galbraith Trust Lands, Lands of Kamananui and Wahiawā, Waialua and Wahiawā Districts, Island of Oahu.* Paul H. Rosendahl, Ph.D., Inc.

Hommon, R.J. and H.M. Ahlo Jr.
1983 *An Archaeological Reconnaissance Survey of a 12 Acre Parcel at Wahiawā, Oahu.* Prepared for Jesse Spencer, Hidden Valley Investments. Science Management, Inc. Honolulu, HI.

I`i, John Papa
1959 *Fragments of Hawaiian History*. Honolulu: Bishop Museum Press.

Kamakau, Samuel M.
1992 *Ruling Chiefs of Hawaii*. Honolulu: Kamehameha Schools Press.

1964 *Ka Po`e Kahiko: The People of Old*. Honolulu: Bishop Musum Press.

Kuykendall, Ralph
1965 *The Hawaiian Kingdom*, vol I. Honolulu: The University Press of Hawaii.

MacDonald, Gordon A. and Agatin T. Abbot
1974 *Volcanoes in the Sea: The Geology of Hawaii*. University of Hawaii Press: Honolulu.

McIntosh, James, Timothy Denham, and Paul Cleghorn
1995 *Report of Archaeological Inventory Survey with Subsurface Testing For Work Area 1 of the Proposed Family Housing Project at Wheeler Army Airfield and Schofield Barracks Military Reservation, Wahiawā District, O`ahu Island, Hawai`i (TKM: 7-7-01).* BioSystems Analysis Inc., Kailua, HI.

McAllister, J. Gilbert
1933 *Archaeology of Oahu*. B.P. Bishop Museum: Honolulu.

Nebalek, Lani
1984 *Wahiawā*. Mililani, Hawaii: Wonder View Press.

Powell, Gary A.
1984 Letter to Robert Borello, Army Corps of Engineers. Waimea Arboretum and Botanical Gardens. Honolulu, HI.

Rosendahl, Paul
1977 Archaeological Inventory and Evaluation Report for Installation Environmental Impact Statement for U.S. Army Support Command, hawaii (USASCH). Prepared for the Department of the Army, U.S. Army Engineer Division, Pacific Ocean. Department of Anthropology, B.P. Bishop Museum. Honolulu, HI.

Tuggle-Tomonari, M.J.
1994 *Archaeology and Histori on the central O`ahu Plateau: A Cultural Resources Assessment of Wheeler Army Airfield.* International Archaeological Research Institute, Inc. Honolulu, HI.

Wahiawa Press
1964 “Old Buildings Go As Library Starts”. July 1, 1964.

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

Appendix C

Air Quality Impact Assessment

June 2002

Environmental Assessment

Wahiawa Transit Center & Park and Ride
TMK: 7-4-006:002 & portion of 7-4-006:012
956 California Avenue, Wahiawa, O`ahu, Hawai`i

Return to list of appendices

Partners, Inc.

AIR QUALITY
ENVIRONMENTAL ASSESSMENT
FINAL REPORT

at

Wahiawa Community Transit Center

(AMP Project No. A0096.30)

June 2002

Prepared for:

AM Partners, Inc.
1164 Bishop St., Suite 1000
Honolulu, HI 96813

Prepared by:

The Environmental Company, Inc.

Air Quality Environmental Assessment
Final Report

Wahiawa Community Bus Transit Center

956 California Avenue, Wahiawa, Hawaii

June 2002

Prepared for:

AM Partners, Inc

Prepared by:

The Environmental Company, Inc.
1001 Bishop St., Pauahi Tower, Suite 1240
Honolulu, Hi 96813

TABLE OF CONTENT

EXECUTIVE SUMMARY

The Honolulu City & County Department of Transportation Services is proposing to construct the Wahiawa Community Bus Transit Center in Wahiawa's Civic Center at 956 California Avenue, Wahiawa, Hawaii. The proposed project will consist of eight bus bays along with passenger waiting facilities and other ancillary facilities. The project is expected to be completed at the end of July 2003 and will result in increased emissions due to exhaust from the increased bus activity at the said location. This study examines the potential short- and long-term air quality impacts that may occur as a result of these extra exhaust emissions and includes potential impact due to construction activities. In addition, this study suggests mitigative measures to reduce any potential air quality impacts where possible and appropriate.

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

Regional and local climate, together with the amount and type of human activity generally dictate the air quality at the project site. Trade winds dominate in the region. Rough terrain plays an important role in local wind pattern. During winter, occasional storms may generate strong winds from the south (kona winds) for brief periods. When the trade winds or kona winds are weak or absent, landbreeze-seabreeze circulations or mountain drainage winds may develop. Wind speeds are often lower compared to more exposed coastal locations, but the trade winds still provide relatively good ventilation much of the time. Temperatures in the Oahu area leeward of the Koolaus are generally very moderate with average daily temperatures ranging from about 70 Fahrenheit (^{o}F) to 85^{o}F. Extreme temperatures range from about 53^{o}F to about 95^{o}F. Rainfall in the Wahiawa area is relatively high, averaging about 50 inches per year.

The present air quality at the project site appears to be reasonably good based on nearby air quality monitoring data. Air quality data from the nearest monitoring stations operated by the Hawaii Department of Health suggest that all national ambient air quality standards are currently being met, although occasional exceedances of the more stringent state standard for ozone may occur.

The resulting increase in the air pollution due to bus emission at the Wahiawa Bus Transit Center was found to be relatively smaller than the significant emission rates as defined in the Hawaii Administrative Rules. Therefore, it is unlikely that any measurable impacts on air quality will occur. Implementing any air quality mitigation measures for long-term impacts from the proposed project is probably unnecessary and unwarranted.

1.0 INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

The Department of Transportation Services (DTS), City and County of Honolulu is proposing to construct and operate the Wahiawa Community Bus Transit Center on the island of Oahu, Hawaii. The proposed project will have eight (8) bus bays with passengers waiting facilities and other ancillary facilities. It will have circulator service line and a trunk line serving the Wahiawa and Honolulu route and is expected to start operation by the end of July 2003. This air quality assessment will be part of the basis to determine whether a more detailed environmental assessment is needed for the proposed development. The Environmental Company, Inc. (TEC, Inc.) conducted an air quality environmental assessment during the month of May 2002 to estimate the impact of future increase emissions due to activities at the Bus Transit Center. To ascertain the potential of the air quality impact on the project, the maximum annual bus volume was predicted for the Transit Center as a worst case scenario.

The purpose of this study is to describe existing air quality in the project area and to assess the potential long-term direct and indirect air quality impacts that could result from the use of the proposed facilities. Measures to mitigate these impacts are suggested where possible and appropriate.

1.2 PROJECT OVERVIEW

1.2.1 Site Description

The proposed **Wahiawa Community Bus Transit Center** will be located in Wahiawa's Civic Center at 956 California Avenue, on portions of TMK 7-4-6:2 and TMK 7-4-6:12 (Fig. 1.1, Site Map). The project site is currently zoned as R-5 Residential area. The Transit Center is located adjacent to the existing Wahiawa Civic Center Building (Fig. 1.2) and across from the Wahiawa Town Center (Fig. 1.3).

The Wahiawa Community Bus Transit Center will provide eight (8) bus bays for the regular bus and paratransit vehicles. A proposed parking lot with a capacity of about 45 cars will remain immediately adjacent to the Transit Center. Passenger waiting shelters, a comfort station with restrooms, bike parking, lockers, and informational kiosks will be provided, along with landscaping and additional street trees. The Transit Center will operate circulator lines that would service the Wahiawa area and a trunk line that will serve the Wahiawa and Downtown Honolulu route.

1.2.2 Interviews

Mr. James Burke of DTS described the activities at the proposed Bus Transit Center including the bus schedule and dwell time or wait-time for the buses to load and unload passengers. He also indicated that there will be 6 regular buses and 2 articulated buses to service the Transit Center. Finally, Mr. Burke concurred with the air quality assessment strategy that utilizes maximum allowable bus traffic at the Transit Center, which represents a worst case scenario as the basis for calculating the annual volume of buses expected at the center.

In an effort to calculate annual emission volumes at the proposed Bus Transit Center, TEC, requested actual emission data from Mr. Rick Hardy of the Oahu Transit Services, Inc. Mr. Hardy explained that these data are not available because emissions from existing buses have not been monitored. He further explained that the Oahu Transit Services Inc. follow a strict maintenance schedule on their engines as per manufacturer specification. He explained that currently, buses serving the island of Oahu are equipped with diesel engines (Detroit Diesel Series 50) that have been tested and approve by the United State Environmental Protection Agency (EPA) prior to commercial production. Furthermore, he indicated that a $9,000 rebuild kit is use on a regular basis to ensure that each engine performs within the allowable EPA emission standard for heavy duty engines.

Pacific Detroit Diesel Company, through the help of Ms. Stella Yara, provided the EPA Emission standard (Table 1) and indicated that the regular buses at the Oahu Transit Services, use 1993 to 1998 model of the Series 50 diesel engines. The articulated buses use the 1999 Series 50 diesel engine. She reiterated that no actual emission data on the currently used buses on Oahu are available.

The Hawaii Department of Health (HDOH) through the help of Ms. Liza Young, provided Hawaii air quality data, including the Hawaii and EPA standards for the six criteria pollutants (Table 2). She further reinforced the claim of Mr. Hardy and Ms. Yara that automobile emission data is not available in the state of Hawaii and not required that the Oahu Transit Services to provide these data. The HDOH relies on the air monitoring stations strategically located in Oahu to monitor the amount of engine emission in the environment (Fig. 1.4).

1.2.3 Annual Bus Volume

The Wahiawa Community Bus Transit Center is expected to operate 20 hours daily. The Transit Center will be serviced with 6 regular buses and 2 articulated buses. Service plan for the Transit Center will reflect a “pulse” of about every ½ hour when the circulators and the trunk lines services are expected to meet at the Transit Center. The loading dwell time is about 3 to 5 minutes to allow the bus to load and unload passengers. It is assumed that the bus will be running in idle mode over this period in order to operate the air-conditioning system.

In order to assess the impact of the Transit Center on the quality of the ambient air, the air quality environmental assessment was evaluated on a worst case scenario. This scenario consisted of assuming that the Bus service remains on normal weekday schedule 365 days a year. Actual buses operate on a limited schedule on weekends and holidays. In addition all buses at the station are assumed to be in idle mode while waiting for passengers. The route numbers and service span for the Transit Center are based on Draft Central Oahu Hub and Spoke Service Plan and current public timetable for the existing service.

Based on the above assumptions, the worst case scenario estimated 84,315 buses expected to visit the Wahiawa Community Bus Transit Center each year.

2.0 AIR QUALITY ENVIRONMENTAL ASSESSMENT

2.1 AMBIENT AIR QUALITY STANDARDS

Ambient concentrations of air pollution are regulated by both national and state ambient air quality standards (AAQS). National AAQS are specified in Section 40, Part 50 of the Code of Federal Regulations (CFR), while State of Hawaii AAQS are defined in Chapter 11-59 of the Hawaii Administrative Rules. Table 2 summarizes both the national and the state AAQS that are specified in the cited documents. As indicated in the table, Federal and state AAQS have been established for particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone and lead. The state has also set a standard for hydrogen sulfide. National AAQS are stated in terms of both primary and secondary standards for most of the regulated air pollutants. National primary standards are designed to protect the public health with an "adequate margin of safety". National secondary standards, on the other hand, define levels of air quality necessary to protect the public welfare from "any known or anticipated adverse effects of a pollutant". Secondary public welfare impacts may include such effects as decreased visibility, diminished comfort levels, or other potential injury to the natural or man-made environment, e.g., soiling of materials, damage to vegetation or other economic damage. In contrast to the national AAQS, Hawaii State AAQS are given in terms of a single standard that is designed "to protect public health and welfare and to prevent the significant deterioration of air quality".

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

The Hawaii AAQS are in some cases considerably more stringent than the comparable national AAQS. In particular, the Hawaii 1-hour AAQS for carbon monoxide is four times more stringent than the comparable national limit, and the state 1-hour limit for ozone is more than two times as stringent as the national 1-hour standard. The national 1-hour ozone standard will be phased out (pending court appeal) the next few years in favor of the new (and more stringent) 8-hour standard (Table 2).

The Hawaii AAQS for sulfur dioxide were relaxed in 1986 to make the state standards essentially the same as the national limits. In 1993, the state also revised its airborne particulate standards to follow those set by the Federal government. During 1997, the Federal government again revised its standards for particulate, but the new standards have been challenged in Federal court. To date, the HDOH has not updated the state particulate standards.

2.2 REGIONAL AND LOCAL CLIMATOLOGY

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

Hawaii lies well within the belt of northeasterly trade winds generated by the semi-permanent Pacific high pressure cell to the north and east. On the island of Oahu, the Koolau and Waianae Mountain Ranges are oriented almost perpendicular to the trade winds, which accounts for much of the variation in the local climatology of the island. Waianae, Wahiawa and Mililani, the sites of the proposed project, are suburban areas within the City and County of Honolulu. Wahiawa is situated between the Koolau and Waianae Ranges. Although climatic conditions vary somewhat across the project area, long-term weather data available from the Honolulu International Airport, located a few miles to the southeast, is at least semi-representative.

Wind frequency data given in Table 3 for Honolulu International Airport show that the annual prevailing wind direction for this area of Oahu is east northeast. On an annual basis, 34.7 percent of the time the wind is from this direction, and nearly 75 percent of the time the wind is in the northeast quadrant. Winds from the south are infrequent occurring only a few days during the year and mostly in association with winter storms. Wind speeds average about 11 mph (10 knots) and mostly vary between about 4 and 18 mph (5 and 15 knots). Surface wind speeds in the project area are somewhat lighter, and local wind directions are likely affected by the terrain.

Air pollution emissions from motor vehicles, the formation of photochemical smog and smoke plume rise all depend in part on air temperature. Colder temperatures tend to result in higher emissions of contaminants from automobiles but lower concentrations of photochemical smog and ground-level concentrations of air pollution from elevated plumes. In Hawaii, the annual and daily variation of temperature depend to a large degree on elevation above sea level, distance inland and exposure to the trade winds. Average temperatures at locations near sea level generally are warmer than those at higher elevations. Areas exposed to the trade wind tend to have the least temperature variation, while inland and leeward areas often have the most. The project area's leeward location results in a relatively moderate temperature profile compared to some other locations around Oahu and the state. At the airport, average annual daily minimum and maximum temperatures are 70°F and 84°F, respectively [1]. The extreme minimum temperature was 53°F during January 1998, and the extreme maximum was 95°F during September 1994. Temperatures in Wahiawa area are cooler due to the higher elevation.

Small scale, random motions in the atmosphere (turbulence) cause air pollutants to be dispersed as a function of distance or time from the point of emission. Turbulence is caused by both mechanical and thermal forces in the atmosphere. It is often measured and described in terms of Pasquill-Gifford stability class. Stability class 1 is the most turbulent and class 6 the least. Thus, air pollution dissipates the best during stability class 1 conditions and the worst when stability class 6 prevails. In suburban areas, like those in the project area, stability class 5 or 6 is generally the highest stability class that occurs, developing during the nighttime and early morning.

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

Rainfall can have a beneficial effect on the air quality of an area in that it helps to suppress fugitive dust emissions, and it also may "washout" gaseous contaminants that are water-soluble. Rainfall in Hawaii is highly variable depending on elevation and on location with respect to the trade wind. Wahiawa, located at a higher elevation and between the Koolau and Waianae Ranges, have a wetter climate receiving about 50 inches per year [2].

2.3 PRESENT AIR QUALITY

Present air quality in the project area is mostly affected by air pollutants from motor vehicles, industrial sources, agricultural operations and to a lesser extent by natural sources. Table 4 presents an air pollutant emission summary for the island of Oahu for calendar year 1993. The emission rates shown in the table pertain to manmade emissions only, i.e., emissions from natural sources are not included. As suggested in the table, much of the particulate emissions on Oahu originate from area sources, such as the mineral products industry and agriculture. Sulfur oxides are emitted almost exclusively by point sources, such as power plants and refineries. Nitrogen oxides emissions emanate predominantly from industrial point sources, although area sources (mostly motor vehicle traffic) also contribute a significant share. The majority of carbon monoxide emissions occur from area sources (motor vehicle traffic), while hydrocarbons are emitted mainly from point sources. Based on previous emission inventories that have been reported for Oahu, it appears that emissions of particulate and nitrogen oxides have increased during the past ten years, while emissions of sulfur oxides, carbon monoxide and hydrocarbons have declined.

Roadways in the vicinity of the Transit Center site carry moderate volumes of motor vehicle traffic at times, and roadway intersections may be congested during peak traffic hours. Emissions from motor vehicles using these roadways, primarily nitrogen oxides and carbon monoxide, may cause localized impacts on air quality.

The Wahiawa Community Bus Transit Center site is farther removed from large industrial sources of air pollution, although emissions from distant sources at Campbell Industrial Park may affect these area during kona wind conditions. With the demise of sugarcane growing on the Ewa Plain, air pollutions impacts from agriculture have significantly diminished in the area. Agriculture-related emissions in Wahiawa area may experience occasional dust and smoke impacts from nearby, large-scale pineapple cultivation and harvesting operations. Natural sources of air pollution emissions that also could affect the project area but cannot be quantified very accurately include the ocean (sea spray), plants (aero-allergens), wind-blown dust, and perhaps distant volcanoes on the island of Hawaii.

The State Department of Health operates a network of air quality monitoring stations at various locations on Oahu. Each station, however, typically does not monitor the full complement of air quality parameters. Table 5 shows annual summaries of air quality measurements that were made nearest to the project area for several of the regulated air pollutants for the period 1996 through 2000. These are the most recent data that are currently available.

During the 1996-2000 period, sulfur dioxide was monitored by the State Department of Health at an air quality station located at Kapolei. Concentrations monitored were consistently low compared to the standards. Annual second-highest 3-hour concentrations (which are most relevant to the air quality standards) ranged from 17 to 64 $\mu g/m^3$, while the annual second-highest 24-hour concentrations ranged from 5 to 16 $\mu g/m^3$. Annual average concentrations were only about 1 to 2 $\mu g/m^3$. There were no exceedances of the state/national 3-hour (1,300 $\mu g/m^3$) or 24-hour (365 $\mu g/m^3$) AAQS for sulfur dioxide during the 5-year period.

Particulate matter less than 10 microns in diameter (PM-10) is also measured at the Kapolei monitoring station. Annual second-highest 24-hour PM-10 concentrations ranged from 26 to 129 $\mu g/m^3$ between 1996 and 2000. Average annual concentrations ranged from 13 to 19 $\mu g/m^3$. All values reported were within the state and national AAQS (50 $\mu g/m^3$ and 150 $\mu g/m^3$ for the average annual and annual values respectively).

Carbon monoxide measurements were also made at the Kapolei monitoring station. The annual second-highest 1-hour concentrations ranged from 1.2 to 1.7 mg/m^3. The annual second-highest 8-hour concentrations ranged from 0.6 to 0.8 mg/m^3. No exceedances of the state 1-hour (10 mg/m^3) or 8-hour (5 mg/m^3) AAQS were reported.

Nitrogen dioxide is also monitored by the Department of Health at the Kapolei monitoring station. Annual average concentrations of this pollutant ranged from 2 to 9 $\mu g/m^3$, safely inside the state and national AAQS at 70 $\mu g/m^3$ and 100 $\mu g/m^3$ respectively.

The nearest available ozone measurements were obtained at Sand Island (about 25 miles southeast of the project area). The second-highest 1-hour concentrations for each year from 1996 to 2000 ranged from 91 to 110 $\mu g/m^3$. Up to 13 exceedances of the state AAQS (100 $\mu g/m^3$ per year) were recorded during the monitoring period. No specific trend is discernable, although the number of exceedances was lower during the latter half of the five-year period.

Although not shown in the table, the nearest and most recent measurements of ambient lead concentrations that have been reported were made at the downtown Honolulu monitoring station between 1996 and 1997. Average quarterly concentrations were near or below the detection limit, and no exceedances of the state AAQS of 1.5 $\mu g/m^3$ were recorded. Monitoring for this parameter was discontinued during 1997.

Based on the data and discussion presented above, it appears likely that the State of Hawaii AAQS for sulfur dioxide, nitrogen dioxide, particulate matter and lead are currently being met at the project site. Due to the abundance of ozone in the state of Hawaii, it is likely, that the state AAQS for ozone may be exceeded on occasion based on the Sand Island measurements for this parameter. The abundance of ozone is greatly influence by the amount of sunshine in the state. While carbon monoxide measurements at the Kapolei monitoring station suggest that concentrations are within the state and national standards, local “hot spots” may exist near traffic-congested intersections.

2.4 PROJECT IMPACT

2.4.1 Bus Emissions

The proposed Transit Center will result in increased bus traffic on nearby roadways, potentially causing long-term impacts on ambient air quality in the vicinity of the Transit Center where the buses will congregate. Motor vehicles with gasoline-powered engines are significant sources of carbon monoxide, and they also emit nitrogen oxides and other contaminates. In urban and suburban areas, carbon monoxide emissions near congested roadway intersections are the usual issue. In the case of diesel-powered buses, however, the primary air pollution emissions consist of nitrogen oxides and particulate matter; carbon monoxide emissions are generally inconsequential compared to automobile emissions.

Although computer models can generally be used to assess the impacts of carbon monoxide emissions from motor vehicle traffic, it is probably impractical to attempt to quantitatively model the bus emissions of nitrogen oxides and particulate that may be associated with the proposed facilities. In lieu of this, annual emissions from project bus operations in the vicinity of the Wahiawa Transit Center was estimated and compared to the "significant" emission rates as defined in the Hawaii Administrative Rules. Strictly speaking, the significant emission rates are intended to be applied to stationary point sources and not mobile sources such as bus traffic. Nevertheless, it is believed that this will provide a reasonable approach to ascertaining the significance of the project-related emissions of nitrogen oxides and particulate. If the project emissions are shown to be below the significant emissions rates, this is usually taken to indicate that a more detailed assessment of the emissions is not warranted.

To begin the evaluation of the potential long-term impacts on air quality related to the proposed facilities, the annual bus volumes at Wahiawa Transit Center was estimated. This was done by first identifying the bus routes that would include each Transit Center and then reviewing the schedules for these routes to enumerate the buses each day that would be associated with each route at the Transit Center. Table 6 shows the estimated annual bus volume at the Wahiawa Transit Center and the basis for the estimate. As indicated in the table, the expected total annual bus volumes at the facility is 84,315. As noted in the table, these estimates assume that weekend service will be the same as weekday service. Actual annual bus volumes will be somewhat lower due to reduced service on weekends and holidays.

Buses using the proposed Transit Center will emit air pollution on approach, during idle and as they depart. To estimate the bus emissions during these modes of operation, the EPA computer model MOBILE6.1 [5] was used in combination with the expected annual bus volumes. MOBILE6.1 can be used to provide composite emission factors for a given year, vehicle class, average vehicle speed and ambient air temperature. The composite emission factors generally pertain to various modes of operation (acceleration, cruise, deceleration and idle) and are specified in terms of grams per vehicle mile of travel. Idle emission rates in terms of grams per minute can be estimated separately. For this project, MOBILE6.1 was used to estimate emission factors for the heavy-duty diesel vehicle (HDDV) class. Emission factors for nitrogen oxides, particulate, volatile organic compounds (VOC), carbon monoxide and sulfur dioxide were calculated for the year 2003, the expected year of project completion. Due to new emission standards for this class of vehicle that will be phased in during the next several years, emissions of nitrogen oxides and particulate will diminish in later years. An average annual temperature of 77ºF was assumed, and it was further assumed that the average approach and departure speeds would be 25 mph.

Table 7 shows the resulting estimated composite and idle emission factors for HDDV. Nitrogen oxides emissions are the most appreciable followed by carbon monoxide, volatile organic compounds, sulfur dioxide and particulate. It is worth noting that carbon monoxide emissions from light-duty gasoline vehicles (LDGV) are about five times higher per vehicle mile of travel than are those for HDDV.

The next task is to determine the total vehicle miles and bus idle times associated with the Transit Center. A reasonable but somewhat arbitrary assumption is that emissions that occur beyond 1 mile of the Transit Centers will not significantly impact air quality in the vicinity of the Transit Center. Thus, the relevant approach and depart vehicle miles at the Transit Center were estimated to amount to the annual bus volume multiplied by 2 miles. Total annual idle times were estimated based on the annual bus volume and the assumption that each bus would idle for an average of 5 minutes at the Transit Centers. The resulting total annual approach and depart miles and the total annual idling times for the Transit Center are shown in Table 8.

The emission factors given in Table 7 combined with the estimated annual approach/depart miles and annual idle times shown in Table 8 will provide estimates of the total annual emissions attributable to the Transit Center. The resulting estimated annual emissions for the Wahiawa Transit Center for the year 2003 are indicated in Table 9. Nitrogen oxides emissions at the Wahiawa Transit Center is about 2.7 tons per year, while carbon monoxide emissions would amount to about 1.0 ton per year. Emissions of particulate, VOC and sulfur dioxide would be much less than 1 ton per year each. Emissions of nitrogen oxides and particulate can be expected to decrease with time as newer buses are phased in that must meet more stringent emission standards.

To ascertain the significance of the Transit Center emissions, the estimated annual emissions shown in Table 8 can be compared to the significant emission rates, which are defined in Hawaii Administrative Rules (HAR), Title 11, Chapter 60.1. Table 10 lists the significant emission rates for nitrogen oxides, particulate, VOC, carbon monoxide and sulfur dioxide. A comparison of these two tables shows that the Transit Center emissions will be substantially less than the defined significant emission rates. Nitrogen oxides emissions at the Wahiawa Transit Center is less than 7.0 percent of the significant emission rate, while all other emissions would amount to about 1 percent or less of the significant values.

2.4.2 Fugitive Dust Emissions During Construction

Although not a primary concern of this air quality assessment, short-term direct and indirect impacts on air quality could potentially occur due to project construction. For a project of this nature, there are two potential types of air pollution emissions that could directly result in short-term air quality impacts during project construction: (1) fugitive dust from vehicle movement and soil excavation; and (2) exhaust emissions from on-site construction equipment. Indirectly, there also could be short-term impacts from slow-moving construction equipment traveling to and from the project sites, from a temporary increase in local traffic caused by commuting construction workers, and from the disruption of normal traffic flow caused by lane closures of adjacent roadways.

Fugitive dust emissions may arise from the grading and dirt-moving activities associated with site clearing and preparation work. The emission rate for fugitive dust emissions from construction activities is difficult to estimate accurately. This is because of its elusive nature of emission and because the potential for its generation varies greatly depending upon the type of type of soil at the construction site, the amount and type of dirt-disturbing activity taking place, the moisture content of exposed soil in work areas, and the wind speed. The EPA [3] has provided a rough estimate for uncontrolled fugitive dust emissions from construction activity of 1.2 tons per acre per month under conditions of "medium" activity, moderate soil silt content (30%), and precipitation/evaporation (P/E) index of 50. Uncontrolled fugitive dust emissions at the three project sites would likely be somewhere near that level, depending on the amount of rainfall that occurs. In any case, State of Hawaii Air Pollution Control Regulations [4] prohibit visible emissions of fugitive dust from construction activities at the property line. Thus, an effective dust control plan for the project construction phase is essential.

Adequate fugitive dust control can usually be accomplished by the establishment of a frequent watering program to keep bare-dirt surfaces in construction areas from becoming significant sources of dust. In dust-prone or dust-sensitive areas, other control measures such as limiting the area that can be disturbed at any given time, applying chemical soil stabilizers, mulching and/or using wind screens may be necessary. Control regulations further stipulate that open-bodied trucks be covered at all times when in motion if they are transporting materials that could be blown away. Haul trucks tracking dirt onto paved streets from unpaved areas is often a significant source of dust in construction areas. Some means to alleviate this problem, such as road cleaning or tire washing, may be appropriate. Paving of parking areas and/or establishment of landscaping as early in the construction schedule as possible can also lower the potential for fugitive dust emissions. Monitoring dust at the project property line could be considered to quantify and document the effectiveness of dust control measures.

On-site mobile and stationary construction equipment also will emit air pollutants from engine exhausts. The largest of this equipment is usually diesel-powered. Nitrogen oxides emissions from diesel engines can be relatively high compared to gasoline-powered equipment, but the 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.

Project construction activities will also likely obstruct the normal flow of traffic at times to such an extent that overall vehicular emissions in the project area will temporarily increase. The only means to alleviate this problem will be to attempt to keep roadways open during peak traffic hours and to move heavy construction equipment and workers to and from construction areas during periods of low traffic volume. Thus, most potential short-term air quality impacts from project construction can be mitigated.

2.5 CONCLUSIONS AND RECOMMENDATIONS

2.5.1 Primary Impact of Long-term Emissions

The purpose of this air quality assessment is to evaluate the impact that increased bus emissions will have on air quality when the Transit Center is in operation. Based on the worst case scenario described in section 1.2.3, it is estimated that any long-term impacts on air quality near the proposed Transit Center due to emissions from project-related bus traffic will be negligible. Annual emissions from bus traffic at the Transit Center will amount to only a small fraction of the state-defined significant emission rates, and thus it can be anticipated that any direct impacts on air quality from bus emissions will be minimal. It is conceivable, however, that indirect impacts on air quality could occur if the normal flow of ambient traffic on adjacent roadways is disrupted by bus traffic, causing excess emissions to occur from other motor vehicle traffic. Thus, the proposed facilities should be designed so as minimize the disruption of traffic on adjacent roadways. Implementing other measures to mitigate long-term impacts is probably unnecessary and unwarranted.

2.5.2 Secondary Impact of Construction Activities

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

During construction phases, emissions from engine exhausts (primarily consisting of carbon monoxide and nitrogen oxides) will also occur both from on-site construction equipment and from vehicles used by construction workers and from trucks traveling to and from the project. Increased vehicular emissions due to disruption of traffic by construction equipment, roadway lane closures and/or commuting construction workers can be alleviated by moving equipment and personnel to the site during off-peak traffic hours and by trying to avoid roadway lane closures during peak traffic periods.

References

1. "Local Climatological Data, Annual Summary with Comparative Data, Honolulu, Hawaii, 1998", National Oceanic and Atmospheric Administration, National Climatic Data Center, Asheville, NC.

2. U.S. Department of Commerce, Weather Bureau, "Climatography of the United States No. 86-44, Decennial Census of the United States Climate, Climatic Summary of the United States, Supplement for 1951 through 1960, Hawaii and Pacific", Washington, D.C., 1965.

3. Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, Fifth Edition, AP-42, U.S. Environmental Protection Agency, Research Triangle Park, NC, January 1995.

4. State of Hawaii. Hawaii Administrative Rules, Chapter 11-60, Air Pollution Control.

5. User's Guide to MOBILE6.1 and 6.2: Mobile Source Emission Factor Model, Draft, U.S. Environmental Protection Agency, Office of Air and Radiation, Office of Mobile Sources, Emission Control Technology Division, Test and Evaluation Branch, Ann Arbor, Michigan, March 2002.

LIST OF FIGURES

LIST OF TABLE

LIST OF ATTACHMENTS

ACRONYMS

AAQS	Ambient Air Quality Standards
AMP	AM Partners, Inc.
CFR	Code of Federal Regulations
CO	Carbon Monoxide
DTS	Dept. of Transportation Services
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FONSI	Finding Of No Significant Impact
HAR	Hawaii Administrative Rules
HC	Hydrocarbons
HDDV	Heavy-duty Diesel Vehicle
HDOH	Hawaii Dept. of Health
LDGV	Light-duty Gasoline Vehicle
NO_x	Nitrogen Oxides
PM	Particulate Matter
TEC	The Environmental Company, Inc.
TC	Transit Center
TMK	Tax Map Key
VOC	Volatile Organic Compounds

Table 1 EPA Emission Standards for Heavy-duty Diesel Engines, g/bhp-hr.

Model Year 1987 – 2003 (Source: Dieselnet.com)

Heavy-Duty Diesel Truck Engines				
Year	HC	CO	NOx	PM
1988	1.3	15.5	10.7	0.6
1990	1.3	15.5	6	0.6
1991	1.3	15.5	5	0.25
1994	1.3	15.5	5	0.1
1998	1.3	15.5	4	0.1
Urban Bus Engines				
Year	HC	CO	NOx	PM
1991	1.3	15.5	5	0.25
1993	1.3	15.5	5	0.1
1994	1.3	15.5	5	0.07
1996	1.3	15.5	5	0.05*
1998	1.3	15.5	4	0.05*

* - in-use PM standard 0.07

Table 2 Summary of State of Hawaii and National Ambient Air Quality Standards

Pollutant	Units	Averaging Time	Maximum Allowable Concentration		
			National Primary	National Secondary	State of Hawaii
Particulate Matter (<10 microns)	$\mu g/m^3$	Annual	50[a]	50[a]	50
		24 Hours	150[b]	150[b]	150[c]
Particulate Matter (<2.5 microns)	$\mu g/m^3$	Annual	15[a]	15[a]	-
		24 Hours	65[d]	65[d]	-
Sulfur Dioxide	$\mu g/m^3$	Annual	80	-	80
		24 Hours	365[c]	-	365[c]
		3 Hours	-	1300[c]	1300[c]
Nitrogen Dioxide	$\mu g/m^3$	Annual	100	100	70
Carbon Monoxide	mg/m^3	8 Hours	10[c]	-	5[c]
		1 Hour	40[c]	-	10[c]
Ozone	$\mu g/m^3$	8 Hours	157[e]	157[e]	-
		1 Hour	235[f]	235[f]	100[c]
Lead	$\mu g/m^3$	Calendar Quarter	1.5	1.5	1.5
Hydrogen Sulfide	$\mu g/m^3$	1 Hour	-	-	35[c]

[a] Three-year average of annual arithmetic mean.

[b] 99th percentile value averaged over three years.

[c] Not to be exceeded more than once per year.

[d] 98th percentile value averaged over three years.

[e] Three-year average of fourth-highest daily 8-hour maximum.

[f] Standard is attained when the expected number of exceedances is less than or equal to 1.

Note: Standards for particulate matter (<2.5 microns) and for 8-hour ozone are subject to court appeal.

Table 3 Annual Wind Frequency for Honolulu International Airport (%)

Wind Direction	Wind Speed (knots)									Total
	0-3	4-6	7-10	11-16	17-21	22-27	28-33	34-40	>40	
N	0.5	2.5	1.3	0.5	0.0	0.0	0.0	0.0	0.0	4.8
NNE	0.3	1.2	1.6	1.5	0.2	0.0	0.0	0.0	0.0	4.7
NE	0.3	2.1	6.1	11.0	3.2	0.3	0.0	0.0	0.0	23.0
ENE	0.2	2.5	10.9	16.6	4.1	0.3	0.0	0.0	0.0	34.7
E	0.1	1.0	2.5	2.8	0.5	0.0	0.0	0.0	0.0	7.0
ESE	0.0	0.3	0.4	0.3	0.0	0.0	0.0	0.0	0.0	1.1
SE	0.0	0.3	0.8	1.0	0.1	0.0	0.0	0.0	0.0	2.2
SSE	0.1	0.4	1.2	0.7	0.1	0.0	0.0	0.0	0.0	2.4
S	0.1	0.5	1.4	0.6	0.1	0.0	0.0	0.0	0.0	2.7
SSW	0.0	0.3	0.8	0.3	0.0	0.0	0.0	0.0	0.0	1.5
SW	0.0	0.2	0.8	0.4	0.0	0.0	0.0	0.0	0.0	1.5
WSW	0.0	0.3	0.5	0.4	0.0	0.0	0.0	0.0	0.0	1.2
W	0.1	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	1.1
WNW	0.2	1.4	0.3	0.1	0.0	0.0	0.0	0.0	0.0	2.0
NW	0.4	2.3	0.8	0.1	0.0	0.0	0.0	0.0	0.0	3.8
NNW	0.5	2.3	0.8	0.2	0.0	0.0	0.0	0.0	0.0	3.8
Calm	2.5									2.5
Total	5.4	18.3	30.6	36.5	8.5	0.7	0.0	0.0	0.0	100.0

Source: Climatography of the United States No. 90 (1965-1974), Airport Climatological Summary, Honolulu International Airport, Honolulu, Hawaii, U.S. Department of Commerce, National Climatic Center, Asheville, NC, August 1978.

Table 4 Air Pollution Emissions Inventory for the Island of Oahu, 1993

Air Pollutant	Point Sources (tons/year)	Area Sources (tons/year)	Total (tons/year)
Particulate	25,891	49,374	75,265
Sulfur Oxides	39,230	nil	39,230
Nitrogen Oxides	92,436	31,141	123,577
Carbon Monoxide	28,757	121,802	150,559
Hydrocarbons	4,160	421	4,581

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

Table 5 Annual Summaries of Air Quality Measurements for Monitoring Stations Near Oahu Transit Center Project (Source: HDOH Annual Summaries, Hawaii Air Quality Data, 1996-2000)

Parameter / Location	1996	1997	1998	1999	2000
Sulfur Dioxide / Kapolei					
3-Hour Averaging Period:					
No. of Samples	2785	2845	2723	2710	2505
Highest Concentration (µg/m^3)	45	61	69	30	23
2nd Highest Concentration (µg/m^3)	42	52	64	17	18
No. of State AAQS Exceedances	0	0	0	0	0
24-Hour Averaging Period:					
No. of Samples	358	361	343	360	362
Highest Concentration (µg/m^3)	14	20	17	6	6
2nd Highest Concentration (µg/m^3)	11	16	16	6	5
No. of State AAQS Exceedances	0	0	0	0	0
Annual Average Concentration (µg/m^3)	2	2	2	2	1
Particulate (PM-10) / Kapolei					
24-Hour Averaging Period:					
No. of Samples	55	269	359	362	356
Highest Concentration (µg/m^3)	52	41	34	129	148
2nd Highest Concentration (µg/m^3)	29	26	34	39	129
No. of State AAQS Exceedances	0	0	0	0	0
Annual Average Concentration (µg/m^3)	19	13	15	15	17
Carbon Monoxide / Kapolei					
1-Hour Averaging Period:					
No. of Samples	8220	8649	8044	8395	8595
Highest Concentration (mg/m^3)	1.7	1.8	1.9	1.5	2.5
2nd Highest Concentration (mg/m^3)	1.6	1.7	1.5	1.2	1.6
No. of State AAQS Exceedances	0	0	0	0	0
8-Hour Averaging Period:					
No. of Samples	1049	1085	1044	1048	1076
Highest Concentration (mg/m^3)	0.7	0.7	0.6	0.6	1.0
2nd Highest Concentration (mg/m^3)	0.7	0.7	0.6	0.6	0.8
No. of State AAQS Exceedances	0	0	0	0	0
Nitrogen Dioxide / Kapolei					
Annual Average Concentration (µg/m^3)	2	8	8	7	9
Ozone / Sand Island					
1-Hour Averaging Period:					
No. of Samples	8263	8702	8688	8566	8482
Highest Concentration (mg/m^3)	92	106	114	110	98
2nd Highest Concentration (mg/m^3)	91	106	110	106	96
No. of State AAQS Exceedances	0	13	7	8	0

Table 6 Estimated Annual Bus Volumes for the Wahiawa Transit Center

Transit Center	Route No.	Service Start Time	Service End Time	Hours/Day	Buses/Hour	Buses/Day	Buses/Year
Wahiawa	511	5:00	22:00	17.0	2	34	12,410
	512	7:00	19:00	12.0	1	12	4,380
	513	6:00	19:00	13.0	1	13	4,745
	514	5:00	0:00	19.0	1	19	6,935
	E	7:30	22:00	14.5	2	29	10,585
	50	6:00	22:00	16.0	2	32	11,680
	51	9:00	18:00	9.0	2	18	6,570
	52	5:10	22:00	17.0	2	34	12,410
	62	4:40	0:35	20.0	2	40	14,600
						Total	84,315

Notes:

1. Route numbers based on Draft Central Oahu Hub and Spoke Service Plan.
2. Service times based on Draft Central Oahu Hub and Spoke Plan and Current Public Timetables for existing service.
3. Buses per hour calculated based on planned service headways.
4. Weekend service assumed to be the same as weekday service.
5. Express routes not included.

Table 7 Emission Factors for Heavy-Duty Diesel Vehicles

Parameter	Composite Emission Factor (g/mile)	Idle Emission Factor (g/min)
Nitrogen Oxides	12.3	0.90
Particulate	0.411	0.017
Volatile Organic Compounds	0.733	0.080
Carbon Monoxide	3.72	0.64
Sulfur Dioxide	0.448	0.019

Notes:

1. Emission factors obtained from MOBILE6.1.
2. Emission factors pertain to calendar year 2003 and ambient temperature of 77ºF.
3. Composite emission factors pertain to an average vehicle speed of 25 mph.
4. Idle emission factors based on 2.5 mph speed.
5. Particulate emission factors pertain to exhaust emissions only.

Table 8 Annual Approach/Depart Miles and Idle Times for the Proposed Transit Center Project

Transit Center	Annual Bus Volume	Annual Approach/Depart Miles	Annual Idle Time (minutes)
Waianae	93,440	186,880	467,200
Wahiawa	84,315	168,630	421,575
Mililani	78,475	156,950	392,375

Table 9 Estimated Annual Emissions for the Wahiawa Transit Center Project

Transit Center	Parameter	Annual Approach/Depart Emissions (tons)	Annual Idle Emissions (tons)	Total Annual Emissions (tons)
Wahiawa	Nitrogen Oxides	2.3	0.42	2.7
	Particulate	0.076	0.0079	0.084
	VOC	0.14	0.037	0.18
	Carbon Monoxide	0.69	0.30	0.99
	Sulfur Dioxide	O.083	0.0088	0.092

Table 10 Significant Emission Rates

Parameter	Emission Rate (tons/year)
Nitrogen Oxides	40
Particulate	15
Volatile Organic Compounds	40
Carbon Monoxide	100
Sulfur Dioxide	40

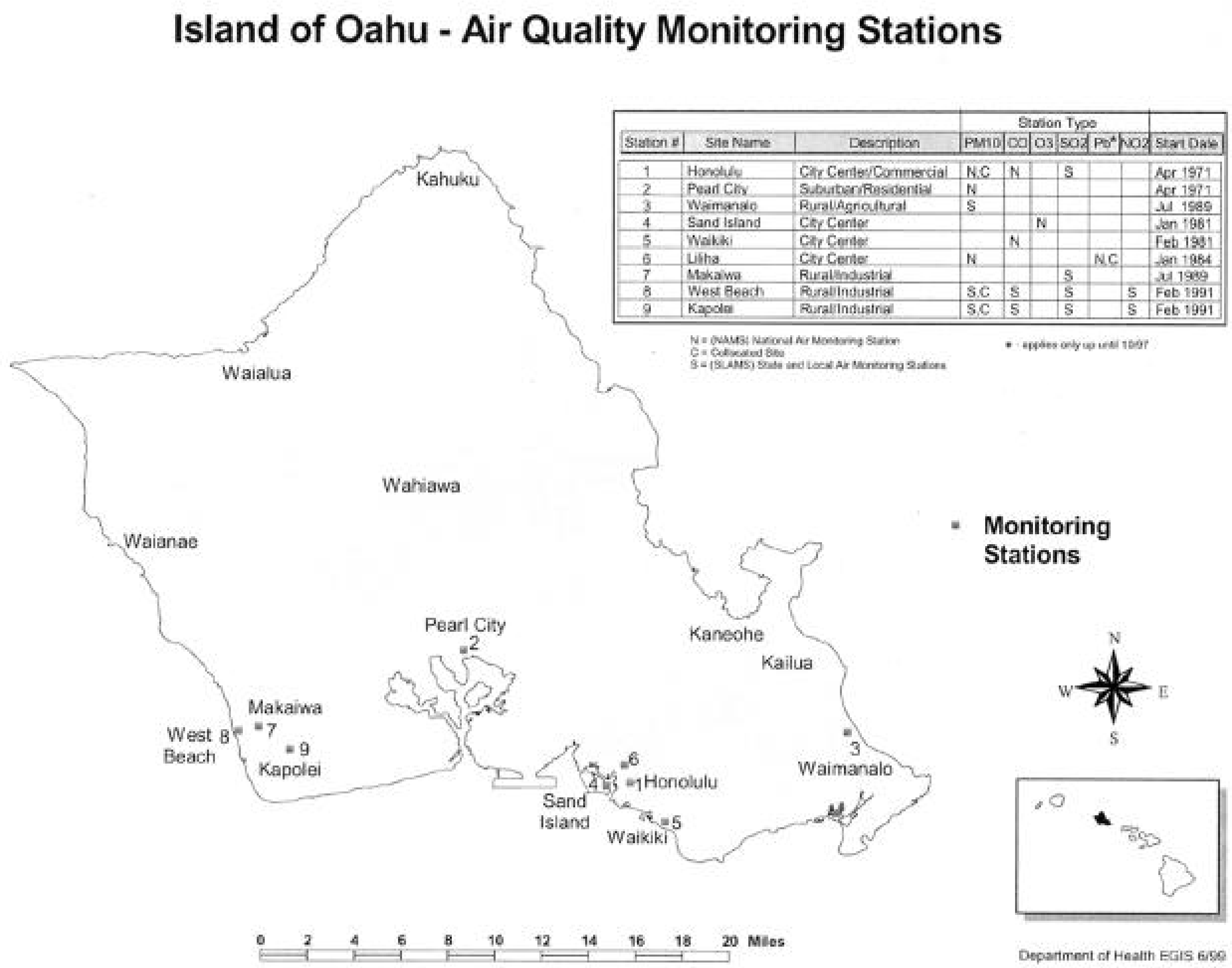
Notes:

1. As defined in Hawaii Administrative Rules, Title 11, Chapter 60.1.
2. Particulate emission rate pertains to particles less than 10 microns aerodynamic diameter.

Figure 1.1 Site Map and Plan of the proposed Wahiawa Community Transit Center.

Figure 1.2 Proposed Site for the Wahiawa Community Transit Center adjacent to the Wahiawa Civic Center Building.

Figure 1.3 Wahiawa Shopping Center across the Wahiawa Community Transit Center.



Station #	Site Name	Description	Station Type						Start Date
			PM10	CO	O3	SO2	Pb*	NO2	
1	Honolulu	City Center/Commercial	N,C	N		S			Apr 1971
2	Pearl City	Suburban/Residential	N						Apr 1971
3	Waimanalo	Rural/Agricultural	S						Jul 1989
4	Sand Island	City Center			N				Jan 1981
5	Waikiki	City Center		N					Feb 1981
6	Liliha	City Center	N				N,C		Jan 1984
7	Makaiwa	Rural/Industrial				S			Jul 1989
8	West Beach	Rural/Industrial	S,C	S		S		S	Feb 1991
9	Kapolei	Rural/Industrial	S,C	S		S		S	Feb 1991

Figure 1.4 Air quality Monitoring Stations on the island of Oahu, Hawaii

AIR QUALITY STUDY

FOR THE PROPOSED

OAHU TRANSIT CENTERS PROJECT

OAHU, HAWAII

Prepared for:

The Environmental Company, Inc.

May 2002

B.D. NEAL & ASSOCIATES

Applied Meteorology * Air Quality * Computer Science

P.O. BOX 1808 * KAILUA-KONA, HAWAII 96745 * TELEPHONE (808) 329-1627 * FAX (808) 331-8428

EMAIL: bdneal@kona.net

CONTENTS

FIGURES

TABLES

TABLES(cont.)

1.0 SUMMARY

The Honolulu City & County Department of Transportation Serivces is proposing to develop the Oahu Transit Centers Project at three locations in West and Central Oahu. The three locations include Waianae, Wahiawa and Mililani. The proposed project will consist of seven to ten bus bays at each location along with passenger waiting facilities and other ancillary facilities. Development of the project is expected to be completed during 2003. This study examines the potential short- and long-term air quality impacts that could occur as a result of construction and use of the proposed facilities and suggests mitigative measures to reduce any potential air quality impacts where possible and appropriate.

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

Regional and local climate together with the amount and type of human activity generally dictate the air quality of a given location. Winds at each location are predominantly trade winds, but they are likely often deviated by the local terrain. During winter, occasional storms may generate strong winds from the south (kona winds) for brief periods. When the trade winds or kona winds are weak or absent, landbreeze-seabreeze circulations or mountain drainage winds may develop. Wind speeds are often lower compared to more exposed coastal locations, but the trade winds still provide relatively good ventilation much of the time. Temperatures in the Oahu area leeward of the Koolaus are generally very moderate with average daily temperatures ranging from about 70°F to 85°F. Extreme temperatures range from about 53°F to about 95°F. Rainfall in the Waianae area is relatively low with an average of about 20 inches per year, while the Wahiawa and Mililani areas receive about 50 inches per year.

The present air quality of the project area appears to be reasonably good based on nearby air quality monitoring data. Air quality data from the nearest monitoring stations operated by the Hawaii Department of Health suggest that all national air quality standards are currently being met, although occasional exceedances of the more stringent state standard for ozone may occur. It is also probable that the more stringent state standards for carbon monoxide are exceeded at times near congested roadway intersections.

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

After construction, buses coming to and from the proposed transit centers will result in a long-term increase in air pollution emissions in the project area. To assess the potential impact of these emissions, estimates of project-related annual emissions were prepared. These were then compared to the significant emission rates defined in the Hawaii Administrative Rules. This comparison showed that the bus emissions at the transit centers will be relatively small compared to the significant emission rates. Therefore, as long as the transit center operations do not disrupt traffic on nearby roadways, it is unlikely that any measurable impacts on air quality will occur. Implementing any air quality mitigation measures for long-term impacts from the proposed project is probably unnecessary and unwarranted.

2.0 INTRODUCTION

The Honolulu City & County Department of Transportation Services is proposing to develop the Oahu Transit Centers Project at three locations on the island of Oahu. These consist of the Waianae

Coast Community Transit Center, the Wahiawa Community Transit Center and the Mililani Community Transit Center. Figure 1 indicates the locations of the three proposed transit centers.

The proposed Waianae Coast Community Transit Center will be located at 86-052 Leihoku Street, on a portion of TMK 8-6-1:29 adjacent to the Waianae Mall and across the street from the site of the Waianae YMCA. This facility will provide seven bays for TheBus and paratransit vehicles, arranged around a central "island" that will accommodate passenger waiting shelters, a comfort station with restrooms, vending and information kiosks, landscaping, bike parking/lockers, and a "gathering place" feature. The facility will also provide three bays for private school buses, a passenger drop-off/pick-up area, and parking for approximately 100 vehicles.

The proposed Wahiawa Community Transit Center will be located in Wahiawa's Civic Center at 956 California Avenue, on portions of TMK 7-4-6:2 and TMK 7-4-6:12. This facility will provide eight bays for TheBus and paratransit vehicles, four of which will be located off-street while the other four will be located along California Avenue. Passenger waiting shelters, a comfort station with restrooms, bike parking/lockers, and informational kiosks will be provided, along with landscaping and additional street trees.

The proposed Mililani Community Transit Center will located along Meheula Parkway fronting Mililani Town Center, and will use air rights over a portion of the shopping center's parking lot and landscape strip. The Center will provide ten bays for TheBus and paratransit vehicles, passenger waiting shelters, a comfort station, informational kiosks, bike parking/lockers, and landscaping. An elevator and open stairways will provide links from the Transit Center to the shopping center parking level. A proposal has also been made to provide community meeting space at the lower level.

Development of all three transit centers is expected to be completed during 2003.

The purpose of this study is to describe existing air quality in the project area and to assess the potential short-term and long-term direct and indirect air quality impacts that could result from construction and use of the proposed facilities. Measures to mitigate these impacts are suggested where possible and appropriate.

3.0 AMBIENT AIR QUALITY STANDARDS

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

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

The Hawaii AAQS are in some cases considerably more stringent than the comparable national AAQS. In particular, the Hawaii 1-hour AAQS for carbon monoxide is four times more stringent than the comparable national limit, and the state 1-hour limit for ozone is more than two times as stringent as the national 1-hour standard. The national 1-hour ozone standard will be phased out (pending court appeal) the next few years in favor of the new (and more stringent) 8-hour standard.

The Hawaii AAQS for sulfur dioxide were relaxed in 1986 to make the state standards essentially the same as the national limits. In 1993, the state also revised its particulate standards to follow those set by the federal government. During 1997, the federal government again revised its standards for particulate, but the new standards have been challenged in federal court. To date, the Hawaii Department of Health has not updated the state particulate standards.

4.0 REGIONAL AND LOCAL CLIMATOLOGY

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

Hawaii lies well within the belt of northeasterly trade winds generated by the semi-permanent Pacific high pressure cell to the north and east. On the island of Oahu, the Koolau and Waianae Mountain Ranges are oriented almost perpendicular to the trade winds, which accounts for much of the variation in the local climatology of the island. Waianae, Wahiawa and Mililani, the sites of the proposed project, are suburban areas within the City and County of Honolulu. Waianae is located leeward of the Waianae Range, while Wahiawa and Mililani are situated between the Koolau and Waianae Ranges. Although climatic conditions vary somewhat across the project area, long-term weather data available from the Honolulu International Airport, located a few miles to the southeast, is at least semi-representative.

Wind frequency data given in Table 2 for Honolulu International Airport show that the annual prevailing wind direction for this area of Oahu is east northeast. On an annual basis, 34.7 percent of the time the wind is from this direction, and nearly 75 percent of the time the wind is in the northeast quadrant. Winds from the south are infrequent occurring only a few days during the year and mostly in association with winter storms. Wind speeds average about 11 mph (10 knots) and mostly vary between about 4 and 18 mph (5 and 15 knots). Surface wind speeds in the project area are somewhat lighter, particularly at the Waianae site, and local wind directions likely are affected by the terrain.

Air pollution emissions from motor vehicles, the formation of photochemical smog and smoke plume rise all depend in part on air temperature. Colder temperatures tend to result in higher emissions of contaminants from automobiles but lower concentrations of photochemical smog and ground-level concentrations of air pollution from elevated plumes. In Hawaii, the annual and daily variation of temperature depend to a large degree on elevation above sea level, distance inland and exposure to the trade winds. Average temperatures at locations near sea level generally are warmer than those at higher elevations. Areas exposed to the trade wind tend to have the least temperature variation, while inland and leeward areas often have the most. The project area's leeward location results in a relatively moderate temperature profile compared to some other locations around Oahu and the state. At the airport, average annual daily minimum and maximum temperatures are 70°F and 84°F, respectively

[1]. The extreme minimum temperature was 53?F during January 1998, and the extreme maximum was 95?F during September 1994. Temperatures in the Waianae area may be slightly higher compared to the airport due to wind-sheltering effects, while the Wahiawa and Mililani areas are probably slightly cooler due to the higher elevation.

Small scale, random motions in the atmosphere (turbulence) cause air pollutants to be dispersed as a function of distance or time from the point of emission. Turbulence is caused by both mechanical and thermal forces in the atmosphere. It is often measured and described in terms of Pasquill-Gifford stability class. Stability class 1 is the most turbulent and class 6 the least. Thus, air pollution dissipates the best during stability class 1 conditions and the worst when stability class 6 prevails. In suburban areas, like those in the project area, stability class 5 or 6 is generally the highest stability class that occurs, developing during the nighttime and early morning.

Mixing height is defined as the height above the surface through which relatively vigorous vertical mixing occurs. Low mixing heights can result in high ground-level air pollution concentrations because contaminants emitted from or near the surface can become trapped within the mixing layer. In Hawaii, minimum mixing heights tend to be high because of mechanical mixing caused by the trade winds and because of the temperature moderating effect of the surrounding ocean. Low mixing heights may sometimes occur, however, at inland locations and even at times along coastal areas early in the morning following a clear, cool, windless night. Coastal areas also may experience low mixing levels during sea breeze conditions when cooler ocean air rushes in over warmer land. Mixing heights in the state typically are above 3000 feet (1000 meters).

Rainfall can have a beneficial effect on the air quality of an area in that it helps to suppress fugitive dust emissions, and it also may "washout" gaseous contaminants that are water-soluble. Rainfall in Hawaii is highly variable depending on elevation and on location with respect to the trade wind. The Waianae area is one of the drier areas on Oahu due to its leeward and near sea level location. Average annual rainfall amounts to about 20 inches [2]. Wahiawa and Mililani, located at a higher elevation and between the Koolau and Waianae Ranges, have a wetter climate receiving about 50 inches per year [2].

5.0 PRESENT AIR QUALITY

Present air quality in the project area is mostly affected by air pollutants from motor vehicles, industrial sources, agricultural operations and to a lesser extent by natural sources. Table 3 presents an air pollutant emission summary for the island of Oahu for calendar year 1993. The emission rates shown in the table pertain to manmade emissions only, i.e., emissions from natural sources are not included. As suggested in the table, much of the particulate emissions on Oahu originate from area sources, such as the mineral products industry and agriculture. Sulfur oxides are emitted almost exclusively by point sources, such as power plants and refineries. Nitrogen oxides emissions emanate predominantly from industrial point sources, although area sources (mostly motor vehicle traffic) also contribute a significant share. The majority of carbon monoxide emissions occur from area sources (motor vehicle traffic), while hydrocarbons are emitted mainly from point sources. Based on previous emission inventories that have been reported for Oahu, it appears that emissions of particulate and nitrogen oxides have increased during the past ten years, while emissions of sulfur oxides, carbon monoxide and hydrocarbons have declined.

Roadways in the vicinity of the three proposed transit center sites carry moderate volumes of motor vehicle traffic at times, and roadway intersections may be congested during peak traffic hours. Emissions from motor vehicles using these roadways, primarily nitrogen oxides and carbon monoxide, may cause localized impacts on air quality.

At the Waianae site, the nearest industrial source of air pollution is the Waianae Wastewater Treatment Plant, which is located a few hundred feet to the south. Wastewater treatment plants emit hydrogen sulfide, which can cause odor nuisance even at very low concentrations. Kahe Power Plant is situated about 7 miles to the southeast, and adjacent to this is the Waimanalo Gulch Sanitary Landfill. Campbell Industrial Park is located about 12 miles to the southeast. Emissions from these facilities consist primarily of sulfur dioxide, nitrogen oxides and particulate. Due to the prevailing wind pattern in the area, it is unlikely that emissions from these sources cause any chronic impacts on air quality in the Waianae area, but occasional impacts may occur with south winds.

The Wahiawa and Mililani sites are farther removed from large industrial sources of air pollution, although emissions from distant sources at Campbell Industrial Park may affect these areas during kona wind conditions.

With the demise of sugarcane growing on the Ewa Plain, air pollutions impacts from agriculture have significantly diminished in the area. Agriculture-related emissions in the Waianae area consist mostly of particulate matter from small-scale operations, while the Wahiawa and Mililani areas may experience occasional dust and smoke impacts from nearby, large-scale pineapple cultivation and harvesting operations.

Natural sources of air pollution emissions that also could affect the project area but cannot be quantified very accurately include the ocean (sea spray), plants (aero-allergens), wind-blown dust, and perhaps distant volcanoes on the island of Hawaii.

The State Department of Health operates a network of air quality monitoring stations at various locations on Oahu. Each station, however, typically does not monitor the full complement of air quality parameters. Table 4 shows annual summaries of air quality measurements that were made nearest to the project area for several of the regulated air pollutants for the period 1996 through 2000. These are the most recent data that are currently available.

During the 1996-2000 period, sulfur dioxide was monitored by the State Department of Health at an air quality station located at Kapolei. Concentrations monitored were consistently low compared to the standards. Annual second-highest 3-hour concentrations (which are most relevant to the air quality standards) ranged from 17 to 64 ?g/m^3, while the annual second-highest 24-hour concentrations ranged from 5 to 16 ?g/m^3. Annual average concentrations were only about 1 to 2 ?g/m^3. There were no exceedances of the state/national 3-hour or 24-hour AAQS for sulfur dioxide during the 5-year period.

Particulate matter less than 10 microns in diameter (PM-10) is also measured at the Kapolei monitoring station. Annual second-highest 24-hour PM-10 concentrations ranged from 26 to 129 ?g/m^3 between 1996 and 2000. Average annual concentrations ranged from 13 to 19 ?g/m^3. All values reported were within the state and national AAQS.

Carbon monoxide measurements were also made at the Kapolei monitoring station. The annual second-highest 1-hour concentrations ranged from 1.2 to 1.7 mg/m^3. The annual second-highest 8-hour concentrations ranged from 0.6 to 0.8 mg/m^3. No exceedances of the state or national 1-hour or 8-hour AAQS were reported.

Nitrogen dioxide is also monitored by the Department of Health at the Kapolei monitoring station. Annual average concentrations of this pollutant ranged from 2 to 9 ?g/m^3, safely inside the state and national AAQS.

The nearest available ozone measurements were obtained at Sand Island (about 15 to 25 miles southeast of the project area). The second-highest 1-hour concentrations for each year from 1996 to 2000 ranged from 91 to 110 ?g/m^3. Up to 13 exceedances of the state AAQS per year were recorded during the monitoring period. No specific trend is discernable, although the number of exceedances was lower during the latter half of the five-year period.

Although not shown in the table, the nearest and most recent measurements of ambient lead concentrations that have been reported were made at the downtown Honolulu monitoring station between 1996 and 1997. Average quarterly concentrations were near or below the detection limit, and no exceedances of the state AAQS were recorded. Monitoring for this parameter was discontinued during 1997.

Based on the data and discussion presented above, it appears likely that the State of Hawaii AAQS for sulfur dioxide, nitrogen dioxide, particulate matter and lead are currently being met at the project site. It is likely, however, that the state AAQS for ozone may be exceeded on occasion based on the Sand Island measurements for this parameter. While carbon monoxide measurements at the Kapolei monitoring station suggest that concentrations are within the state and national standards, local “hot spots” may exist near traffic-congested intersections.

6.0 SHORT-TERM IMPACTS OF PROJECT

Short-term direct and indirect impacts on air quality could potentially occur due to project construction. For a project of this nature, there are two potential types of air pollution emissions that could directly result in short-term air quality impacts during project construction: (1) fugitive dust from vehicle movement and soil excavation; and (2) exhaust emissions from on-site construction equipment. Indirectly, there also could be short-term impacts from slow-moving construction equipment traveling to and from the project sites, from a temporary increase in local traffic caused by commuting construction workers, and from the disruption of normal traffic flow caused by lane closures of adjacent roadways.

Fugitive dust emissions may arise from the grading and dirt-moving activities associated with site clearing and preparation work. The emission rate for fugitive dust emissions from construction activities is difficult to estimate accurately. This is because of its elusive nature of emission and because the potential for its generation varies greatly depending upon the type of soil at the construction site, the amount and type of dirt-disturbing activity taking place, the moisture content of exposed soil in work areas, and the wind speed. The EPA [3] has provided a rough estimate for uncontrolled fugitive dust emissions from construction activity of 1.2 tons per acre per month under conditions of "medium" activity, moderate soil silt content (30%), and precipitation/evaporation (P/E) index of 50. Uncontrolled fugitive dust emissions at the three project sites would likely be somewhere near that level, depending on the amount of rainfall that occurs. In any case, State of Hawaii Air Pollution Control Regulations [4] prohibit visible emissions of fugitive dust from construction activities at the property line. Thus, an effective dust control plan for the project construction phase is essential.

Adequate fugitive dust control can usually be accomplished by the establishment of a frequent watering program to keep bare-dirt surfaces in construction areas from becoming significant sources of dust. In dust-prone or dust-sensitive areas, other control measures such as limiting the area that can be disturbed at any given time, applying chemical soil stabilizers, mulching and/or using wind screens may be necessary. Control regulations further stipulate that open-bodied trucks be covered at all times when in motion if they are transporting materials that could be blown away. Haul trucks tracking dirt onto paved streets from unpaved areas is often a significant source of dust in construction areas. Some means to alleviate this problem, such as road cleaning or tire washing, may be appropriate. Paving of parking areas and/or establishment of landscaping as early in the construction schedule as possible can also lower the potential for fugitive dust emissions. Monitoring dust at the project property line could be considered to quantify and document the effectiveness of dust control measures.

On-site mobile and stationary construction equipment also will emit air pollutants from engine exhausts. The largest of this equipment is usually diesel-powered. Nitrogen oxides emissions from diesel engines can be relatively high compared to gasoline-powered equipment, but the 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.

Project construction activities will also likely obstruct the normal flow of traffic at times to such an extent that overall vehicular emissions in the project area will temporarily increase. The only means to alleviate this problem will be to attempt to keep roadways open during peak traffic hours and to move heavy construction equipment and workers to and from construction areas during periods of low traffic volume. Thus, most potential short-term air quality impacts from project construction can be mitigated.

7.0 LONG-TERM IMPACTS OF PROJECT

After construction is completed, use of the proposed facilities will result in increased bus traffic on nearby roadways, potentially causing long-term impacts on ambient air quality in the vicinity of each of the three transit centers where the buses will congregate. Motor vehicles with gasoline-powered engines are significant sources of carbon monoxide, and they also emit nitrogen oxides and other contaminates. In urban and suburban areas, carbon monoxide emissions near congested roadway intersections are the usual issue. In the case of diesel-powered buses, however, the primary air pollution emissions consist of nitrogen oxides and particulate matter; carbon monoxide emissions are generally inconsequential compared to automobile emissions.

Although computer models can generally be used to assess the impacts of carbon monoxide emissions from motor vehicle traffic, it is probably impractical to attempt to quantitatively model the bus emissions of nitrogen oxides and particulate that may be associated with the proposed facilities. In lieu of this, annual emissions from project bus operations in the vicinity of each of the proposed transit centers were estimated and compared to the "significant" emission rates as defined in the Hawaii Administrative Rules. Strictly speaking, the significant emission rates are intended to be applied to stationary point sources and not mobile sources such as bus traffic. Nevertheless, it is believed that this will provide a reasonable approach to ascertaining the significance of the project-related emissions of nitrogen oxides and particulate. If the project emissions are shown to be below the significant emissions rates, this is usually taken to indicated that a more detailed assessment of the emissions is not warranted.

To begin the evaluation of the potential long-term impacts on air quality related to the proposed facilities, the annual bus volumes at each of the three transit centers were estimated. These were estimated by first identifying the bus routes that would include each transit center and then reviewing the schedules for these routes to enumerate the buses each day that would be associated with each route at the transit centers. Table 5 shows the resulting estimated annual bus volume at each facility and the basis for these estimates. As indicated in the table, the expected total annual bus volumes at each transit center are 93,440 at Waianae, 84,315 at Wahiawa and 78,475 at Mililani. As noted in the table, these estimates assume that weekend service will be the same as weekday service. Actual annual bus volumes will be somewhat lower due to reduced service on weekends and holidays.

Buses using the proposed transit centers will emit air pollution on approach, during idle and as they depart. To estimate the bus emissions during these modes of operation, the EPA computer model MOBILE6.1 [5] was used in combination with the expected annual bus volumes. MOBILE6.1 can be used to provide composite emission factors for a given year, vehicle class, average vehicle speed and ambient air temperature. The composite emission factors generally pertain to various modes of operation (acceleration, cruise, deceleration and idle) and are specified in terms of grams per vehicle mile of travel. Idle emission rates in terms of grams per minute can be estimated separately. For this project, MOBILE6.1 was used to estimate emission factors for the heavy-duty diesel vehicle (HDDV) class. Emission factors for nitrogen oxides, particulate, volatile organic compounds (VOC), carbon monoxide and sulfur dioxide were calculated for the year 2003, the expected year of project completion. Due to new emission standards for this class of vehicle that will be phased in during the next several years, emissions of nitrogen oxides and particulate will diminish in later years. An average annual temperature of 77ºF was assumed, and it was further assumed that the average approach and departure speeds would be 25 mph.

Table 6 shows the resulting estimated composite and idle emission factors for HDDV. Nitrogen oxides emissions are the most appreciable followed by carbon monoxide, volatile organic compounds, sulfur dioxide and particulate. It is worth noting that carbon monoxide emissions from light-duty gasoline vehicles (LDGV) are about five times higher per vehicle mile of travel than are those for HDDV.

The next task is to determine the total vehicle miles and bus idle times associated with each transit center. A reasonable but somewhat arbitrary assumption is that emissions that occur beyond 1 mile of the transit centers will not significantly impact air quality in the vicinity of the transit centers. Thus, the relevant approach and depart vehicle miles at each facility were estimated to amount to the annual bus volume multiplied by 2 miles. Total annual idle times were estimated based on the annual bus volume and the assumption that each bus would idle for an average of 5 minutes at the transit centers. The resulting total annual approach and depart miles and the total annual idling times for each transit center are shown in Table 7.

The emission factors given in Table 6 combined with the estimated annual approach/depart miles and annual idle times shown in Table 7 will provide estimates of the total annual emissions attributable to each transit center. The resulting estimated annual emissions for each facility for the year 2003 are indicated in Table 8. Nitrogen oxides emissions would amount to less than 3 tons per year at each transit center, while carbon monoxide emissions would amount to about 1 ton per year at each location. Emissions of particulate, VOC and sulfur dioxide would be much less than 1 ton per year each. Emissions of nitrogen oxides and particulate can be expected to decrease with time as newer buses are phased in that must meet more stringent emission standards.

To ascertain the significance of the transit center emissions, the estimated annual emissions shown in Table 8 can be compared to the significant emission rates, which are defined in Hawaii Administrative Rules (HAR), Title 11, Chapter 60.1. Table 9 lists the significant emission rates for nitrogen oxides, particulate, VOC, carbon monoxide and sulfur dioxide. A comparison of these two tables shows that the transit center emissions will be substantially less than the defined significant emission rates. Nitrogen oxides emissions at each location would amount to about 8 percent of the significant emission rate, while all other emissions would amount to about 1 percent or less of the significant values.

8.0 CONCLUSIONS AND RECOMMENDATIONS

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

During construction phases, emissions from engine exhausts (primarily consisting of carbon monoxide and nitrogen oxides) will also occur both from on-site construction equipment and from vehicles used by construction workers and from trucks traveling to and from the project. Increased vehicular emissions due to disruption of traffic by construction equipment, roadway lane closures and/or commuting construction workers can be alleviated by moving equipment and personnel to the site during off-peak traffic hours and by trying to avoid roadway lane closures during peak traffic periods.

After the proposed project is completed, any long-term impacts on air quality near the three proposed transit centers due to emissions from project-related bus traffic will be negligible. Annual emissions from bus traffic at each transit center will amount to only a small fraction of the state-defined significant emission rates, and thus it can be anticipated that any direct impacts on air quality from bus emissions will be minimal. It is conceivable, however, that indirect impacts on air quality could occur if the normal flow of ambient traffic on adjacent roadways is disrupted by bus traffic, causing excess emissions to occur from other motor vehicle traffic. Thus, the proposed facilities should be designed so as minimize the disruption of traffic on adjacent roadways. Implementing other measures to mitigate long-term impacts is probably unnecessary and unwarranted.

REFERENCES

1. "Local Climatological Data, Annual Summary with Comparative Data, Honolulu, Hawaii, 1998", National Oceanic and Atmospheric Administration, National Climatic Data Center, Asheville, NC.

2. U.S. Department of Commerce, Weather Bureau, "Climatography of the United States No. 86-44, Decennial Census of the United States Climate, Climatic Summary of the United States, Supplement for 1951 through 1960, Hawaii and Pacific", Washington, D.C., 1965.

3. Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, Fifth Edition, AP-42, U.S. Environmental Protection Agency, Research Triangle Park, NC, January 1995.

4. State of Hawaii. Hawaii Administrative Rules, Chapter 11-60, Air Pollution Control.

5. User's Guide to MOBILE6.1 and 6.2: Mobile Source Emission Factor Model, Draft, U.S. Environmental Protection Agency, Office of Air and Radiation, Office of Mobile Sources, Emission Control Technology Division, Test and Evaluation Branch, Ann Arbor, Michigan, March 2002.

Figure 1 - Project Location Map

Table 1

SUMMARY OF STATE OF HAWAII AND NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Units	Averaging Time	Maximum Allowable Concentration		
			National Primary	National Secondary	State of Hawaii
Particulate Matter (<10 microns)	?g/m³	Annual 24 Hours	50[a] 150[b]	50[a] 150[b]	50 150[c]
Particulate Matter (<2.5 microns)	?g/m³	Annual 24 Hours	15[a] 65[d]	15[a] 65[d]	- -
Sulfur Dioxide	?g/m³	Annual 24 Hours 3 Hours	80 365[c] -	- - 1300[c]	80 365[c] 1300[c]
Nitrogen Dioxide	?g/m³	Annual	100	100	70
Carbon Monoxide	mg/m³	8 Hours 1 Hour	10[c] 40[c]	- -	5[c] 10[c]
Ozone	?g/m³	8 Hours 1 Hour	157[e] 235[f]	157[e] 235[f]	- 100[c]
Lead	?g/m³	Calendar Quarter	1.5	1.5	1.5
Hydrogen Sulfide	?g/m³	1 Hour	-	-	35[c]

[a] Three-year average of annual arithmetic mean.

[b] 99th percentile value averaged over three years.

[c] Not to be exceeded more than once per year.

[d] 98th percentile value averaged over three years.

[e] Three-year average of fourth-highest daily 8-hour maximum.

[f] Standard is attained when the expected number of exceedances is less than or equal to 1.

Note: Standards for particulate matter (<2.5 microns) and for 8-hour ozone are subject to court appeal.

Table 2

ANNUAL WIND FREQUENCY FOR HONOLULU INTERNATIONAL AIRPORT (%)

Wind Direction	Wind Speed (knots)									Total
	0-3	4-6	7-10	11-16	17-21	22-27	28-33	34-40	>40	
N	0.5	2.5	1.3	0.5	0.0	0.0	0.0	0.0	0.0	4.8
NNE	0.3	1.2	1.6	1.5	0.2	0.0	0.0	0.0	0.0	4.7
NE	0.3	2.1	6.1	11.0	3.2	0.3	0.0	0.0	0.0	23.0
ENE	0.2	2.5	10.9	16.6	4.1	0.3	0.0	0.0	0.0	34.7
E	0.1	1.0	2.5	2.8	0.5	0.0	0.0	0.0	0.0	7.0
ESE	0.0	0.3	0.4	0.3	0.0	0.0	0.0	0.0	0.0	1.1
SE	0.0	0.3	0.8	1.0	0.1	0.0	0.0	0.0	0.0	2.2
SSE	0.1	0.4	1.2	0.7	0.1	0.0	0.0	0.0	0.0	2.4
S	0.1	0.5	1.4	0.6	0.1	0.0	0.0	0.0	0.0	2.7
SSW	0.0	0.3	0.8	0.3	0.0	0.0	0.0	0.0	0.0	1.5
SW	0.0	0.2	0.8	0.4	0.0	0.0	0.0	0.0	0.0	1.5
WSW	0.0	0.3	0.5	0.4	0.0	0.0	0.0	0.0	0.0	1.2
W	0.1	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	1.1
WNW	0.2	1.4	0.3	0.1	0.0	0.0	0.0	0.0	0.0	2.0
NW	0.4	2.3	0.8	0.1	0.0	0.0	0.0	0.0	0.0	3.8
NNW	0.5	2.3	0.8	0.2	0.0	0.0	0.0	0.0	0.0	3.8
Calm	2.5									2.5
Total	5.4	18.3	30.6	36.5	8.5	0.7	0.0	0.0	0.0	100.0

Source: Climatography of the United States No. 90 (1965-1974), Airport Climatological Summary, Honolulu International Airport, Honolulu, Hawaii, U.S. Department of Commerce, National Climatic Center, Asheville, NC, August 1978.

Table 3

AIR POLLUTION EMISSIONS INVENTORY FOR ISLAND OF OAHU, 1993

Air Pollutant	Point Sources (tons/year)	Area Sources (tons/year)	Total (tons/year)
Particulate	25,891	49,374	75,265
Sulfur Oxides	39,230	nil	39,230
Nitrogen Oxides	92,436	31,141	123,577
Carbon Monoxide	28,757	121,802	150,559
Hydrocarbons	4,160	421	4,581

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

Table 4

ANNUAL SUMMARIES OF AIR QUALITY MEASUREMENTS FOR MONITORING STATIONS NEAREST OAHU TRANSIT CENTERS PROJECT

Parameter / Location	1996	1997	1998	1999	2000
Sulfur Dioxide / Kapolei					
3-Hour Averaging Period:					
No. of Samples	2785	2845	2723	2710	2505
Highest Concentration (?g/m^3)	45	61	69	30	23
2nd Highest Concentration (?g/m^3)	42	52	64	17	18
No. of State AAQS Exceedances	0	0	0	0	0
24-Hour Averaging Period:					
No. of Samples	358	361	343	360	362
Highest Concentration (?g/m^3)	14	20	17	6	6
2nd Highest Concentration (?g/m^3)	11	16	16	6	5
No. of State AAQS Exceedances	0	0	0	0	0
Annual Average Concentration (?g/m^3)	2	2	2	2	1
Particulate (PM-10) / Kapolei					
24-Hour Averaging Period:					
No. of Samples	55	269	359	362	356
Highest Concentration (?g/m^3)	52	41	34	129	148
2nd Highest Concentration (?g/m^3)	29	26	34	39	129
No. of State AAQS Exceedances	0	0	0	0	0
Annual Average Concentration (?g/m^3)	19	13	15	15	17
Carbon Monoxide / Kapolei					
1-Hour Averaging Period:					
No. of Samples	8220	8649	8044	8395	8595
Highest Concentration (mg/m^3)	1.7	1.8	1.9	1.5	2.5
2nd Highest Concentration (mg/m^3)	1.6	1.7	1.5	1.2	1.6
No. of State AAQS Exceedances	0	0	0	0	0
8-Hour Averaging Period:					
No. of Samples	1049	1085	1044	1048	1076
Highest Concentration (mg/m^3)	0.7	0.7	0.6	0.6	1.0
2nd Highest Concentration (mg/m^3)	0.7	0.7	0.6	0.6	0.8
No. of State AAQS Exceedances	0	0	0	0	0
Nitrogen Dioxide / Kapolei					
Annual Average Concentration (?g/m^3)	2	8	8	7	9
Ozone / Sand Island					
1-Hour Averaging Period:					
No. of Samples	8263	8702	8688	8566	8482
Highest Concentration (mg/m^3)	92	106	114	110	98
2nd Highest Concentration (mg/m^3)	91	106	110	106	96
No. of State AAQS Exceedances	0	13	7	8	0

Source: State of Hawaii Department of Health, “Annual Summaries, Hawaii Air Quality Data, 1996 - 2000”

Table 5

ESTIMATED ANNUAL BUS VOLUMES FOR OAHU TRANSIT CENTERS PROJECT

Transit Center	Route No.	Service Start Time	Service End Time	Hours/Day	Buses/Hour	Buses/Day	Buses/Year
Waianae	All	-	-	16	14	224	81,760
	All	-	-	8	4	32	11,680
						Total	93,440
Wahiawa	511	5:00	22:00	17.0	2	34	12,410
	512	7:00	19:00	12.0	1	12	4,380
	513	6:00	19:00	13.0	1	13	4,745
	514	5:00	0:00	19.0	1	19	6,935
	E	7:30	22:00	14.5	2	29	10,585
	50	6:00	22:00	16.0	2	32	11,680
	51	9:00	18:00	9.0	2	18	6,570
	52	5:10	22:00	17.0	2	34	12,410
	62	4:40	0:35	20.0	2	40	14,600
						Total	84,315
Mililani	501	5:00	21:30	16.5	2	33	12,045
	502	5:00	19:30	14.5	1	14	5,110
	503	5:00	19:30	14.5	1	15	5,475
	E	7:30	22:00	14.5	2	29	10,585
	50	6:00	22:00	16.0	2	32	11,680
	51	9:00	18:00	9.0	2	18	6,570
	52	5:10	22:00	17.0	2	34	12,410
	62	4:40	0:35	20.0	2	40	14,600
						Total	78,475

Notes:

1. Route numbers based on Draft Central Oahu Hub and Spoke Service Plan.
2. Service times based on Draft Central Oahu Hub and Spoke Plan and Current Public Timetables for existing service.
3. Buses per hour calculated based on planned service headways.
4. Weekend service assumed to be the same as weekday service.
5. Express routes not included.

Table 6

EMISSION FACTORS FOR HEAVY-DUTY DIESEL VEHICLES

Parameter	Composite Emission Factor (g/mile)	Idle Emission Factor (g/min)
Nitrogen Oxides	12.3	0.90
Particulate	0.411	0.017
Volatile Organic Compounds	0.733	0.080
Carbon Monoxide	3.72	0.64
Sulfur Dioxide	0.448	0.019

Notes:

1. Emission factors obtained from MOBILE6.1.
2. Emission factors pertain to calendar year 2003 and ambient temperature of 77°F.
3. Composite emission factors pertain to an average vehicle speed of 25 mph.
4. Idle emission factors based on 2.5 mph speed.
5. Particulate emission factors pertain to exhaust emissions only.

Table 7

ANNUAL APPROACH/DEPART MILES AND IDLE TIMES FOR OAHU TRANSIT CENTERS PROJECT

Transit Center	Annual Bus Volume	Annual Approach/Depart Miles	Annual Idle Time (minutes)
Waianae	93,440	186,880	467,200
Wahiawa	84,315	168,630	421,575
Mililani	78,475	156,950	392,375

Table 8

ESTIMATED ANNUAL EMISSIONS FOR OAHU TRANSIT CENTERS PROJECT

Transit Center	Parameter	Annual Approach/Depart Emissions (tons)	Annual Idle Emissions (tons)	Total Annual Emissions (tons)
Waianae	Nitrogen Oxides	2.5	0.46	3.0
	Particulate	0.085	0.0087	0.094
	VOC	0.15	0.041	0.19
	Carbon Monoxide	0.76	0.33	1.1
	Sulfur Dioxide	0.092	0.0098	0.10
Wahiawa	Nitrogen Oxides	2.3	0.42	2.7
	Particulate	0.076	0.0079	0.084
	VOC	0.14	0.037	0.18
	Carbon Monoxide	0.69	0.30	0.99
	Sulfur Dioxide	0.083	0.0088	0.092
Mililani	Nitrogen Oxides	2.1	0.39	2.5
	Particulate	0.071	0.0074	0.078
	VOC	0.13	0.034	0.16
	Carbon Monoxide	0.64	0.28	0.92
	Sulfur Dioxide	0.077	0.0082	0.085

Table 9

SIGNIFICANT EMISSION RATES

Parameter	Emission Rate (tons/year)
Nitrogen Oxides	40
Particulate	15
Volatile Organic Compounds	40
Carbon Monoxide	100
Sulfur Dioxide	40

Notes:

1. As defined in Hawaii Administrative Rules, Title 11, Chapter 60.1.
2. Particulate emission rate pertains to particles less than 10 microns aerodynamic diameter.

State of Hawaii

Department of Health
Clean Air Branch
Honolulu, Hawaii

Annual Summary
Hawaii Air Quality Data

2000

2000
HAWAII AIR QUALITY DATA

CONTENTS

LIST OF TABLES

LIST OF FIGURES

Section 1
INTRODUCTION

The Department of Health has been monitoring ambient air quality in the State of Hawaii since 1957. Until 1971, there was only one air monitoring site, which was located on the island of Oahu. The air monitoring network today has expanded to include 17 monitoring stations on Oahu, Kauai, Maui and Hawaii. The primary purpose of the statewide monitoring network is to measure ambient air concentrations of the six criteria pollutants that the United States Environmental Protection Agency (EPA) has promulgated National Ambient Air Quality Standards (NAAQS). The six criteria pollutants with NAAQS are: carbon monoxide, nitrogen dioxide, sulfur dioxide, lead, ozone and particulate matter less than or equal to 10 micrometers (PM_{10}). The State of Hawaii also has standards for ozone, carbon monoxide and nitrogen dioxide more stringent than the NAAQS and an ambient air standard for hydrogen sulfide.

Ambient air monitoring for lead was discontinued in October 1997 with EPA approval. Since sampling for lead began, levels in the state have been far below the federal standard, and with the elimination of lead in gasoline, measured levels were consistently zero or nearly zero.

Most commercial, industrial and transportation activities and their associated air quality effects occur on Oahu where nine of the stations are located. Agricultural operations produce the greatest air quality impacts on Maui and Kauai. Impacts on ambient air quality from the ongoing eruption of the Kilauea Volcano and from activities associated with geothermal energy production are being monitored on the island of Hawaii. Current plans call for the continuation of sampling at these sites, however, relocations, additions and/or discontinuations can occur in the future as the need arises.

This report summarizes the air pollutant data collected at the 17 monitoring stations during calendar year 2000. Tabular and graphic summaries are provided which compare the measured concentrations with State and Federal ambient air quality standards. In addition, air pollutant concentration trend summaries are depicted in graphic form.

Various other data may be summarized as the need arises. Questions regarding these data and other air quality data should be addressed to:

State of Hawaii
Department of Health
Clean Air Branch
P.O. Box 3378
Honolulu, Hawaii 96801-3378
Phone: 808-586-4200
Fax: 808-586-4359

Section 2
DEFINITIONS

"Ambient Air": The general outdoor atmosphere, external to buildings, to which the general public has access.

"Ambient Air Quality": The quality or state of purity of the ambient air.

"Ambient Air Quality Standard": A limit in the quantity and exposure to pollutants dispersed or suspended in the ambient air.

"Carbon Monoxide": Carbon monoxide (CO) is a colorless, odorless, tasteless gas under atmospheric conditions. It is produced by the incomplete combustion of carbon fuels with the majority of emissions coming from transportation sources.

"Collocated": Procedure required for a certain percentage of PM_{10} samplers in the monitoring network. Collocated samplers determine precision or variation in the PM_{10} concentration measurements of identical samplers run in the same location under the same sampling conditions.

"EPA": The United States Environmental Protection Agency.

"Hydrogen Sulfide": Hydrogen sulfide (H_2S) is a toxic, colorless gas with a characteristic "rotten egg" odor detectable at very low levels. Also known as sewer gas, it is naturally occurring from sources such as volcanic activity, petroleum exploration and bacterial decomposition of organic matter.

"NAAQS": National Ambient Air Quality Standards. These are pollutant standards that the EPA has established to protect public health and welfare. NAAQS have been set for carbon monoxide, nitrogen dioxide, PM_{10}, ozone, sulfur dioxide, and lead. These are commonly referred to as the six criteria pollutants.

"NAMS": National Air Monitoring Stations. Sites which are part of the SLAMS network, must meet more stringent siting requirements, equipment type and quality assurance criteria.

"Nitrogen Dioxide": Nitrogen dioxide (NO_2) is a brownish, highly corrosive gas with a pungent odor. It is formed in the atmosphere from emissions of nitrogen oxides (NO_x). Sources of nitrogen oxides include electric utilities, industrial boilers, motor vehicle exhaust and combustion of fossil fuels. NO_2 is also a component in the atmospheric reaction that produces ground-level ozone.

“Ozone”: This is the main constituent in photochemical air pollution. It is formed in the atmosphere by a chemical reaction of nitrogen oxides (NO_x) and volatile organic compounds (VOCs) in the presence of sunlight. In the upper atmosphere, ozone (O_3) shields the earth from harmful ultraviolet radiation; however, at ground level, it can cause harmful effects in humans and plants.

“Particulate Matter”: Any dispersed matter, solid or liquid, in which the individual aggregates are larger than the single molecules in diameter, but smaller than 500 microns. Particulate matter includes dust, soot, smoke, and liquid droplets from sources such as factories, power plants, motor vehicles, construction activities, agricultural activities, and fires.

“PM_{10}”: Particulate matter that is 10 microns or less in aerodynamic diameter. The EPA revised the NAAQS for particulate matter in 1987 to cover only PM_{10} because the smaller particles have a greater potential for respiratory health impacts.

“SLAMS” State and Local Air Monitoring Stations. The Clean Air Act requires that every state establish a network of air monitoring stations for criteria pollutants, using requirements set by the EPA Office of Air Quality Planning and Standards.

“Sulfur Oxides”: Sulfur oxides are colorless gases which include sulfur dioxide (SO_2), sulfur trioxide, their acids and the salts of their acids. Emissions of sulfur oxides are largely from sources that burn fossil fuels such as coal and oil. In the State of Hawaii, another source of sulfur oxide emissions is from the eruption of Kilauea Volcano on the Big Island.

“Vog”: Vog is a local term used when referring to the atmospheric haze produced by the combination of volcanic gas and particles with air and sunlight.

Table 2-1 **State of Hawaii and Federal Ambient Air Quality Standards**

Air Pollutant	Averaging Time	Standards		
		Hawaii State Standard [a] ($\mu g/m^3$)	Federal Primary Standard [b] ($\mu g/m^3$)	Federal Secondary Standard [c] ($\mu g/m^3$)
Carbon Monoxide	1-hour 8-hour	10,000 5,000	40,000 10,000	40,000 10,000
Nitrogen Dioxide	Annual (arithmetic)	70	100	100
PM_{10}	24-hour Annual (arithmetic)	150 50	150 50	150 50
Ozone	1-hour	100	235	235
Sulfur Dioxide	3-hour 24-hour Annual (arithmetic)	1,300 365 80	--- 365 80	1,300 --- ---
Lead	Calendar Quarter (arithmetic)	1.5	1.5	1.5
Hydrogen Sulfide	1-hour	35	—	---

[a] Designated to protect public health and welfare and to prevent the significant deterioration of air quality. Source: HAR §11-59-1
[b] Designated to prevent against adverse effects on public health. Source: 40CFR Part 50
[c] Designated to prevent against adverse effects on public welfare, including effects on comfort, visibility, vegetation, animals, aesthetic values, and soiling and deterioration of materials. Source: 40CFR Part 50

Section 3
SITE LOCATIONS AND DESCRIPTIONS

This section provides a description of the monitoring stations in the State of Hawaii. Table 3-1 lists the air pollutant(s) measured at each monitoring station, characterizes the area surrounding the station, and indicates the start dates for data collection. Table 3-2 identifies the type of sampler used to measure the concentration of each air pollutant. Figures 3-1, 3-2, 3-3 and 3-4 show the location of each monitoring station on the islands of Oahu, Kauai, Maui and Hawaii, respectively.

The following three subsections discuss each monitoring station in more detail.

A. ISLAND OF OAHU

1. Honolulu: Located atop the Department of Health (DOH) building (Kinau Hale), at 1250 Punchbowl Street in downtown Honolulu, this site is in a commercial, institutional, and residential area. It was established in April 1971 as a NAMS and SLAMS station. The pollutants sampled at this site are PM_{10}, CO, and SO_2.

2. Pearl City: Located atop the Leeward Medical Center, at 860 Fourth Street, the area is a combination of commercial and residential units and is approximately nine and a half miles northwest of downtown Honolulu. This site was established in April 1971 as a NAMS site initially for collection of Total Suspended Particulates (TSP) before it was changed to PM_{10} sampling in July 1985.

3. Waimanalo: Located within the Waimanalo Sewage Treatment Facility, at 41-1069 Kalanianaole Highway, this site is in a sparsely populated rural and agricultural community. Waimanalo is on the windward (upwind) side of Oahu approximately ten miles east-northeast of downtown Honolulu. This site was established in June 1971 as a SLAMS site initially for the sampling of TSP before it was changed to PM_{10} sampling in July 1989.

4. Sand Island: Located at the Anuenue Fisheries, the area is composed of light industrial, commercial, recreational, and harbor units and is approximately two miles southwest (typically downwind) of downtown Honolulu. This is a NAMS station that was established in February 1981 for the sampling of ozone.

5. Waikiki: Located at 2131 Kalakaua Avenue, Waikiki is a busy commercial and residential area with heavy vehicular traffic. It is approximately three miles southeast of downtown Honolulu. The station was established in January 1981as a NAMS site for the sampling of carbon monoxide.

6. Liliha: Located at Kauluwela Elementary School, 1486 Aala Street, this site is in a residential and commercial area near the H-1 freeway, approximately one and a quarter miles north of downtown Honolulu. This NAMS station was established in January 1984 and currently monitors for PM_{10}.

7. Makaiwa: Located at 92-670 Farrington Highway, this site is in a residential and agricultural area approximately twenty-five miles west of downtown Honolulu. This station is downwind and to the southeast of an electrical power plant. This site was established in July 1989 as a SLAMS station monitoring for SO_2.

8. West Beach: Located within the Ko'Olina Golf Course, this site is in a recreational, residential, and agricultural area approximately 27 miles west of downtown Honolulu and 1.5 miles northwest of Campbell Industrial Park. This SLAMS station was established in February 1991 for NO_2, PM_{10}, CO and SO_2.

9. Kapolei: Located at 91-591 Kalaeloa Boulevard at the entrance to Campbell Industrial Park, this site is in a commercial, industrial, and residential area with nearby agricultural lands. It is approximately 25 miles west of downtown Honolulu and was established in February 1991 as a SLAMS site. Air pollutants measured at the site include NO_2, PM_{10}, CO and SO_2.

B. ISLAND OF KAUAI

Lihue: The Lihue monitoring station is located in downtown Lihue at the District Health Office, 3034 Umi Street. This site is in a commercial and residential area with nearby agricultural areas. It is a SLAMS station that was established in November 1972 for the sampling of total particulates but was changed to a PM_{10} sampling site in October 1985.

C. ISLAND OF MAUI

1. Kihei: This station is located in Hale Piilani Park. This special purpose monitoring station is in a residential and agricultural area and was established to monitor PM_{10} from sugarcane burning activities.

2. Paia: This station is located in a residential area at 141 Baldwin Avenue. The site is downwind of several sugarcane fields and is just northeast of the HC&S Co. Paia Mill. This site was established in August 1996 as a special PM_{10} sampling station for sugarcane burning activities.

D. ISLAND OF HAWAII

1. Kona: This station is located on the grounds of the Konawaena High School at 81-1043 Konawaena School Road in Kealakekua, Hawaii. This special purpose site was established in April 1997 to monitor vog in the Kona area. The pollutants sampled at this site are SO_2 and PM_{10}. The 1-in 6-day sampling for PM_{10} at this site was discontinued on June 11, 2000.

2. Hilo: Established in March 1995, this station is located on the grounds of the Adult Rehabilitation Center of Hilo at 1099 Waianuenue Avenue to monitor vog. The pollutants sampled are SO_2 and PM_{10}.

3. Honokaa: Located at Honokaa High and Intermediate School at 45-527 Pakalana Street, this station was established in August 1997 on the upwind side of the island to monitor vog. The pollutants sampled at this site are SO_2 and PM_{10}. This site was discontinued on August 1, 2000.

4. Lava Tree: This station in Puna, is located on the eastern border of the Lava Tree State Park in a residential-agricultural area near Nanawale Estates. It is approximately 1.4 miles northwest of the Puna Geothermal Venture power plant. The station was established in August 1993 and monitors for H_2S.

5. Puna E: Located in the Leilani Estates residential subdivision in Puna, it is approximately 3 miles south-southwest of the Puna Geothermal Venture power plant. Established in 1992, this station monitors for H_2S.

Table 3-1 **State of Hawaii Air Monitoring Network**

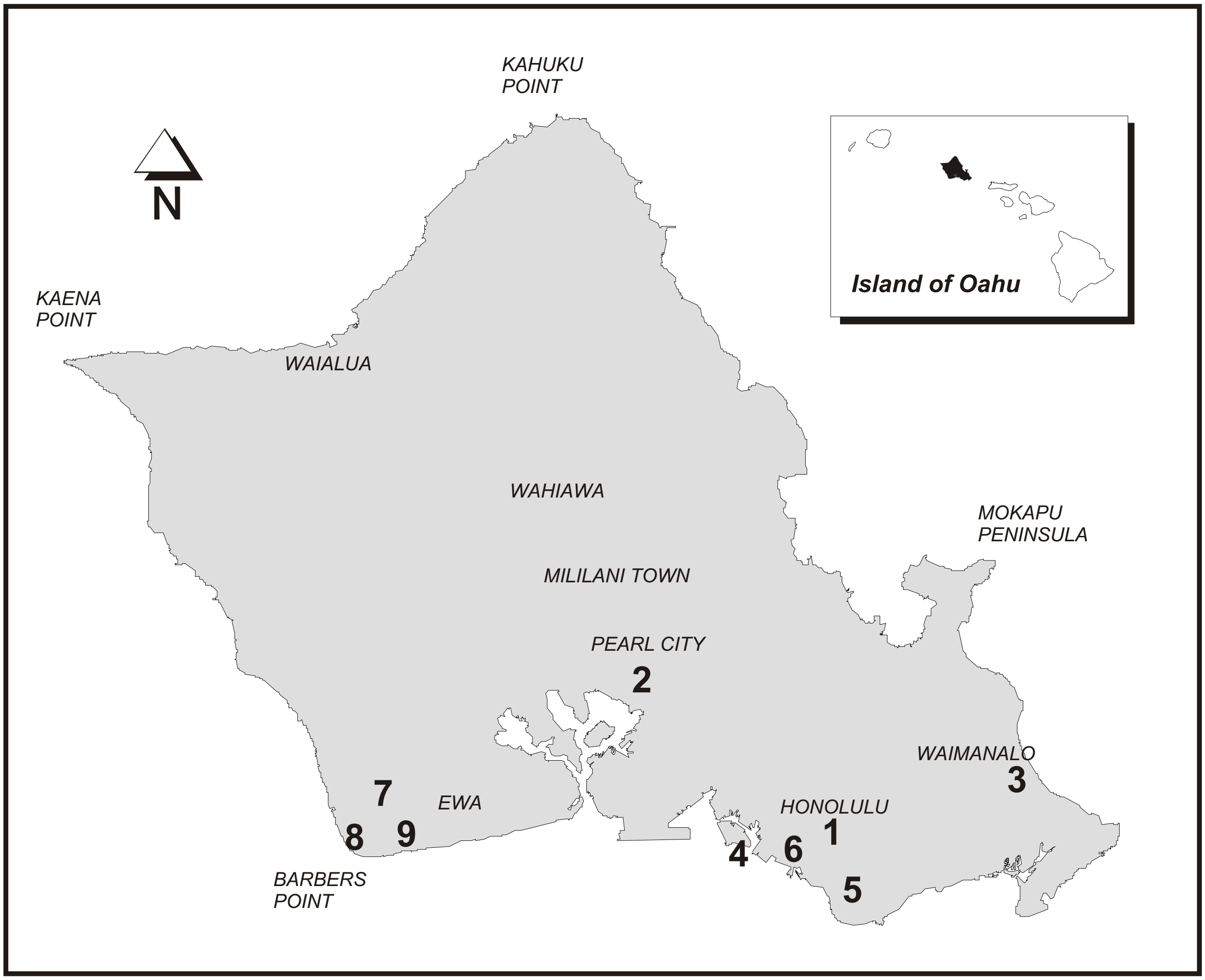
SITE	Station Type: PM_{10}	CO	O_3	SO_2	NO_2	H_2S	SITE DESCRIPTION	START DATE
OAHU								
HONOLULU	N	N	-	S	-	-	Center City/Commercial	April 1971
PEARL CITY	N	-	-	-	-	-	Suburban/Residential	April 1971
WAIMANALO	S	-	-	-	-	-	Rural / Agricultural	July 1989
SAND ISLAND	-	-	N	-	-	-	Center City	January 1981
WAIKIKI	-	N	-	-	-	-	Center City	February 1981
LILIHA	N	-	-	-	-	-	Center City	January 1981
MAKAIWA	-	-	-	S	-	-	Rural / Industrial	July 1989
WEST BEACH	S,C	S	-	S	S	-	Rural/Industrial	February 1991
KAPOLEI	S	S	-	S	S	-	Rural / Industrial	February 1991
KAUAI								
LIHUE	S	-	-	-	-	-	Center City / Commercial	October 1985
MAUI								
KIHEI	SS	-	-	-	-	-	Suburban / Residential	June 1996
PAIA	SS	-	-	-	-	-	Rural / Residential	August 1996
HAWAII								
KONA	SS	-	-	SS	-	-	Suburban	April 1997
HILO	SS	-	-	SS	-	-	Center City	March 1995
HONOKAA	SS	-	-	SS	-	-	Rural/Agricultural	May 1997
LAVA TREE	-	-	-	-	-	SS	Rural/Agricultural	August 1993
PUNA E	-	-	-	-	-	SS	Rural/Agricultural	1992

N = (NAMS) National Air Monitoring Station
C = Collocated Site
S = (SLAMS) State and Local Air Monitoring Stations
SS = Special Study (for sugar cane burning, vog, and geothermal energy)

Table 3-2 **Sampling Equipment at Each Monitoring Station**

Monitoring Station	PM_{10} Continuous Ambient Particulate Monitor	PM_{10} Manual Ambient Particulate Monitor (1 in 6 day)	CO Continuous Non-dispersive Infrared Analyzer	SO_2 Continuous Pulsed Fluorescent Ambient Air Analyzer	O_3 Continuous UV Photometric Analyzer	NO_2 Continuous Chemiluminescence Analyzer	H_2S Continuous Pulsed Fluorescent Ambient Air Analyzer
OAHU							
Honolulu	X		X	X			
Pearl City	X						
Waimanalo		X					
Sand Island					X		
Waikiki			X				
Liliha	X						
Makaiwa				X			
West Beach		X	X	X		X	
Kapolei	X		X	X		X	
KAUAI							
Lihue		X					
MAUI							
Kihei	X						
Paia	X						
HAWAII							
Kona		X		X			
Hilo		X		X			
Honokaa		X		X			
Lava Tree							X
Puna E							X

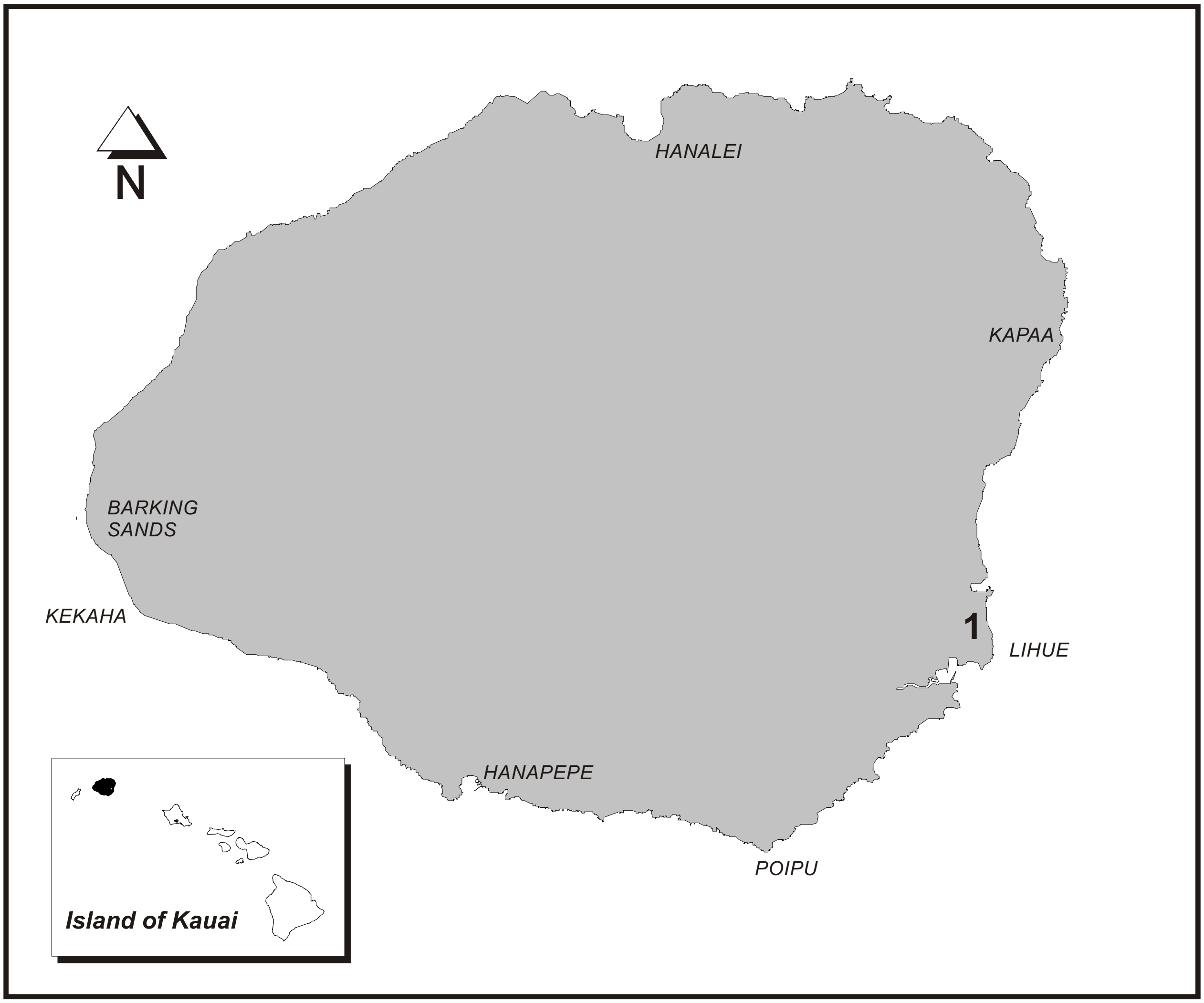
Figure 3-1 **Island of Oahu: Location of Air Monitoring Stations**



LEGEND

1 Honolulu (PM_{10}, SO_2, CO)
2 Pearl City (PM_{10})
3 Waimanalo (PM_{10})
4 Sand Island (O_3)
5 Waikiki (CO)
6 Liliha (PM_{10})
7 Makaiwa (SO_2)
8 West Beach (PM_{10}, SO_2, CO, NO_2)
9 Kapolei (PM_{10}, SO_2, CO, NO_2)

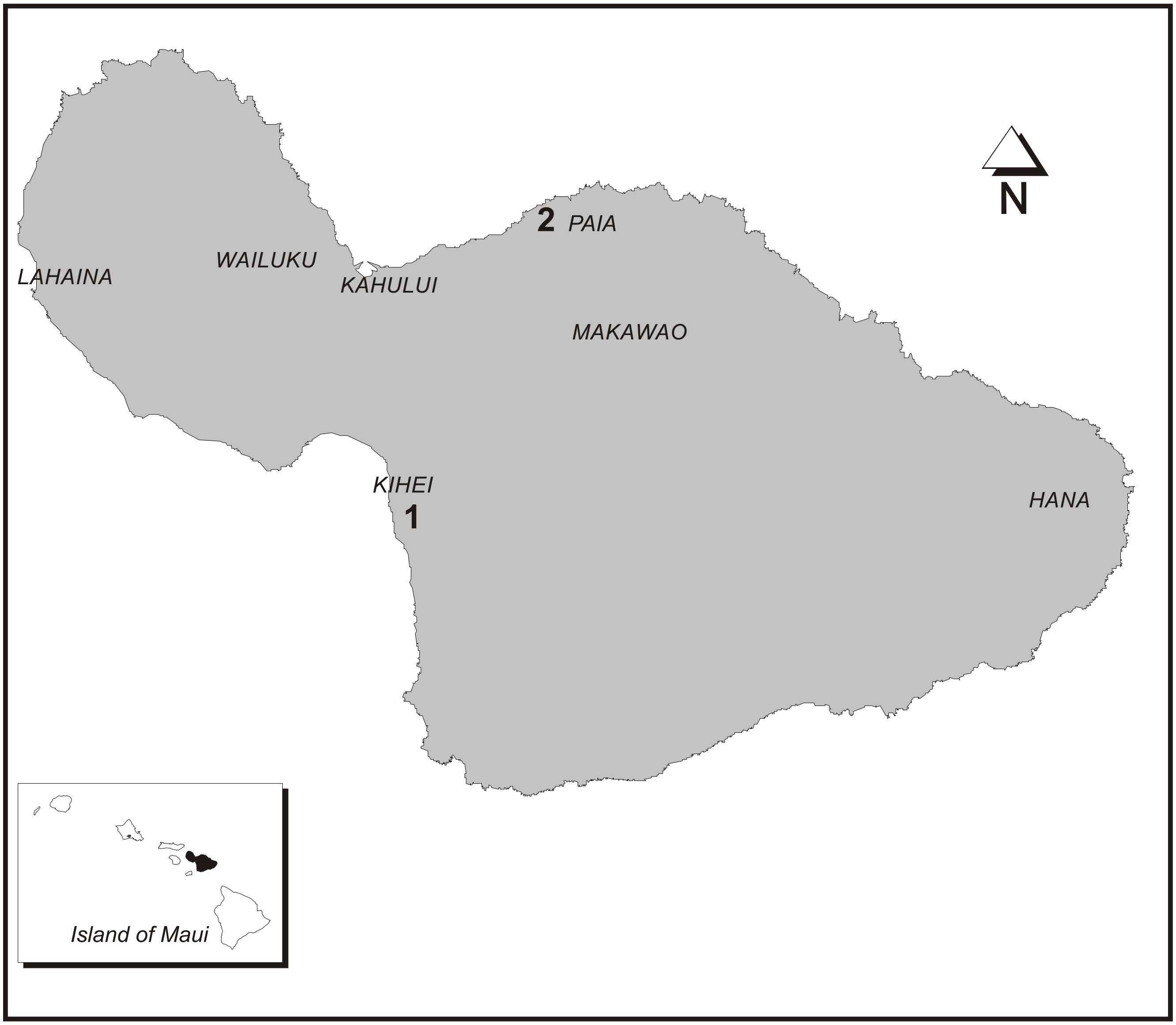
Figure 3-2 **Island of Kauai: Location of Air Monitoring Station**



LEGEND

1 Lihue (PM_{10})

Figure 3-3 **Island of Maui: Location of Air Monitoring Stations**

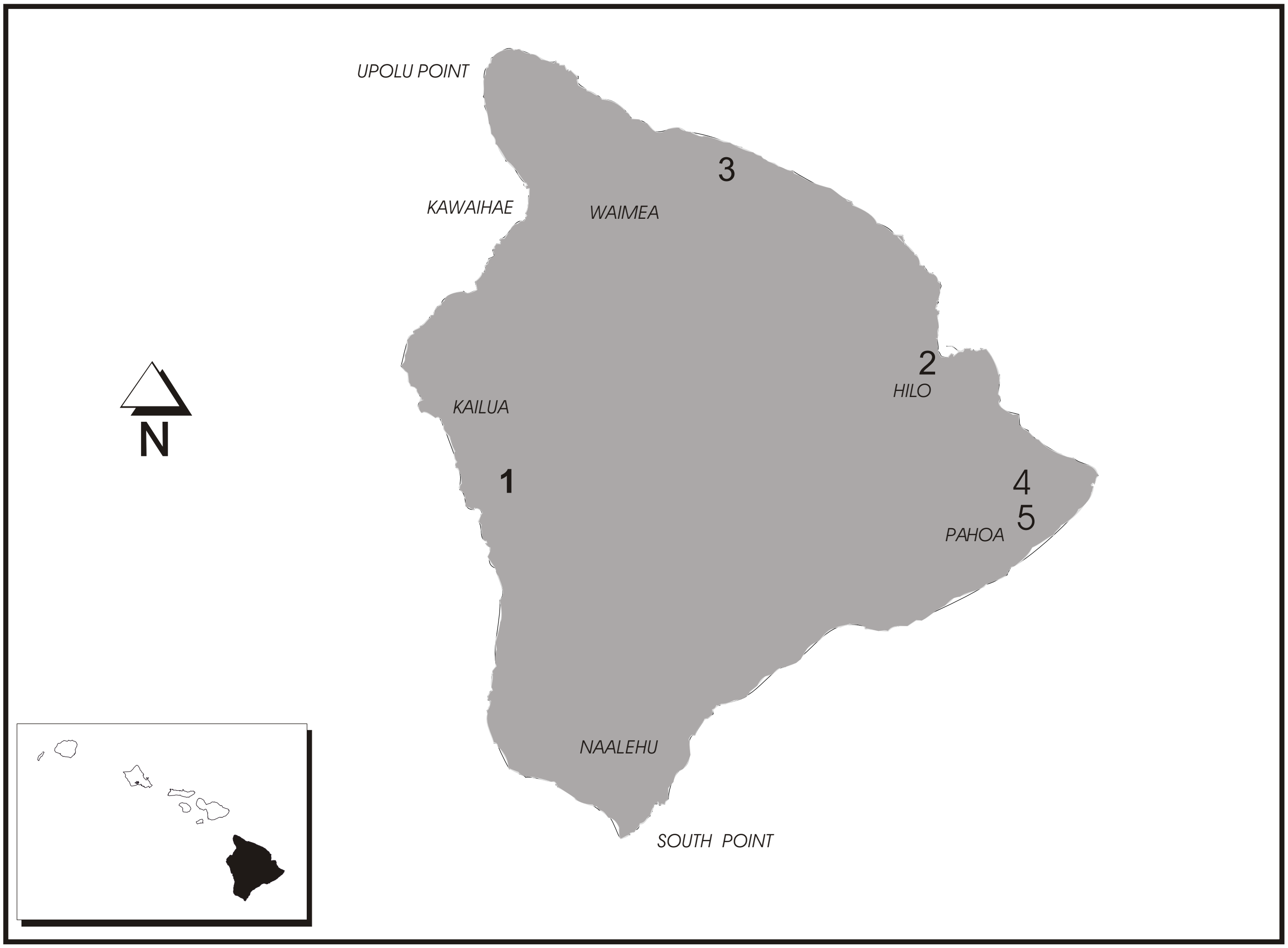


LEGEND

1 Kihei (PM_{10})

2 Paia (PM_{10})

Figure 3-4 **Island of Hawaii: Location of Air Monitoring Stations**



LEGEND

1 Kona (PM_{10}, SO_2)
2 Hilo (PM_{10}, SO_2)
3 Honokaa (PM_{10}, SO_2)
4 Lava Tree (H_2S)
5 Puna E (H_2S)

Section 4

2000 AIR QUALITY DATA

Hawaii enjoys some of the best air quality in the nation and, being an island state, is not impacted by pollution from neighboring states. However, as in any metropolitan area, there is some air pollution from various industrial and mobile sources in addition to agricultural and natural sources. The Department of Health, Clean Air Branch, has the responsibility for monitoring, protecting and enhancing the state's air quality and regulates and monitors pollution sources to ensure that the levels of criteria pollutants remain well below the state and federal air quality standards.

The following tables summarize the pollutant concentrations measured at each monitoring station. Tables 4-1 through 4-7 are annual summaries grouped by pollutant and provide the number of occurrences exceeding the NAAQS. There is no federal ambient air quality standard for H_2S, and Table 4-8 provides the number of occurrences exceeding the state standard.

The annual statistics provided in tables 4-1 through 4-8 are the highest and second highest $\mu g/m^3$ values recorded in the year for the averaging period and the annual means, which is the arithmetic mean of all valid hours recorded in the year. The possible periods is the total number of possible sampling periods in the year for the averaging time, and valid periods is the total number of sampling periods after data validation.

Tables 4-9 through 4-16 are monthly summaries of the range and average of each pollutant for each averaging period. The range is the lowest and highest $\mu g/m^3$ values recorded in the month for the averaging period and the average is the arithmetic mean of all hours recorded in the month. The highest value recorded in the year for each site is highlighted.

In the year 2000, the State of Hawaii was in attainment for all federal ambient air quality standards.

Table 4-1 **Annual Summary of 24-Hour PM_{10}**

	Annual Statistics			24-hour Occurrences Greater than 150 µg/m³													
	Max Hr		Annual Means														
	1st High	2nd High	All Hours	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Possible Periods	Valid Periods
OAHU																	
Honolulu	83	31	14	0	0	0	0	0	0	0	0	0	0	0	0	366	361
Liliha	65	44	15	0	0	0	0	0	0	0	0	0	0	0	0	366	363
Waikiki	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sand Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
[a]Waimanalo	35	28	17	0	0	0	0	0	0	0	0	0	0	0	0	61	47
Pearl City	164[b]	154[b]	16	1[b]	0	0	0	0	0	0	0	0	0	0	1[b]	366	358
Makaiwa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kapolei	148	129	17	0	0	0	0	0	0	0	0	0	0	0	0	366	356
[a]West Beach	41	40	14	0	0	0	0	0	0	0	0	0	0	0	0	61	54
KAUAI																	
[a]Lihue	39	36	18	0	0	0	0	0	0	0	0	0	0	0	0	61	50
MAUI																	
Kihei	83	77	25	0	0	0	0	0	0	0	0	0	0	0	0	366	355
Paia	48	45	18	0	0	0	0	0	0	0	0	0	0	0	0	366	350
HAWAII																	
[a]Kona	23	23	18	0	0	0	0	0	0	0	0	0	0	0	0	28[c]	17
[a]Hilo	18	16	11	0	0	0	0	0	0	0	0	0	0	0	0	61	41
[a]Honokaa	23	17	10	0	0	0	0	0	0	0	0	0	0	0	0	36[d]	22
Lava Tree	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

[a] PM_{10} sampling once every 6th day [b] Highest values, measured by a continuous method, occurred on 1/1/00 and 12/31/00, probably due to fireworks
[c] PM_{10} sampling was discontinued at this site on 6/11/00 [d] This station was discontinued on 8/1/00

Table 4-2 **Annual Summary of 1-Hour Carbon Monoxide**

	Annual Statistics			1-hour Occurrences Greater than 40,000 µg/m³													
	Max Hr		Annual Means														
	1st High	2nd High	All Hours	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Possible Periods	Valid Periods
OAHU																	
Honolulu	3990	3762	774	0	0	0	0	0	0	0	0	0	0	0	0	8784	8726
Liliha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waikiki	4332	4332	905	0	0	0	0	0	0	0	0	0	0	0	0	8784	8728
Sand Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waimanalo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pearl City	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Makaiwa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kapolei	2508	1596	336	0	0	0	0	0	0	0	0	0	0	0	0	8784	8595
West Beach	1596	1596	197	0	0	0	0	0	0	0	0	0	0	0	0	8784	8368
KAUAI																	
Lihue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAUI																	
Kihei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII																	
Kona	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hilo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Honokaa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lava Tree	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 4-3 **Annual Summary of 8-Hour Carbon Monoxide**

	Annual Statistics			8-hour Occurrences Greater than 10,000 µg/m³													
	Max Hr		Annual Means														
	1st High	2nd High	All Hours	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Possible Periods	Valid Periods
OAHU																	
Honolulu	1753	1724	774	0	0	0	0	0	0	0	0	0	0	0	0	1098	1091
Liliha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waikiki	2166	2038	905	0	0	0	0	0	0	0	0	0	0	0	0	1098	1094
Sand Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waimanalo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pearl City	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Makaiwa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kapolei	1055	827	336	0	0	0	0	0	0	0	0	0	0	0	0	1098	1076
West Beach	1012	627	197	0	0	0	0	0	0	0	0	0	0	0	0	1098	1042
KAUAI																	
Lihue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAUI																	
Kihei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII																	
Kona	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hilo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Honokaa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lava Tree	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 4-4 **Annual Summary of 1-Hour Ozone**

	Annual Statistics			1-hour Occurrences Greater than 235 µg/m³													
	Max Hr		Annual Means														
	1st High	2nd High	All Hours	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Possible Periods	Valid Periods
OAHU																	
Honolulu	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Liliha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waikiki	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sand Island	98	96	32	0	0	0	0	0	0	0	0	0	0	0	0	8784	8482
Waimanalo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pearl City	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Makaiwa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kapolei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
West Beach	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KAUAI																	
Lihue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAUI																	
Kihei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII																	
Kona	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hilo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Honokaa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lava Tree	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 4-5 **Annual Summary of 3-Hour Sulfur Dioxide**

	Annual Statistics			3-hour Occurrences Greater than 1,300 µg/m³													
	Max Hr		Annual Means														
	1st High	2nd High	All Hours	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Possible Periods	Valid Periods
OAHU																	
Honolulu	65	18	1	0	0	0	0	0	0	0	0	0	0	0	0	2928	2832
Liliha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waikiki	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sand Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waimanalo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pearl City	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Makaiwa	72	69	3	0	0	0	0	0	0	0	0	0	0	0	0	2928	2862
Kapolei	23	18	1	0	0	0	0	0	0	0	0	0	0	0	0	2928	2505
West Beach	11	9	1	0	0	0	0	0	0	0	0	0	0	0	0	2928	2304
KAUAI																	
Lihue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAUI																	
Kihei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII																	
Kona	50	49	6	0	0	0	0	0	0	0	0	0	0	0	0	2928	2897
Hilo	438	301	4	0	0	0	0	0	0	0	0	0	0	0	0	2928	2277
Honokaa	213	176	4	0	0	0	0	0	0	0	0	0	0	0	0	1704[a]	1691
Lava Tree	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

[a] This station was discontinued on 8/1/00

Table 4-6 **Annual Summary of 24-Hour Sulfur Dioxide**

	Annual Statistics: Max Hr 1st High	Annual Statistics: Max Hr 2nd High	Annual Statistics: Annual Means All Hours	24-hour Occurrences Greater than 365 µg/m³: Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Possible Periods	Valid Periods
OAHU																	
Honolulu	9	7	1	0	0	0	0	0	0	0	0	0	0	0	0	366	357
Liliha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waikiki	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sand Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waimanalo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pearl City	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Makaiwa	20	17	3	0	0	0	0	0	0	0	0	0	0	0	0	366	361
Kapolei	6	5	1	0	0	0	0	0	0	0	0	0	0	0	0	366	362
West Beach	4	4	1	0	0	0	0	0	0	0	0	0	0	0	0	366	333
KAUAI																	
Lihue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAUI																	
Kihei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII																	
Kona	25	16	6	0	0	0	0	0	0	0	0	0	0	0	0	366	365
Hilo	94	73	4	0	0	0	0	0	0	0	0	0	0	0	0	366	284
Honokaa	61	28	4	0	0	0	0	0	0	0	0	0	0	0	0	213[a]	213
Lava Tree	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

[a] This station was discontinued on 8/1/00

Table 4-7 **Annual Summary of Nitrogen Dioxide**

	Annual Statistics			Annual Occurrences Greater than 100 µg/m^3													
	Max Hr		Annual Means														
	1st High	2nd High	All Hours	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Possible Periods	Valid Periods
OAHU																	
Honolulu	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Liliha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waikiki	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sand Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waimanalo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pearl City	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Makaiwa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kapolei	-	-	9	-	-	-	-	-	-	-	-	-	-	-	0	8784	7213
West Beach	-	-	7	-	-	-	-	-	-	-	-	-	-	-	0	8784	8104
KAUAI																	
Lihue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAUI																	
Kihei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII																	
Kona	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hilo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Honokaa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lava Tree	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 4-8 **Annual Summary of 1-Hour Hydrogen Sulfide**

	Annual Statistics			1-hour Occurrences Greater than 35 μg/m³													
	Max Hr		Annual Means														
	1st High	2nd High	All Hours	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Possible Periods	Valid Periods
OAHU																	
Honolulu	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Liliha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waikiki	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sand Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waimanalo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pearl City	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Makaiwa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kapolei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
West Beach	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KAUAI																	
Lihue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAUI																	
Kihei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII																	
Kona	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hilo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Honokaa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lava Tree	7	7	2	0	0	0	0	0	0	0	0	0	0	0	0	8784	8319
Puna E	13	7	<1	0	0	0	0	0	0	0	0	0	0	0	0	8784	8276

Table 4-9 **Monthly Summary of 24-Hour PM_{10} ($\mu g/m^3$)**

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Honolulu	Range	7-***83***	9-21	7-31	8-21	8-21	7-15	10-17	9-21	7-18	12-22	9-23	8-20
	Average	15	15	16	15	14	11	13	15	13	16	15	14
Liliha	Range	10-***65***	9-21	13-36	9-25	9-22	8-16	10-18	9-19	7-18	9-21	10-20	8-44
	Average	16	16	19	16	15	11	14	14	12	15	15	14
Pearl City	Range	8-***164***	9-24	8-33	8-21	9-21	7-17	10-19	10-20	8-18	13-24	13-26	11-154
	Average	19	16	17	15	14	12	14	15	13	16	19	15
Waimanalo [a]	Range	10	20	6-15	16-***35***	12-20	11-15	17-22	14-25	9-18	12-28	7-22	8-18
	Average	10	20	10	23	16	14	18	17	14	22	16	13
Kapolei	Range	8-***148***	7-38	9-41	7-129	9-35	8-27	10-30	8-19	8-16	8-52	8-26	7-22
	Average	19	19	17	28	18	16	14	13	12	16	14	14
West Beach [a]	Range	3-19	7-16	10-32	13-19	10-***41***	10-40	8-12	8-11	7-12	8-17	8	5-13
	Average	11	14	17	15	23	18	10	10	9	14	8	9
Lihue [a]	Range	11-21	27-36	13-***39***	16-21	12-24	13-18	15-20	16-29	13-21	14-27	12-22	8-22
	Average	14	32	20	18	20	15	17	24	17	21	16	15
Kihei	Range	9-48	14-67	10-41	10-77	15-64	13-54	16-62	10-46	14-52	13-77	5-37	9-***83***
	Average	17	25	20	23	28	26	35	29	27	30	17	18
Paia	Range	7-***48***	9-30	10-42	10-23	10-28	11-45	12-26	13-32	12-30	12-21	12-23	10-33
	Average	15	19	22	16	16	16	17	18	19	16	16	19
Kona [a]	Range	No Data	13-21	16-17	16-22	17-***23***	14-15	PM_{10} Sampling discontinued at this site on 6/16/00					
	Average		18	16	19	20	14						
Hilo [a]	Range	7-13	10-16	8-12	No Data	No Data	10-10	10-15	9-14	6-11	7-16	8	6-***18***
	Average	10	13	11			10	13	11	8	12	8	10
Honokaa [a]	Range	4-11	8-***23***	12-12	No Data	9-11	7-11	4-10	Station discontinued on 8/01/00				
	Average	7	15	12		10	10	8					

[a] Sampling is once every 6th day

Table 4-10 **Monthly Summary of 1-Hour Carbon Monoxide (µg/m^3)**

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Honolulu	Range	342-***3990***	456-3192	456-2508	456-1368	342-2052	114-2166	342-2052	456-1824	342-2508	228-2052	456-3762	342-2964
	Average	755	925	870	706	710	746	696	793	813	549	907	832
Waikiki	Range	342-***4332***	456-4332	342-2964	228-1938	456-2280	114-2166	114-1710	456-2166	456-2850	570-2508	0-3078	0-2964
	Average	963	1193	1175	679	907	1065	603	790	1003	978	718	788
Kapolei	Range	0-1368	0-1596	0-912	0-798	0-1596	0-1140	0-***2508***	228-912	0-1140	0-1140	0-1482	114-1596
	Average	285	287	283	219	353	216	490	404	345	327	320	495
West Beach	Range	0-798	0-1254	0-798	0-570	0-1140	0-456	0-1026	114-456	0-570	0-684	0-***1596***	0-912
	Average	133	230	267	181	274	235	164	146	103	218	228	189

Table 4-11 **Monthly Summary of 8-Hour Carbon Monoxide (µg/m^3)**

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Honolulu	Range	371-1582	641-1525	599-1268	485-955	442-1012	356-1097	371-998	556-1112	413-1724	342-1254	584-***1753***	399-1397
	Average	755	925	870	706	710	746	696	793	813	549	907	832
Waikiki	Range	485-***2166***	684-2009	684-1724	342-1411	684-1226	399-1496	257-1040	542-1466	627-2038	670-1425	14-1995	86-1568
	Average	963	1193	1175	679	907	1065	603	790	1003	978	718	788
Kapolei	Range	95-613	100-556	100-584	29-485	0-***1055***	0-584	114-741	257-584	71-827	86-556	14-684	114-812
	Average	285	287	283	219	353	216	490	404	345	327	320	495
West Beach	Range	71-314	128-371	114-456	100-342	114-385	100-413	49-342	114-342	0-244	14-499	0-***1012***	14-399
	Average	133	230	267	181	274	235	164	146	103	2128	228	189

Table 4-12 **Monthly Summary of 1-Hour Ozone (μg/m^3)**

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Sand Island	Range	0-86	0-88	0-90	2-***98***	2-76	2-47	2-51	0-53	0-39	0-55	0-69	0-80
	Average	47	32	45	55	32	20	21	22	15	27	33	30

Table 4-13 **Monthly Summary of 3-Hour Sulfur Dioxide (μg/m^3)**

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Honolulu	Range	0-***65***	0-17	3-18	0-3	0-2	0-3	0-2	0-17	0-6	0-7	0-7	0-5
	Average	1	4	3	<1	<1	<1	<1	<1	1	3	<1	1
Makaiwa	Range	0-27	0-48	0-55	0-12	0-61	0-46	0-8	0-18	0-49	0-61	0-25	2-***72***
	Average	2	5	3	2	4	3	2	3	4	3	3	6
Kapolei	Range	0-18	0-14	0-5	0-3	0-16	0-14	0-14	0-9	0-3	0-10	0-3	0-***23***
	Average	3	1	1	<1	1	1	1	<1	<1	<1	<1	2
West Beach	Range	0-***11***	0-3	0-5	0-4	0-4	0-5	0-5	3-5	3-4	0-1	0-0	0-8
	Average	1	<1	1	1	2	3	3	3	3	<1	0	<1
Kona	Range	3-37	2-49	3-***50***	3-44	0-23	5-13	5-10	5-16	0-22	0-41	0-28	0-38
	Average	7	7	7	8	7	6	6	7	5	4	4	6
Hilo	Range	0-136	0-***438***	0-106	0-187	0-5	0-20	0-3	0-3	0-115	0-2	0-16	0-174
	Average	4	19	6	4	2	1	1	<1	1	<1	2	11
Honokaa	Range	0-98	1-***213***	1-49	2-3	0-3	3-45	0-3	Station discontinued on 8/01/00				
	Average	4	9	4	3	2	3	3					

Table 4-14 **Monthly Summary of 24-Hour Sulfur Dioxide (µg/m³)**

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Honolulu	Range	0-***9***	<1-7	3-6	0-3	0-<1	0-<1	0-<1	0-2	0-3	1-3	0-3	0-3
	Average	1	4	3	<1	<1	<1	<1	<1	1	3	<1	1
Makaiwa	Range	<1-12	2-16	1-13	<1-5	<1-11	<1-17	1-4	0-6	<1-10	1-11	1-7	3-***20***
	Average	2	5	3	2	4	3	2	3	4	3	3	6
Kapolei	Range	2-5	0-5	0-3	0-1	0-5	0-5	0-4	0-3	0-1	0-2	0-1	<1-***6***
	Average	3	1	1	<1	1	1	1	<1	<1	<1	<1	2
West Beach	Range	<1-***4***	<1-1	<1-3	1-2	1-3	1-4	1-4	3-4	3-3	0-<1	0-0	0-2
	Average	1	<1	1	1	2	3	3	3	3	<1	0	<1
Kona	Range	4-16	2-14	3-***25***	3-15	4-11	5-9	5-7	5-9	0-10	<1-12	0-10	2-16
	Average	7	7	7	8	7	6	6	7	5	4	4	6
Hilo	Range	0-41	1-***94***	<1-34	2-28	<1-3	<1-5	<1-3	0-1	0-26	<1-1	1-5	1-73
	Average	4	19	6	4	2	1	1	<1	1	<1	2	11
Honokaa	Range	1-25	2-***61***	2-15	2-3	1-3	3-12	2-3	Station discontinued on 8/01/00				
	Average	4	9	4	3	2	3	3					

Table 4-15 **Monthly Summary of 24-Hour Nitrogen Dioxide (µg/m^3) [a]**

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Kapolei	Range	3-14	1-19	5-19	2-11	5-11	4-12	5-11	6-17	6-15	7-14	4-14	7-***21***
	Average	7	11	10	7	7	7	8	11	9	11	8	12
West Beach	Range	1-14	2-***18***	2-12	1-11	3-11	2-10	3-6	3-12	3-10	0-11	4-12	5-16
	Average	5	9	5	4	6	5	5	5	6	4	7	10

[a] There is no 24-hour state or federal standard for nitrogen dioxide

Table 4-16 **Monthly Summary of 1-Hour Hydrogen Sulfide (µg/m^3)**

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Lava Tree	Range	3-***7***	0-4	0-4	0-4	0-4	0-3	0-1	0-1	1-1	1-3	1-7	0-3
	Average	3	3	3	2	1	1	1	1	1	1	1	1
Puna E	Range	0-1	0-1	0-3	0-3	0-1	0-7	0-1	0-1	0-1	0-0	0-***13***	0-0
	Average	<1	<1	<1	<1	1	1	<1	<1	<1	0	<1	0

Section 5
AMBIENT AIR QUALITY TRENDS

The following graphs illustrate 5-year trends for PM_{10}, ozone, carbon monoxide, sulfur dioxide, and nitrogen dioxide from 1996 to 2000.

The graphs for PM_{10}, sulfur dioxide and nitrogen dioxide (figures 5-1, 5-2, 5-5 and 5-6, respectively) represent the annual averages for each year and for each station that monitors for that pollutant. Annual averages are derived by calculating the arithmetic mean of all valid hours recorded in the year. Included in the graphs are the state and federal annual standard(s).

The graphs for 1-hour ozone and 1-hour carbon monoxide (figures 5-3 and 5-4, respectively) represent the average of the daily maximum 1-hour values recorded in the year. These values are obtained by taking the highest recorded 1-hour value for each day then calculating the arithmetic mean of all those hours to arrive at the annual maximum average. Ozone and carbon monoxide do not have state or federal annual standards, however, included in the graphs are the 1-hour standards.

Figure 5-1 **Island of Oahu: PM_{10} Annual Average 1996 - 2000**

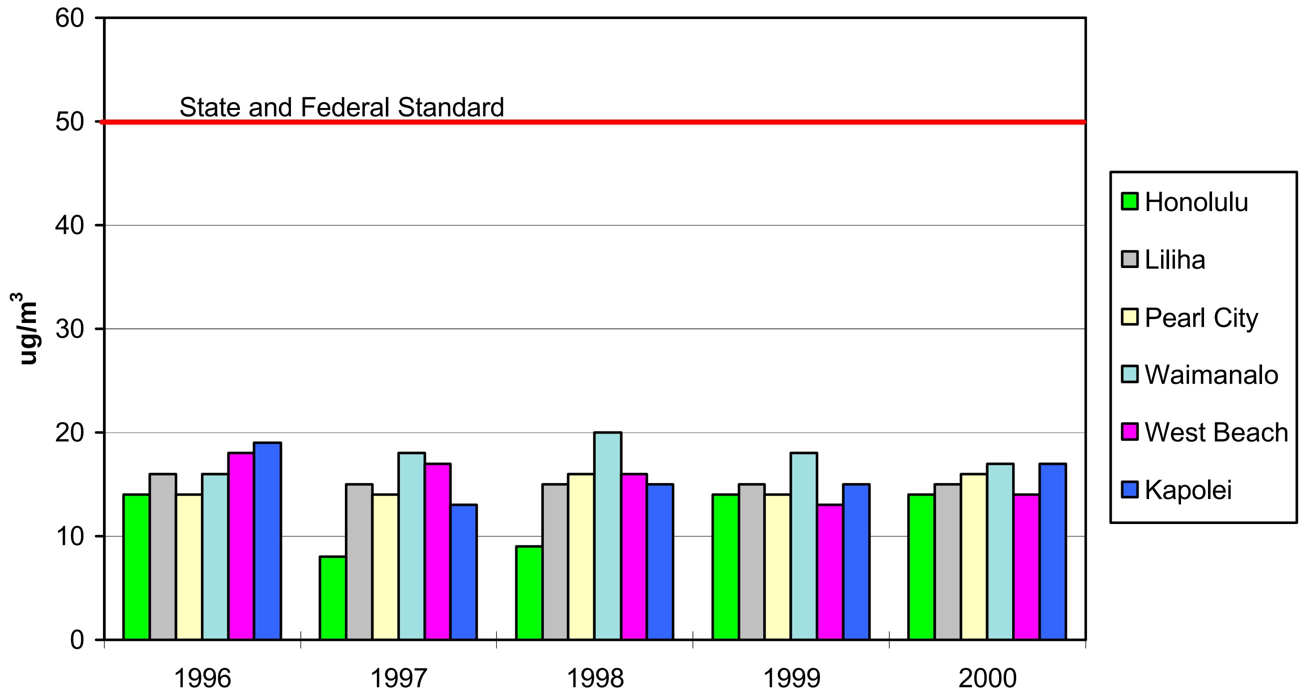


Figure 5-2 **Island of Kauai: PM_{10} Annual Average 1996 - 2000**

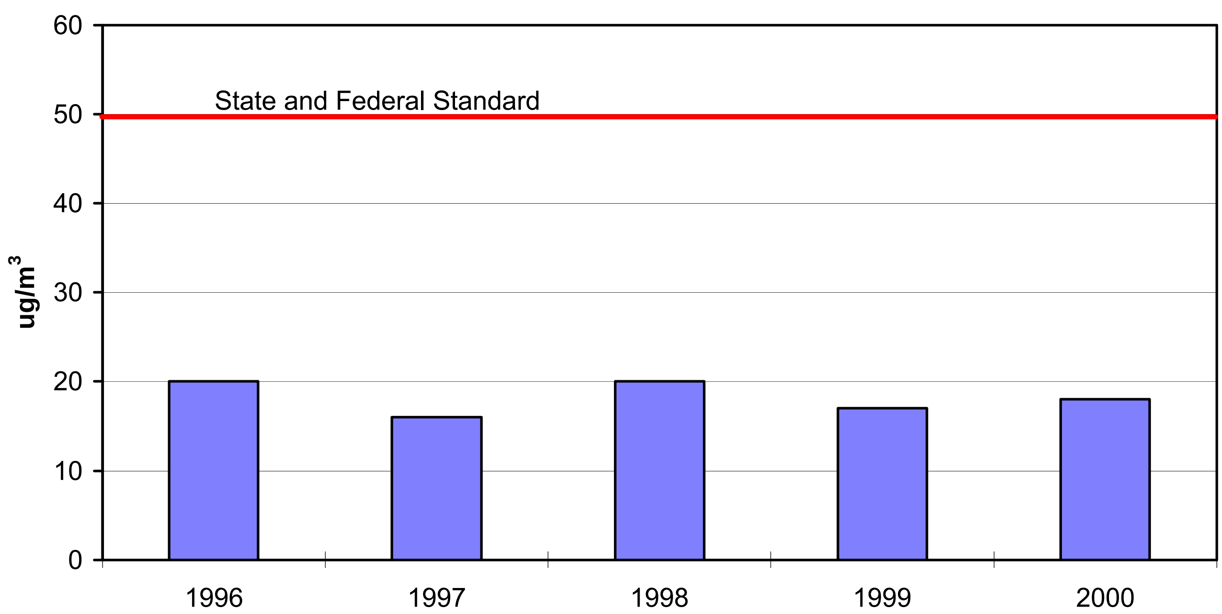


Figure 5-3 **Annual Average of Daily Maximum 1-Hour Ozone 1996 - 2000**

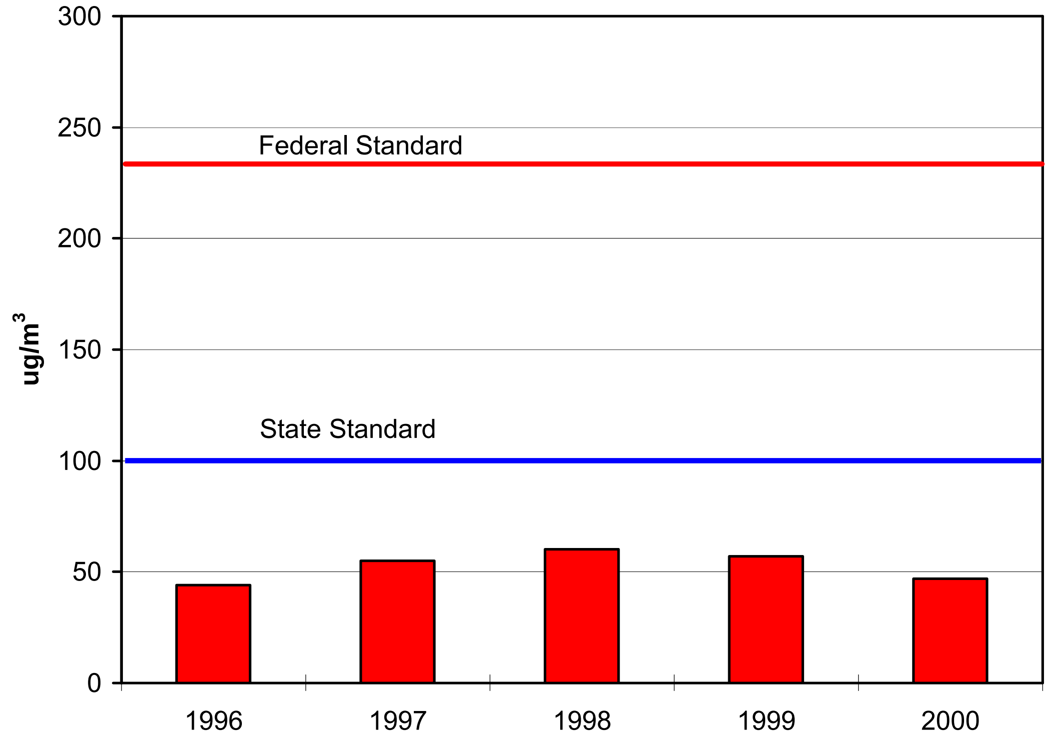


Figure 5-4 **Annual Average of Daily Maximum 1-Hour Carbon Monoxide 1996 - 2000**

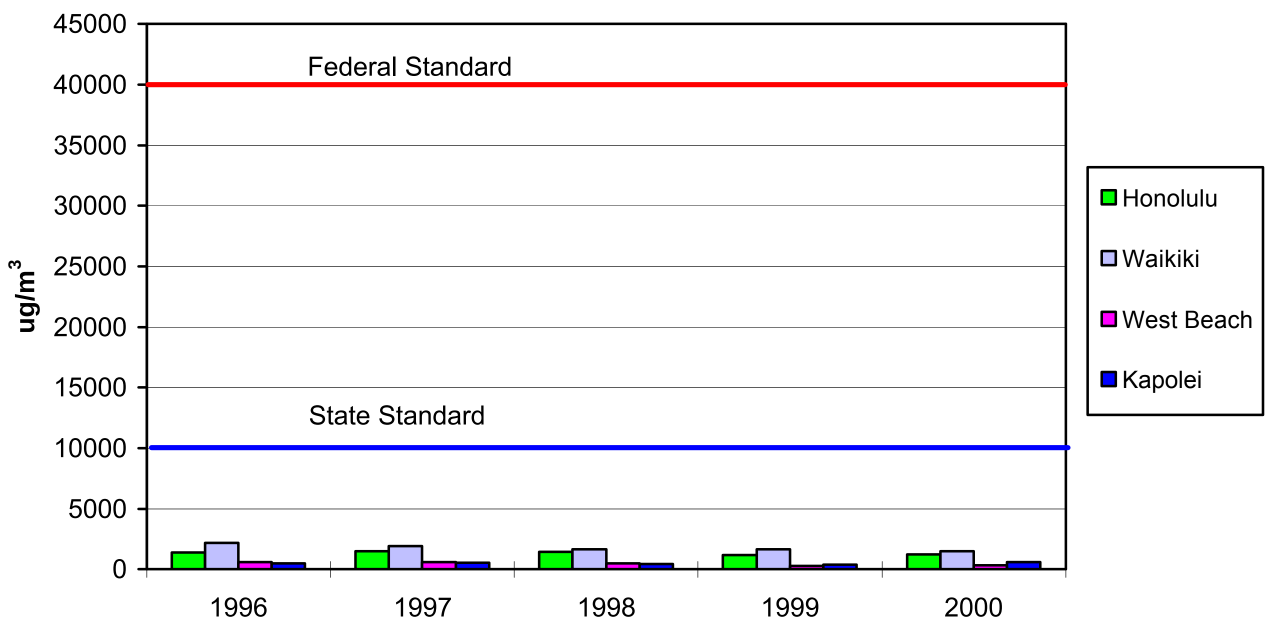


Figure 5-5 **Annual Average Sulfur Dioxide 1996 - 2000**

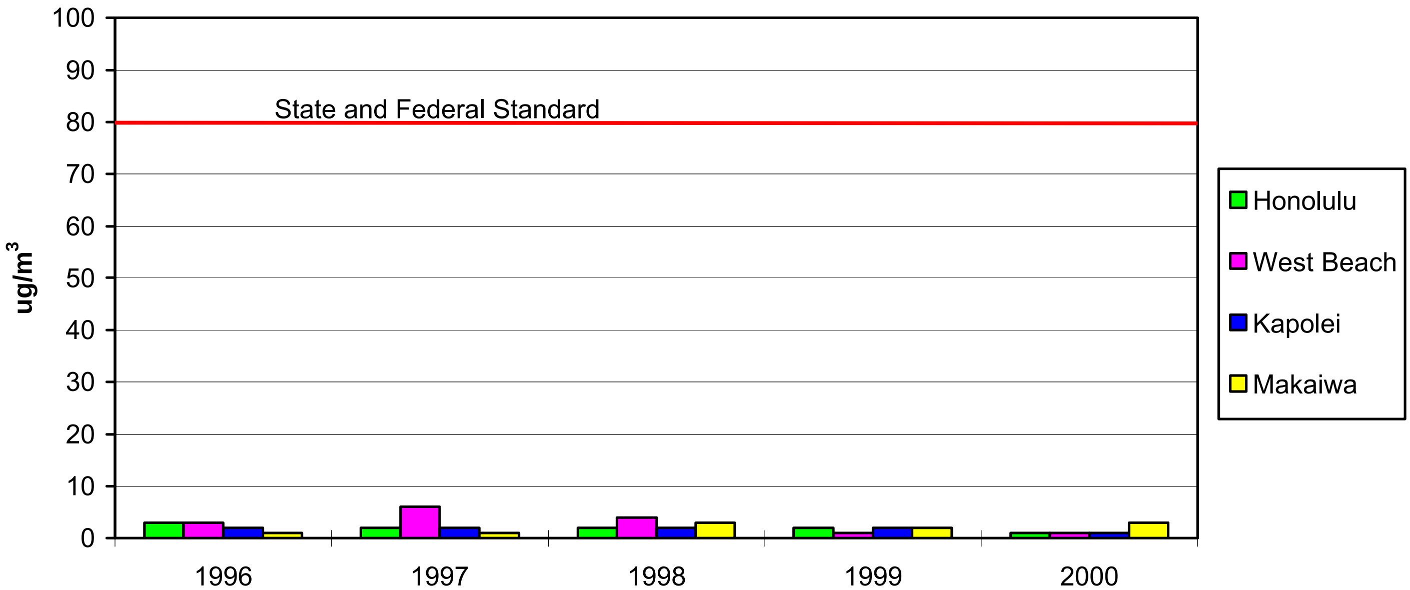
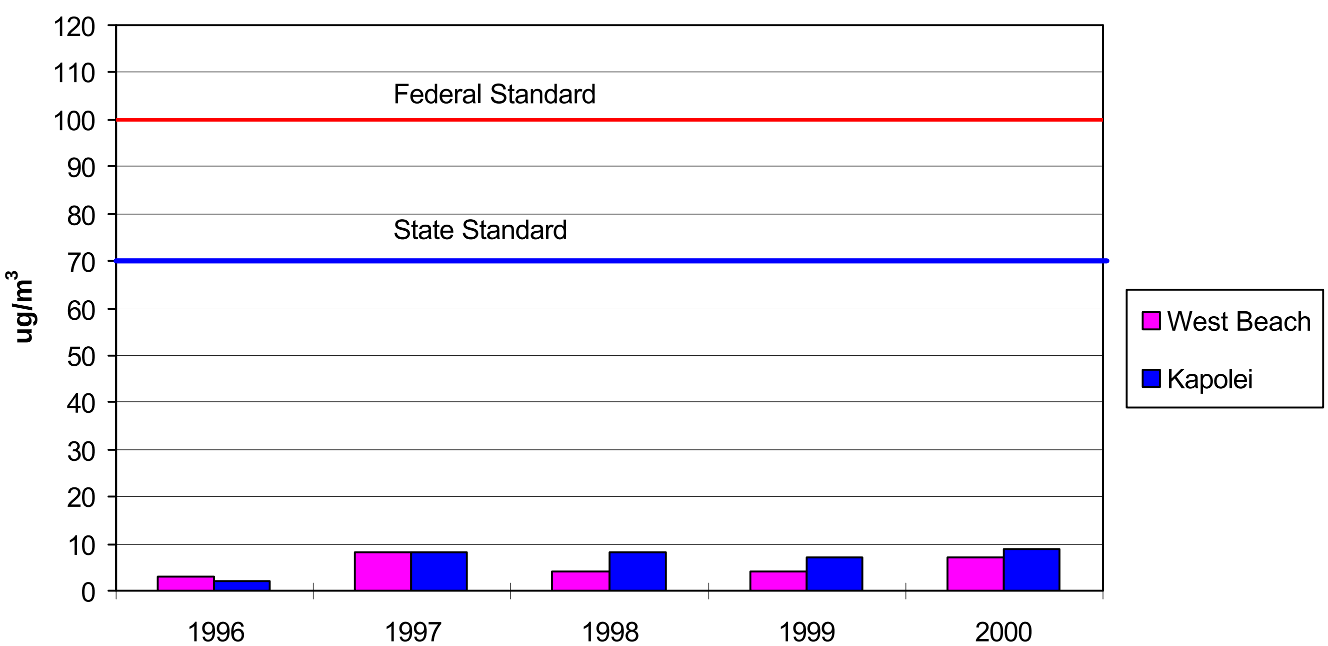


Figure 5-6 **Annual Average Nitrogen Dioxide 1996 - 2000**



Appendix C

Air Quality Impact Assessment

June 2002

Environmental Assessment

Wahiawa Transit Center & Park and Ride
TMK: 7-4-006:002 & portion of 7-4-006:012
956 California Avenue, Wahiawa, O`ahu, Hawai`i

Return to list of appendices

Partners, Inc.

AIR QUALITY

ENVIRONMENTAL ASSESSMENT

FINAL REPORT

at

Wahiawa Community Transit Center

(AMP Project No. A0096.30)

June 2002

Prepared for:

AM Partners, Inc.
1164 Bishop St., Suite 1000
Honolulu, HI 96813

Prepared by:

The Environmental Company, Inc.

Air Quality Environmental Assessment
Final Report

Wahiawa Community Bus Transit Center

956 California Avenue, Wahiawa, Hawaii

June 2002

Prepared for:

AM Partners, Inc

Prepared by:

The Environmental Company, Inc.
1001 Bishop St., Pauahi Tower, Suite 1240
Honolulu, Hi 96813

TABLE OF CONTENT

EXECUTIVE SUMMARY

The Honolulu City & County Department of Transportation Services is proposing to construct the Wahiawa Community Bus Transit Center in Wahiawa's Civic Center at 956 California Avenue, Wahiawa, Hawaii. The proposed project will consist of eight bus bays along with passenger waiting facilities and other ancillary facilities. The project is expected to be completed at the end of July 2003 and will result in increased emissions due to exhaust from the increased bus activity at the said location. This study examines the potential short- and long-term air quality impacts that may occur as a result of these extra exhaust emissions and includes potential impact due to construction activities. In addition, this study suggests mitigative measures to reduce any potential air quality impacts where possible and appropriate.

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

Regional and local climate, together with the amount and type of human activity generally dictate the air quality at the project site. Trade winds dominate in the region. Rough terrain plays an important role in local wind pattern. During winter, occasional storms may generate strong winds from the south (kona winds) for brief periods. When the trade winds or kona winds are weak or absent, landbreeze-seabreeze circulations or mountain drainage winds may develop. Wind speeds are often lower compared to more exposed coastal locations, but the trade winds still provide relatively good ventilation much of the time. Temperatures in the Oahu area leeward of the Koolaus are generally very moderate with average daily temperatures ranging from about 70 Fahrenheit (^{o}F) to 85^{o}F. Extreme temperatures range from about 53^{o}F to about 95^{o}F. Rainfall in the Wahiawa area is relatively high, averaging about 50 inches per year.

The present air quality at the project site appears to be reasonably good based on nearby air quality monitoring data. Air quality data from the nearest monitoring stations operated by the Hawaii Department of Health suggest that all national ambient air quality standards are currently being met, although occasional exceedances of the more stringent state standard for ozone may occur.

The resulting increase in the air pollution due to bus emission at the Wahiawa Bus Transit Center was found to be relatively smaller than the significant emission rates as defined in the Hawaii Administrative Rules. Therefore, it is unlikely that any measurable impacts on air quality will occur. Implementing any air quality mitigation measures for long-term impacts from the proposed project is probably unnecessary and unwarranted.

1.0 INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

The Department of Transportation Services (DTS), City and County of Honolulu is proposing to construct and operate the Wahiawa Community Bus Transit Center on the island of Oahu, Hawaii. The proposed project will have eight (8) bus bays with passengers waiting facilities and other ancillary facilities. It will have circulator service line and a trunk line serving the Wahiawa and Honolulu route and is expected to start operation by the end of July 2003. This air quality assessment will be part of the basis to determine whether a more detailed environmental assessment is needed for the proposed development. The Environmental Company, Inc. (TEC, Inc.) conducted an air quality environmental assessment during the month of May 2002 to estimate the impact of future increase emissions due to activities at the Bus Transit Center. To ascertain the potential of the air quality impact on the project, the maximum annual bus volume was predicted for the Transit Center as a worst case scenario.

The purpose of this study is to describe existing air quality in the project area and to assess the potential long-term direct and indirect air quality impacts that could result from the use of the proposed facilities. Measures to mitigate these impacts are suggested where possible and appropriate.

1.2 PROJECT OVERVIEW

1.2.1 Site Description

The proposed **Wahiawa Community Bus Transit Center** will be located in Wahiawa's Civic Center at 956 California Avenue, on portions of TMK 7-4-6:2 and TMK 7-4-6:12 (Fig. 1.1, Site Map). The project site is currently zoned as R-5 Residential area. The Transit Center is located adjacent to the existing Wahiawa Civic Center Building (Fig. 1.2) and across from the Wahiawa Town Center (Fig. 1.3).

The Wahiawa Community Bus Transit Center will provide eight (8) bus bays for the regular bus and paratransit vehicles. A proposed parking lot with a capacity of about 45 cars will remain immediately adjacent to the Transit Center. Passenger waiting shelters, a comfort station with restrooms, bike parking, lockers, and informational kiosks will be provided, along with landscaping and additional street trees. The Transit Center will operate circulator lines that would service the Wahiawa area and a trunk line that will serve the Wahiawa and Downtown Honolulu route.

1.2.2 Interviews

Mr. James Burke of DTS described the activities at the proposed Bus Transit Center including the bus schedule and dwell time or wait-time for the buses to load and unload passengers. He also indicated that there will be 6 regular buses and 2 articulated buses to service the Transit Center. Finally, Mr. Burke concurred with the air quality assessment strategy that utilizes maximum allowable bus traffic at the Transit Center, which represents a worst case scenario as the basis for calculating the annual volume of buses expected at the center.

In an effort to calculate annual emission volumes at the proposed Bus Transit Center, TEC, requested actual emission data from Mr. Rick Hardy of the Oahu Transit Services, Inc. Mr. Hardy explained that these data are not available because emissions from existing buses have not been monitored. He further explained that the Oahu Transit Services Inc. follow a strict maintenance schedule on their engines as per manufacturer specification. He explained that currently, buses serving the island of Oahu are equipped with diesel engines (Detroit Diesel Series 50) that have been tested and approve by the United State Environmental Protection Agency (EPA) prior to commercial production. Furthermore, he indicated that a $9,000 rebuild kit is use on a regular basis to ensure that each engine performs within the allowable EPA emission standard for heavy duty engines.

Pacific Detroit Diesel Company, through the help of Ms. Stella Yara, provided the EPA Emission standard (Table 1) and indicated that the regular buses at the Oahu Transit Services, use 1993 to 1998 model of the Series 50 diesel engines. The articulated buses use the 1999 Series 50 diesel engine. She reiterated that no actual emission data on the currently used buses on Oahu are available.

The Hawaii Department of Health (HDOH) through the help of Ms. Liza Young, provided Hawaii air quality data, including the Hawaii and EPA standards for the six criteria pollutants (Table 2). She further reinforced the claim of Mr. Hardy and Ms. Yara that automobile emission data is not available in the state of Hawaii and not required that the Oahu Transit Services to provide these data. The HDOH relies on the air monitoring stations strategically located in Oahu to monitor the amount of engine emission in the environment (Fig. 1.4).

1.2.3 Annual Bus Volume

The Wahiawa Community Bus Transit Center is expected to operate 20 hours daily. The Transit Center will be serviced with 6 regular buses and 2 articulated buses. Service plan for the Transit Center will reflect a “pulse” of about every ½ hour when the circulators and the trunk lines services are expected to meet at the Transit Center. The loading dwell time is about 3 to 5 minutes to allow the bus to load and unload passengers. It is assumed that the bus will be running in idle mode over this period in order to operate the air-conditioning system.

In order to assess the impact of the Transit Center on the quality of the ambient air, the air quality environmental assessment was evaluated on a worst case scenario. This scenario consisted of assuming that the Bus service remains on normal weekday schedule 365 days a year. Actual buses operate on a limited schedule on weekends and holidays. In addition all buses at the station are assumed to be in idle mode while waiting for passengers. The route numbers and service span for the Transit Center are based on Draft Central Oahu Hub and Spoke Service Plan and current public timetable for the existing service.

Based on the above assumptions, the worst case scenario estimated 84,315 buses expected to visit the Wahiawa Community Bus Transit Center each year.

2.0 AIR QUALITY ENVIRONMENTAL ASSESSMENT

2.1 AMBIENT AIR QUALITY STANDARDS

Ambient concentrations of air pollution are regulated by both national and state ambient air quality standards (AAQS). National AAQS are specified in Section 40, Part 50 of the Code of Federal Regulations (CFR), while State of Hawaii AAQS are defined in Chapter 11-59 of the Hawaii Administrative Rules. Table 2 summarizes both the national and the state AAQS that are specified in the cited documents. As indicated in the table, Federal and state AAQS have been established for particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone and lead. The state has also set a standard for hydrogen sulfide. National AAQS are stated in terms of both primary and secondary standards for most of the regulated air pollutants. National primary standards are designed to protect the public health with an "adequate margin of safety". National secondary standards, on the other hand, define levels of air quality necessary to protect the public welfare from "any known or anticipated adverse effects of a pollutant". Secondary public welfare impacts may include such effects as decreased visibility, diminished comfort levels, or other potential injury to the natural or man-made environment, e.g., soiling of materials, damage to vegetation or other economic damage. In contrast to the national AAQS, Hawaii State AAQS are given in terms of a single standard that is designed "to protect public health and welfare and to prevent the significant deterioration of air quality".

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

The Hawaii AAQS are in some cases considerably more stringent than the comparable national AAQS. In particular, the Hawaii 1-hour AAQS for carbon monoxide is four times more stringent than the comparable national limit, and the state 1-hour limit for ozone is more than two times as stringent as the national 1-hour standard. The national 1-hour ozone standard will be phased out (pending court appeal) the next few years in favor of the new (and more stringent) 8-hour standard (Table 2).

The Hawaii AAQS for sulfur dioxide were relaxed in 1986 to make the state standards essentially the same as the national limits. In 1993, the state also revised its airborne particulate standards to follow those set by the Federal government. During 1997, the Federal government again revised its standards for particulate, but the new standards have been challenged in Federal court. To date, the HDOH has not updated the state particulate standards.

2.2 REGIONAL AND LOCAL CLIMATOLOGY

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

Hawaii lies well within the belt of northeasterly trade winds generated by the semi-permanent Pacific high pressure cell to the north and east. On the island of Oahu, the Koolau and Waianae Mountain Ranges are oriented almost perpendicular to the trade winds, which accounts for much of the variation in the local climatology of the island. Waianae, Wahiawa and Mililani, the sites of the proposed project, are suburban areas within the City and County of Honolulu. Wahiawa is situated between the Koolau and Waianae Ranges. Although climatic conditions vary somewhat across the project area, long-term weather data available from the Honolulu International Airport, located a few miles to the southeast, is at least semi-representative.

Wind frequency data given in Table 3 for Honolulu International Airport show that the annual prevailing wind direction for this area of Oahu is east northeast. On an annual basis, 34.7 percent of the time the wind is from this direction, and nearly 75 percent of the time the wind is in the northeast quadrant. Winds from the south are infrequent occurring only a few days during the year and mostly in association with winter storms. Wind speeds average about 11 mph (10 knots) and mostly vary between about 4 and 18 mph (5 and 15 knots). Surface wind speeds in the project area are somewhat lighter, and local wind directions are likely affected by the terrain.

Air pollution emissions from motor vehicles, the formation of photochemical smog and smoke plume rise all depend in part on air temperature. Colder temperatures tend to result in higher emissions of contaminants from automobiles but lower concentrations of photochemical smog and ground-level concentrations of air pollution from elevated plumes. In Hawaii, the annual and daily variation of temperature depend to a large degree on elevation above sea level, distance inland and exposure to the trade winds. Average temperatures at locations near sea level generally are warmer than those at higher elevations. Areas exposed to the trade wind tend to have the least temperature variation, while inland and leeward areas often have the most. The project area's leeward location results in a relatively moderate temperature profile compared to some other locations around Oahu and the state. At the airport, average annual daily minimum and maximum temperatures are 70°F and 84°F, respectively [1]. The extreme minimum temperature was 53°F during January 1998, and the extreme maximum was 95°F during September 1994. Temperatures in Wahiawa area are cooler due to the higher elevation.

Small scale, random motions in the atmosphere (turbulence) cause air pollutants to be dispersed as a function of distance or time from the point of emission. Turbulence is caused by both mechanical and thermal forces in the atmosphere. It is often measured and described in terms of Pasquill-Gifford stability class. Stability class 1 is the most turbulent and class 6 the least. Thus, air pollution dissipates the best during stability class 1 conditions and the worst when stability class 6 prevails. In suburban areas, like those in the project area, stability class 5 or 6 is generally the highest stability class that occurs, developing during the nighttime and early morning.

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

Rainfall can have a beneficial effect on the air quality of an area in that it helps to suppress fugitive dust emissions, and it also may "washout" gaseous contaminants that are water-soluble. Rainfall in Hawaii is highly variable depending on elevation and on location with respect to the trade wind. Wahiawa, located at a higher elevation and between the Koolau and Waianae Ranges, have a wetter climate receiving about 50 inches per year [2].

2.3 PRESENT AIR QUALITY

Present air quality in the project area is mostly affected by air pollutants from motor vehicles, industrial sources, agricultural operations and to a lesser extent by natural sources. Table 4 presents an air pollutant emission summary for the island of Oahu for calendar year 1993. The emission rates shown in the table pertain to manmade emissions only, i.e., emissions from natural sources are not included. As suggested in the table, much of the particulate emissions on Oahu originate from area sources, such as the mineral products industry and agriculture. Sulfur oxides are emitted almost exclusively by point sources, such as power plants and refineries. Nitrogen oxides emissions emanate predominantly from industrial point sources, although area sources (mostly motor vehicle traffic) also contribute a significant share. The majority of carbon monoxide emissions occur from area sources (motor vehicle traffic), while hydrocarbons are emitted mainly from point sources. Based on previous emission inventories that have been reported for Oahu, it appears that emissions of particulate and nitrogen oxides have increased during the past ten years, while emissions of sulfur oxides, carbon monoxide and hydrocarbons have declined.

Roadways in the vicinity of the Transit Center site carry moderate volumes of motor vehicle traffic at times, and roadway intersections may be congested during peak traffic hours. Emissions from motor vehicles using these roadways, primarily nitrogen oxides and carbon monoxide, may cause localized impacts on air quality.

The Wahiawa Community Bus Transit Center site is farther removed from large industrial sources of air pollution, although emissions from distant sources at Campbell Industrial Park may affect these area during kona wind conditions. With the demise of sugarcane growing on the Ewa Plain, air pollutions impacts from agriculture have significantly diminished in the area. Agriculture-related emissions in Wahiawa area may experience occasional dust and smoke impacts from nearby, large-scale pineapple cultivation and harvesting operations. Natural sources of air pollution emissions that also could affect the project area but cannot be quantified very accurately include the ocean (sea spray), plants (aero-allergens), wind-blown dust, and perhaps distant volcanoes on the island of Hawaii.

The State Department of Health operates a network of air quality monitoring stations at various locations on Oahu. Each station, however, typically does not monitor the full complement of air quality parameters. Table 5 shows annual summaries of air quality measurements that were made nearest to the project area for several of the regulated air pollutants for the period 1996 through 2000. These are the most recent data that are currently available.

During the 1996-2000 period, sulfur dioxide was monitored by the State Department of Health at an air quality station located at Kapolei. Concentrations monitored were consistently low compared to the standards. Annual second-highest 3-hour concentrations (which are most relevant to the air quality standards) ranged from 17 to 64 $\mu g/m^3$, while the annual second-highest 24-hour concentrations ranged from 5 to 16 $\mu g/m^3$. Annual average concentrations were only about 1 to 2 $\mu g/m^3$. There were no exceedances of the state/national 3-hour (1,300 $\mu g/m^3$) or 24-hour (365 $\mu g/m^3$) AAQS for sulfur dioxide during the 5-year period.

Particulate matter less than 10 microns in diameter (PM-10) is also measured at the Kapolei monitoring station. Annual second-highest 24-hour PM-10 concentrations ranged from 26 to 129 $\mu g/m^3$ between 1996 and 2000. Average annual concentrations ranged from 13 to 19 $\mu g/m^3$. All values reported were within the state and national AAQS (50 $\mu g/m^3$ and 150 $\mu g/m^3$ for the average annual and annual values respectively).

Carbon monoxide measurements were also made at the Kapolei monitoring station. The annual second-highest 1-hour concentrations ranged from 1.2 to 1.7 mg/m^3. The annual second-highest 8-hour concentrations ranged from 0.6 to 0.8 mg/m^3. No exceedances of the state 1-hour (10 mg/m^3) or 8-hour (5 mg/m^3) AAQS were reported.

Nitrogen dioxide is also monitored by the Department of Health at the Kapolei monitoring station. Annual average concentrations of this pollutant ranged from 2 to 9 $\mu g/m^3$, safely inside the state and national AAQS at 70 $\mu g/m^3$ and 100 $\mu g/m^3$ respectively.

The nearest available ozone measurements were obtained at Sand Island (about 25 miles southeast of the project area). The second-highest 1-hour concentrations for each year from 1996 to 2000 ranged from 91 to 110 $\mu g/m^3$. Up to 13 exceedances of the state AAQS (100 $\mu g/m^3$ per year) were recorded during the monitoring period. No specific trend is discernable, although the number of exceedances was lower during the latter half of the five-year period.

Although not shown in the table, the nearest and most recent measurements of ambient lead concentrations that have been reported were made at the downtown Honolulu monitoring station between 1996 and 1997. Average quarterly concentrations were near or below the detection limit, and no exceedances of the state AAQS of 1.5 $\mu g/m^3$ were recorded. Monitoring for this parameter was discontinued during 1997.

Based on the data and discussion presented above, it appears likely that the State of Hawaii AAQS for sulfur dioxide, nitrogen dioxide, particulate matter and lead are currently being met at the project site. Due to the abundance of ozone in the state of Hawaii, it is likely, that the state AAQS for ozone may be exceeded on occasion based on the Sand Island measurements for this parameter. The abundance of ozone is greatly influence by the amount of sunshine in the state. While carbon monoxide measurements at the Kapolei monitoring station suggest that concentrations are within the state and national standards, local “hot spots” may exist near traffic-congested intersections.

2.4 PROJECT IMPACT

2.4.1 Bus Emissions

The proposed Transit Center will result in increased bus traffic on nearby roadways, potentially causing long-term impacts on ambient air quality in the vicinity of the Transit Center where the buses will congregate. Motor vehicles with gasoline-powered engines are significant sources of carbon monoxide, and they also emit nitrogen oxides and other contaminates. In urban and suburban areas, carbon monoxide emissions near congested roadway intersections are the usual issue. In the case of diesel-powered buses, however, the primary air pollution emissions consist of nitrogen oxides and particulate matter; carbon monoxide emissions are generally inconsequential compared to automobile emissions.

Although computer models can generally be used to assess the impacts of carbon monoxide emissions from motor vehicle traffic, it is probably impractical to attempt to quantitatively model the bus emissions of nitrogen oxides and particulate that may be associated with the proposed facilities. In lieu of this, annual emissions from project bus operations in the vicinity of the Wahiawa Transit Center was estimated and compared to the "significant" emission rates as defined in the Hawaii Administrative Rules. Strictly speaking, the significant emission rates are intended to be applied to stationary point sources and not mobile sources such as bus traffic. Nevertheless, it is believed that this will provide a reasonable approach to ascertaining the significance of the project-related emissions of nitrogen oxides and particulate. If the project emissions are shown to be below the significant emissions rates, this is usually taken to indicate that a more detailed assessment of the emissions is not warranted.

To begin the evaluation of the potential long-term impacts on air quality related to the proposed facilities, the annual bus volumes at Wahiawa Transit Center was estimated. This was done by first identifying the bus routes that would include each Transit Center and then reviewing the schedules for these routes to enumerate the buses each day that would be associated with each route at the Transit Center. Table 6 shows the estimated annual bus volume at the Wahiawa Transit Center and the basis for the estimate. As indicated in the table, the expected total annual bus volumes at the facility is 84,315. As noted in the table, these estimates assume that weekend service will be the same as weekday service. Actual annual bus volumes will be somewhat lower due to reduced service on weekends and holidays.

Buses using the proposed Transit Center will emit air pollution on approach, during idle and as they depart. To estimate the bus emissions during these modes of operation, the EPA computer model MOBILE6.1 [5] was used in combination with the expected annual bus volumes. MOBILE6.1 can be used to provide composite emission factors for a given year, vehicle class, average vehicle speed and ambient air temperature. The composite emission factors generally pertain to various modes of operation (acceleration, cruise, deceleration and idle) and are specified in terms of grams per vehicle mile of travel. Idle emission rates in terms of grams per minute can be estimated separately. For this project, MOBILE6.1 was used to estimate emission factors for the heavy-duty diesel vehicle (HDDV) class. Emission factors for nitrogen oxides, particulate, volatile organic compounds (VOC), carbon monoxide and sulfur dioxide were calculated for the year 2003, the expected year of project completion. Due to new emission standards for this class of vehicle that will be phased in during the next several years, emissions of nitrogen oxides and particulate will diminish in later years. An average annual temperature of 77ºF was assumed, and it was further assumed that the average approach and departure speeds would be 25 mph.

Table 7 shows the resulting estimated composite and idle emission factors for HDDV. Nitrogen oxides emissions are the most appreciable followed by carbon monoxide, volatile organic compounds, sulfur dioxide and particulate. It is worth noting that carbon monoxide emissions from light-duty gasoline vehicles (LDGV) are about five times higher per vehicle mile of travel than are those for HDDV.

The next task is to determine the total vehicle miles and bus idle times associated with the Transit Center. A reasonable but somewhat arbitrary assumption is that emissions that occur beyond 1 mile of the Transit Centers will not significantly impact air quality in the vicinity of the Transit Center. Thus, the relevant approach and depart vehicle miles at the Transit Center were estimated to amount to the annual bus volume multiplied by 2 miles. Total annual idle times were estimated based on the annual bus volume and the assumption that each bus would idle for an average of 5 minutes at the Transit Centers. The resulting total annual approach and depart miles and the total annual idling times for the Transit Center are shown in Table 8.

The emission factors given in Table 7 combined with the estimated annual approach/depart miles and annual idle times shown in Table 8 will provide estimates of the total annual emissions attributable to the Transit Center. The resulting estimated annual emissions for the Wahiawa Transit Center for the year 2003 are indicated in Table 9. Nitrogen oxides emissions at the Wahiawa Transit Center is about 2.7 tons per year, while carbon monoxide emissions would amount to about 1.0 ton per year. Emissions of particulate, VOC and sulfur dioxide would be much less than 1 ton per year each. Emissions of nitrogen oxides and particulate can be expected to decrease with time as newer buses are phased in that must meet more stringent emission standards.

To ascertain the significance of the Transit Center emissions, the estimated annual emissions shown in Table 8 can be compared to the significant emission rates, which are defined in Hawaii Administrative Rules (HAR), Title 11, Chapter 60.1. Table 10 lists the significant emission rates for nitrogen oxides, particulate, VOC, carbon monoxide and sulfur dioxide. A comparison of these two tables shows that the Transit Center emissions will be substantially less than the defined significant emission rates. Nitrogen oxides emissions at the Wahiawa Transit Center is less than 7.0 percent of the significant emission rate, while all other emissions would amount to about 1 percent or less of the significant values.

2.4.2 Fugitive Dust Emissions During Construction

Although not a primary concern of this air quality assessment, short-term direct and indirect impacts on air quality could potentially occur due to project construction. For a project of this nature, there are two potential types of air pollution emissions that could directly result in short-term air quality impacts during project construction: (1) fugitive dust from vehicle movement and soil excavation; and (2) exhaust emissions from on-site construction equipment. Indirectly, there also could be short-term impacts from slow-moving construction equipment traveling to and from the project sites, from a temporary increase in local traffic caused by commuting construction workers, and from the disruption of normal traffic flow caused by lane closures of adjacent roadways.

Fugitive dust emissions may arise from the grading and dirt-moving activities associated with site clearing and preparation work. The emission rate for fugitive dust emissions from construction activities is difficult to estimate accurately. This is because of its elusive nature of emission and because the potential for its generation varies greatly depending upon the type of type of soil at the construction site, the amount and type of dirt-disturbing activity taking place, the moisture content of exposed soil in work areas, and the wind speed. The EPA [3] has provided a rough estimate for uncontrolled fugitive dust emissions from construction activity of 1.2 tons per acre per month under conditions of "medium" activity, moderate soil silt content (30%), and precipitation/evaporation (P/E) index of 50. Uncontrolled fugitive dust emissions at the three project sites would likely be somewhere near that level, depending on the amount of rainfall that occurs. In any case, State of Hawaii Air Pollution Control Regulations [4] prohibit visible emissions of fugitive dust from construction activities at the property line. Thus, an effective dust control plan for the project construction phase is essential.

Adequate fugitive dust control can usually be accomplished by the establishment of a frequent watering program to keep bare-dirt surfaces in construction areas from becoming significant sources of dust. In dust-prone or dust-sensitive areas, other control measures such as limiting the area that can be disturbed at any given time, applying chemical soil stabilizers, mulching and/or using wind screens may be necessary. Control regulations further stipulate that open-bodied trucks be covered at all times when in motion if they are transporting materials that could be blown away. Haul trucks tracking dirt onto paved streets from unpaved areas is often a significant source of dust in construction areas. Some means to alleviate this problem, such as road cleaning or tire washing, may be appropriate. Paving of parking areas and/or establishment of landscaping as early in the construction schedule as possible can also lower the potential for fugitive dust emissions. Monitoring dust at the project property line could be considered to quantify and document the effectiveness of dust control measures.

On-site mobile and stationary construction equipment also will emit air pollutants from engine exhausts. The largest of this equipment is usually diesel-powered. Nitrogen oxides emissions from diesel engines can be relatively high compared to gasoline-powered equipment, but the 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.

Project construction activities will also likely obstruct the normal flow of traffic at times to such an extent that overall vehicular emissions in the project area will temporarily increase. The only means to alleviate this problem will be to attempt to keep roadways open during peak traffic hours and to move heavy construction equipment and workers to and from construction areas during periods of low traffic volume. Thus, most potential short-term air quality impacts from project construction can be mitigated.

2.5 CONCLUSIONS AND RECOMMENDATIONS

2.5.1 Primary Impact of Long-term Emissions

The purpose of this air quality assessment is to evaluate the impact that increased bus emissions will have on air quality when the Transit Center is in operation. Based on the worst case scenario described in section 1.2.3, it is estimated that any long-term impacts on air quality near the proposed Transit Center due to emissions from project-related bus traffic will be negligible. Annual emissions from bus traffic at the Transit Center will amount to only a small fraction of the state-defined significant emission rates, and thus it can be anticipated that any direct impacts on air quality from bus emissions will be minimal. It is conceivable, however, that indirect impacts on air quality could occur if the normal flow of ambient traffic on adjacent roadways is disrupted by bus traffic, causing excess emissions to occur from other motor vehicle traffic. Thus, the proposed facilities should be designed so as minimize the disruption of traffic on adjacent roadways. Implementing other measures to mitigate long-term impacts is probably unnecessary and unwarranted.

2.5.2 Secondary Impact of Construction Activities

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

During construction phases, emissions from engine exhausts (primarily consisting of carbon monoxide and nitrogen oxides) will also occur both from on-site construction equipment and from vehicles used by construction workers and from trucks traveling to and from the project. Increased vehicular emissions due to disruption of traffic by construction equipment, roadway lane closures and/or commuting construction workers can be alleviated by moving equipment and personnel to the site during off-peak traffic hours and by trying to avoid roadway lane closures during peak traffic periods.

References

1. "Local Climatological Data, Annual Summary with Comparative Data, Honolulu, Hawaii, 1998", National Oceanic and Atmospheric Administration, National Climatic Data Center, Asheville, NC.

2. U.S. Department of Commerce, Weather Bureau, "Climatography of the United States No. 86-44, Decennial Census of the United States Climate, Climatic Summary of the United States, Supplement for 1951 through 1960, Hawaii and Pacific", Washington, D.C., 1965.

3. Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, Fifth Edition, AP-42, U.S. Environmental Protection Agency, Research Triangle Park, NC, January 1995.

4. State of Hawaii. Hawaii Administrative Rules, Chapter 11-60, Air Pollution Control.

5. User's Guide to MOBILE6.1 and 6.2: Mobile Source Emission Factor Model, Draft, U.S. Environmental Protection Agency, Office of Air and Radiation, Office of Mobile Sources, Emission Control Technology Division, Test and Evaluation Branch, Ann Arbor, Michigan, March 2002.

LIST OF FIGURES

LIST OF TABLE

LIST OF ATTACHMENTS

ACRONYMS

AAQS	Ambient Air Quality Standards
AMP	AM Partners, Inc.
CFR	Code of Federal Regulations
CO	Carbon Monoxide
DTS	Dept. of Transportation Services
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FONSI	Finding Of No Significant Impact
HAR	Hawaii Administrative Rules
HC	Hydrocarbons
HDDV	Heavy-duty Diesel Vehicle
HDOH	Hawaii Dept. of Health
LDGV	Light-duty Gasoline Vehicle
NO_x	Nitrogen Oxides
PM	Particulate Matter
TEC	The Environmental Company, Inc.
TC	Transit Center
TMK	Tax Map Key
VOC	Volatile Organic Compounds

Table 1 EPA Emission Standards for Heavy-duty Diesel Engines, g/bhp-hr.

Model Year 1987 – 2003 (Source: Dieselnet.com)

Heavy-Duty Diesel Truck Engines				
Year	HC	CO	NOx	PM
1988	1.3	15.5	10.7	0.6
1990	1.3	15.5	6	0.6
1991	1.3	15.5	5	0.25
1994	1.3	15.5	5	0.1
1998	1.3	15.5	4	0.1
Urban Bus Engines				
Year	HC	CO	NOx	PM
1991	1.3	15.5	5	0.25
1993	1.3	15.5	5	0.1
1994	1.3	15.5	5	0.07
1996	1.3	15.5	5	0.05*
1998	1.3	15.5	4	0.05*

* - in-use PM standard 0.07

Table 2 Summary of State of Hawaii and National Ambient Air Quality Standards

Pollutant	Units	Averaging Time	Maximum Allowable Concentration		
			National Primary	National Secondary	State of Hawaii
Particulate Matter (<10 microns)	$\mu g/m^3$	Annual 24 Hours	50[a] 150[b]	50[a] 150[b]	50 150[c]
Particulate Matter (<2.5 microns)	$\mu g/m^3$	Annual 24 Hours	15[a] 65[d]	15[a] 65[d]	- -
Sulfur Dioxide	$\mu g/m^3$	Annual 24 Hours 3 Hours	80 365[c] -	- - 1300[c]	80 365[c] 1300[c]
Nitrogen Dioxide	$\mu g/m^3$	Annual	100	100	70
Carbon Monoxide	mg/m^3	8 Hours 1 Hour	10[c] 40[c]	- -	5[c] 10[c]
Ozone	$\mu g/m^3$	8 Hours 1 Hour	157[e] 235[f]	157[e] 235[f]	- 100[c]
Lead	$\mu g/m^3$	Calendar Quarter	1.5	1.5	1.5
Hydrogen Sulfide	$\mu g/m^3$	1 Hour	-	-	35[c]

[a]Three-year average of annual arithmetic mean.

[b]99th percentile value averaged over three years.

[c]Not to be exceeded more than once per year.

[d]98th percentile value averaged over three years.

[e]Three-year average of fourth-highest daily 8-hour maximum.

[f]Standard is attained when the expected number of exceedances is less than or equal to 1.

Note: Standards for particulate matter (<2.5 microns) and for 8-hour ozone are subject to court appeal.

Table 3 Annual Wind Frequency for Honolulu International Airport (%)

Wind Direction	Wind Speed (knots)									Total
	0-3	4-6	7-10	11-16	17-21	22-27	28-33	34-40	>40	
N	0.5	2.5	1.3	0.5	0.0	0.0	0.0	0.0	0.0	4.8
NNE	0.3	1.2	1.6	1.5	0.2	0.0	0.0	0.0	0.0	4.7
NE	0.3	2.1	6.1	11.0	3.2	0.3	0.0	0.0	0.0	23.0
ENE	0.2	2.5	10.9	16.6	4.1	0.3	0.0	0.0	0.0	34.7
E	0.1	1.0	2.5	2.8	0.5	0.0	0.0	0.0	0.0	7.0
ESE	0.0	0.3	0.4	0.3	0.0	0.0	0.0	0.0	0.0	1.1
SE	0.0	0.3	0.8	1.0	0.1	0.0	0.0	0.0	0.0	2.2
SSE	0.1	0.4	1.2	0.7	0.1	0.0	0.0	0.0	0.0	2.4
S	0.1	0.5	1.4	0.6	0.1	0.0	0.0	0.0	0.0	2.7
SSW	0.0	0.3	0.8	0.3	0.0	0.0	0.0	0.0	0.0	1.5
SW	0.0	0.2	0.8	0.4	0.0	0.0	0.0	0.0	0.0	1.5
WSW	0.0	0.3	0.5	0.4	0.0	0.0	0.0	0.0	0.0	1.2
W	0.1	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	1.1
WNW	0.2	1.4	0.3	0.1	0.0	0.0	0.0	0.0	0.0	2.0
NW	0.4	2.3	0.8	0.1	0.0	0.0	0.0	0.0	0.0	3.8
NNW	0.5	2.3	0.8	0.2	0.0	0.0	0.0	0.0	0.0	3.8
Calm	2.5									2.5
Total	5.4	18.3	30.6	36.5	8.5	0.7	0.0	0.0	0.0	100.0

Source: Climatography of the United States No. 90 (1965-1974), Airport Climatological Summary, Honolulu International Airport, Honolulu, Hawaii, U.S. Department of Commerce, National Climatic Center, Asheville, NC, August 1978.

Table 4 Air Pollution Emissions Inventory for the Island of Oahu, 1993

Air Pollutant	Point Sources (tons/year)	Area Sources (tons/year)	Total (tons/year)
Particulate	25,891	49,374	75,265
Sulfur Oxides	39,230	nil	39,230
Nitrogen Oxides	92,436	31,141	123,577
Carbon Monoxide	28,757	121,802	150,559
Hydrocarbons	4,160	421	4,581

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

Table 5 Annual Summaries of Air Quality Measurements for Monitoring Stations Near Oahu Transit Center Project (Source: HDOH Annual Summaries, Hawaii Air Quality Data, 1996-2000)

Parameter / Location	1996	1997	1998	1999	2000
Sulfur Dioxide / Kapolei					
3-Hour Averaging Period:					
No. of Samples	2785	2845	2723	2710	2505
Highest Concentration ($\mu g/m^3$)	45	61	69	30	23
2nd Highest Concentration ($\mu g/m^3$)	42	52	64	17	18
No. of State AAQS Exceedances	0	0	0	0	0
24-Hour Averaging Period:					
No. of Samples	358	361	343	360	362
Highest Concentration ($\mu g/m^3$)	14	20	17	6	6
2nd Highest Concentration ($\mu g/m^3$)	11	16	16	6	5
No. of State AAQS Exceedances	0	0	0	0	0
Annual Average Concentration ($\mu g/m^3$)	2	2	2	2	1
Particulate (PM-10) / Kapolei					
24-Hour Averaging Period:					
No. of Samples	55	269	359	362	356
Highest Concentration ($\mu g/m^3$)	52	41	34	129	148
2nd Highest Concentration ($\mu g/m^3$)	29	26	34	39	129
No. of State AAQS Exceedances	0	0	0	0	0
Annual Average Concentration ($\mu g/m^3$)	19	13	15	15	17
Carbon Monoxide / Kapolei					
1-Hour Averaging Period:					
No. of Samples	8220	8649	8044	8395	8595
Highest Concentration (mg/m^3)	1.7	1.8	1.9	1.5	2.5
2nd Highest Concentration (mg/m^3)	1.6	1.7	1.5	1.2	1.6
No. of State AAQS Exceedances	0	0	0	0	0
8-Hour Averaging Period:					
No. of Samples	1049	1085	1044	1048	1076
Highest Concentration (mg/m^3)	0.7	0.7	0.6	0.6	1.0
2nd Highest Concentration (mg/m^3)	0.7	0.7	0.6	0.6	0.8
No. of State AAQS Exceedances	0	0	0	0	0
Nitrogen Dioxide / Kapolei					
Annual Average Concentration ($\mu g/m^3$)	2	8	8	7	9
Ozone / Sand Island					
1-Hour Averaging Period:					
No. of Samples	8263	8702	8688	8566	8482
Highest Concentration (mg/m^3)	92	106	114	110	98
2nd Highest Concentration (mg/m^3)	91	106	110	106	96
No. of State AAQS Exceedances	0	13	7	8	0

Table 6 Estimated Annual Bus Volumes for the Wahiawa Transit Center

Transit Center	Route No.	Service Start Time	Service End Time	Hours/Day	Buses/Hour	Buses/Day	Buses/Year
Wahiawa	511	5:00	22:00	17.0	2	34	12,410
	512	7:00	19:00	12.0	1	12	4,380
	513	6:00	19:00	13.0	1	13	4,745
	514	5:00	0:00	19.0	1	19	6,935
	E	7:30	22:00	14.5	2	29	10,585
	50	6:00	22:00	16.0	2	32	11,680
	51	9:00	18:00	9.0	2	18	6,570
	52	5:10	22:00	17.0	2	34	12,410
	62	4:40	0:35	20.0	2	40	14,600
						Total	84,315

Notes:

1. Route numbers based on Draft Central Oahu Hub and Spoke Service Plan.
2. Service times based on Draft Central Oahu Hub and Spoke Plan and Current Public Timetables for existing service.
3. Buses per hour calculated based on planned service headways.
4. Weekend service assumed to be the same as weekday service.
5. Express routes not included.

Table 7 Emission Factors for Heavy-Duty Diesel Vehicles

Parameter	Composite Emission Factor (g/mile)	Idle Emission Factor (g/min)
Nitrogen Oxides	12.3	0.90
Particulate	0.411	0.017
Volatile Organic Compounds	0.733	0.080
Carbon Monoxide	3.72	0.64
Sulfur Dioxide	0.448	0.019

Notes:

1. Emission factors obtained from MOBILE6.1.
2. Emission factors pertain to calendar year 2003 and ambient temperature of 77ºF.
3. Composite emission factors pertain to an average vehicle speed of 25 mph.
4. Idle emission factors based on 2.5 mph speed.
5. Particulate emission factors pertain to exhaust emissions only.

Table 8 Annual Approach/Depart Miles and Idle Times for the Proposed Transit Center Project

Transit Center	Annual Bus Volume	Annual Approach/Depart Miles	Annual Idle Time (minutes)
Waianae	93,440	186,880	467,200
Wahiawa	84,315	168,630	421,575
Mililani	78,475	156,950	392,375

Table 9 Estimated Annual Emissions for the Wahiawa Transit Center Project

Transit Center	Parameter	Annual Approach/Depart Emissions (tons)	Annual Idle Emissions (tons)	Total Annual Emissions (tons)
Wahiawa	Nitrogen Oxides	2.3	0.42	2.7
	Particulate	0.076	0.0079	0.084
	VOC	0.14	0.037	0.18
	Carbon Monoxide	0.69	0.30	0.99
	Sulfur Dioxide	O.083	0.0088	0.092

Table 10 Significant Emission Rates

Parameter	Emission Rate (tons/year)
Nitrogen Oxides	40
Particulate	15
Volatile Organic Compounds	40
Carbon Monoxide	100
Sulfur Dioxide	40

Notes:

1. As defined in Hawaii Administrative Rules, Title 11, Chapter 60.1.
2. Particulate emission rate pertains to particles less than 10 microns aerodynamic diameter.

Figure 1.1 Site Map and Plan of the proposed Wahiawa Community Transit Center.

Figure 1.2 Proposed Site for the Wahiawa Community Transit Center adjacent to the Wahiawa Civic Center Building.

Figure 1.3 Wahiawa Shopping Center across the Wahiawa Community Transit Center.

Island of Oahu - Air Quality Monitoring Stations

			Station Type						
Station #	Site Name	Description	PM10	CO	O3	SO2	Pb*	NO2	Start Date
1	Honolulu	City Center/Commercial	N,C	N		S			Apr 1971
2	Pearl City	Suburban/Residential	N						Apr 1971
3	Waimanalo	Rural/Agricultural	S						Jul 1989
4	Sand Island	City Center			N				Jan 1981
5	Waikiki	City Center		N					Feb 1981
6	Liliha	City Center	N				N,C		Jan 1984
7	Makaiwa	Rural/Industrial				S			Jul 1989
8	West Beach	Rural/Industrial	S,C	S		S		S	Feb 1991
9	Kapolei	Rural/Industrial	S,C	S		S		S	Feb 1991

N = (NAMS) National Air Monitoring Station
C = Collocated Site
S = (SLAMS) State and Local Air Monitoring Stations

* - applies only up until 10/97

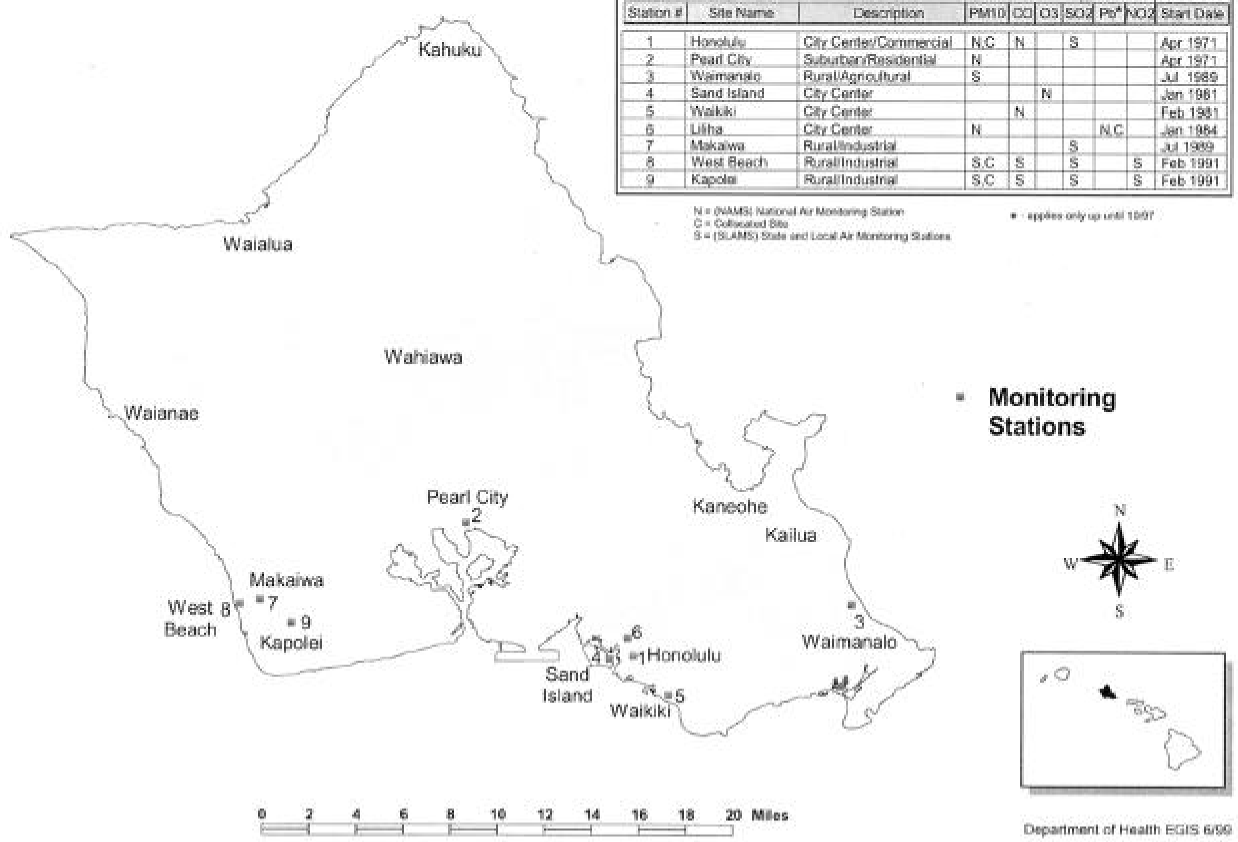


Figure 1.4 Air quality Monitoring Stations on the island of Oahu, Hawaii

AIR QUALITY STUDY

FOR THE PROPOSED

OAHU TRANSIT CENTERS PROJECT

OAHU, HAWAII

Prepared for:

The Environmental Company, Inc.

May 2002

B.D. NEAL & ASSOCIATES

Applied Meteorology * Air Quality * Computer Science

P.O. BOX 1808 * KAILUA-KONA, HAWAII 96745 * TELEPHONE (808) 329-1627 * FAX (808) 331-8428

EMAIL: bdneal@kona.net

CONTENTS

FIGURES

TABLES

TABLES(cont.)

1.0 SUMMARY

The Honolulu City & County Department of Transportation Serivces is proposing to develop the Oahu Transit Centers Project at three locations in West and Central Oahu. The three locations include Waianae, Wahiawa and Mililani. The proposed project will consist of seven to ten bus bays at each location along with passenger waiting facilities and other ancillary facilities. Development of the project is expected to be completed during 2003. This study examines the potential short- and long-term air quality impacts that could occur as a result of construction and use of the proposed facilities and suggests mitigative measures to reduce any potential air quality impacts where possible and appropriate.

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

Regional and local climate together with the amount and type of human activity generally dictate the air quality of a given location. Winds at each location are predominantly trade winds, but they are likely often deviated by the local terrain. During winter, occasional storms may generate strong winds from the south (kona winds) for brief periods. When the trade winds or kona winds are weak or absent, landbreeze-seabreeze circulations or mountain drainage winds may develop. Wind speeds are often lower compared to more exposed coastal locations, but the trade winds still provide relatively good ventilation much of the time. Temperatures in the Oahu area leeward of the Koolaus are generally very moderate with average daily temperatures ranging from about 70?F to 85?F. Extreme temperatures range from about 53?F to about 95?F. Rainfall in the Waianae area is relatively low with an average of about 20 inches per year, while the Wahiawa and Mililani areas receive about 50 inches per year.

The present air quality of the project area appears to be reasonably good based on nearby air quality monitoring data. Air quality data from the nearest monitoring stations operated by the Hawaii Department of Health suggest that all national air quality standards are currently being met, although occasional exceedances of the more stringent state standard for ozone may occur. It is also probable that the more stringent state standards for carbon monoxide are exceeded at times near congested roadway intersections.

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

After construction, buses coming to and from the proposed transit centers will result in a long-term increase in air pollution emissions in the project area. To assess the potential impact of these emissions, estimates of project-related annual emissions were prepared. These were then compared to the significant emission rates defined in the Hawaii Administrative Rules. This comparison showed that the bus emissions at the transit centers will be relatively small compared to the significant emission rates. Therefore, as long as the transit center operations do not disrupt traffic on nearby roadways, it is unlikely that any measurable impacts on air quality will occur. Implementing any air quality mitigation measures for long-term impacts from the proposed project is probably unnecessary and unwarranted.

2.0 INTRODUCTION

The Honolulu City & County Department of Transportation Services is proposing to develop the Oahu Transit Centers Project at three locations on the island of Oahu. These consist of the Waianae

Coast Community Transit Center, the Wahiawa Community Transit Center and the Mililani Community Transit Center. Figure 1 indicates the locations of the three proposed transit centers.

The proposed Waianae Coast Community Transit Center will be located at 86-052 Leihoku Street, on a portion of TMK 8-6-1:29 adjacent to the Waianae Mall and across the street from the site of the Waianae YMCA. This facility will provide seven bays for TheBus and paratransit vehicles, arranged around a central "island" that will accommodate passenger waiting shelters, a comfort station with restrooms, vending and information kiosks, landscaping, bike parking/lockers, and a "gathering place" feature. The facility will also provide three bays for private school buses, a passenger drop-off/pick-up area, and parking for approximately 100 vehicles.

The proposed Wahiawa Community Transit Center will be located in Wahiawa's Civic Center at 956 California Avenue, on portions of TMK 7-4-6:2 and TMK 7-4-6:12. This facility will provide eight bays for TheBus and paratransit vehicles, four of which will be located off-street while the other four will be located along California Avenue. Passenger waiting shelters, a comfort station with restrooms, bike parking/lockers, and informational kiosks will be provided, along with landscaping and additional street trees.

The proposed Mililani Community Transit Center will located along Meheula Parkway fronting Mililani Town Center, and will use air rights over a portion of the shopping center's parking lot and landscape strip. The Center will provide ten bays for TheBus and paratransit vehicles, passenger waiting shelters, a comfort station, informational kiosks, bike parking/lockers, and landscaping. An elevator and open stairways will provide links from the Transit Center to the shopping center parking level. A proposal has also been made to provide community meeting space at the lower level.

Development of all three transit centers is expected to be completed during 2003.

The purpose of this study is to describe existing air quality in the project area and to assess the potential short-term and long-term direct and indirect air quality impacts that could result from construction and use of the proposed facilities. Measures to mitigate these impacts are suggested where possible and appropriate.

3.0 AMBIENT AIR QUALITY STANDARDS

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

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

The Hawaii AAQS are in some cases considerably more stringent than the comparable national AAQS. In particular, the Hawaii 1-hour AAQS for carbon monoxide is four times more stringent than the comparable national limit, and the state 1-hour limit for ozone is more than two times as stringent as the national 1-hour standard. The national 1-hour ozone standard will be phased out (pending court appeal) the next few years in favor of the new (and more stringent) 8-hour standard.

The Hawaii AAQS for sulfur dioxide were relaxed in 1986 to make the state standards essentially the same as the national limits. In 1993, the state also revised its particulate standards to follow those set by the federal government. During 1997, the federal government again revised its standards for particulate, but the new standards have been challenged in federal court. To date, the Hawaii Department of Health has not updated the state particulate standards.

4.0 REGIONAL AND LOCAL CLIMATOLOGY

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

Hawaii lies well within the belt of northeasterly trade winds generated by the semi-permanent Pacific high pressure cell to the north and east. On the island of Oahu, the Koolau and Waianae Mountain Ranges are oriented almost perpendicular to the trade winds, which accounts for much of the variation in the local climatology of the island. Waianae, Wahiawa and Mililani, the sites of the proposed project, are suburban areas within the City and County of Honolulu. Waianae is located leeward of the Waianae Range, while Wahiawa and Mililani are situated between the Koolau and Waianae Ranges. Although climatic conditions vary somewhat across the project area, long-term weather data available from the Honolulu International Airport, located a few miles to the southeast, is at least semi-representative.

Wind frequency data given in Table 2 for Honolulu International Airport show that the annual prevailing wind direction for this area of Oahu is east northeast. On an annual basis, 34.7 percent of the time the wind is from this direction, and nearly 75 percent of the time the wind is in the northeast quadrant. Winds from the south are infrequent occurring only a few days during the year and mostly in association with winter storms. Wind speeds average about 11 mph (10 knots) and mostly vary between about 4 and 18 mph (5 and 15 knots). Surface wind speeds in the project area are somewhat lighter, particularly at the Waianae site, and local wind directions likely are affected by the terrain.

Air pollution emissions from motor vehicles, the formation of photochemical smog and smoke plume rise all depend in part on air temperature. Colder temperatures tend to result in higher emissions of contaminants from automobiles but lower concentrations of photochemical smog and ground-level concentrations of air pollution from elevated plumes. In Hawaii, the annual and daily variation of temperature depend to a large degree on elevation above sea level, distance inland and exposure to the trade winds. Average temperatures at locations near sea level generally are warmer than those at higher elevations. Areas exposed to the trade wind tend to have the least temperature variation, while inland and leeward areas often have the most. The project area's leeward location results in a relatively moderate temperature profile compared to some other locations around Oahu and the state. At the airport, average annual daily minimum and maximum temperatures are 70?F and 84?F, respectively

[1]. The extreme minimum temperature was 53?F during January 1998, and the extreme maximum was 95?F during September 1994. Temperatures in the Waianae area may be slightly higher compared to the airport due to wind-sheltering effects, while the Wahiawa and Mililani areas are probably slightly cooler due to the higher elevation.

Small scale, random motions in the atmosphere (turbulence) cause air pollutants to be dispersed as a function of distance or time from the point of emission. Turbulence is caused by both mechanical and thermal forces in the atmosphere. It is often measured and described in terms of Pasquill-Gifford stability class. Stability class 1 is the most turbulent and class 6 the least. Thus, air pollution dissipates the best during stability class 1 conditions and the worst when stability class 6 prevails. In suburban areas, like those in the project area, stability class 5 or 6 is generally the highest stability class that occurs, developing during the nighttime and early morning.

Mixing height is defined as the height above the surface through which relatively vigorous vertical mixing occurs. Low mixing heights can result in high ground-level air pollution concentrations because contaminants emitted from or near the surface can become trapped within the mixing layer. In Hawaii, minimum mixing heights tend to be high because of mechanical mixing caused by the trade winds and because of the temperature moderating effect of the surrounding ocean. Low mixing heights may sometimes occur, however, at inland locations and even at times along coastal areas early in the morning following a clear, cool, windless night. Coastal areas also may experience low mixing levels during sea breeze conditions when cooler ocean air rushes in over warmer land. Mixing heights in the state typically are above 3000 feet (1000 meters).

Rainfall can have a beneficial effect on the air quality of an area in that it helps to suppress fugitive dust emissions, and it also may "washout" gaseous contaminants that are water-soluble. Rainfall in Hawaii is highly variable depending on elevation and on location with respect to the trade wind. The Waianae area is one of the drier areas on Oahu due to its leeward and near sea level location. Average annual rainfall amounts to about 20 inches [2]. Wahiawa and Mililani, located at a higher elevation and between the Koolau and Waianae Ranges, have a wetter climate receiving about 50 inches per year [2].

5.0 PRESENT AIR QUALITY

Present air quality in the project area is mostly affected by air pollutants from motor vehicles, industrial sources, agricultural operations and to a lesser extent by natural sources. Table 3 presents an air pollutant emission summary for the island of Oahu for calendar year 1993. The emission rates shown in the table pertain to manmade emissions only, i.e., emissions from natural sources are not included. As suggested in the table, much of the particulate emissions on Oahu originate from area sources, such as the mineral products industry and agriculture. Sulfur oxides are emitted almost exclusively by point sources, such as power plants and refineries. Nitrogen oxides emissions emanate predominantly from industrial point sources, although area sources (mostly motor vehicle traffic) also contribute a significant share. The majority of carbon monoxide emissions occur from area sources (motor vehicle traffic), while hydrocarbons are emitted mainly from point sources. Based on previous emission inventories that have been reported for Oahu, it appears that emissions of particulate and nitrogen oxides have increased during the past ten years, while emissions of sulfur oxides, carbon monoxide and hydrocarbons have declined.

Roadways in the vicinity of the three proposed transit center sites carry moderate volumes of motor vehicle traffic at times, and roadway intersections may be congested during peak traffic hours. Emissions from motor vehicles using these roadways, primarily nitrogen oxides and carbon monoxide, may cause localized impacts on air quality.

At the Waianae site, the nearest industrial source of air pollution is the Waianae Wastewater Treatment Plant, which is located a few hundred feet to the south. Wastewater treatment plants emit hydrogen sulfide, which can cause odor nuisance even at very low concentrations. Kahe Power Plant is situated about 7 miles to the southeast, and adjacent to this is the Waimanalo Gulch Sanitary Landfill. Campbell Industrial Park is located about 12 miles to the southeast. Emissions from these facilities consist primarily of sulfur dioxide, nitrogen oxides and particulate. Due to the prevailing wind pattern in the area, it is unlikely that emissions from these sources cause any chronic impacts on air quality in the Waianae area, but occasional impacts may occur with south winds.

The Wahiawa and Mililani sites are farther removed from large industrial sources of air pollution, although emissions from distant sources at Campbell Industrial Park may affect these areas during kona wind conditions.

With the demise of sugarcane growing on the Ewa Plain, air pollutions impacts from agriculture have significantly diminished in the area. Agriculture-related emissions in the Waianae area consist mostly of particulate matter from small-scale operations, while the Wahiawa and Mililani areas may experience occasional dust and smoke impacts from nearby, large-scale pineapple cultivation and harvesting operations.

Natural sources of air pollution emissions that also could affect the project area but cannot be quantified very accurately include the ocean (sea spray), plants (aero-allergens), wind-blown dust, and perhaps distant volcanoes on the island of Hawaii.

The State Department of Health operates a network of air quality monitoring stations at various locations on Oahu. Each station, however, typically does not monitor the full complement of air quality parameters. Table 4 shows annual summaries of air quality measurements that were made nearest to the project area for several of the regulated air pollutants for the period 1996 through 2000. These are the most recent data that are currently available.

During the 1996-2000 period, sulfur dioxide was monitored by the State Department of Health at an air quality station located at Kapolei. Concentrations monitored were consistently low compared to the standards. Annual second-highest 3-hour concentrations (which are most relevant to the air quality standards) ranged from 17 to 64 ?g/m^3, while the annual second-highest 24-hour concentrations ranged from 5 to 16 ?g/m^3. Annual average concentrations were only about 1 to 2 ?g/m^3. There were no exceedances of the state/national 3-hour or 24-hour AAQS for sulfur dioxide during the 5-year period.

Particulate matter less than 10 microns in diameter (PM-10) is also measured at the Kapolei monitoring station. Annual second-highest 24-hour PM-10 concentrations ranged from 26 to 129 ?g/m^3 between 1996 and 2000. Average annual concentrations ranged from 13 to 19 ?g/m^3. All values reported were within the state and national AAQS.

Carbon monoxide measurements were also made at the Kapolei monitoring station. The annual second-highest 1-hour concentrations ranged from 1.2 to 1.7 mg/m^3. The annual second-highest 8-hour concentrations ranged from 0.6 to 0.8 mg/m^3. No exceedances of the state or national 1-hour or 8-hour AAQS were reported.

Nitrogen dioxide is also monitored by the Department of Health at the Kapolei monitoring station. Annual average concentrations of this pollutant ranged from 2 to 9 ?g/m^3, safely inside the state and national AAQS.

The nearest available ozone measurements were obtained at Sand Island (about 15 to 25 miles southeast of the project area). The second-highest 1-hour concentrations for each year from 1996 to 2000 ranged from 91 to 110 ?g/m^3. Up to 13 exceedances of the state AAQS per year were recorded during the monitoring period. No specific trend is discernable, although the number of exceedances was lower during the latter half of the five-year period.

Although not shown in the table, the nearest and most recent measurements of ambient lead concentrations that have been reported were made at the downtown Honolulu monitoring station between 1996 and 1997. Average quarterly concentrations were near or below the detection limit, and no exceedances of the state AAQS were recorded. Monitoring for this parameter was discontinued during 1997.

Based on the data and discussion presented above, it appears likely that the State of Hawaii AAQS for sulfur dioxide, nitrogen dioxide, particulate matter and lead are currently being met at the project site. It is likely, however, that the state AAQS for ozone may be exceeded on occasion based on the Sand Island measurements for this parameter. While carbon monoxide measurements at the Kapolei monitoring station suggest that concentrations are within the state and national standards, local “hot spots” may exist near traffic-congested intersections.

6.0 SHORT-TERM IMPACTS OF PROJECT

Short-term direct and indirect impacts on air quality could potentially occur due to project construction. For a project of this nature, there are two potential types of air pollution emissions that could directly result in short-term air quality impacts during project construction: (1) fugitive dust from vehicle movement and soil excavation; and (2) exhaust emissions from on-site construction equipment. Indirectly, there also could be short-term impacts from slow-moving construction equipment traveling to and from the project sites, from a temporary increase in local traffic caused by commuting construction workers, and from the disruption of normal traffic flow caused by lane closures of adjacent roadways.

Fugitive dust emissions may arise from the grading and dirt-moving activities associated with site clearing and preparation work. The emission rate for fugitive dust emissions from construction activities is difficult to estimate accurately. This is because of its elusive nature of emission and because the potential for its generation varies greatly depending upon the type of soil at the construction site, the amount and type of dirt-disturbing activity taking place, the moisture content of exposed soil in work areas, and the wind speed. The EPA [3] has provided a rough estimate for uncontrolled fugitive dust emissions from construction activity of 1.2 tons per acre per month under conditions of "medium" activity, moderate soil silt content (30%), and precipitation/evaporation (P/E) index of 50. Uncontrolled fugitive dust emissions at the three project sites would likely be somewhere near that level, depending on the amount of rainfall that occurs. In any case, State of Hawaii Air Pollution Control Regulations [4] prohibit visible emissions of fugitive dust from construction activities at the property line. Thus, an effective dust control plan for the project construction phase is essential.

Adequate fugitive dust control can usually be accomplished by the establishment of a frequent watering program to keep bare-dirt surfaces in construction areas from becoming significant sources of dust. In dust-prone or dust-sensitive areas, other control measures such as limiting the area that can be disturbed at any given time, applying chemical soil stabilizers, mulching and/or using wind screens may be necessary. Control regulations further stipulate that open-bodied trucks be covered at all times when in motion if they are transporting materials that could be blown away. Haul trucks tracking dirt onto paved streets from unpaved areas is often a significant source of dust in construction areas. Some means to alleviate this problem, such as road cleaning or tire washing, may be appropriate. Paving of parking areas and/or establishment of landscaping as early in the construction schedule as possible can also lower the potential for fugitive dust emissions. Monitoring dust at the project property line could be considered to quantify and document the effectiveness of dust control measures.

On-site mobile and stationary construction equipment also will emit air pollutants from engine exhausts. The largest of this equipment is usually diesel-powered. Nitrogen oxides emissions from diesel engines can be relatively high compared to gasoline-powered equipment, but the 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.

Project construction activities will also likely obstruct the normal flow of traffic at times to such an extent that overall vehicular emissions in the project area will temporarily increase. The only means to alleviate this problem will be to attempt to keep roadways open during peak traffic hours and to move heavy construction equipment and workers to and from construction areas during periods of low traffic volume. Thus, most potential short-term air quality impacts from project construction can be mitigated.

7.0 LONG-TERM IMPACTS OF PROJECT

After construction is completed, use of the proposed facilities will result in increased bus traffic on nearby roadways, potentially causing long-term impacts on ambient air quality in the vicinity of each of the three transit centers where the buses will congregate. Motor vehicles with gasoline-powered engines are significant sources of carbon monoxide, and they also emit nitrogen oxides and other contaminates. In urban and suburban areas, carbon monoxide emissions near congested roadway intersections are the usual issue. In the case of diesel-powered buses, however, the primary air pollution emissions consist of nitrogen oxides and particulate matter; carbon monoxide emissions are generally inconsequential compared to automobile emissions.

Although computer models can generally be used to assess the impacts of carbon monoxide emissions from motor vehicle traffic, it is probably impractical to attempt to quantitatively model the bus emissions of nitrogen oxides and particulate that may be associated with the proposed facilities. In lieu of this, annual emissions from project bus operations in the vicinity of each of the proposed transit centers were estimated and compared to the "significant" emission rates as defined in the Hawaii Administrative Rules. Strictly speaking, the significant emission rates are intended to be applied to stationary point sources and not mobile sources such as bus traffic. Nevertheless, it is believed that this will provide a reasonable approach to ascertaining the significance of the project-related emissions of nitrogen oxides and particulate. If the project emissions are shown to be below the significant emissions rates, this is usually taken to indicated that a more detailed assessment of the emissions is not warranted.

To begin the evaluation of the potential long-term impacts on air quality related to the proposed facilities, the annual bus volumes at each of the three transit centers were estimated. These were estimated by first identifying the bus routes that would include each transit center and then reviewing the schedules for these routes to enumerate the buses each day that would be associated with each route at the transit centers. Table 5 shows the resulting estimated annual bus volume at each facility and the basis for these estimates. As indicated in the table, the expected total annual bus volumes at each transit center are 93,440 at Waianae, 84,315 at Wahiawa and 78,475 at Mililani. As noted in the table, these estimates assume that weekend service will be the same as weekday service. Actual annual bus volumes will be somewhat lower due to reduced service on weekends and holidays.

Buses using the proposed transit centers will emit air pollution on approach, during idle and as they depart. To estimate the bus emissions during these modes of operation, the EPA computer model MOBILE6.1 [5] was used in combination with the expected annual bus volumes. MOBILE6.1 can be used to provide composite emission factors for a given year, vehicle class, average vehicle speed and ambient air temperature. The composite emission factors generally pertain to various modes of operation (acceleration, cruise, deceleration and idle) and are specified in terms of grams per vehicle mile of travel. Idle emission rates in terms of grams per minute can be estimated separately. For this project, MOBILE6.1 was used to estimate emission factors for the heavy-duty diesel vehicle (HDDV) class. Emission factors for nitrogen oxides, particulate, volatile organic compounds (VOC), carbon monoxide and sulfur dioxide were calculated for the year 2003, the expected year of project completion. Due to new emission standards for this class of vehicle that will be phased in during the next several years, emissions of nitrogen oxides and particulate will diminish in later years. An average annual temperature of 77ºF was assumed, and it was further assumed that the average approach and departure speeds would be 25 mph.

Table 6 shows the resulting estimated composite and idle emission factors for HDDV. Nitrogen oxides emissions are the most appreciable followed by carbon monoxide, volatile organic compounds, sulfur dioxide and particulate. It is worth noting that carbon monoxide emissions from light-duty gasoline vehicles (LDGV) are about five times higher per vehicle mile of travel than are those for HDDV.

The next task is to determine the total vehicle miles and bus idle times associated with each transit center. A reasonable but somewhat arbitrary assumption is that emissions that occur beyond 1 mile of the transit centers will not significantly impact air quality in the vicinity of the transit centers. Thus, the relevant approach and depart vehicle miles at each facility were estimated to amount to the annual bus volume multiplied by 2 miles. Total annual idle times were estimated based on the annual bus volume and the assumption that each bus would idle for an average of 5 minutes at the transit centers. The resulting total annual approach and depart miles and the total annual idling times for each transit center are shown in Table 7.

The emission factors given in Table 6 combined with the estimated annual approach/depart miles and annual idle times shown in Table 7 will provide estimates of the total annual emissions attributable to each transit center. The resulting estimated annual emissions for each facility for the year 2003 are indicated in Table 8. Nitrogen oxides emissions would amount to less than 3 tons per year at each transit center, while carbon monoxide emissions would amount to about 1 ton per year at each location. Emissions of particulate, VOC and sulfur dioxide would be much less than 1 ton per year each. Emissions of nitrogen oxides and particulate can be expected to decrease with time as newer buses are phased in that must meet more stringent emission standards.

To ascertain the significance of the transit center emissions, the estimated annual emissions shown in Table 8 can be compared to the significant emission rates, which are defined in Hawaii Administrative Rules (HAR), Title 11, Chapter 60.1. Table 9 lists the significant emission rates for nitrogen oxides, particulate, VOC, carbon monoxide and sulfur dioxide. A comparison of these two tables shows that the transit center emissions will be substantially less than the defined significant emission rates. Nitrogen oxides emissions at each location would amount to about 8 percent of the significant emission rate, while all other emissions would amount to about 1 percent or less of the significant values.

8.0 CONCLUSIONS AND RECOMMENDATIONS

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

During construction phases, emissions from engine exhausts (primarily consisting of carbon monoxide and nitrogen oxides) will also occur both from on-site construction equipment and from vehicles used by construction workers and from trucks traveling to and from the project. Increased vehicular emissions due to disruption of traffic by construction equipment, roadway lane closures and/or commuting construction workers can be alleviated by moving equipment and personnel to the site during off-peak traffic hours and by trying to avoid roadway lane closures during peak traffic periods.

After the proposed project is completed, any long-term impacts on air quality near the three proposed transit centers due to emissions from project-related bus traffic will be negligible. Annual emissions from bus traffic at each transit center will amount to only a small fraction of the state-defined significant emission rates, and thus it can be anticipated that any direct impacts on air quality from bus emissions will be minimal. It is conceivable, however, that indirect impacts on air quality could occur if the normal flow of ambient traffic on adjacent roadways is disrupted by bus traffic, causing excess emissions to occur from other motor vehicle traffic. Thus, the proposed facilities should be designed so as minimize the disruption of traffic on adjacent roadways. Implementing other measures to mitigate long-term impacts is probably unnecessary and unwarranted.

REFERENCES

1. "Local Climatological Data, Annual Summary with Comparative Data, Honolulu, Hawaii, 1998", National Oceanic and Atmospheric Administration, National Climatic Data Center, Asheville, NC.

2. U.S. Department of Commerce, Weather Bureau, "Climatography of the United States No. 86-44, Decennial Census of the United States Climate, Climatic Summary of the United States, Supplement for 1951 through 1960, Hawaii and Pacific", Washington, D.C., 1965.

3. Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, Fifth Edition, AP-42, U.S. Environmental Protection Agency, Research Triangle Park, NC, January 1995.

4. State of Hawaii. Hawaii Administrative Rules, Chapter 11-60, Air Pollution Control.

5. User's Guide to MOBILE6.1 and 6.2: Mobile Source Emission Factor Model, Draft, U.S. Environmental Protection Agency, Office of Air and Radiation, Office of Mobile Sources, Emission Control Technology Division, Test and Evaluation Branch, Ann Arbor, Michigan, March 2002.

Figure 1 - Project Location Map

Table 1

SUMMARY OF STATE OF HAWAII AND NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Units	Averaging Time	Maximum Allowable Concentration		
			National Primary	National Secondary	State of Hawaii
Particulate Matter (<10 microns)	?g/m^3	Annual 24 Hours	50[a] 150[b]	50[a] 150[b]	50 150[c]
Particulate Matter (<2.5 microns)	?g/m^3	Annual 24 Hours	15[a] 65[d]	15[a] 65[d]	- -
Sulfur Dioxide	?g/m^3	Annual 24 Hours 3 Hours	80 365[c] -	- - 1300[c]	80 365[c] 1300[c]
Nitrogen Dioxide	?g/m^3	Annual	100	100	70
Carbon Monoxide	mg/m^3	8 Hours 1 Hour	10[c] 40[c]	- -	5[c] 10[c]
Ozone	?g/m^3	8 Hours 1 Hour	157[e] 235[f]	157[e] 235[f]	- 100[c]
Lead	?g/m^3	Calendar Quarter	1.5	1.5	1.5
Hydrogen Sulfide	?g/m^3	1 Hour	-	-	35[c]

[a] Three-year average of annual arithmetic mean.

[b] 99th percentile value averaged over three years.

[c] Not to be exceeded more than once per year.

[d] 98th percentile value averaged over three years.

[e] Three-year average of fourth-highest daily 8-hour maximum.

[f] Standard is attained when the expected number of exceedances is less than or equal to 1.

Note: Standards for particulate matter (<2.5 microns) and for 8-hour ozone are subject to court appeal.

Table 2

ANNUAL WIND FREQUENCY FOR HONOLULU INTERNATIONAL AIRPORT (%)

Wind Direction	Wind Speed (knots)									Total
	0-3	4-6	7-10	11-16	17-21	22-27	28-33	34-40	>40	
N	0.5	2.5	1.3	0.5	0.0	0.0	0.0	0.0	0.0	4.8
NNE	0.3	1.2	1.6	1.5	0.2	0.0	0.0	0.0	0.0	4.7
NE	0.3	2.1	6.1	11.0	3.2	0.3	0.0	0.0	0.0	23.0
ENE	0.2	2.5	10.9	16.6	4.1	0.3	0.0	0.0	0.0	34.7
E	0.1	1.0	2.5	2.8	0.5	0.0	0.0	0.0	0.0	7.0
ESE	0.0	0.3	0.4	0.3	0.0	0.0	0.0	0.0	0.0	1.1
SE	0.0	0.3	0.8	1.0	0.1	0.0	0.0	0.0	0.0	2.2
SSE	0.1	0.4	1.2	0.7	0.1	0.0	0.0	0.0	0.0	2.4
S	0.1	0.5	1.4	0.6	0.1	0.0	0.0	0.0	0.0	2.7
SSW	0.0	0.3	0.8	0.3	0.0	0.0	0.0	0.0	0.0	1.5
SW	0.0	0.2	0.8	0.4	0.0	0.0	0.0	0.0	0.0	1.5
WSW	0.0	0.3	0.5	0.4	0.0	0.0	0.0	0.0	0.0	1.2
W	0.1	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	1.1
WNW	0.2	1.4	0.3	0.1	0.0	0.0	0.0	0.0	0.0	2.0
NW	0.4	2.3	0.8	0.1	0.0	0.0	0.0	0.0	0.0	3.8
NNW	0.5	2.3	0.8	0.2	0.0	0.0	0.0	0.0	0.0	3.8
Calm	2.5									2.5
Total	5.4	18.3	30.6	36.5	8.5	0.7	0.0	0.0	0.0	100.0

Source: Climatography of the United States No. 90 (1965-1974), Airport Climatological Summary, Honolulu International Airport, Honolulu, Hawaii, U.S. Department of Commerce, National Climatic Center, Asheville, NC, August 1978.

Table 3

AIR POLLUTION EMISSIONS INVENTORY FOR ISLAND OF OAHU, 1993

Air Pollutant	Point Sources (tons/year)	Area Sources (tons/year)	Total (tons/year)
Particulate	25,891	49,374	75,265
Sulfur Oxides	39,230	nil	39,230
Nitrogen Oxides	92,436	31,141	123,577
Carbon Monoxide	28,757	121,802	150,559
Hydrocarbons	4,160	421	4,581

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

Table 4

ANNUAL SUMMARIES OF AIR QUALITY MEASUREMENTS FOR MONITORING STATIONS NEAREST OAHU TRANSIT CENTERS PROJECT

Parameter / Location	1996	1997	1998	1999	2000
Sulfur Dioxide / Kapolei					
3-Hour Averaging Period:					
No. of Samples	2785	2845	2723	2710	2505
Highest Concentration (?g/m^3)	45	61	69	30	23
2nd Highest Concentration (?g/m^3)	42	52	64	17	18
No. of State AAQS Exceedances	0	0	0	0	0
24-Hour Averaging Period:					
No. of Samples	358	361	343	360	362
Highest Concentration (?g/m^3)	14	20	17	6	6
2nd Highest Concentration (?g/m^3)	11	16	16	6	5
No. of State AAQS Exceedances	0	0	0	0	0
Annual Average Concentration (?g/m^3)	2	2	2	2	1
Particulate (PM-10) / Kapolei					
24-Hour Averaging Period:					
No. of Samples	55	269	359	362	356
Highest Concentration (?g/m^3)	52	41	34	129	148
2nd Highest Concentration (?g/m^3)	29	26	34	39	129
No. of State AAQS Exceedances	0	0	0	0	0
Annual Average Concentration (?g/m^3)	19	13	15	15	17
Carbon Monoxide / Kapolei					
1-Hour Averaging Period:					
No. of Samples	8220	8649	8044	8395	8595
Highest Concentration (mg/m^3)	1.7	1.8	1.9	1.5	2.5
2nd Highest Concentration (mg/m^3)	1.6	1.7	1.5	1.2	1.6
No. of State AAQS Exceedances	0	0	0	0	0
8-Hour Averaging Period:					
No. of Samples	1049	1085	1044	1048	1076
Highest Concentration (mg/m^3)	0.7	0.7	0.6	0.6	1.0
2nd Highest Concentration (mg/m^3)	0.7	0.7	0.6	0.6	0.8
No. of State AAQS Exceedances	0	0	0	0	0
Nitrogen Dioxide / Kapolei					
Annual Average Concentration (?g/m^3)	2	8	8	7	9
Ozone / Sand Island					
1-Hour Averaging Period:					
No. of Samples	8263	8702	8688	8566	8482
Highest Concentration (mg/m^3)	92	106	114	110	98
2nd Highest Concentration (mg/m^3)	91	106	110	106	96
No. of State AAQS Exceedances	0	13	7	8	0

Source: State of Hawaii Department of Health, “Annual Summaries, Hawaii Air Quality Data, 1996 - 2000”

Table 5

ESTIMATED ANNUAL BUS VOLUMES FOR OAHU TRANSIT CENTERS PROJECT

Transit Center	Route No.	Service Start Time	Service End Time	Hours/Day	Buses/Hour	Buses/Day	Buses/Year
Waianae	All	-	-	16	14	224	81,760
	All	-	-	8	4	32	11,680
						Total	93,440
Wahiawa	511	5:00	22:00	17.0	2	34	12,410
	512	7:00	19:00	12.0	1	12	4,380
	513	6:00	19:00	13.0	1	13	4,745
	514	5:00	0:00	19.0	1	19	6,935
	E	7:30	22:00	14.5	2	29	10,585
	50	6:00	22:00	16.0	2	32	11,680
	51	9:00	18:00	9.0	2	18	6,570
	52	5:10	22:00	17.0	2	34	12,410
	62	4:40	0:35	20.0	2	40	14,600
						Total	84,315
Mililani	501	5:00	21:30	16.5	2	33	12,045
	502	5:00	19:30	14.5	1	14	5,110
	503	5:00	19:30	14.5	1	15	5,475
	E	7:30	22:00	14.5	2	29	10,585
	50	6:00	22:00	16.0	2	32	11,680
	51	9:00	18:00	9.0	2	18	6,570
	52	5:10	22:00	17.0	2	34	12,410
	62	4:40	0:35	20.0	2	40	14,600
						Total	78,475

Notes:

1. Route numbers based on Draft Central Oahu Hub and Spoke Service Plan.
2. Service times based on Draft Central Oahu Hub and Spoke Plan and Current Public Timetables for existing service.
3. Buses per hour calculated based on planned service headways.
4. Weekend service assumed to be the same as weekday service.
5. Express routes not included.

Table 6

EMISSION FACTORS FOR HEAVY-DUTY DIESEL VEHICLES

Parameter	Composite Emission Factor (g/mile)	Idle Emission Factor (g/min)
Nitrogen Oxides	12.3	0.90
Particulate	0.411	0.017
Volatile Organic Compounds	0.733	0.080
Carbon Monoxide	3.72	0.64
Sulfur Dioxide	0.448	0.019

Notes:

1. Emission factors obtained from MOBILE6.1.
2. Emission factors pertain to calendar year 2003 and ambient temperature of 77°F.
3. Composite emission factors pertain to an average vehicle speed of 25 mph.
4. Idle emission factors based on 2.5 mph speed.
5. Particulate emission factors pertain to exhaust emissions only.

Table 7

ANNUAL APPROACH/DEPART MILES AND IDLE TIMES FOR OAHU TRANSIT CENTERS PROJECT

Transit Center	Annual Bus Volume	Annual Approach/Depart Miles	Annual Idle Time (minutes)
Waianae	93,440	186,880	467,200
Wahiawa	84,315	168,630	421,575
Mililani	78,475	156,950	392,375

Table 8

ESTIMATED ANNUAL EMISSIONS FOR OAHU TRANSIT CENTERS PROJECT

Transit Center	Parameter	Annual Approach/Depart Emissions (tons)	Annual Idle Emissions (tons)	Total Annual Emissions (tons)
Waianae	Nitrogen Oxides	2.5	0.46	3.0
	Particulate	0.085	0.0087	0.094
	VOC	0.15	0.041	0.19
	Carbon Monoxide	0.76	0.33	1.1
	Sulfur Dioxide	0.092	0.0098	0.10
Wahiawa	Nitrogen Oxides	2.3	0.42	2.7
	Particulate	0.076	0.0079	0.084
	VOC	0.14	0.037	0.18
	Carbon Monoxide	0.69	0.30	0.99
	Sulfur Dioxide	0.083	0.0088	0.092
Mililani	Nitrogen Oxides	2.1	0.39	2.5
	Particulate	0.071	0.0074	0.078
	VOC	0.13	0.034	0.16
	Carbon Monoxide	0.64	0.28	0.92
	Sulfur Dioxide	0.077	0.0082	0.085

Table 9

SIGNIFICANT EMISSION RATES

Parameter	Emission Rate (tons/year)
Nitrogen Oxides	40
Particulate	15
Volatile Organic Compounds	40
Carbon Monoxide	100
Sulfur Dioxide	40

Notes:

1. As defined in Hawaii Administrative Rules, Title 11, Chapter 60.1.
2. Particulate emission rate pertains to particles less than 10 microns aerodynamic diameter.

State of Hawaii

Department of Health
Clean Air Branch
Honolulu, Hawaii

Annual Summary
Hawaii Air Quality Data

2000

2000
HAWAII AIR QUALITY DATA

CONTENTS

LIST OF TABLES

LIST OF FIGURES

Section 1
INTRODUCTION

The Department of Health has been monitoring ambient air quality in the State of Hawaii since 1957. Until 1971, there was only one air monitoring site, which was located on the island of Oahu. The air monitoring network today has expanded to include 17 monitoring stations on Oahu, Kauai, Maui and Hawaii. The primary purpose of the statewide monitoring network is to measure ambient air concentrations of the six criteria pollutants that the United States Environmental Protection Agency (EPA) has promulgated National Ambient Air Quality Standards (NAAQS). The six criteria pollutants with NAAQS are: carbon monoxide, nitrogen dioxide, sulfur dioxide, lead, ozone and particulate matter less than or equal to 10 micrometers (PM_{10}). The State of Hawaii also has standards for ozone, carbon monoxide and nitrogen dioxide more stringent than the NAAQS and an ambient air standard for hydrogen sulfide.

Ambient air monitoring for lead was discontinued in October 1997 with EPA approval. Since sampling for lead began, levels in the state have been far below the federal standard, and with the elimination of lead in gasoline, measured levels were consistently zero or nearly zero.

Most commercial, industrial and transportation activities and their associated air quality effects occur on Oahu where nine of the stations are located. Agricultural operations produce the greatest air quality impacts on Maui and Kauai. Impacts on ambient air quality from the ongoing eruption of the Kilauea Volcano and from activities associated with geothermal energy production are being monitored on the island of Hawaii. Current plans call for the continuation of sampling at these sites, however, relocations, additions and/or discontinuations can occur in the future as the need arises.

This report summarizes the air pollutant data collected at the 17 monitoring stations during calendar year 2000. Tabular and graphic summaries are provided which compare the measured concentrations with State and Federal ambient air quality standards. In addition, air pollutant concentration trend summaries are depicted in graphic form.

Various other data may be summarized as the need arises. Questions regarding these data and other air quality data should be addressed to:

State of Hawaii
Department of Health
Clean Air Branch
P.O. Box 3378
Honolulu, Hawaii 96801-3378
Phone: 808-586-4200
Fax: 808-586-4359

Section 2
DEFINITIONS

"Ambient Air": The general outdoor atmosphere, external to buildings, to which the general public has access.

"Ambient Air Quality": The quality or state of purity of the ambient air.

"Ambient Air Quality Standard": A limit in the quantity and exposure to pollutants dispersed or suspended in the ambient air.

"Carbon Monoxide": Carbon monoxide (CO) is a colorless, odorless, tasteless gas under atmospheric conditions. It is produced by the incomplete combustion of carbon fuels with the majority of emissions coming from transportation sources.

"Collocated": Procedure required for a certain percentage of PM_{10} samplers in the monitoring network. Collocated samplers determine precision or variation in the PM_{10} concentration measurements of identical samplers run in the same location under the same sampling conditions.

"EPA": The United States Environmental Protection Agency.

"Hydrogen Sulfide": Hydrogen sulfide (H_2S) is a toxic, colorless gas with a characteristic "rotten egg" odor detectable at very low levels. Also known as sewer gas, it is naturally occurring from sources such as volcanic activity, petroleum exploration and bacterial decomposition of organic matter.

"NAAQS": National Ambient Air Quality Standards. These are pollutant standards that the EPA has established to protect public health and welfare. NAAQS have been set for carbon monoxide, nitrogen dioxide, PM_{10}, ozone, sulfur dioxide, and lead. These are commonly referred to as the six criteria pollutants.

"NAMS": National Air Monitoring Stations. Sites which are part of the SLAMS network, must meet more stringent siting requirements, equipment type and quality assurance criteria.

"Nitrogen Dioxide": Nitrogen dioxide (NO_2) is a brownish, highly corrosive gas with a pungent odor. It is formed in the atmosphere from emissions of nitrogen oxides (NO_x). Sources of nitrogen oxides include electric utilities, industrial boilers, motor vehicle exhaust and combustion of fossil fuels. NO_2 is also a component in the atmospheric reaction that produces ground-level ozone.

“Ozone”: This is the main constituent in photochemical air pollution. It is formed in the atmosphere by a chemical reaction of nitrogen oxides (NO_x) and volatile organic compounds (VOCs) in the presence of sunlight. In the upper atmosphere, ozone (O_3) shields the earth from harmful ultraviolet radiation; however, at ground level, it can cause harmful effects in humans and plants.

“Particulate Matter”: Any dispersed matter, solid or liquid, in which the individual aggregates are larger than the single molecules in diameter, but smaller than 500 microns. Particulate matter includes dust, soot, smoke, and liquid droplets from sources such as factories, power plants, motor vehicles, construction activities, agricultural activities, and fires.

“PM_{10}”: Particulate matter that is 10 microns or less in aerodynamic diameter. The EPA revised the NAAQS for particulate matter in 1987 to cover only PM_{10} because the smaller particles have a greater potential for respiratory health impacts.

“SLAMS” State and Local Air Monitoring Stations. The Clean Air Act requires that every state establish a network of air monitoring stations for criteria pollutants, using requirements set by the EPA Office of Air Quality Planning and Standards.

“Sulfur Oxides”: Sulfur oxides are colorless gases which include sulfur dioxide (SO_2), sulfur trioxide, their acids and the salts of their acids. Emissions of sulfur oxides are largely from sources that burn fossil fuels such as coal and oil. In the State of Hawaii, another source of sulfur oxide emissions is from the eruption of Kilauea Volcano on the Big Island.

“Vog”: Vog is a local term used when referring to the atmospheric haze produced by the combination of volcanic gas and particles with air and sunlight.

Table 2-1 **State of Hawaii and Federal Ambient Air Quality Standards**

Air Pollutant	Averaging Time	Standards		
		Hawaii State Standard [a] ($\mu g/m^3$)	Federal Primary Standard [b] ($\mu g/m^3$)	Federal Secondary Standard [c] ($\mu g/m^3$)
Carbon Monoxide	1-hour 8-hour	10,000 5,000	40,000 10,000	40,000 10,000
Nitrogen Dioxide	Annual (arithmetic)	70	100	100
PM_{10}	24-hour Annual (arithmetic)	150 50	150 50	150 50
Ozone	1-hour	100	235	235
Sulfur Dioxide	3-hour 24-hour Annual (arithmetic)	1,300 365 80	--- 365 80	1,300 --- ---
Lead	Calendar Quarter (arithmetic)	1.5	1.5	1.5
Hydrogen Sulfide	1-hour	35	—	---

[a] Designated to protect public health and welfare and to prevent the significant deterioration of air quality. Source: HAR §11-59-1

[b] Designated to prevent against adverse effects on public health. Source: 40CFR Part 50

[c] Designated to prevent against adverse effects on public welfare, including effects on comfort, visibility, vegetation, animals, aesthetic values, and soiling and deterioration of materials. Source: 40CFR Part 50

Section 3
SITE LOCATIONS AND DESCRIPTIONS

This section provides a description of the monitoring stations in the State of Hawaii. Table 3-1 lists the air pollutant(s) measured at each monitoring station, characterizes the area surrounding the station, and indicates the start dates for data collection. Table 3-2 identifies the type of sampler used to measure the concentration of each air pollutant. Figures 3-1, 3-2, 3-3 and 3-4 show the location of each monitoring station on the islands of Oahu, Kauai, Maui and Hawaii, respectively.

The following three subsections discuss each monitoring station in more detail.

A. ISLAND OF OAHU

1. Honolulu: Located atop the Department of Health (DOH) building (Kinau Hale), at 1250 Punchbowl Street in downtown Honolulu, this site is in a commercial, institutional, and residential area. It was established in April 1971 as a NAMS and SLAMS station. The pollutants sampled at this site are PM_{10}, CO, and SO_2.

2. Pearl City: Located atop the Leeward Medical Center, at 860 Fourth Street, the area is a combination of commercial and residential units and is approximately nine and a half miles northwest of downtown Honolulu. This site was established in April 1971 as a NAMS site initially for collection of Total Suspended Particulates (TSP) before it was changed to PM_{10} sampling in July 1985.

3. Waimanalo: Located within the Waimanalo Sewage Treatment Facility, at 41-1069 Kalanianaole Highway, this site is in a sparsely populated rural and agricultural community. Waimanalo is on the windward (upwind) side of Oahu approximately ten miles east-northeast of downtown Honolulu. This site was established in June 1971 as a SLAMS site initially for the sampling of TSP before it was changed to PM_{10} sampling in July 1989.

4. Sand Island: Located at the Anuenue Fisheries, the area is composed of light industrial, commercial, recreational, and harbor units and is approximately two miles southwest (typically downwind) of downtown Honolulu. This is a NAMS station that was established in February 1981 for the sampling of ozone.

5. Waikiki: Located at 2131 Kalakaua Avenue, Waikiki is a busy commercial and residential area with heavy vehicular traffic. It is approximately three miles southeast of downtown Honolulu. The station was established in January 1981as a NAMS site for the sampling of carbon monoxide.

6. Liliha: Located at Kauluwela Elementary School, 1486 Aala Street, this site is in a residential and commercial area near the H-1 freeway, approximately one and a quarter miles north of downtown Honolulu. This NAMS station was established in January 1984 and currently monitors for PM_{10}.

7. Makaiwa: Located at 92-670 Farrington Highway, this site is in a residential and agricultural area approximately twenty-five miles west of downtown Honolulu. This station is downwind and to the southeast of an electrical power plant. This site was established in July 1989 as a SLAMS station monitoring for SO_2.

8. West Beach: Located within the Ko'Olina Golf Course, this site is in a recreational, residential, and agricultural area approximately 27 miles west of downtown Honolulu and 1.5 miles northwest of Campbell Industrial Park. This SLAMS station was established in February 1991 for NO_2, PM_{10}, CO and SO_2.

9. Kapolei: Located at 91-591 Kalaeloa Boulevard at the entrance to Campbell Industrial Park, this site is in a commercial, industrial, and residential area with nearby agricultural lands. It is approximately 25 miles west of downtown Honolulu and was established in February 1991 as a SLAMS site. Air pollutants measured at the site include NO_2, PM_{10}, CO and SO_2.

B. ISLAND OF KAUAI

Lihue: The Lihue monitoring station is located in downtown Lihue at the District Health Office, 3034 Umi Street. This site is in a commercial and residential area with nearby agricultural areas. It is a SLAMS station that was established in November 1972 for the sampling of total particulates but was changed to a PM_{10} sampling site in October 1985.

C. ISLAND OF MAUI

1. Kihei: This station is located in Hale Piilani Park. This special purpose monitoring station is in a residential and agricultural area and was established to monitor PM_{10} from sugarcane burning activities.

2. Paia: This station is located in a residential area at 141 Baldwin Avenue. The site is downwind of several sugarcane fields and is just northeast of the HC&S Co. Paia Mill. This site was established in August 1996 as a special PM_{10} sampling station for sugarcane burning activities.

D. ISLAND OF HAWAII

1. Kona: This station is located on the grounds of the Konawaena High School at 81-1043 Konawaena School Road in Kealakekua, Hawaii. This special purpose site was established in April 1997 to monitor vog in the Kona area. The pollutants sampled at this site are SO_2 and PM_{10}. The 1-in 6-day sampling for PM_{10} at this site was discontinued on June 11, 2000.

2. Hilo: Established in March 1995, this station is located on the grounds of the Adult Rehabilitation Center of Hilo at 1099 Waianuenue Avenue to monitor vog. The pollutants sampled are SO_2 and PM_{10}.

3. Honokaa: Located at Honokaa High and Intermediate School at 45-527 Pakalana Street, this station was established in August 1997 on the upwind side of the island to monitor vog. The pollutants sampled at this site are SO_2 and PM_{10}. This site was discontinued on August 1, 2000.

4. Lava Tree: This station in Puna, is located on the eastern border of the Lava Tree State Park in a residential-agricultural area near Nanawale Estates. It is approximately 1.4 miles northwest of the Puna Geothermal Venture power plant. The station was established in August 1993 and monitors for H_2S.

5. Puna E: Located in the Leilani Estates residential subdivision in Puna, it is approximately 3 miles south-southwest of the Puna Geothermal Venture power plant. Established in 1992, this station monitors for H_2S.

Table 3-1 **State of Hawaii Air Monitoring Network**

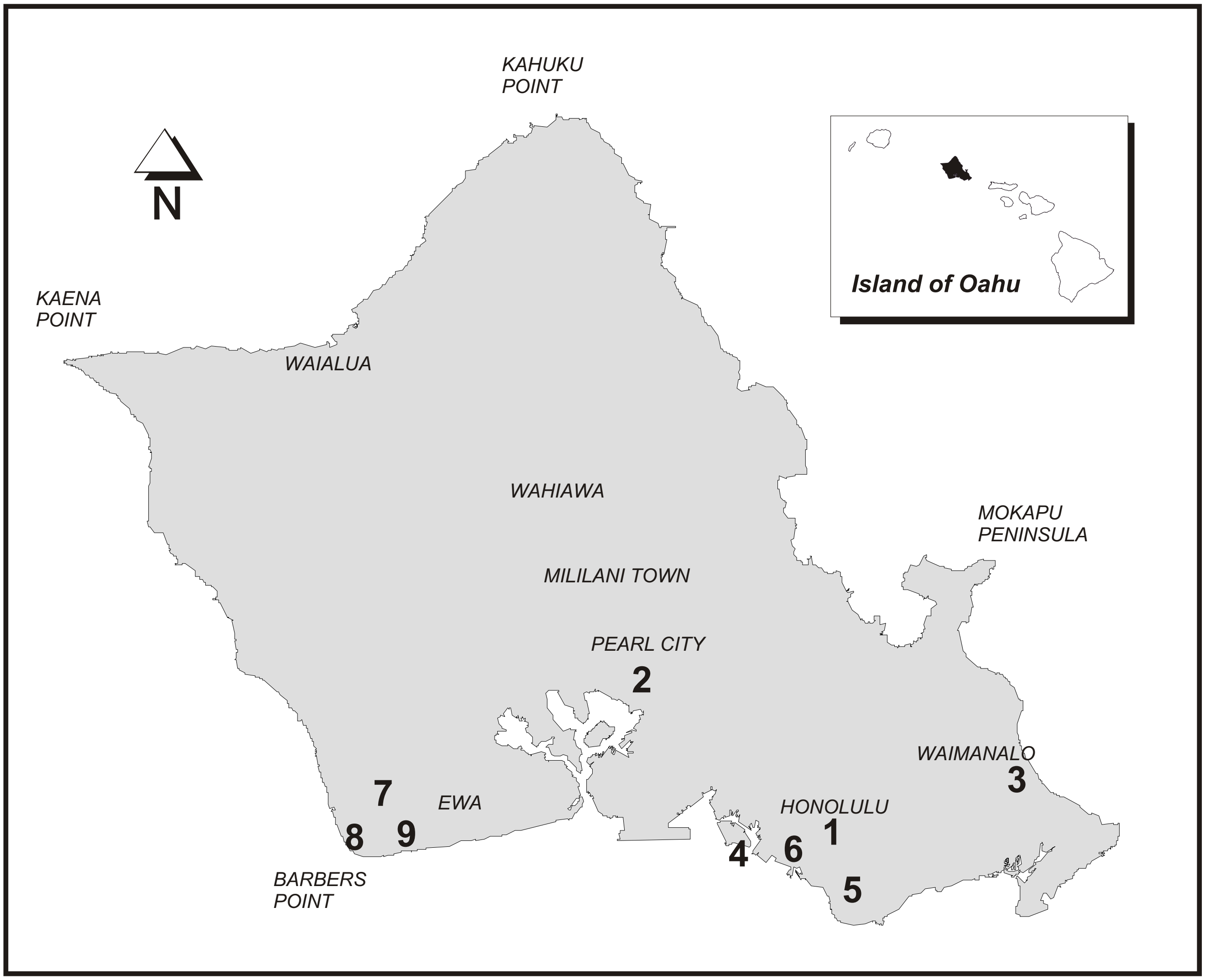
SITE	Station Type: PM_{10}	CO	O_3	SO_2	NO_2	H_2S	SITE DESCRIPTION	START DATE
OAHU								
HONOLULU	N	N	-	S	-	-	Center City/Commercial	April 1971
PEARL CITY	N	-	-	-	-	-	Suburban/Residential	April 1971
WAIMANALO	S	-	-	-	-	-	Rural / Agricultural	July 1989
SAND ISLAND	-	-	N	-	-	-	Center City	January 1981
WAIKIKI	-	N	-	-	-	-	Center City	February 1981
LILIHA	N	-	-	-	-	-	Center City	January 1981
MAKAIWA	-	-	-	S	-	-	Rural / Industrial	July 1989
WEST BEACH	S,C	S	-	S	S	-	Rural/Industrial	February 1991
KAPOLEI	S	S	-	S	S	-	Rural / Industrial	February 1991
KAUAI								
LIHUE	S	-	-	-	-	-	Center City / Commercial	October 1985
MAUI								
KIHEI	SS	-	-	-	-	-	Suburban / Residential	June 1996
PAIA	SS	-	-	-	-	-	Rural / Residential	August 1996
HAWAII								
KONA	SS	-	-	SS	-	-	Suburban	April 1997
HILO	SS	-	-	SS	-	-	Center City	March 1995
HONOKAA	SS	-	-	SS	-	-	Rural/Agricultural	May 1997
LAVA TREE	-	-	-	-	-	SS	Rural/Agricultural	August 1993
PUNA E	-	-	-	-	-	SS	Rural/Agricultural	1992

N = (NAMS) National Air Monitoring Station
C = Collocated Site
S = (SLAMS) State and Local Air Monitoring Stations
SS = Special Study (for sugar cane burning, vog, and geothermal energy)

Table 3-2 **Sampling Equipment at Each Monitoring Station**

Monitoring Station	PM_{10} Continuous Ambient Particulate Monitor	PM_{10} Manual Ambient Particulate Monitor (1 in 6 day)	CO Continuous Non-dispersive Infrared Analyzer	SO_2 Continuous Pulsed Fluorescent Ambient Air Analyzer	O_3 Continuous UV Photometric Analyzer	NO_2 Continuous Chemiluminescence Analyzer	H_2S Continuous Pulsed Fluorescent Ambient Air Analyzer
OAHU							
Honolulu	X		X	X			
Pearl City	X						
Waimanalo		X					
Sand Island					X		
Waikiki			X				
Liliha	X						
Makaiwa				X			
West Beach		X	X	X		X	
Kapolei	X		X	X		X	
KAUAI							
Lihue		X					
MAUI							
Kihei	X						
Paia	X						
HAWAII							
Kona		X		X			
Hilo		X		X			
Honokaa		X		X			
Lava Tree							X
Puna E							X

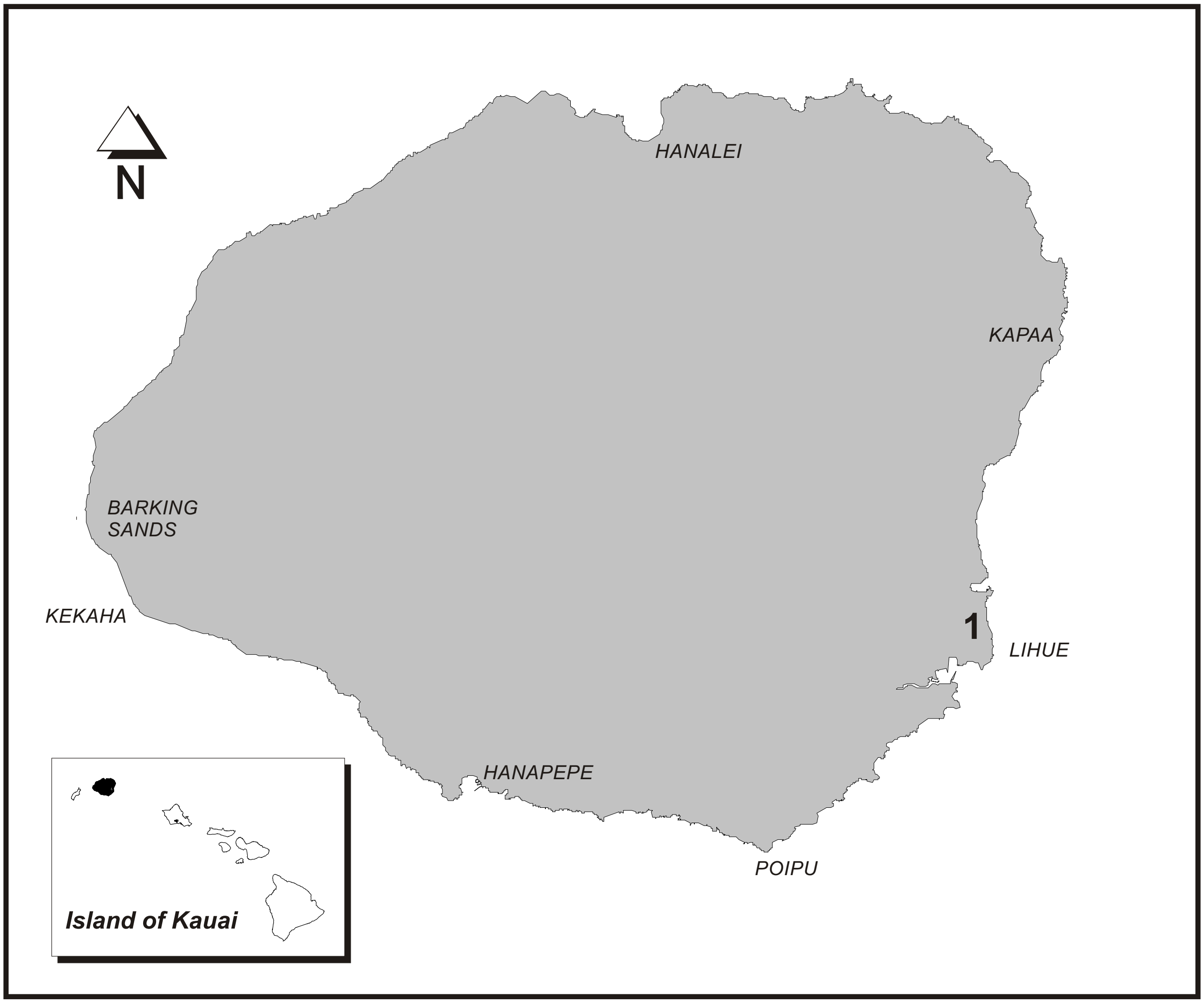
Figure 3-1 **Island of Oahu: Location of Air Monitoring Stations**



LEGEND

1 Honolulu (PM_{10}, $SO_{2,}$ CO)
2 Pearl City (PM_{10})
3 Waimanalo (PM_{10})
4 Sand Island (O_3)
5 Waikiki (CO)
6 Liliha (PM_{10})
7 Makaiwa (SO_2)
8 West Beach (PM_{10}, SO_2, CO, NO_2)
9 Kapolei (PM_{10}, SO_2, CO, NO_2)

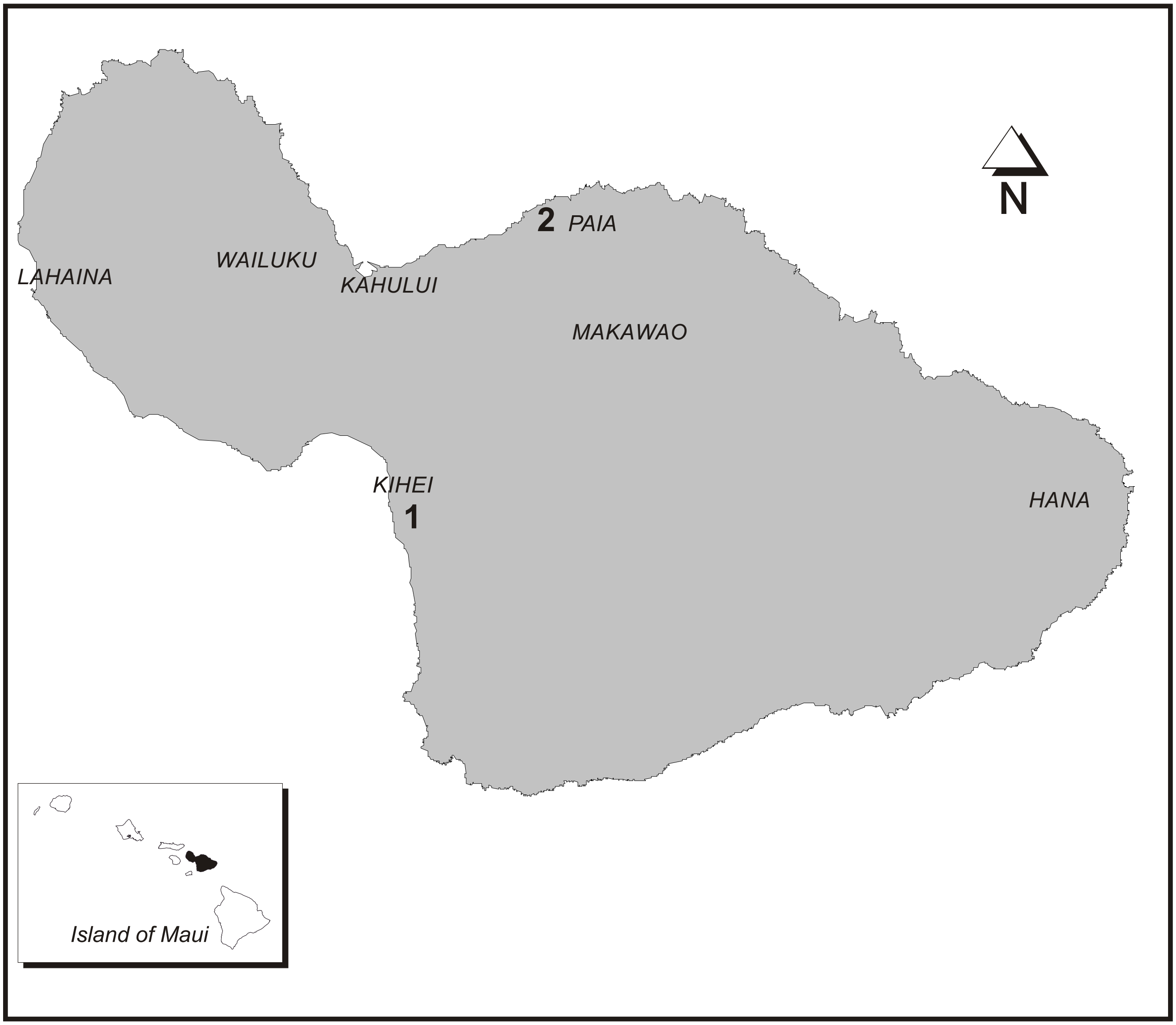
Figure 3-2 **Island of Kauai: Location of Air Monitoring Station**



LEGEND

1 Lihue (PM_{10})

Figure 3-3 **Island of Maui: Location of Air Monitoring Stations**

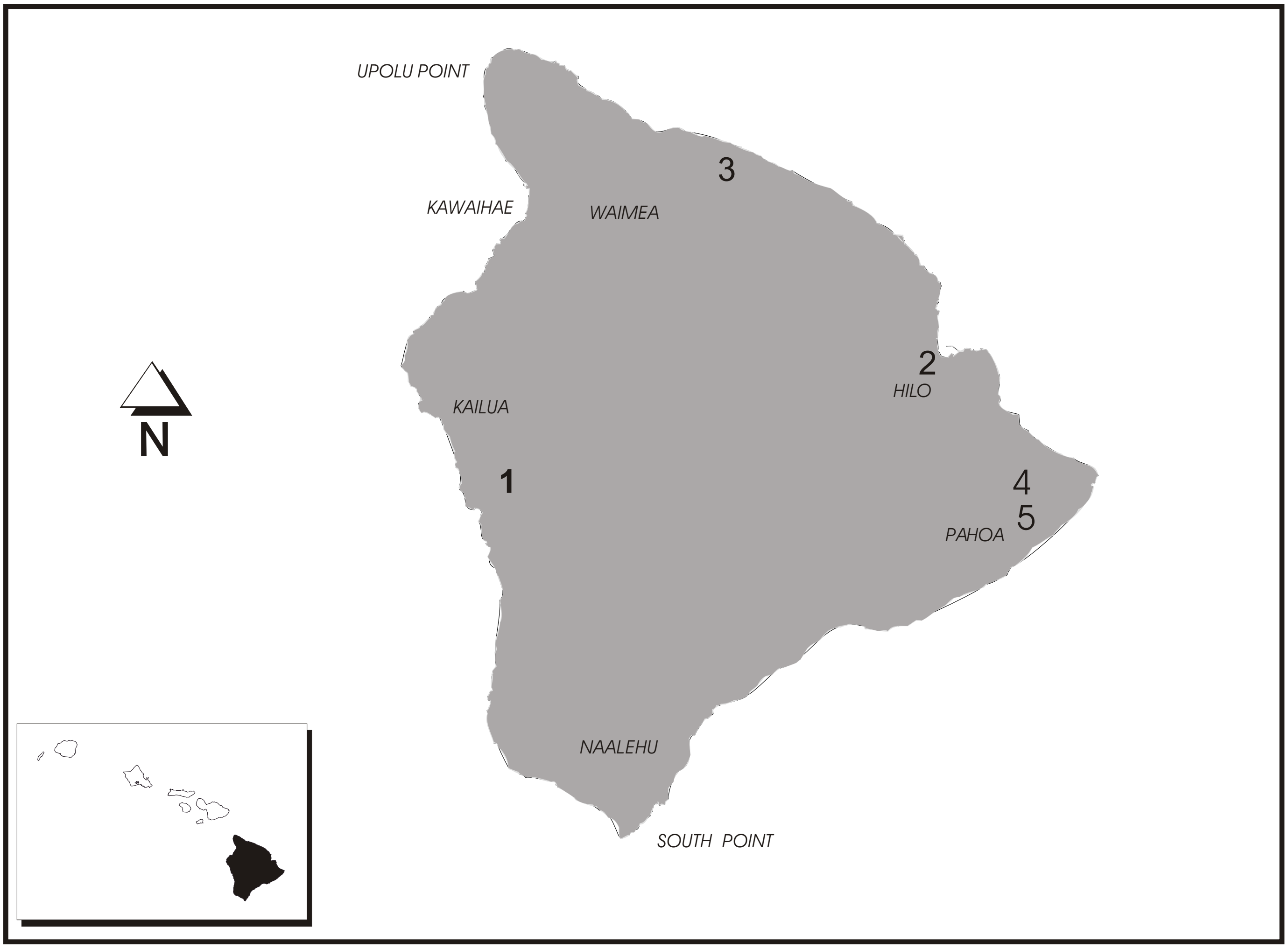


LEGEND

1 Kihei (PM_{10})

2 Paia (PM_{10})

Figure 3-4 **Island of Hawaii: Location of Air Monitoring Stations**



LEGEND

1 Kona (PM_{10}, SO_2)
2 Hilo (PM_{10}, SO_2)
3 Honokaa (PM_{10}, SO_2)
4 Lava Tree (H_2S)
5 Puna E (H_2S)

Section 4
2000 AIR QUALITY DATA

Hawaii enjoys some of the best air quality in the nation and, being an island state, is not impacted by pollution from neighboring states. However, as in any metropolitan area, there is some air pollution from various industrial and mobile sources in addition to agricultural and natural sources. The Department of Health, Clean Air Branch, has the responsibility for monitoring, protecting and enhancing the state's air quality and regulates and monitors pollution sources to ensure that the levels of criteria pollutants remain well below the state and federal air quality standards.

The following tables summarize the pollutant concentrations measured at each monitoring station. Tables 4-1 through 4-7 are annual summaries grouped by pollutant and provide the number of occurrences exceeding the NAAQS. There is no federal ambient air quality standard for H_2S, and Table 4-8 provides the number of occurrences exceeding the state standard.

The annual statistics provided in tables 4-1 through 4-8 are the highest and second highest µg/m^3 values recorded in the year for the averaging period and the annual means, which is the arithmetic mean of all valid hours recorded in the year. The possible periods is the total number of possible sampling periods in the year for the averaging time, and valid periods is the total number of sampling periods after data validation.

Tables 4-9 through 4-16 are monthly summaries of the range and average of each pollutant for each averaging period. The range is the lowest and highest µg/m^3 values recorded in the month for the averaging period and the average is the arithmetic mean of all hours recorded in the month. The highest value recorded in the year for each site is highlighted.

In the year 2000, the State of Hawaii was in attainment for all federal ambient air quality standards.

Table 4-1 **Annual Summary of 24-Hour PM_{10}**

	----------Annual Statistics------------			-----24-hour Occurrences Greater than 150 µg/m³-----													
	— Max Hr----		--Annual Means--														
	1st High	2nd High	All Hours	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Possible Periods	Valid Periods
OAHU																	
Honolulu	83	31	14	0	0	0	0	0	0	0	0	0	0	0	0	366	361
Liliha	65	44	15	0	0	0	0	0	0	0	0	0	0	0	0	366	363
Waikiki	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sand Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
[a]Waimanalo	35	28	17	0	0	0	0	0	0	0	0	0	0	0	0	61	47
Pearl City	164[b]	154[b]	16	1[b]	0	0	0	0	0	0	0	0	0	0	1[b]	366	358
Makaiwa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kapolei	148	129	17	0	0	0	0	0	0	0	0	0	0	0	0	366	356
[a]West Beach	41	40	14	0	0	0	0	0	0	0	0	0	0	0	0	61	54
KAUAI																	
[a]Lihue	39	36	18	0	0	0	0	0	0	0	0	0	0	0	0	61	50
MAUI																	
Kihei	83	77	25	0	0	0	0	0	0	0	0	0	0	0	0	366	355
Paia	48	45	18	0	0	0	0	0	0	0	0	0	0	0	0	366	350
HAWAII																	
[a]Kona	23	23	18	0	0	0	0	0	0	0	0	0	0	0	0	28[c]	17
[a]Hilo	18	16	11	0	0	0	0	0	0	0	0	0	0	0	0	61	41
[a]Honokaa	23	17	10	0	0	0	0	0	0	0	0	0	0	0	0	36[d]	22
Lava Tree	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

[a] PM_{10} sampling once every 6th day [b] Highest values, measured by a continuous method, occurred on 1/1/00 and 12/31/00, probably due to fireworks

[c] PM_{10} sampling was discontinued at this site on 6/11/00 [d] This station was discontinued on 8/1/00

Table 4-2 **Annual Summary of 1-Hour Carbon Monoxide**

	Annual Statistics			1-hour Occurrences Greater than 40,000 μg/m³													
	Max Hr		Annual Means														
	1st High	2nd High	All Hours	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Possible Periods	Valid Periods
OAHU																	
Honolulu	3990	3762	774	0	0	0	0	0	0	0	0	0	0	0	0	8784	8726
Liliha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waikiki	4332	4332	905	0	0	0	0	0	0	0	0	0	0	0	0	8784	8728
Sand Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waimanalo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pearl City	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Makaiwa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kapolei	2508	1596	336	0	0	0	0	0	0	0	0	0	0	0	0	8784	8595
West Beach	1596	1596	197	0	0	0	0	0	0	0	0	0	0	0	0	8784	8368
KAUAI																	
Lihue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAUI																	
Kihei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII																	
Kona	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hilo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Honokaa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lava Tree	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 4-3 **Annual Summary of 8-Hour Carbon Monoxide**

	Annual Statistics			8-hour Occurrences Greater than 10,000 μg/m³													
	Max Hr		Annual Means														
	1st High	2nd High	All Hours	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Possible Periods	Valid Periods
OAHU																	
Honolulu	1753	1724	774	0	0	0	0	0	0	0	0	0	0	0	0	1098	1091
Liliha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waikiki	2166	2038	905	0	0	0	0	0	0	0	0	0	0	0	0	1098	1094
Sand Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waimanalo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pearl City	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Makaiwa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kapolei	1055	827	336	0	0	0	0	0	0	0	0	0	0	0	0	1098	1076
West Beach	1012	627	197	0	0	0	0	0	0	0	0	0	0	0	0	1098	1042
KAUAI																	
Lihue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAUI																	
Kihei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII																	
Kona	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hilo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Honokaa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lava Tree	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 4-4 **Annual Summary of 1-Hour Ozone**

	Annual Statistics: Max Hr 1st High	Annual Statistics: Max Hr 2nd High	Annual Statistics: Annual Means All Hours	1-hour Occurrences Greater than 235 µg/m^3 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Possible Periods	Valid Periods
OAHU																	
Honolulu	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Liliha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waikiki	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sand Island	98	96	32	0	0	0	0	0	0	0	0	0	0	0	0	8784	8482
Waimanalo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pearl City	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Makaiwa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kapolei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
West Beach	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KAUAI																	
Lihue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAUI																	
Kihei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII																	
Kona	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hilo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Honokaa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lava Tree	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 4-5 **Annual Summary of 3-Hour Sulfur Dioxide**

	Annual Statistics			3-hour Occurrences Greater than 1,300 µg/m³													
	Max Hr		Annual Means														
	1st High	2nd High	All Hours	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Possible Periods	Valid Periods
OAHU																	
Honolulu	65	18	1	0	0	0	0	0	0	0	0	0	0	0	0	2928	2832
Liliha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waikiki	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sand Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waimanalo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pearl City	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Makaiwa	72	69	3	0	0	0	0	0	0	0	0	0	0	0	0	2928	2862
Kapolei	23	18	1	0	0	0	0	0	0	0	0	0	0	0	0	2928	2505
West Beach	11	9	1	0	0	0	0	0	0	0	0	0	0	0	0	2928	2304
KAUAI																	
Lihue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAUI																	
Kihei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII																	
Kona	50	49	6	0	0	0	0	0	0	0	0	0	0	0	0	2928	2897
Hilo	438	301	4	0	0	0	0	0	0	0	0	0	0	0	0	2928	2277
Honokaa	213	176	4	0	0	0	0	0	0	0	0	0	0	0	0	1704[a]	1691
Lava Tree	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

[a] This station was discontinued on 8/1/00

Table 4-6 **Annual Summary of 24-Hour Sulfur Dioxide**

	Annual Statistics: Max Hr 1st High	Annual Statistics: Max Hr 2nd High	Annual Statistics: Annual Means All Hours	24-hour Occurrences Greater than 365 µg/m³: Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Possible Periods	Valid Periods
OAHU																	
Honolulu	9	7	1	0	0	0	0	0	0	0	0	0	0	0	0	366	357
Liliha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waikiki	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sand Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waimanalo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pearl City	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Makaiwa	20	17	3	0	0	0	0	0	0	0	0	0	0	0	0	366	361
Kapolei	6	5	1	0	0	0	0	0	0	0	0	0	0	0	0	366	362
West Beach	4	4	1	0	0	0	0	0	0	0	0	0	0	0	0	366	333
KAUAI																	
Lihue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAUI																	
Kihei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII																	
Kona	25	16	6	0	0	0	0	0	0	0	0	0	0	0	0	366	365
Hilo	94	73	4	0	0	0	0	0	0	0	0	0	0	0	0	366	284
Honokaa	61	28	4	0	0	0	0	0	0	0	0	0	0	0	0	213[a]	213
Lava Tree	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

[a] This station was discontinued on 8/1/00

Table 4-7 **Annual Summary of Nitrogen Dioxide**

	------------Annual Statistics------------			-----Annual Occurrences Greater than 100 µg/m³-----													
	— Max Hr---		-Annual Means-														
	1st High	2nd High	All Hours	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Possible Periods	Valid Periods
OAHU																	
Honolulu	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Liliha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waikiki	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sand Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waimanalo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pearl City	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Makaiwa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kapolei	-	-	9	-	-	-	-	-	-	-	-	-	-	-	0	8784	7213
West Beach	-	-	7	-	-	-	-	-	-	-	-	-	-	-	0	8784	8104
KAUAI																	
Lihue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAUI																	
Kihei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII																	
Kona	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hilo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Honokaa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lava Tree	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Puna E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 4-8 **Annual Summary of 1-Hour Hydrogen Sulfide**

	Annual Statistics			1-hour Occurrences Greater than 35 µg/m³													
	Max Hr		Annual Means														
	1st High	2nd High	All Hours	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Possible Periods	Valid Periods
OAHU																	
Honolulu	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Liliha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waikiki	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sand Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waimanalo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pearl City	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Makaiwa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kapolei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
West Beach	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KAUAI																	
Lihue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAUI																	
Kihei	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HAWAII																	
Kona	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hilo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Honokaa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lava Tree	7	7	2	0	0	0	0	0	0	0	0	0	0	0	0	8784	8319
Puna E	13	7	<1	0	0	0	0	0	0	0	0	0	0	0	0	8784	8276

Table 4-9 **Monthly Summary of 24-Hour PM_{10} ($\mu g/m^3$)**

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Honolulu	Range	7-***83***	9-21	7-31	8-21	8-21	7-15	10-17	9-21	7-18	12-22	9-23	8-20
	Average	15	15	16	15	14	11	13	15	13	16	15	14
Liliha	Range	10-***65***	9-21	13-36	9-25	9-22	8-16	10-18	9-19	7-18	9-21	10-20	8-44
	Average	16	16	19	16	15	11	14	14	12	15	15	14
Pearl City	Range	8-***164***	9-24	8-33	8-21	9-21	7-17	10-19	10-20	8-18	13-24	13-26	11-154
	Average	19	16	17	15	14	12	14	15	13	16	19	15
Waimanalo [a]	Range	10	20	6-15	16-***35***	12-20	11-15	17-22	14-25	9-18	12-28	7-22	8-18
	Average	10	20	10	23	16	14	18	17	14	22	16	13
Kapolei	Range	8-***148***	7-38	9-41	7-129	9-35	8-27	10-30	8-19	8-16	8-52	8-26	7-22
	Average	19	19	17	28	18	16	14	13	12	16	14	14
West Beach [a]	Range	3-19	7-16	10-32	13-19	10-***41***	10-40	8-12	8-11	7-12	8-17	8	5-13
	Average	11	14	17	15	23	18	10	10	9	14	8	9
Lihue [a]	Range	11-21	27-36	13-***39***	16-21	12-24	13-18	15-20	16-29	13-21	14-27	12-22	8-22
	Average	14	32	20	18	20	15	17	24	17	21	16	15
Kihei	Range	9-48	14-67	10-41	10-77	15-64	13-54	16-62	10-46	14-52	13-77	5-37	9-***83***
	Average	17	25	20	23	28	26	35	29	27	30	17	18
Paia	Range	7-***48***	9-30	10-42	10-23	10-28	11-45	12-26	13-32	12-30	12-21	12-23	10-33
	Average	15	19	22	16	16	16	17	18	19	16	16	19
Kona [a]	Range	No Data	13-21	16-17	16-22	17-***23***	14-15	PM_{10} Sampling discontinued at this site on 6/16/00					
	Average		18	16	19	20	14						
Hilo [a]	Range	7-13	10-16	8-12	No Data	No Data	10-10	10-15	9-14	6-11	7-16	8	6-***18***
	Average	10	13	11			10	13	11	8	12	8	10
Honokaa [a]	Range	4-11	8-***23***	12-12	No Data	9-11	7-11	4-10	Station discontinued on 8/01/00				
	Average	7	15	12		10	10	8					

[a] Sampling is once every 6th day

Table 4-10 **Monthly Summary of 1-Hour Carbon Monoxide (µg/m³)**

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Honolulu	Range	342-***3990***	456-3192	456-2508	456-1368	342-2052	114-2166	342-2052	456-1824	342-2508	228-2052	456-3762	342-2964
	Average	755	925	870	706	710	746	696	793	813	549	907	832
Waikiki	Range	342-***4332***	456-4332	342-2964	228-1938	456-2280	114-2166	114-1710	456-2166	456-2850	570-2508	0-3078	0-2964
	Average	963	1193	1175	679	907	1065	603	790	1003	978	718	788
Kapolei	Range	0-1368	0-1596	0-912	0-798	0-1596	0-1140	0-***2508***	228-912	0-1140	0-1140	0-1482	114-1596
	Average	285	287	283	219	353	216	490	404	345	327	320	495
West Beach	Range	0-798	0-1254	0-798	0-570	0-1140	0-456	0-1026	114-456	0-570	0-684	0-***1596***	0-912
	Average	133	230	267	181	274	235	164	146	103	218	228	189

Table 4-11 **Monthly Summary of 8-Hour Carbon Monoxide (µg/m³)**

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Honolulu	Range	371-1582	641-1525	599-1268	485-955	442-1012	356-1097	371-998	556-1112	413-1724	342-1254	584-***1753***	399-1397
	Average	755	925	870	706	710	746	696	793	813	549	907	832
Waikiki	Range	485-***2166***	684-2009	684-1724	342-1411	684-1226	399-1496	257-1040	542-1466	627-2038	670-1425	14-1995	86-1568
	Average	963	1193	1175	679	907	1065	603	790	1003	978	718	788
Kapolei	Range	95-613	100-556	100-584	29-485	0-***1055***	0-584	114-741	257-584	71-827	86-556	14-684	114-812
	Average	285	287	283	219	353	216	490	404	345	327	320	495
West Beach	Range	71-314	128-371	114-456	100-342	114-385	100-413	49-342	114-342	0-244	14-499	0-***1012***	14-399
	Average	133	230	267	181	274	235	164	146	103	2128	228	189

Table 4-12 **Monthly Summary of 1-Hour Ozone (µg/m³)**

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Sand Island	Range	0-86	0-88	0-90	2-***98***	2-76	2-47	2-51	0-53	0-39	0-55	0-69	0-80
	Average	47	32	45	55	32	20	21	22	15	27	33	30

Table 4-13 **Monthly Summary of 3-Hour Sulfur Dioxide (µg/m³)**

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Honolulu	Range	0-***65***	0-17	3-18	0-3	0-2	0-3	0-2	0-17	0-6	0-7	0-7	0-5
	Average	1	4	3	<1	<1	<1	<1	<1	1	3	<1	1
Makaiwa	Range	0-27	0-48	0-55	0-12	0-61	0-46	0-8	0-18	0-49	0-61	0-25	2-***72***
	Average	2	5	3	2	4	3	2	3	4	3	3	6
Kapolei	Range	0-18	0-14	0-5	0-3	0-16	0-14	0-14	0-9	0-3	0-10	0-3	0-***23***
	Average	3	1	1	<1	1	1	1	<1	<1	<1	<1	2
West Beach	Range	0-***11***	0-3	0-5	0-4	0-4	0-5	0-5	3-5	3-4	0-1	0-0	0-8
	Average	1	<1	1	1	2	3	3	3	3	<1	0	<1
Kona	Range	3-37	2-49	3-***50***	3-44	0-23	5-13	5-10	5-16	0-22	0-41	0-28	0-38
	Average	7	7	7	8	7	6	6	7	5	4	4	6
Hilo	Range	0-136	0-***438***	0-106	0-187	0-5	0-20	0-3	0-3	0-115	0-2	0-16	0-174
	Average	4	19	6	4	2	1	1	<1	1	<1	2	11
Honokaa	Range	0-98	1-***213***	1-49	2-3	0-3	3-45	0-3	Station discontinued on 8/01/00				
	Average	4	9	4	3	2	3	3					

Table 4-14 **Monthly Summary of 24-Hour Sulfur Dioxide (µg/m³)**

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Honolulu	Range	0-***9***	<1-7	3-6	0-3	0-<1	0-<1	0-<1	0-2	0-3	1-3	0-3	0-3
	Average	1	4	3	<1	<1	<1	<1	<1	1	3	<1	1
Makaiwa	Range	<1-12	2-16	1-13	<1-5	<1-11	<1-17	1-4	0-6	<1-10	1-11	1-7	3-***20***
	Average	2	5	3	2	4	3	2	3	4	3	3	6
Kapolei	Range	2-5	0-5	0-3	0-1	0-5	0-5	0-4	0-3	0-1	0-2	0-1	<1-***6***
	Average	3	1	1	<1	1	1	1	<1	<1	<1	<1	2
West Beach	Range	<1-***4***	<1-1	<1-3	1-2	1-3	1-4	1-4	3-4	3-3	0-<1	0-0	0-2
	Average	1	<1	1	1	2	3	3	3	3	<1	0	<1
Kona	Range	4-16	2-14	3-***25***	3-15	4-11	5-9	5-7	5-9	0-10	<1-12	0-10	2-16
	Average	7	7	7	8	7	6	6	7	5	4	4	6
Hilo	Range	0-41	1-***94***	<1-34	2-28	<1-3	<1-5	<1-3	0-1	0-26	<1-1	1-5	1-73
	Average	4	19	6	4	2	1	1	<1	1	<1	2	11
Honokaa	Range	1-25	2-***61***	2-15	2-3	1-3	3-12	2-3	Station discontinued on 8/01/00				
	Average	4	9	4	3	2	3	3					

Table 4-15 **Monthly Summary of 24-Hour Nitrogen Dioxide (µg/m³) [a]**

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Kapolei	Range	3-14	1-19	5-19	2-11	5-11	4-12	5-11	6-17	6-15	7-14	4-14	7-***21***
	Average	7	11	10	7	7	7	8	11	9	11	8	12
West Beach	Range	1-14	2-***18***	2-12	1-11	3-11	2-10	3-6	3-12	3-10	0-11	4-12	5-16
	Average	5	9	5	4	6	5	5	5	6	4	7	10

[a] There is no 24-hour state or federal standard for nitrogen dioxide

Table 4-16 **Monthly Summary of 1-Hour Hydrogen Sulfide (µg/m³)**

Station		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Lava Tree	Range	3-***7***	0-4	0-4	0-4	0-4	0-3	0-1	0-1	1-1	1-3	1-7	0-3
	Average	3	3	3	2	1	1	1	1	1	1	1	1
Puna E	Range	0-1	0-1	0-3	0-3	0-1	0-7	0-1	0-1	0-1	0-0	0-***13***	0-0
	Average	<1	<1	<1	<1	1	1	<1	<1	<1	0	<1	0

Section 5
AMBIENT AIR QUALITY TRENDS

The following graphs illustrate 5-year trends for PM_{10}, ozone, carbon monoxide, sulfur dioxide, and nitrogen dioxide from 1996 to 2000.

The graphs for PM_{10}, sulfur dioxide and nitrogen dioxide (figures 5-1, 5-2, 5-5 and 5-6, respectively) represent the annual averages for each year and for each station that monitors for that pollutant. Annual averages are derived by calculating the arithmetic mean of all valid hours recorded in the year. Included in the graphs are the state and federal annual standard(s).

The graphs for 1-hour ozone and 1-hour carbon monoxide (figures 5-3 and 5-4, respectively) represent the average of the daily maximum 1-hour values recorded in the year. These values are obtained by taking the highest recorded 1-hour value for each day then calculating the arithmetic mean of all those hours to arrive at the annual maximum average. Ozone and carbon monoxide do not have state or federal annual standards, however, included in the graphs are the 1-hour standards.

Figure 5-1 **Island of Oahu: PM_{10} Annual Average 1996 - 2000**

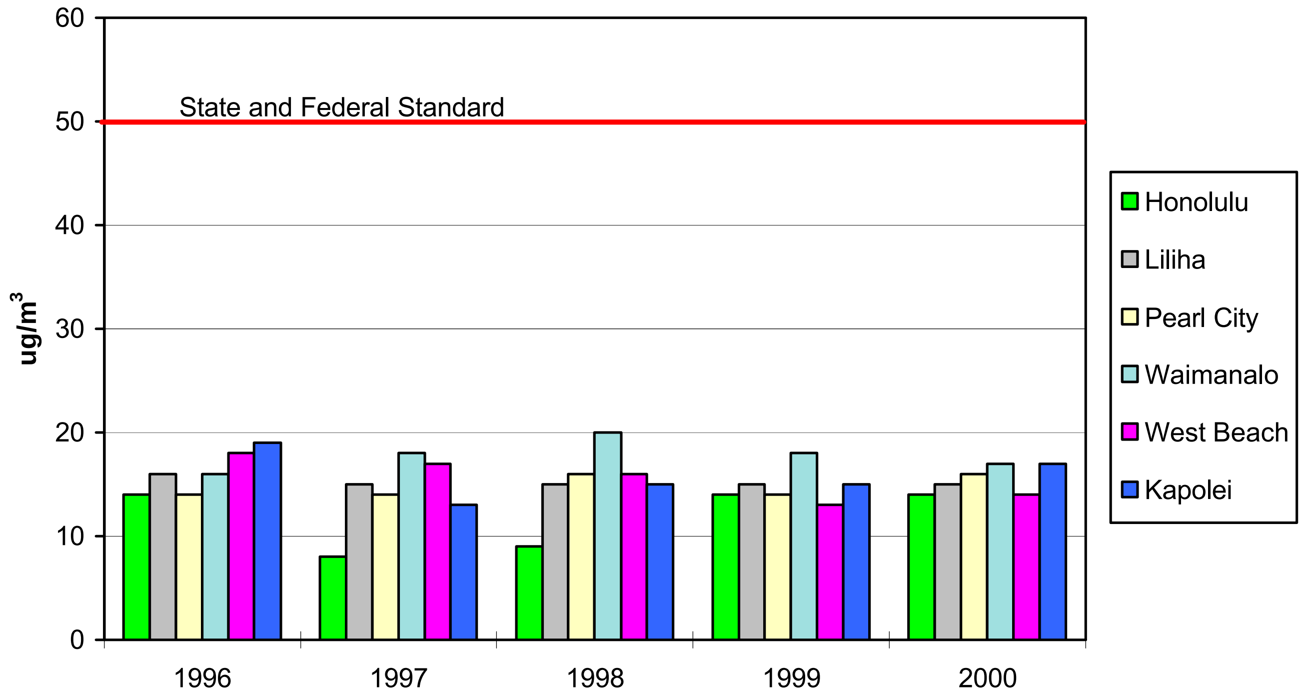


Figure 5-2 **Island of Kauai: PM_{10} Annual Average 1996 - 2000**

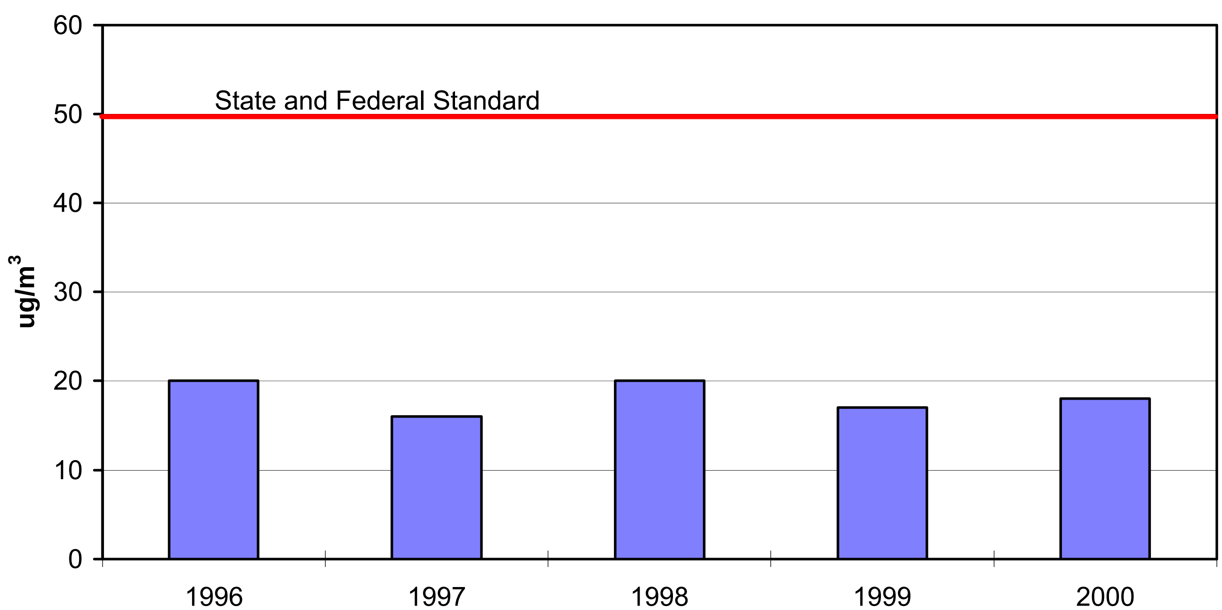


Figure 5-3 **Annual Average of Daily Maximum 1-Hour Ozone 1996 - 2000**

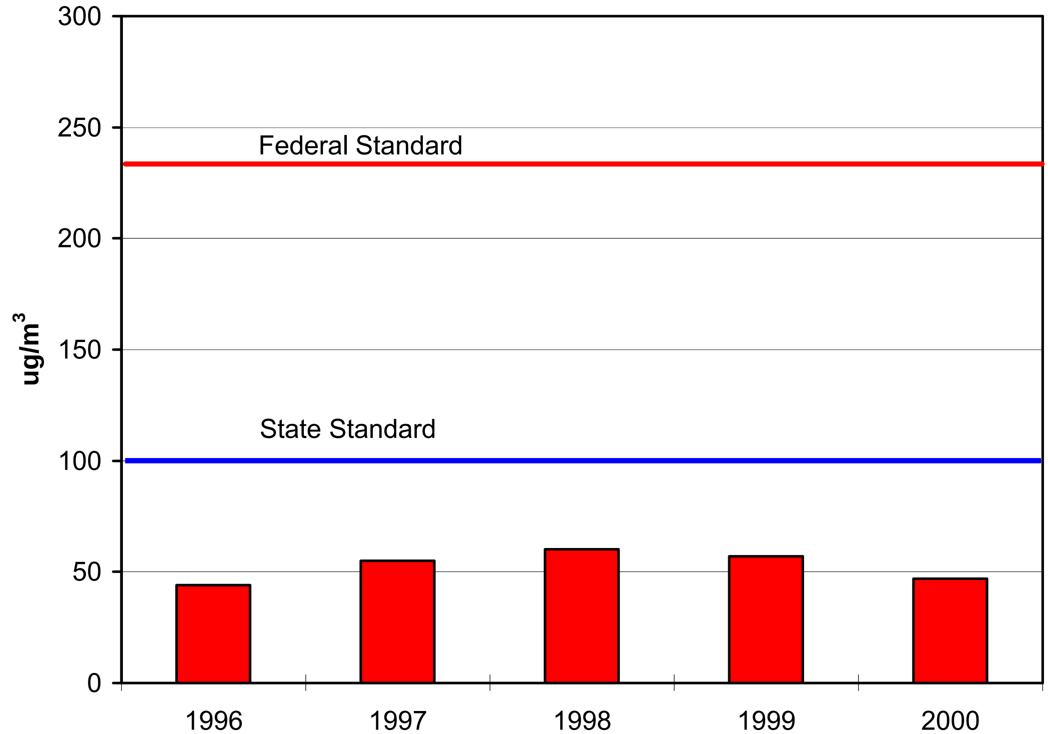


Figure 5-4 **Annual Average of Daily Maximum 1-Hour Carbon Monoxide 1996 - 2000**

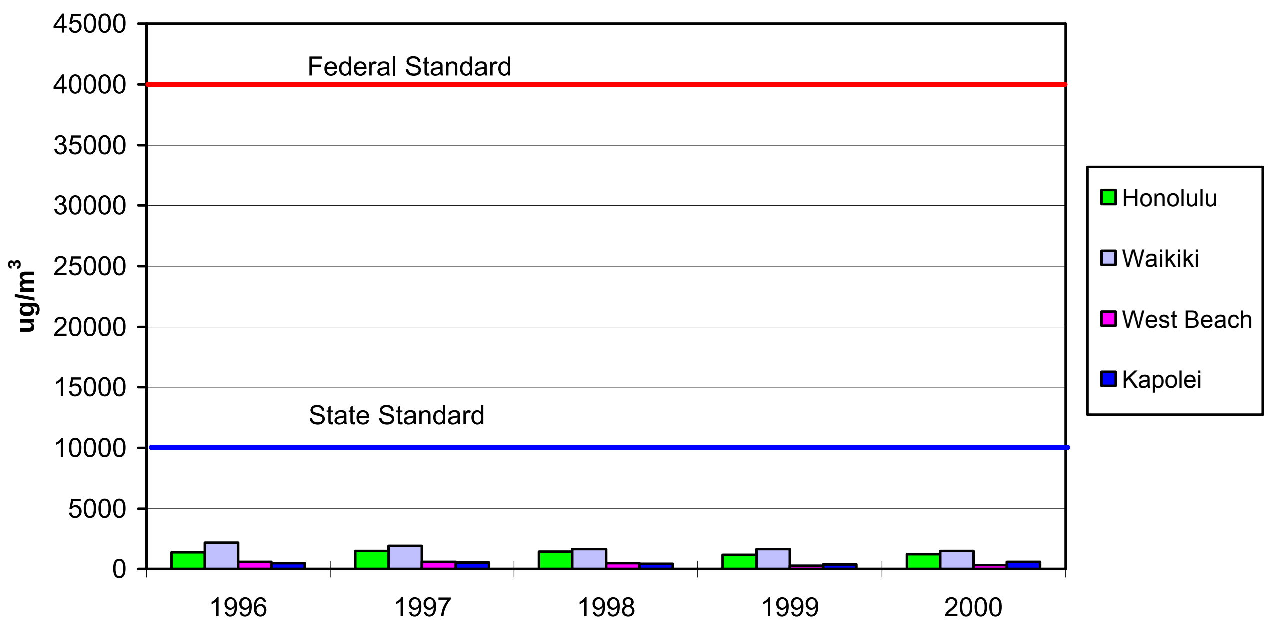


Figure 5-5 **Annual Average Sulfur Dioxide**
1996 - 2000

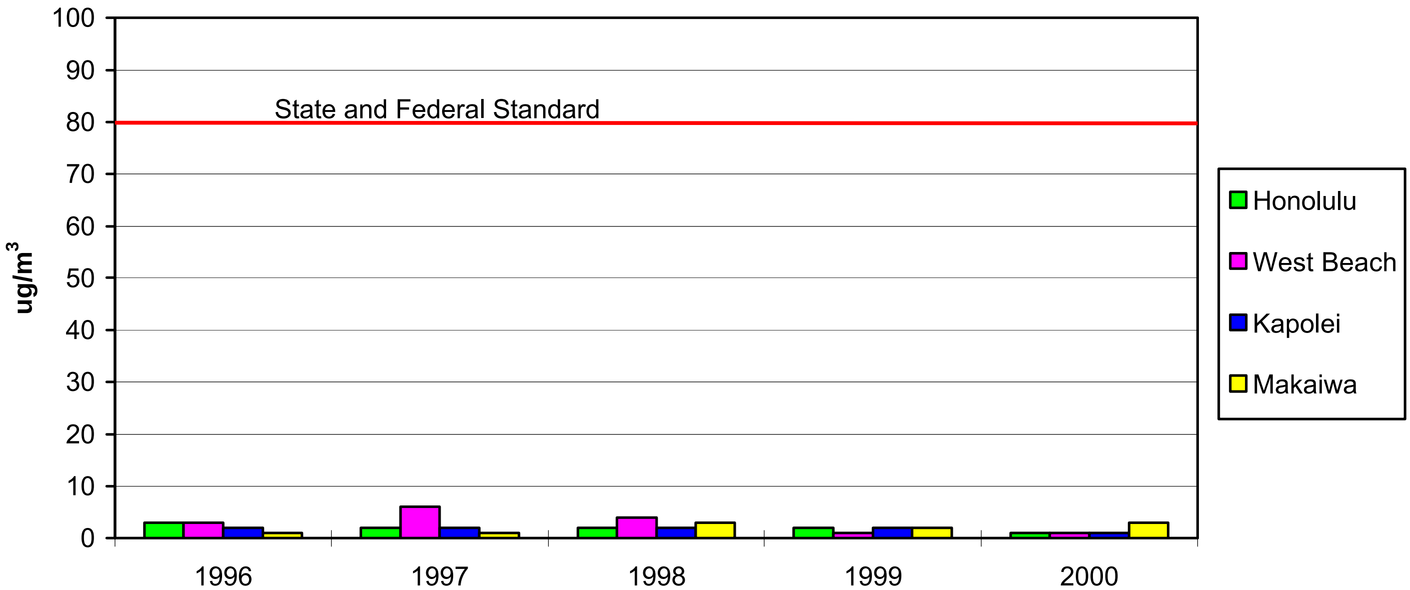
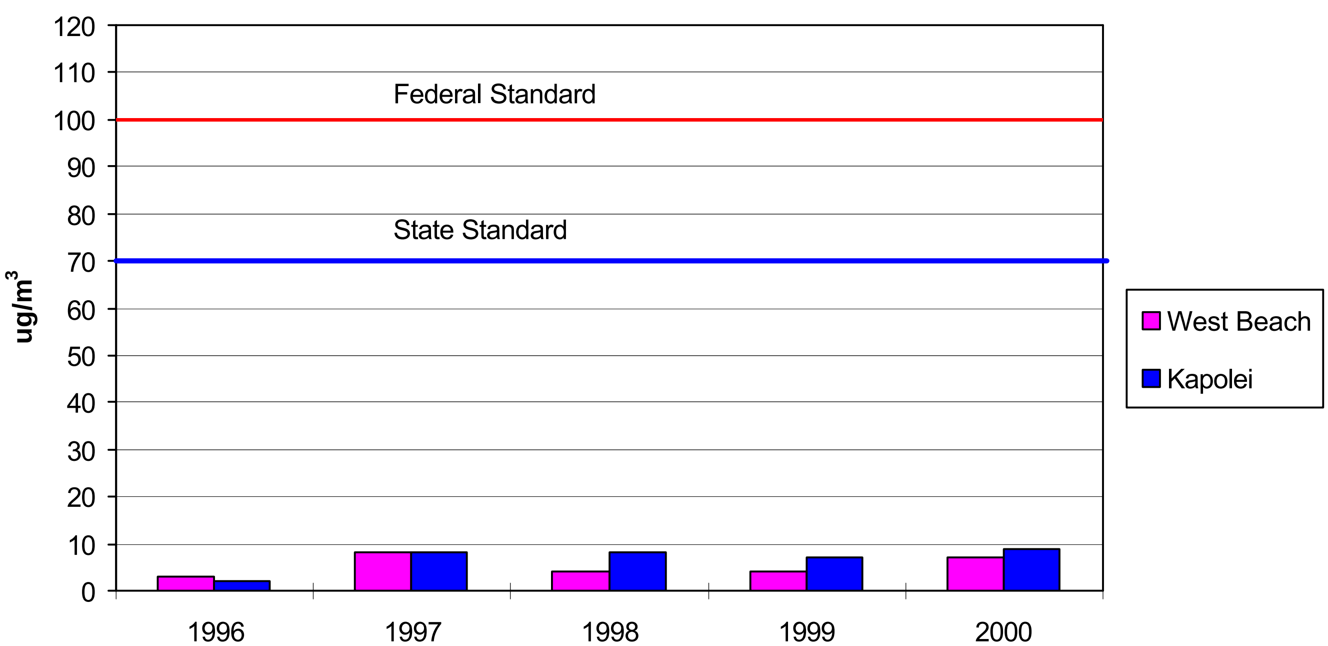


Figure 5-6 **Annual Average Nitrogen Dioxide**
1996 - 2000



Appendix D

Traffic Impact Analysis Report

November 2008

Environmental Assessment

Wahiawa Transit Center & Park and Ride
TMK: 7-4-006:002 & portion of 7-4-006:012
956 California Avenue, Wahiawa, O`ahu, Hawai`i

Traffic Impact Analysis Report

Prepared For

AM Partners LLC

Prepared By

Wilson Okamoto Corporation

November 2008

TRAFFIC IMPACT ANALYSIS REPORT

FOR

WAHIAWA TRANSIT CENTER

Prepared for:

AM Partners LLC
1100 Alakea Street, Suite 800
Honolulu, Hawaii 96813

Prepared by:

Wilson Okamoto Corporation
1907 S. Beretania Street, Suite 400
Honolulu, Hawaii 96826
WOC Ref. 7904-01

November 2008

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF APPENDICIES

I. INTRODUCTION

A. Purpose of Study

The purpose of this study is to identify and assess the traffic impacts resulting from the development of the Wahiawa Transit Center in Wahiawa on the island of Oahu. The project site is located at 956 California Avenue and is currently occupied by 45 public parking spaces. The project entails the development of a bus transit center and supporting park-and-ride facility to accommodate express and circulator bus services.

B. Scope of Study

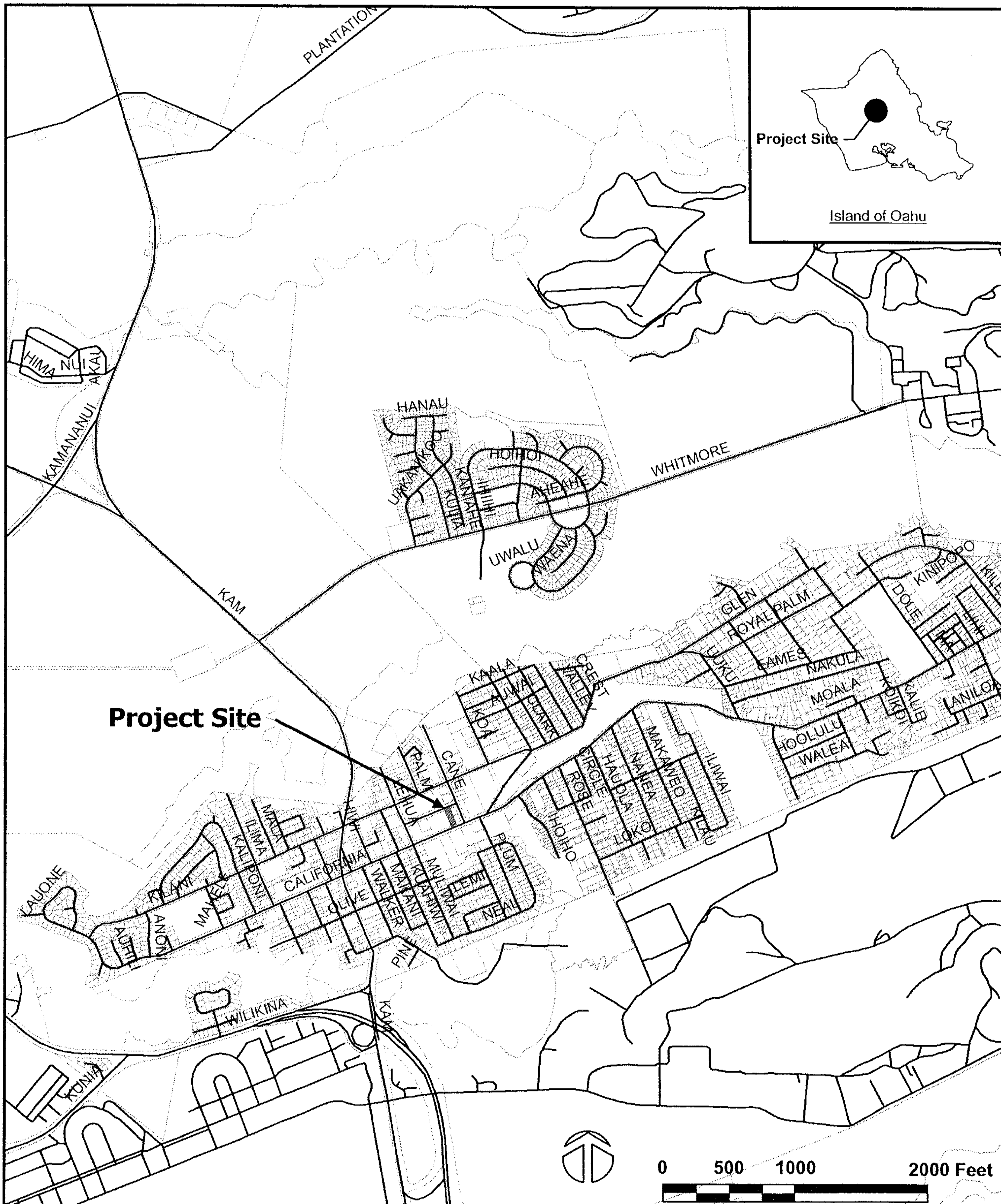
This report presents the findings and conclusions of the traffic study, the scope of which includes:

1. Description of the proposed project.
2. Evaluation of existing roadway and traffic operations in the vicinity.
3. Analysis of future roadway and traffic conditions without the proposed project.
4. Analysis and development of trip generation characteristics for the proposed project.
5. Superimposing site-generated traffic over future traffic conditions.
6. The identification and analysis of traffic impacts resulting from the proposed project.
7. Recommendations of improvements, if appropriate, that would mitigate the traffic impacts resulting from the proposed project.

II. PROJECT DESCRIPTION

A. Location

The project site is 29,000 square feet and is further identified as Tax Map Keys: 7-4-006:02 and 7-4-02: por. 12. The site is bounded by California Avenue to the southeast, the existing Wahiawa Civic Center to the southwest, Center Street to the northwest, and a Jiffy Lube Store and abandoned gas station to the northeast. Public roadways that surround the site include California Avenue, North Cane Street, Center Street, and Lehua Street (see Figure 1). Proposed vehicular access to the



WILSON OKAMOTO CORPORATION
ENGINEERS - PLANNERS

WAHIAWA TRANSIT CENTER

LOCATION MAP AND VICINITY MAP

FIGURE
1

proposed transit center is along California Avenue and Center Street.

B. Project Characteristics

The existing project site currently houses approximately 81 parking stalls with access in the vicinity of Center Street. Twenty-five parking spaces are designated for use by the adjacent Wahiawa Civic Center, with the balance serving as unrestricted public use. The proposed project includes redevelopment of the site and the construction of a multi-level parking structure with transit facilities located on the ground level. The transit center facilities will include eight bus bays, bus passenger waiting areas, single use restroom, and storage closets. The proposed project includes a second level of the parking structure that will include 58 parking stalls intended to serve as a park-and-ride facility supporting the transit center. The State Department of Accounting and General Services (DAGS) is currently considering the development of a Judiciary Center Complex located adjacent to the proposed transit center site, and is considering an additional 182 parking stalls to be incorporated in future potential parking levels within the parking structure, for a total of approximately 240 parking spaces. It is assumed that the additional 182 anticipated parking stalls to be designated for the Judiciary Center Complex meet the parking requirements and demand for that project. However, the Judiciary Center Complex project is currently in the planning stages with no definite timeline for completion. The Judiciary Center Complex development, assuming that the project proceeds, may be completed in ten years or roughly in the Year 2018. Completion of the proposed transit center project however, including the 58 parking stall park-and-ride component of the parking structure, is expected in Year 2010. This document evaluates and identifies the traffic conditions and impacts associated with the proposed transit center, supporting park-and-ride facility, and future additions to the parking structure. It is expected that traffic impacts associated with the potential development of the Judiciary Center Complex will be identified and mitigated with the development of that project. In any case, this document evaluates future traffic conditions, beyond the build-out of the proposed transit center and park-and-ride facility, to account for the additional proposed parking stalls associated with the proposed Judiciary Center contained within the on-site parking structure. Since definite development plans for the proposed Judiciary Center Complex are not available at this writing, the analysis of the additional parking supply beyond the 58-stall park-and-ride facility is based on development assumptions covered in latter sections of this document. Figure 2 shows the site plan depicting the ground floor access points for the proposed Wahiawa Transit Center and parking structure.

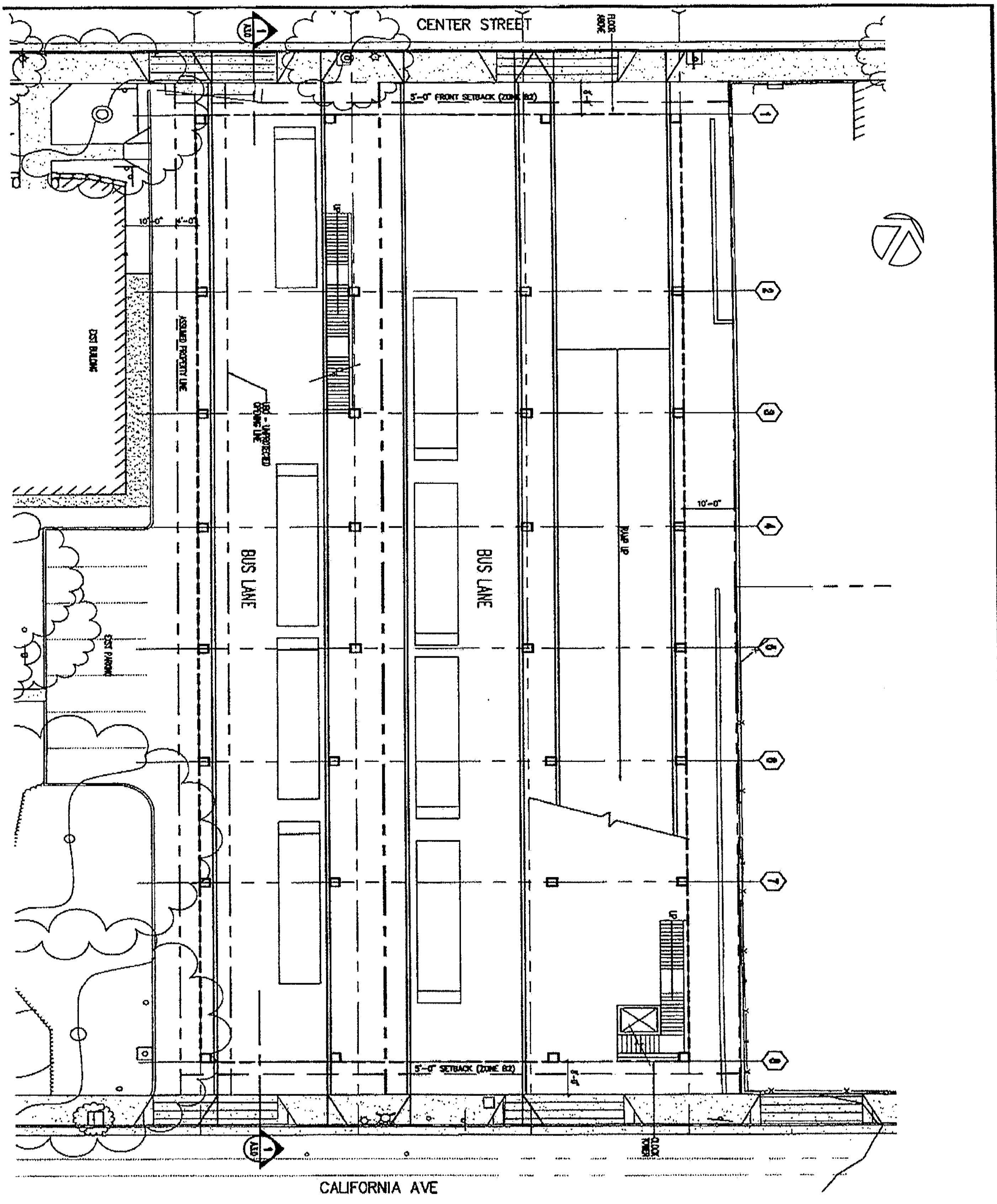
III. EXISTING TRAFFIC CONDITIONS

A. General

Wahiawa Town has experienced minimal growth with traffic demands in the general vicinity of the proposed project remaining relatively stable in recent years. California Avenue and Kilani Avenue are the two primary collector streets providing access to a residential uses and a variety of other uses in Wahiawa. Traffic conditions in the vicinity of the proposed project generally operate well with several connector streets linking the primary roadways providing circulation opportunities throughout the localized region.

B. Area Roadway System

California Avenue is predominantly a two-way, four-lane City and County of Honolulu roadway in the project vicinity and generally oriented in the east-west direction between Kamehameha Highway and North Cane Street. Beyond these intersections to the west and east, California Avenue transitions to two-lane, two-way roadways until Malulu Place towards the west and near Puninoni Street towards the east. In the project vicinity, California Avenue intersects with Lehua Street/Muliwai Place. At this signalized intersection, the eastbound and westbound approaches of California Avenue include two lanes serving all movements at the intersection. The northbound approach of Muliwai Avenue includes one lane serving all movements while the southbound approach of Lehua Street has a shared left-turn/through lane and an exclusive right-turn movement lane. Further east in the project vicinity, California Avenue intersects with North Cane Street. At this signalized intersection, the eastbound approach of California Avenue has two through lanes and an exclusive



WILSON OKAMOTO CORPORATION
ENGINEERS - PLANNERS

WAHIAWA TRANSIT CENTER

PROJECT SITE PLAN

FIGURE 2

left-turn lane while the westbound approach of California Avenue has one through lane and a shared through/right-turn lane. On the southbound approach to the intersection, North Cane Road has a shared left-turn/through lane and an exclusive right-turn lane. The northbound approach to the intersection is a driveway for Tamura Wholesale Outlet. Further north of the intersection with California Avenue, North Cane Street intersects with Center Street to form an unsignalized T-intersection. The northbound approach of North Cane Street includes a shared left-turn/through lane and an exclusive through lane while the southbound approach of North Cane Street includes a through lane and a shared through/right-turn lane. The Center Street approach includes exclusive left-turn and right-turn lanes. Further west of the intersection with North Cane Street, Center Street intersects with Lehua Street to form an unsignalized T-intersection. On the northbound approach to the intersection, Lehua Street includes an exclusive through movement lane and a shared through/right-turn movement lane while the southbound approach to the intersection includes a shared left-turn/through movement lane and an exclusive through movement lane. The Center Street westbound intersection approach includes one lane serving left- and right-turn movements. Opposite Center Street is an exit driveway for the adjacent First Hawaiian Bank.

C. Traffic Volumes and Conditions

1. General

a. Field Investigation

Field investigations were conducted on the week of September 22, 2008 and consisted of site inspections and manual turning movement count surveys in the project vicinity. Based on historical 24-hour count surveys, the manual intersection turning movement count surveys were conducted between the morning peak hours of 6:00 AM and 8:00 AM, and the afternoon peak hours of 4:00 PM and 6:00 PM at the following intersections:

- California Avenue and Lehua Street/Muliwai Avenue
- California Avenue and North Cane Street
- Center Street and North Cane Street

- Center Street and Lehua Street

Appendix A includes the existing traffic count data and field notes.

b. Capacity Analysis Methodology

The highway capacity analysis performed in this study is based upon procedures presented in the "Highway Capacity Manual", Transportation Research Board, 2000, and the "Highway Capacity Software", developed by the Federal Highway Administration. The analysis is based on the concept of Level of Service (LOS).

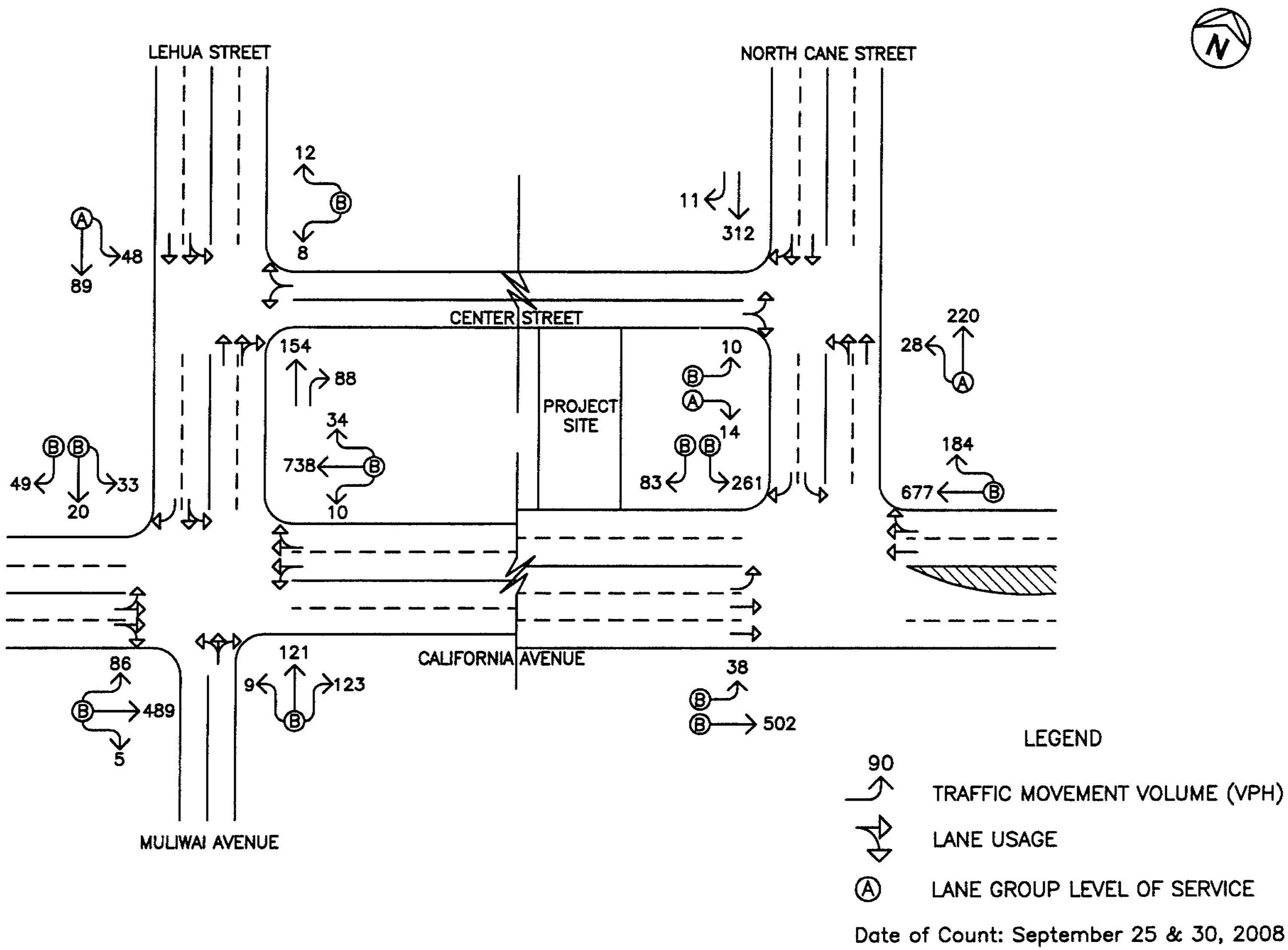
LOS is a quantitative and qualitative assessment of traffic operations. Levels of Service are defined by LOS "A" through "F"; LOS "A" representing ideal or free-flow traffic operating conditions and LOS "F" unacceptable or potentially congested traffic operating conditions.

"Volume-to-Capacity" (v/c) ratio is another measure indicating the relative traffic demand to the road carrying capacity. A v/c ratio of one (1.00) indicates that the roadway is operating at or near capacity. A v/c ratio of greater than 1.00 indicates that the traffic demand exceeds the road's carrying capacity. The LOS definitions are included in Appendix B.

2. Existing Peak Hour Traffic

a. General

Figures 3 and 4 show the existing AM and PM peak hour traffic volumes and operating traffic conditions. The AM peak hour of traffic generally occurs between the hours of 7:00 AM and 8:00 AM. In the afternoon, the PM peak hour of traffic generally occurs between the hours of 4:00 PM and 5:00 PM. The analysis is based on the absolute peak hour time periods for each intersection to identify the traffic impacts resulting from the proposed project. LOS calculations are included in Appendix C.

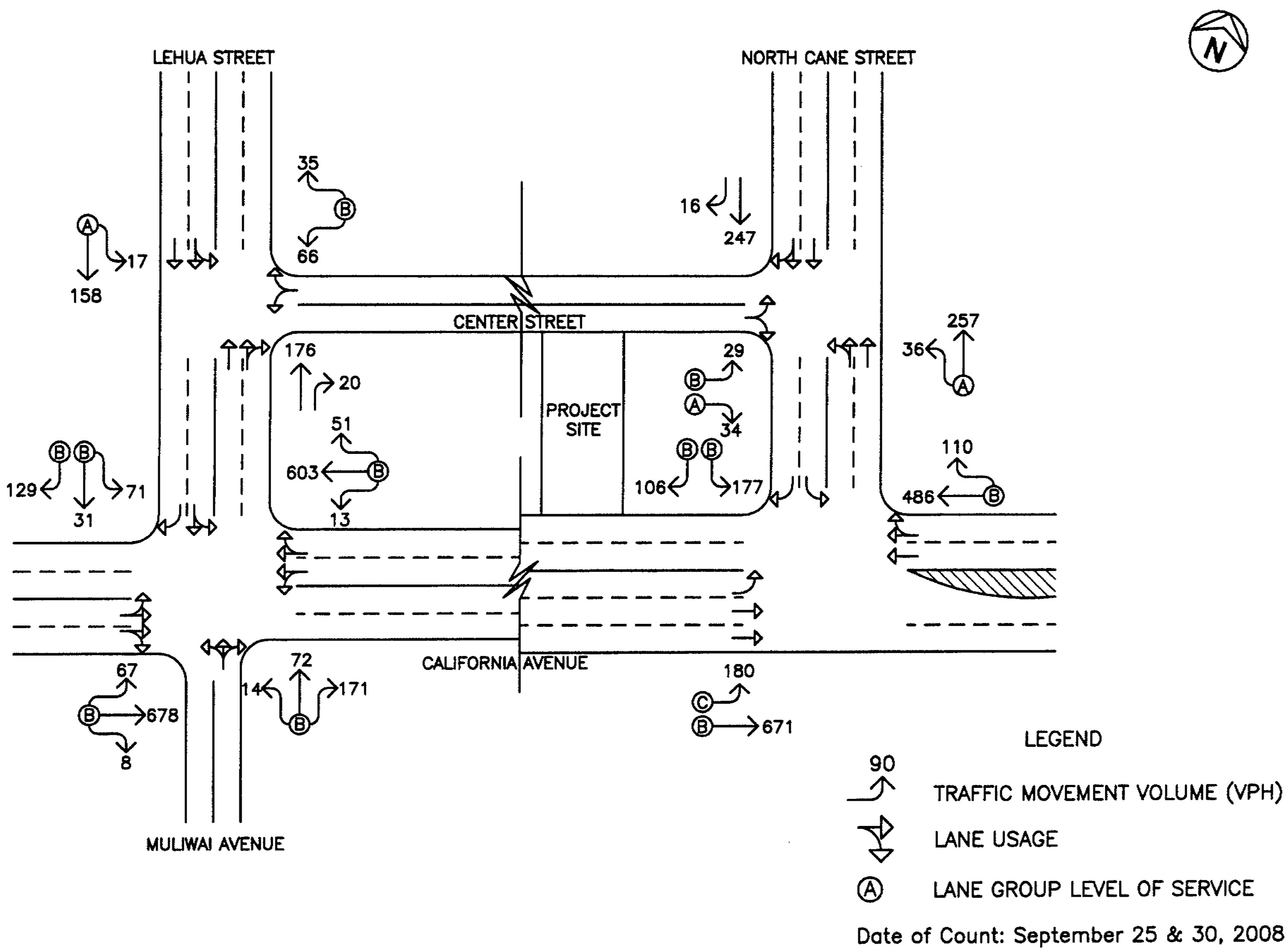


WILSON OKAMOTO CORPORATION
ENGINEERS · PLANNERS

WAHIAWA TRANSIT CENTER

EXISTING AM PEAK HOUR OF TRAFFIC

FIGURE
3



WILSON OKAMOTO CORPORATION
ENGINEERS · PLANNERS

WAHIAWA TRANSIT CENTER

EXISTING PM PEAK HOUR OF TRAFFIC

FIGURE 4

b. California Avenue and Lehua Street/Muliwai Avenue

At the intersection with Lehua Street/Muliwai Avenue, California Avenue carries 580 vehicles eastbound and 782 vehicles westbound during the AM peak hour of traffic. During the PM peak hour, traffic volumes are higher with 753 vehicles traveling eastbound and 667 vehicles traveling westbound. The critical traffic movement on the California Avenue intersection approaches is the eastbound left-turn traffic movements which operate at LOS "B" during both peak periods. The signalized intersection functions under two-phase operations allowing permitted eastbound left-turn movements on the California Avenue traffic signal phase. Left-turn queue lengths generally of two vehicles were observed during the AM peak hour of traffic, and generally about four vehicles during the PM peak traffic hours. However, queues dissipate quickly as a result of gaps created in the westbound through traffic stream caused by the adjacent signalized intersections.

The Lehua Street intersection approach carries 102 vehicles traveling southbound during the AM peak hour of traffic. During the PM peak hour, the traffic volume is greater with 231 vehicles traveling southbound. The critical traffic movement on the Lehua Street approach of the intersection is the southbound left-turn traffic movement which operates at LOS "B" during both peak periods. Vehicular queue lengths of approximately four vehicles were observed on the Lehua Street southbound approach during both peak periods. However, similar to other traffic movements at the intersection, gaps in the westbound through traffic stream facilitate the southbound approach movements of Lehua Street.

The Muliwai Avenue intersection approach carries 253 vehicles traveling northbound during the AM peak hour of traffic.

During the PM peak hour, the traffic volume is slightly greater with 257 vehicles traveling northbound. Based on field observations, Muliwai Street I frequently utilized as a bypass route via Olive Street to avoid the signalized intersections along California Avenue for trips destined to primarily residential areas further east. The relatively high northbound right-turn traffic demand of 123 vehicles and 171 vehicles on the Muliwai Avenue approach to California Avenue during the AM and PM peak hours, respectively, reflect the condition.

c. California Avenue and North Cane Street

At the intersection with North Cane Street, California Avenue carries 540 vehicles eastbound and 861 vehicles westbound during the AM peak hour of traffic. During the PM peak hour, the overall traffic volume is higher with 851 vehicles traveling eastbound and 596 vehicles traveling southbound. It should be noted that outbound trips nearly mirror inbound trips between the morning and afternoon peak periods of traffic. Hence, home-work-home trips are evident during the peak traffic hours. The critical traffic movement on the California Avenue approaches of this intersection is the eastbound left-turn traffic movement which operates at LOS "B" during both peak periods. Vehicular queue lengths on the eastbound approach of California Avenue range from two to four vehicles and three to five vehicles for the left-turn lane and through lanes, respectively, during the AM peak hour of traffic. During the PM peak hour, vehicular queue lengths range from two to six for the eastbound left-turn lane and 10 to 18 vehicles for the through traffic lanes. On the westbound approach of California Avenue, vehicular queue lengths of six to over 20 vehicles, and seven to 13 vehicles were observed during the AM and PM peak hours of traffic, respectively.

The southbound intersection approach of North Cane Street carries 344 vehicles during the AM peak hour of traffic. During the

PM peak hour, the traffic volume is slightly less with 283 vehicles traveling southbound. The critical traffic movement is the southbound left-turn movements which operates at LOS "B" during peak periods. Vehicular queue lengths on the southbound approach of North Cane Street during the AM and PM peak hours range from about two vehicles to approximately nine vehicles. On occasions, vehicle queues would extend further northward through the adjacent Center Street intersection. These queues would clear the adjacent intersection with the traffic signal cycle changes at the intersection of California Avenue and North Cane Street.

d. North Cane Street and Center Street

At the intersection North Cane Street and Center Street, the northbound and southbound approaches of North Cane Street carry 248 vehicles and 323 vehicles during the AM peak hour of traffic, respectively. During the PM peak hour of traffic the northbound and southbound approaches of North Cane Street carry 293 vehicles and 263 vehicles, respectively. During the AM peak hour, the critical left-turn movement on the northbound approach operates at LOS "A" during both the AM and PM peak hours of traffic. Vehicles queue lengths on the northbound approach of North Cane Street range from one to four vehicles during both the AM and PM peak periods.

The eastbound approach of Center Street and the North Cane Street intersection carries 24 vehicles and operates at LOS "B" during the AM peak hour of traffic. During the PM peak hour, Center Street carries 63 vehicles with the intersection approach also operating at LOS "B". Vehicular queue lengths on Center Street at the intersection with North Cane Street range from one to three vehicles during both the AM and PM peak hours of traffic.

e. Lehua Street and Center Street

At the intersection with Center Street, Lehua Street carries 242 vehicles northbound and 137 vehicles southbound during the AM peak hour of traffic. During the PM peak hour, Lehua Street carries196 vehicles northbound and 175 vehicles southbound. The southbound left-turn movement operates at LOS "A" for both the AM and PM peak hours of traffic with maximum queues of three vehicles between both the AM and PM peak hours of traffic. It should be noted that school children board and alight private school buses on the active through movement lane on Lehua Street just south of the intersection with Center Street. The buses were observed to park in the through lanes for approximately 15 minutes during the AM peak hour of traffic and approximately 5 minutes during the PM peak hour of traffic. This activity continued daily during the entire one-week filed investigation period which confirmed that such activity was daily practice and procedure.

The westbound approach of Center Street at the intersection with Lehua Street carries 20 vehicles 101 vehicles during the AM and PM peak hours of traffic, respectively. The westbound approach operates at LOS "B" during both peak periods. Vehicular queue lengths of one to four vehicles were observed on Center Street during the PM peak hour of traffic, with no visible queues occurring during the AM peak period of traffic.

IV. PROJECTED TRAFFIC CONDITIONS

A. Site-Generated Traffic

1. Trip Generation Methodology

The trip generation methodology used in this study is based upon generally accepted techniques developed by the Institute of Transportation Engineers (ITE) and published in "Trip Generation, 7th Edition," 2003. The

ITE trip generation rates are developed empirically by correlating the vehicle trip generation data with various land use characteristics such as the number of parking stalls within a park-and-ride facility. Table 1 summarizes the project site trip generation characteristics applied to the AM and PM peak hours of traffic to measure the impact resulting from the proposed Wahiawa Transit Center.

Table 1: Peak Hour Trip Generation

PARK AND RIDE FACILITY INDEPENDENT VARIABLE:		# of Parking Stalls = 58
		PROJECTED TRIP ENDS
AM PEAK	ENTER	35
	EXIT	9
	TOTAL	44
PM PEAK	ENTER	8
	EXIT	28
	TOTAL	36

2. Trip Distribution

Primary access for vehicles to the proposed transit center park and ride facility will be via a driveway along Center Street. All trips associated with the park and ride facility were assumed to utilize this driveway. The directional distribution of site-generated vehicles at the study intersections was assumed to follow the prevailing traffic demands and patterns associated with the peak hours of traffic.

B. Through Traffic Forecasting Methodology

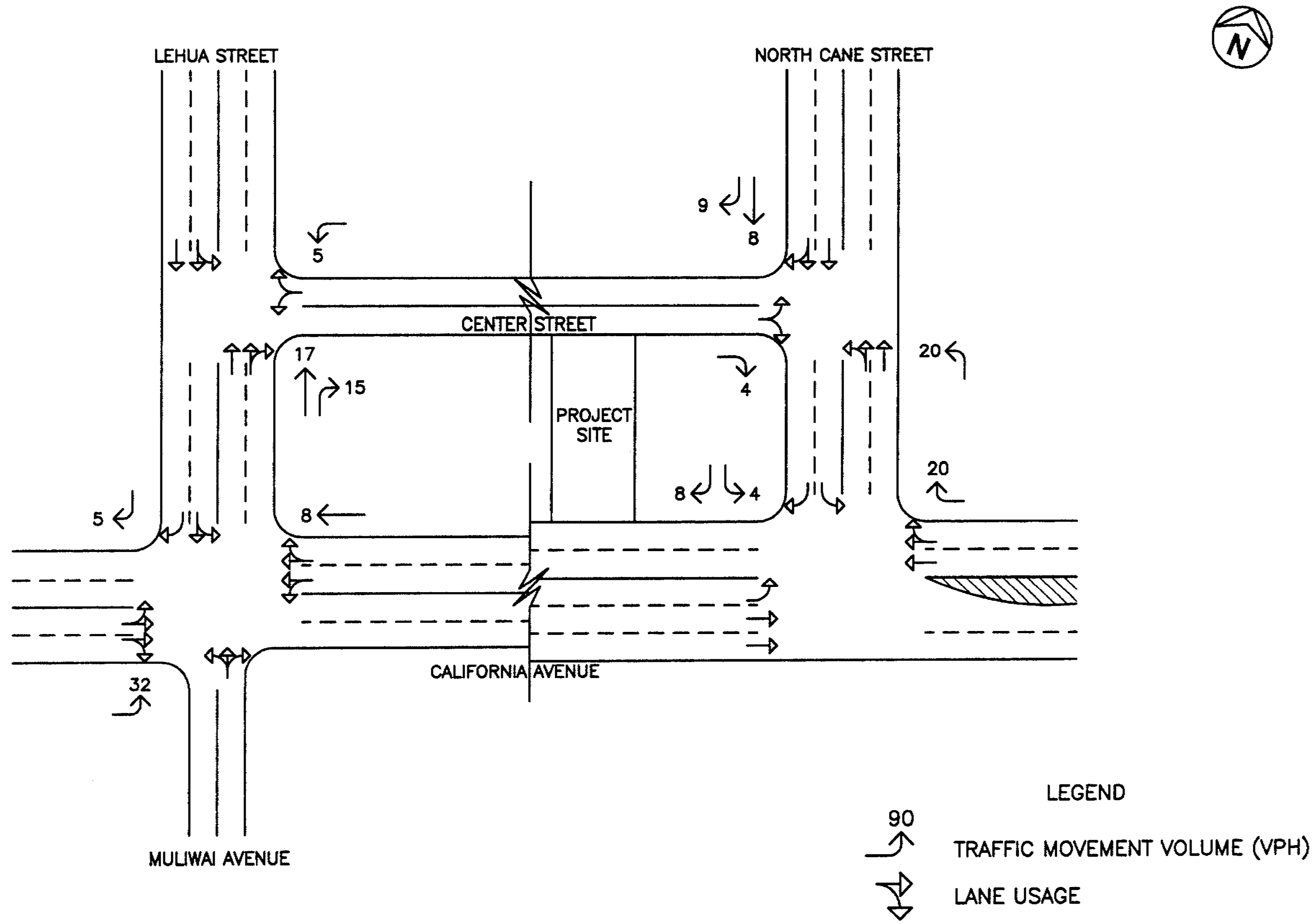
For the purpose of this report, an average annual ambient growth rate of 2.0% per year was conservatively assumed for all movements at the study intersections although the area has not experienced significant growth. As such, using 2008 as the Base Year, a growth rate factor of 1.04 was applied to the existing through traffic demands along California Avenue, North Cane Street, Lehua Street, and Center Street to achieve the projected Year 2010 traffic demands.

C. Other Considerations

With the development of the Wahiawa Transit Center, adjustments to public bus service are expected in the vicinity. The proposed service plans for the Wahiawa Transit Center is shown in Table 2 and is based on information provided in *Oahu Transit Centers, Traffic Impact Analysis and Environmental Analysis,* prepared for the City and County of Honolulu, dated June 2002, and in consultation with the City Department of Transportation Services. Also based on the aforementioned document are the bus service routes that identify inbound buses to head eastbound on California Avenue, turn left onto Lehua Street, turn right on Kilani Avenue, turn right on North Cane Street, and either proceed to Center Street or continue and turn right on California Avenue. It is expected that buses are able to access both California Avenue and Center Street for outbound trips. Figures 5 and 6 show the distribution of cumulative site-generated vehicular trips at the study intersections during the AM and PM peak hours based on the proposed bus service plans and park and ride facility.

Table 2: AM and PM Peak Hour Bus Service

Wahiawa Transit Center					
Route No.	EXISTING		PROPOSED		
	Headway (min)	Buses per Hour	Headway (min)	Buses per Hour	Trip Ends
52	30	4	30	4	8
62	30	4	30	4	8
83	Varies	1	-	-	-
83A	Varies	1	-	-	-
CE-E	-	-	30	2	4
50	-	-	30	2	4
51	-	-	60	1	2
511	-	-	60	1	2
512	-	-	60	1	2
513	-	-	60	1	2
514	-	-	60	1	2

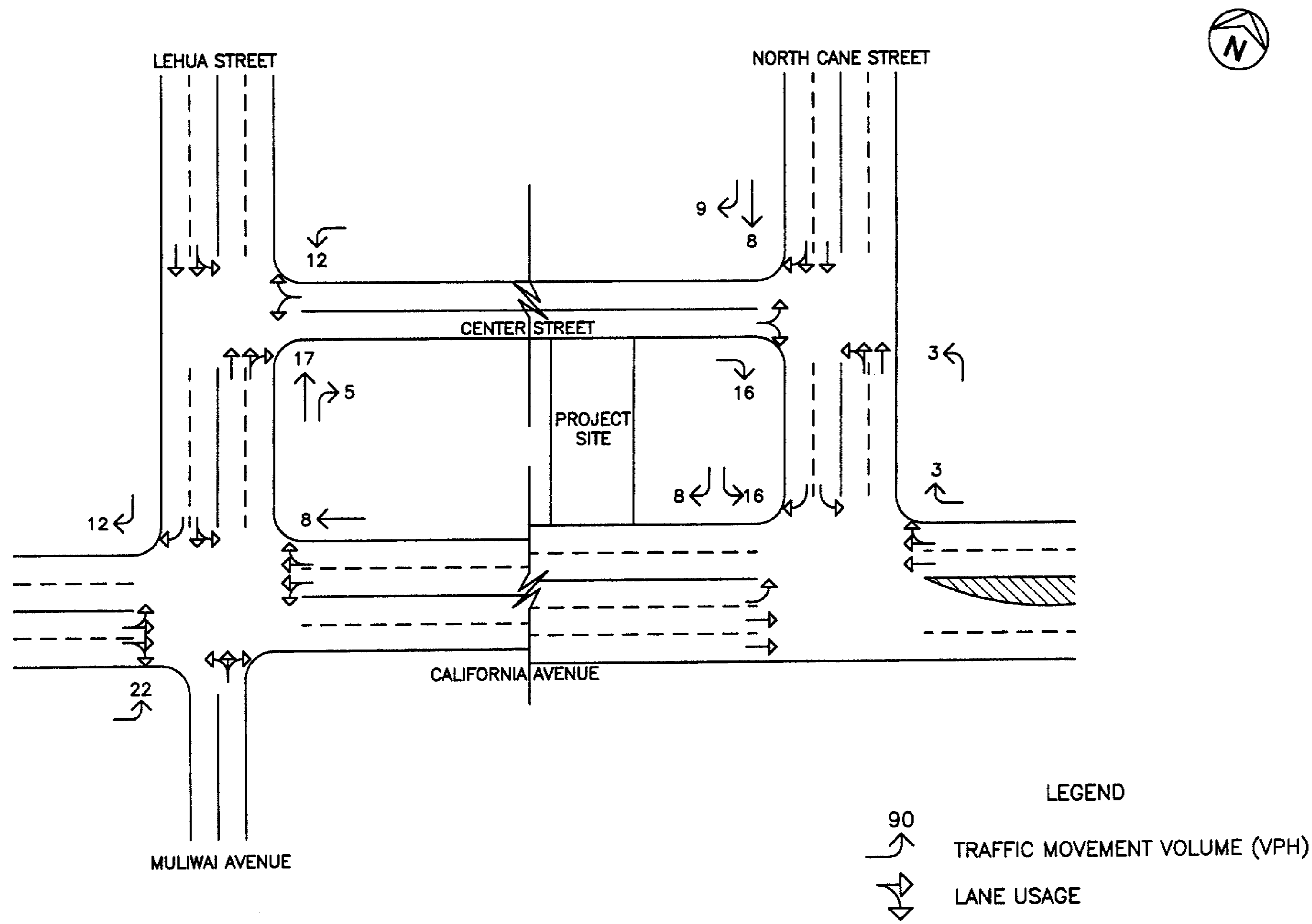


WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

WAHIAWA TRANSIT CENTER

SITE-GENERATED TRAFFIC
AM PEAK HOUR

FIGURE 5



WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

WAHIAWA TRANSIT CENTER

SITE-GENERATED TRAFFIC
PM PEAK HOUR

FIGURE 6

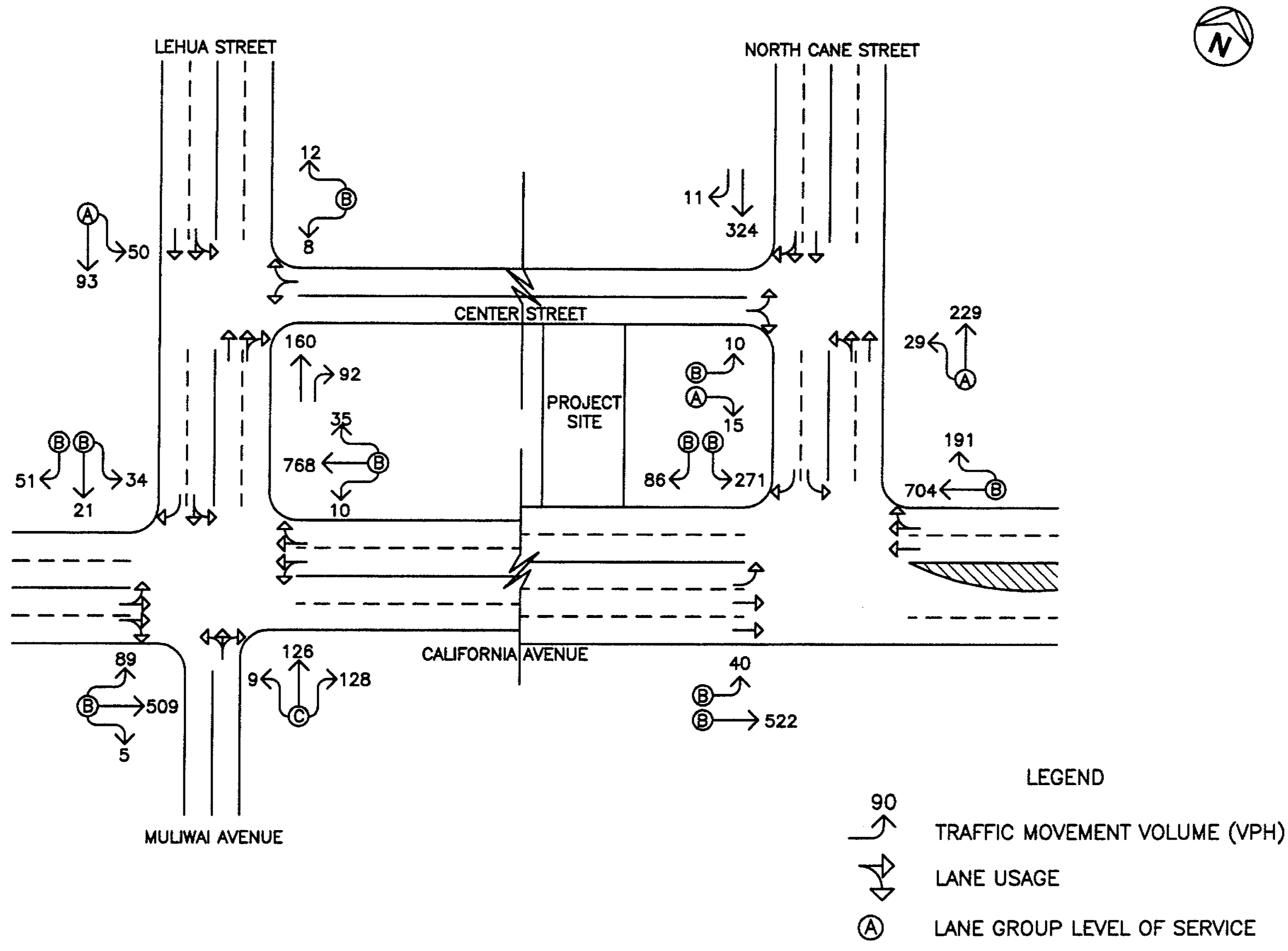
D. Total Traffic Volumes Without Project

The projected Year 2010 AM and PM peak hour traffic volumes and operating conditions in the project vicinity without the proposed Wahiawa Transit Center and associated facilities are shown on Figures 7 and 8, and summarized in Table 3. The existing levels of service are provided for comparison purposes. LOS calculations are included in Appendix D.

Table 3: Existing and Projected (Without Project) LOS Traffic Operating Conditions

Intersection	Traffic Movement Lane Group		AM		PM	
			Exist	Year 2010 w/out Proj	Exist	Year 2010 w/out Proj
California Ave/ Lehua Street/ Muliwai Ave	Eastbound	LT-TH-RT	B	B	B	B
	Westbound	LT-TH-RT	B	B	B	B
	Northbound	LT-TH-RT	B	C	B	B
	Southbound	LT-TH	B	B	B	B
		RT	B	B	B	B
California Ave/ North Cane St	Eastbound	LT	B	B	C	C
		TH	B	B	B	B
	Westbound	TH-RT	B	B	B	B
	Southbound	LT	B	B	B	B
		RT	B	B	B	B
Center St/ North Cane St	Eastbound	LT	B	B	B	B
		RT	A	A	A	A
	Northbound	LT-TH	A	A	A	A
Center St/ Lehua St	Westbound	LT-RT	B	B	B	B
	Southbound	LT-TH	A	A	A	A

Under Year 2010 without project conditions, traffic operations in the project vicinity are expected, in general, to remain similar to existing conditions during both peak hours of traffic. At the intersection of California Avenue with Lehua Street and

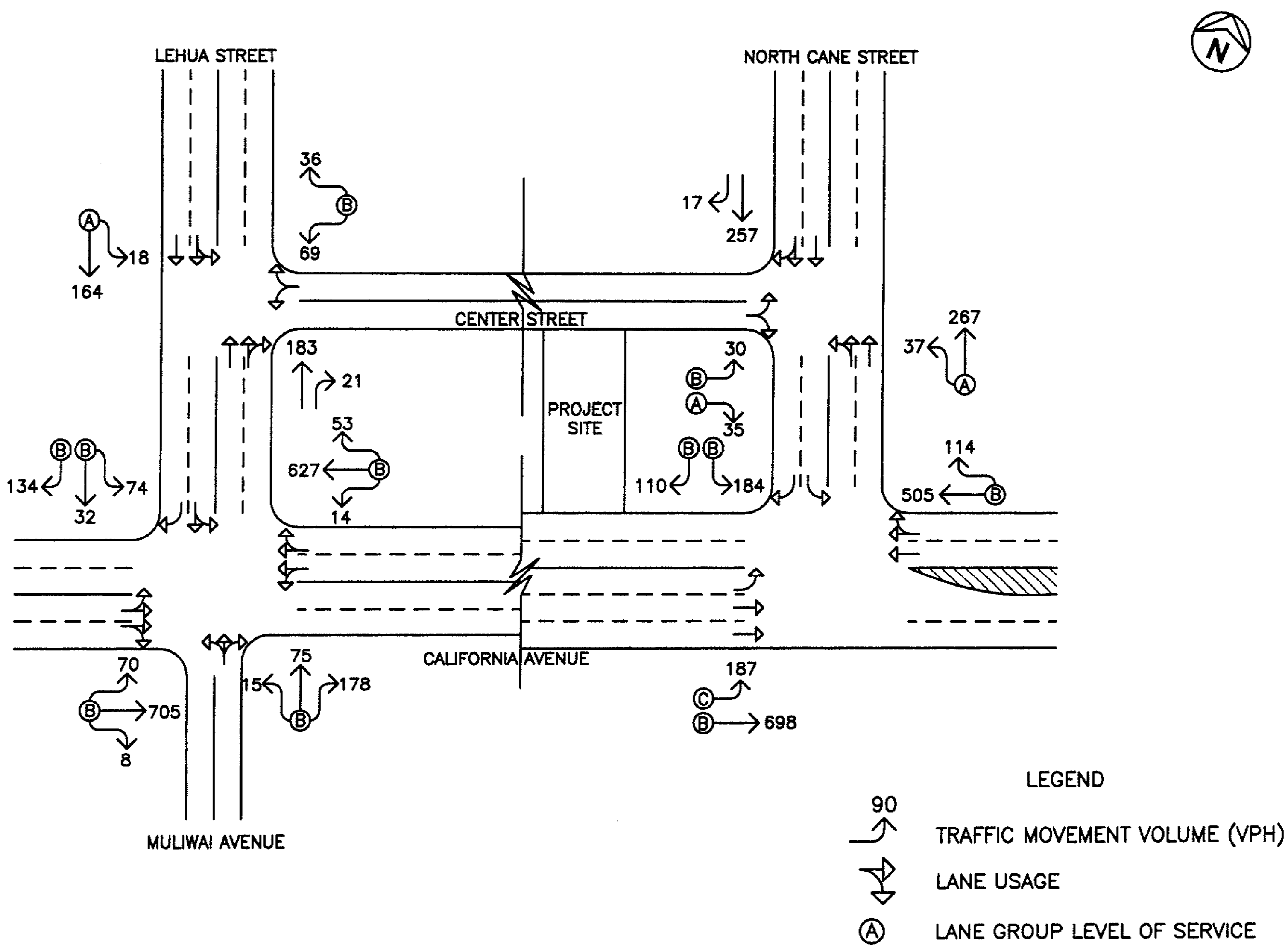


WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

WAHIAWA TRANSIT CENTER

YEAR 2010 AM PEAK HOUR OF TRAFFIC WITHOUT PROJECT

FIGURE 7



WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

WAHIAWA TRANSIT CENTER

YEAR 2010 PM PEAK HOUR OF TRAFFIC WITHOUT PROJECT

FIGURE 8

Muliwai Avenue, the northbound approach of Muliwai Avenue is expected to operate at LOS "C" in Year 2010 without the project from LOS "B" under existing conditions. The decrease in intersection service quality is due to the increase in traffic demands from other movements at the intersection. However, the LOS "C" conditions reflect acceptable operating conditions. The other critical traffic movements at that intersection, as well as, the remaining study intersections are anticipated to continue operating at levels of service similar to existing conditions.

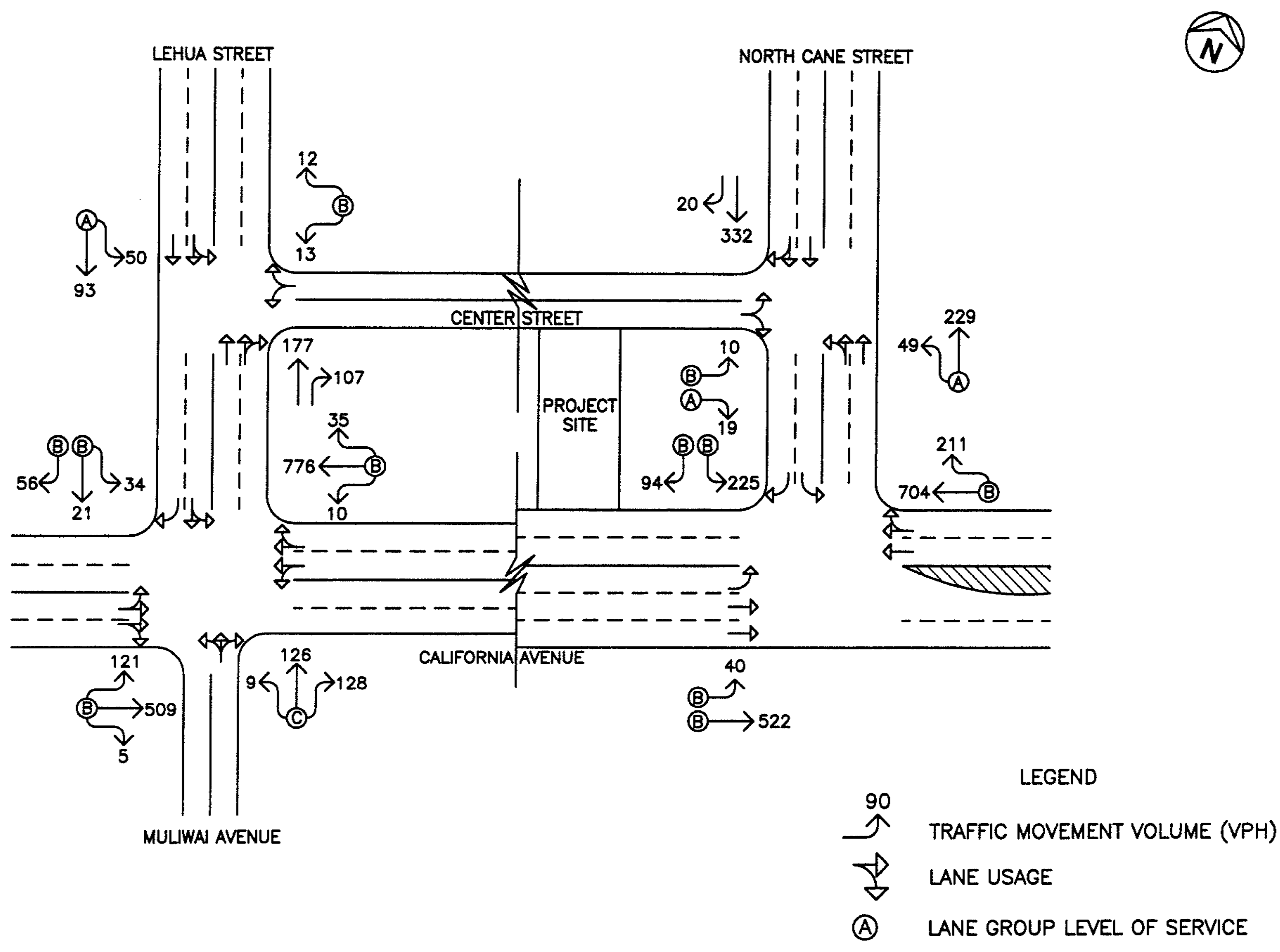
E. Total Traffic Volumes With Project

Figures 9 and 10 show the Year 2010 cumulative AM and PM peak hour traffic conditions resulting from the projected external traffic, the proposed bus service schedule, and the proposed Wahiawa Transit Center, and park-and-ride facility and parking structure. The cumulative volumes consist of site-generated traffic superimposed over Year 2010 projected traffic demands. The traffic impacts resulting from the proposed project are addressed in the following section.

V. TRAFFIC IMPACT ANALYSIS

The Year 2010 cumulative AM and PM peak hour traffic conditions with the proposed Wahiawa Transit Center and parking structure are summarized in Table 4. The existing and projected Year 2010 (Without Project) operating conditions are provided for comparison purposes. LOS calculations are included in Appendix E.

Traffic operations in the project vicinity are expected to remain similar to Year 2010 without project conditions to the surrounding roadway network despite the addition of site-generated vehicles and bus service plan changes. The critical traffic movements at the intersection of California Avenue and Lehua Street/Muliwai Avenue are expected to continue operating at LOS "C" or LOS "B" conditions during both peak periods. Similarly, the individual movements at the intersection of California Avenue and North Cane Street would operate at LOS "C" or better conditions with the proposed project. The intersections of Center Street with North Cane Street and Center Street would continue to operate even better at LOS "B" or LOS "A" conditions.

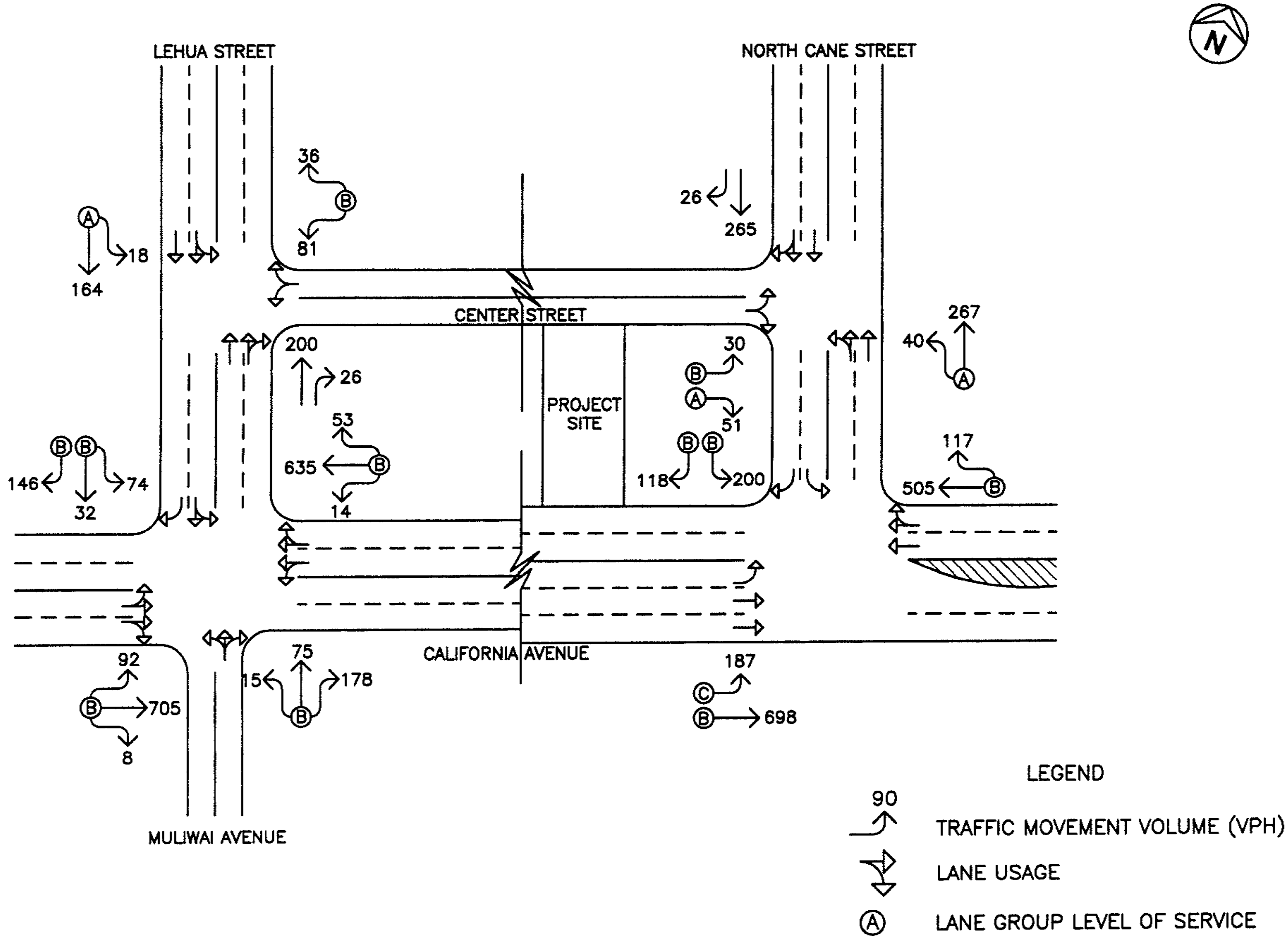


WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

WAHIAWA TRANSIT CENTER

CUMULATIVE YEAR 2010 AM PEAK HOUR OF TRAFFIC WITH PROJECT

FIGURE 9



WILSON OKAMOTO CORPORATION
ENGINEERS · PLANNERS

WAHIAWA TRANSIT CENTER

CUMULATIVE YEAR 2010 PM PEAK HOUR OF TRAFFIC WITH PROJECT

FIGURE 10

Table 4: Existing and Projected (Without and With Project) LOS Traffic Operating Conditions

Intersection	Traffic Movement Lane Group		AM			PM		
			Exist	Year 2010		Exist	Year 2010	
				w/out Proj	w/ Proj		w/out Proj	w/ Proj
California Ave/ Lehua St/ Muliwai Ave	Eastbound	LT-TH-RT	B	B	B	B	B	B
	Westbound	LT-TH-RT	B	B	B	B	B	B
	Northbound	LT-TH-RT	B	C	C	B	B	B
	Southbound	LT-TH	B	B	B	B	B	B
		RT	B	B	B	B	B	B
California Ave/ North Cane St	Eastbound	LT	B	B	B	C	C	C
		TH	B	B	B	B	B	B
	Westbound	TH-RT	B	B	B	B	B	B
	Southbound	LT	B	B	B	B	B	B
		RT	B	B	B	B	B	B
Center St/ North Cane St	Eastbound	LT	B	B	B	B	B	B
		RT	A	A	A	A	A	A
	Northbound	LT-TH	A	A	A	A	A	A
Center St/ Lehua St	Westbound	LT-RT	B	B	B	B	B	B
	Southbound	LT-TH	A	A	A	A	A	A

A. Parking Structure for Proposed Judiciary Center Complex

1. Trip Generation Methodology

The trip generation methodology used in the analysis associated with the proposed Judiciary Center Complex is based upon generally accepted techniques developed by the Institute of Transportation Engineers (ITE) and published in "Trip Generation, 7th Edition," 2003. The ITE trip generation rates are developed empirically by correlating the vehicle trip generation data with various land use characteristics such as the square-footage of a particular development. Since development plans for the proposed Judiciary Center Complex are not available at this writing, the gross floor area of the proposed project was based on the maximum number of 182 parking stalls and resulting maximum floor area meeting the City and County Land Use Ordinances for office use requiring 182 parking stalls. A ratio of one parking stall for every 400 square feet would result in a gross floor area of 72,800 square feet. Therefore, the trip generating characteristics associated with the proposed Judiciary Center Complex for Year 2018 is based on the development of a 72,800 square-feet facility. Table 4 summarizes the project site trip generation values applied to the AM and PM peak hours of traffic to measure the impact resulting from the development.

Table 4: Peak Hour Trip Generation

GENERAL OFFICE INDEPENDENT VARIABLE:		1,000 SF GFA = 72.8
		PROJECTED TRIP ENDS
AM PEAK	ENTER	99
	EXIT	14
	TOTAL	113
PM PEAK	ENTER	18
	EXIT	90
	TOTAL	108

2. Trip Distribution

Primary access for vehicles to the proposed parking structure as a result of the Judiciary Center Complex is expected along Center Street. All trips associated with the project, hence, vehicular trips associated with the parking structure were assumed to utilize this driveway. The directional distribution of site-generated vehicles at the study intersections was assumed to follow the prevailing traffic demands and patterns associated with the peak hours of traffic.

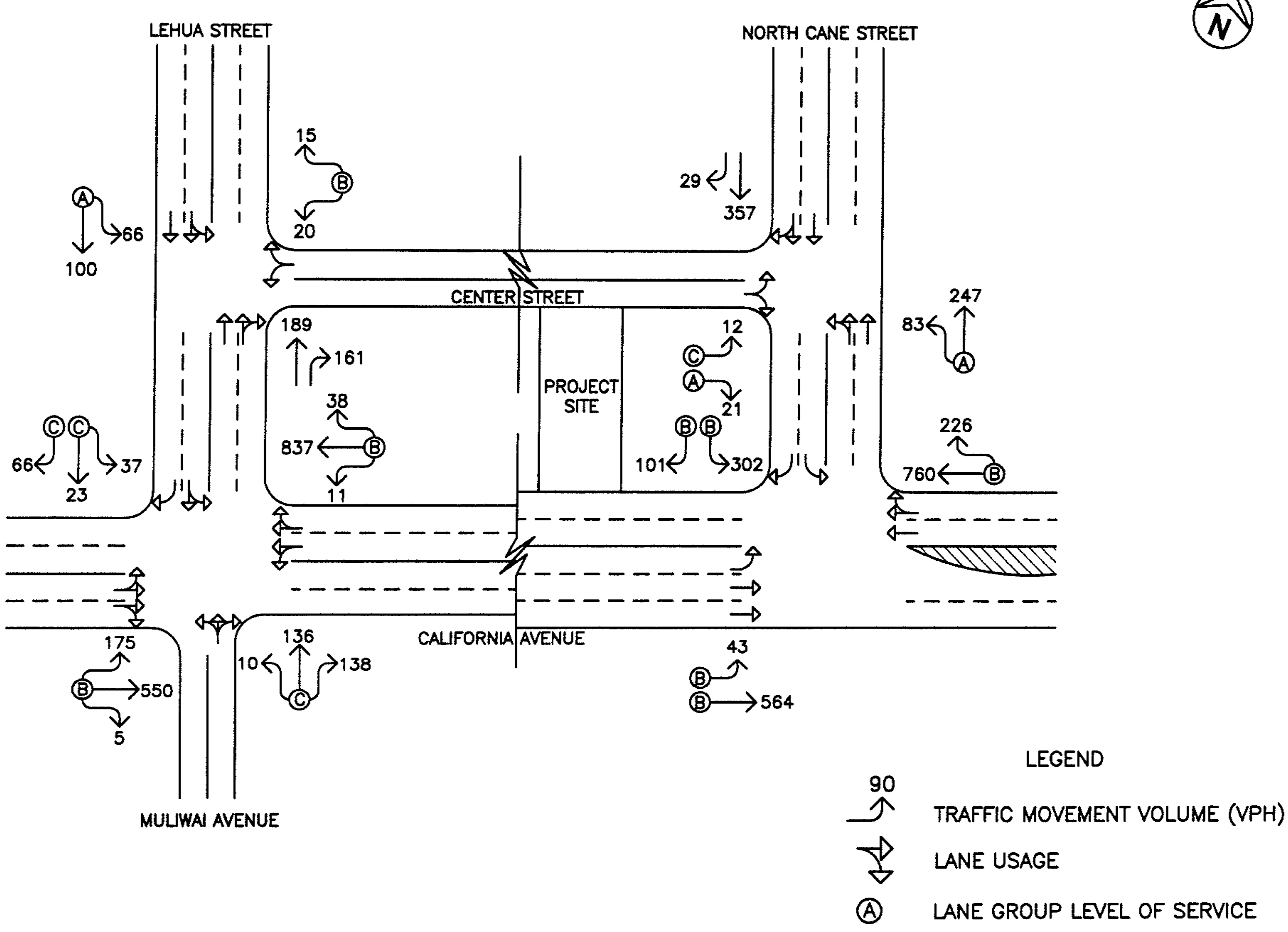
3. Through Traffic Forecasting Methodology

Although it is not expected that significant traffic growth in the vicinity would occur in the near future, an average annual ambient growth rate of 1.0% per year was conservatively assumed for all movements at the study intersections. As such, using the build-out of the Wahiawa Transit Center Development in Year 2010 as the Base Year, a growth rate factor of 1.08 was applied to the existing traffic demands along California Avenue, North Cane Street, Lehua Street, and Center Street to achieve the projected Year 2018 traffic demands.

4. Future Conditions Associated with the Proposed Judiciary Center Complex

Traffic operations in the project vicinity for Year 2018 with the proposed parking structure supporting the anticipated future Judiciary Center Complex are expected to remain similar to Year 2010 cumulative traffic conditions, and is shown in Figures 11 and 12. The critical traffic movements at the intersection of California Avenue and Lehua Street/Muliwai Avenue are expected to continue operating at LOS "C" or LOS "B" conditions during both peak periods. Similarly, the individual movements at the intersection of California Avenue and North Cane Street would operate at LOS "C" or better conditions under future conditions. The intersections of Center Street with North Cane Street and Center Street would also continue to operate at LOS "C" or better conditions.

The Year 2018 AM and PM peak hour traffic conditions with the proposed Wahiawa Transit Center, parking structure, and anticipated Judiciary Center Complex are summarized in Table 5. The projected Year 2010 operating conditions are provided for comparison purposes. LOS calculations are included in Appendix F.

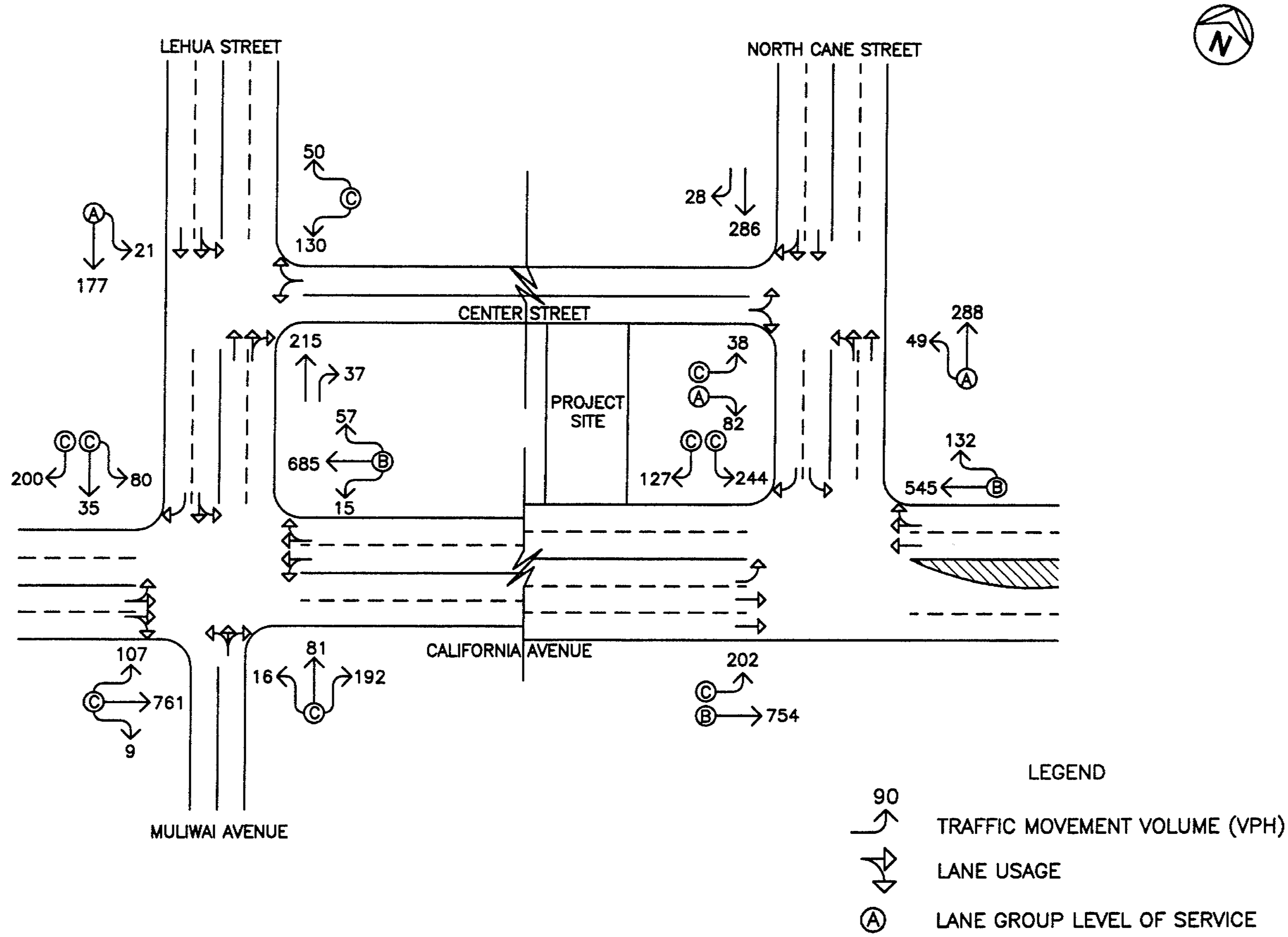


WILSON OKAMOTO CORPORATION ENGINEERS · PLANNERS

WAHIAWA TRANSIT CENTER

YEAR 2018 AM PEAK HOUR OF TRAFFIC
WITH PROJECT AND PARKING STRUCTURE

FIGURE
11



WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

WAHIAWA TRANSIT CENTER

YEAR 2018 PM PEAK HOUR OF TRAFFIC WITH PROJECT AND PARKING STRUCTURE

FIGURE 12

Table 5: Year 2018 Projected LOS

Intersection	Traffic Movement Lane Group		AM		PM	
			Year 2010 with WTC	Year 2018 with JCC	Year 2010 with WTC	Year 2018 with JCC
California Ave/ Lehua Street/ Muliwai Ave	Eastbound	LT-TH-RT	B	B	B	C
	Westbound	LT-TH-RT	B	B	B	B
	Northbound	LT-TH-RT	C	C	B	C
	Southbound	LT-TH	B	C	B	C
		RT	B	C	B	C
California Ave/ North Cane St	Eastbound	LT	B	B	C	C
		TH	B	B	B	B
	Westbound	TH-RT	B	B	B	B
	Southbound	LT	B	B	B	C
		RT	B	B	B	C
Center St/ North Cane St	Eastbound	LT	B	C	B	C
		RT	A	A	A	A
	Northbound	LT-TH	A	A	A	A
Center St/ Lehua St	Westbound	LT-RT	B	B	B	C
	Southbound	LT-TH	A	A	A	A

Note: WTC = Wahiawa Transit Center
JCC = Judiciary Center Complex

VI. RECOMMENDATIONS

Based on the analysis of the traffic data, the following are the recommendations of this study:

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

2. Maintain adequate on-site loading and off-loading service areas and prohibit off-site loading operations on public streets.

3. If applicable, maintain adequate turn-around area for service, delivery, and refuse collection vehicles to maneuver on the project site to avoid vehicle-reversing maneuvers onto public roadways.

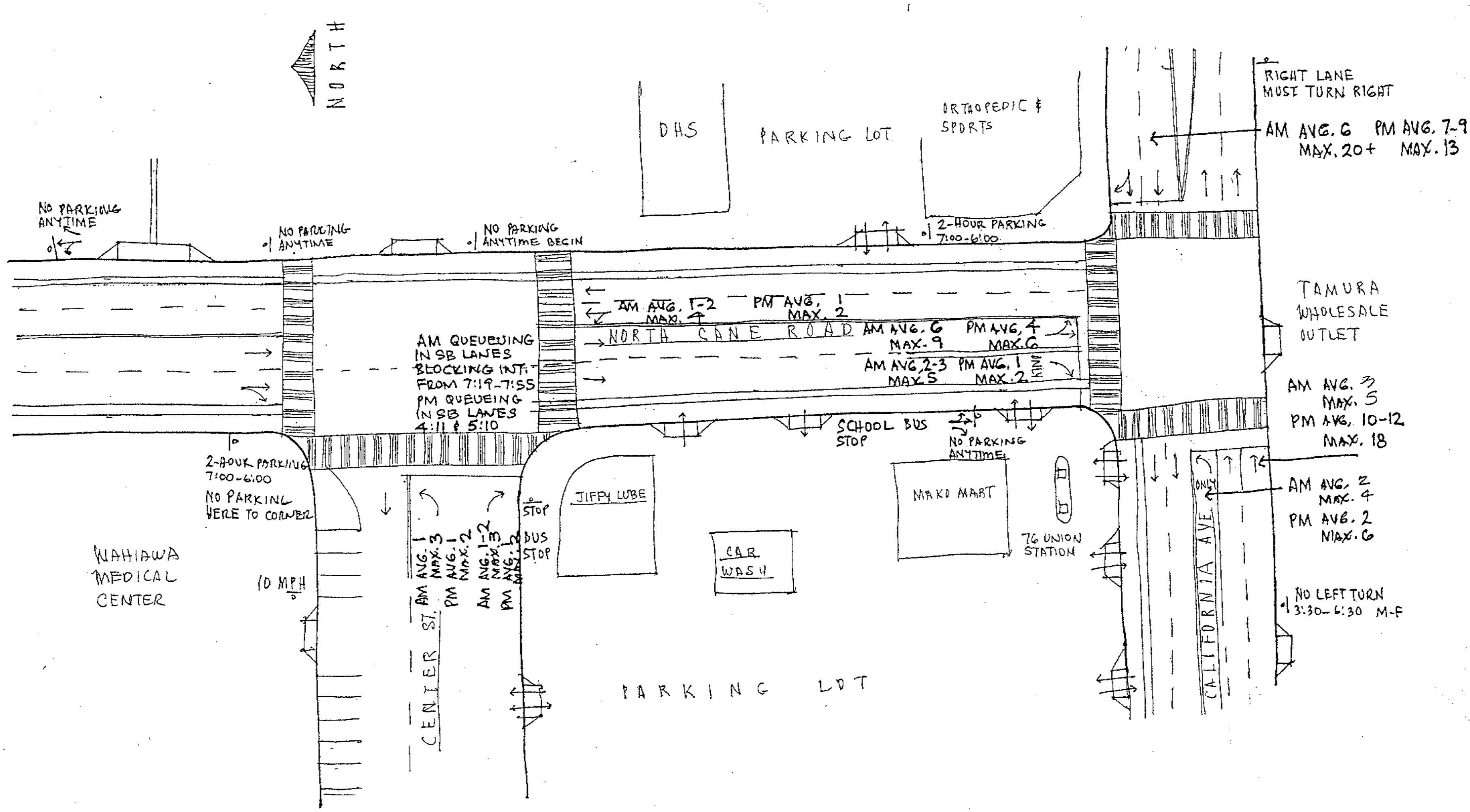
4. Maintain sufficient turning radii at all project driveways/roadways to avoid or minimize vehicle encroachments to oncoming traffic lanes by buses and passenger vehicles.

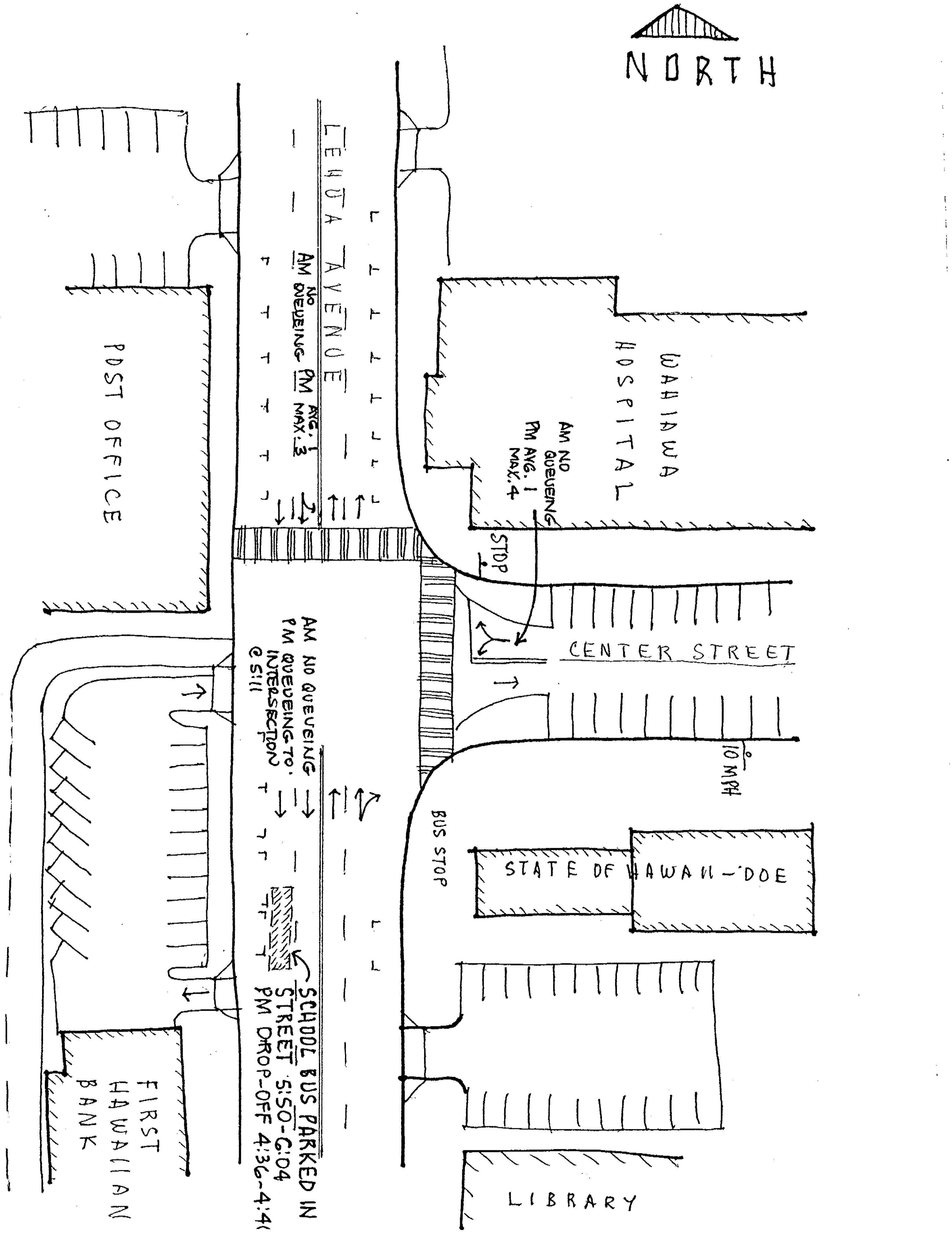
VII. CONCLUSION

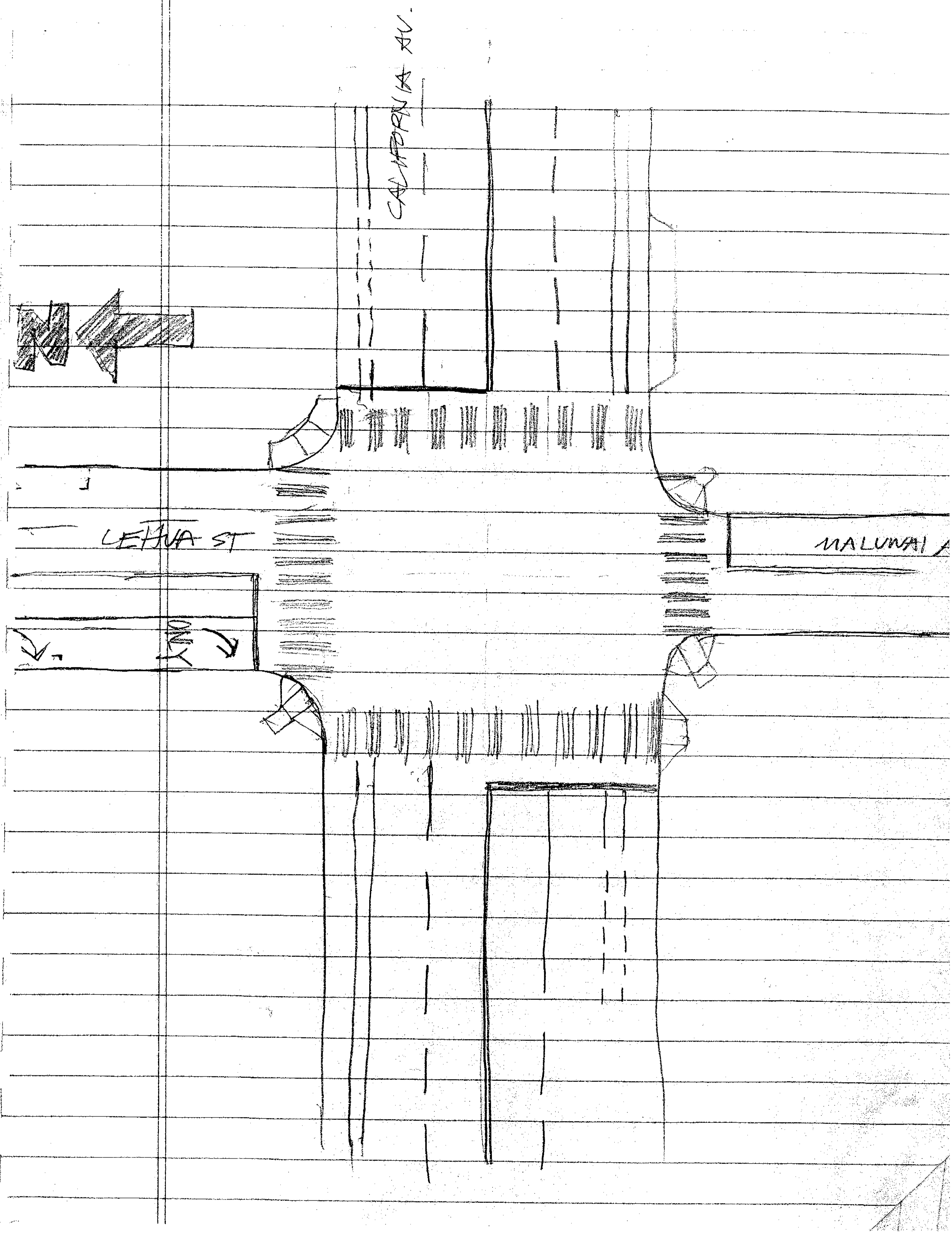
The proposed Wahiawa Transit Center and parking structure would provide increased bus service and convenient parking. Traffic volumes on the roadways surrounding the project site will increase as a result of the project. However, traffic operations of individual movements at intersections would operate adequately at LOS "C" or better conditions. The traffic volumes at the major intersections in the vicinity of the project along California Avenue would increase by 2.0% at Lehua Street and Muliwai Avenue, and by 1.8% at North Cane Street during the projected Year 2010 conditions with the proposed project. During the PM peak hour conditions, the intersections of California Avenue with Lehua Street and Muliwai Avenue would increase by 1.7% while the intersection of California Avenue and North Cane Street increase by 1.5%. These minimal increases would result in similar levels of service to projected conditions without the proposed project as well as existing conditions. Similarly, Year 2018 traffic conditions are expected to operate at acceptable levels of service. As such, with the implementation of the aforementioned recommendations, the proposed Wahiawa Transit Center and parking structure are not expected to have a significant impact on traffic operations in the project vicinity.

APPENDIX A

FIELD NOTES AND EXISTING TRAFFIC COUNT DATA


NORTH
DHS
PARKING LOT
ORTHOPEDIC & SPORTS
RIGHT LANE MUST TURN RIGHT
AM AVG. 6 MAX. 20+
PM AVG. 7-9 MAX. 13
NO PARKING ANYTIME
NO PARKING ANYTIME
NO PARKING ANYTIME BEGIN
2-HOUR PARKING 7:00-6:00
TAMURA WHOLESALE OUTLET
AM AVG. 1-2 MAX. 4
PM AVG. 1 MAX. 2
NORTH CANE ROAD
AM AVG. 6 MAX. 9
PM AVG. 4 MAX. 6
AM AVG. 2-3 MAX. 5
PM AVG. 1 MAX. 2
ONLY
AM QUEUEING IN SB LANES BLOCKING INT. FROM 7:19-7:55
PM QUEUEING IN SB LANES 4:11 & 5:10
AM AVG. 3 MAX. 5
PM AVG. 10-12 MAX. 18
SCHOOL BUS STOP
NO PARKING ANYTIME
2-HOUR PARKING 7:00-6:00
NO PARKING HERE TO CORNER
STOP
BUS STOP
JIFFY LUBE
CAR WASH
MAKO MART
76 UNION STATION
AM AVG. 2 MAX. 4
PM AVG. 2 MAX. 6
ONLY
CALIFORNIA AVE
NO LEFT TURN 3:30-6:30 M-F
WAHIAWA MEDICAL CENTER
10 MPH
AM AVG. 1 MAX. 3
PM AVG. 1 MAX. 2
AM AVG. 1-2 MAX. 3
PM AVG. 1 MAX. 2
CENTER ST.
PARKING LOT


NORTH
LEHUA AVENUE
AM NO QUEUEING
PM AVG. 1
MAX. 3
POST OFFICE
WAHIAWA
HOSPITAL
AM NO
QUEUEING
PM AVG. 1
MAX. 4
STOP
CENTER STREET
10 MPH
AM NO QUEUEING
PM QUEUEING TO
INTERSECTION
@ 5:11
BUS STOP
STATE OF HAWAII - DOE
SCHOOL BUS PARKED IN
STREET 5:50-6:04
PM DROP-OFF 4:36-4:4
FIRST
HAWAIIAN
BANK
LIBRARY


CALIFORNIA AV.
LEHUA ST
MALUWAI
ONLY

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-5675, D4-3891
Counted:ER, MM
Weather:Clear

File Name : CalLeh AM
Site Code : 00000001
Start Date : 9/30/2008
Page No : 1

Groups Printed- Unshifted

	Lehua Street Southbound					California Avenue Westbound					Muliwai Avenue Northbound					California Avenue Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
06:00 AM	1	2	13	5	21	12	144	6	1	163	0	8	9	5	22	12	34	1	3	50	256
06:15 AM	0	1	5	5	11	11	140	10	3	164	2	11	5	1	19	7	41	1	0	49	243
06:30 AM	2	2	6	6	16	6	152	8	1	167	0	4	8	4	16	22	66	3	4	95	294
06:45 AM	3	3	9	1	16	6	152	9	1	168	0	7	14	13	34	22	72	0	0	94	312
Total	6	8	33	17	64	35	588	33	6	662	2	30	36	23	91	63	213	5	7	288	1105
07:00 AM	6	3	8	4	21	4	144	3	3	154	1	18	16	9	44	16	96	1	1	114	333
07:15 AM	4	5	12	3	24	2	209	7	1	219	2	30	38	13	83	24	113	2	7	146	472
07:30 AM	7	8	15	3	33	2	183	12	4	201	3	31	33	7	74	20	131	1	4	156	464
07:45 AM	16	4	14	9	43	2	202	12	2	218	3	42	36	16	97	26	149	1	10	186	544
Total	33	20	49	19	121	10	738	34	10	792	9	121	123	45	298	86	489	5	22	602	1813
Grand Total	39	28	82	36	185	45	1326	67	16	1454	11	151	159	68	389	149	702	10	29	890	2918
Apprch %	21.1	15.1	44.3	19.5		3.1	91.2	4.6	1.1		2.8	38.8	40.9	17.5		16.7	78.9	1.1	3.3		
Total %	1.3	1	2.8	1.2	6.3	1.5	45.4	2.3	0.5	49.8	0.4	5.2	5.4	2.3	13.3	5.1	24.1	0.3	1	30.5	

	Lehua Street Southbound					California Avenue Westbound					Muliwai Avenue Northbound					California Avenue Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 07:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	6	3	8	4	21	**4**	144	3	3	154	1	18	16	9	44	16	96	1	1	114	333
07:15 AM	4	5	12	3	24	2	**209**	7	1	**219**	2	30	**38**	13	83	24	113	**2**	7	146	472
07:30 AM	7	**8**	**15**	3	33	2	183	**12**	**4**	201	**3**	31	33	7	74	20	131	1	4	156	464
07:45 AM	**16**	4	14	**9**	**43**	2	202	12	2	218	3	**42**	36	**16**	**97**	**26**	**149**	1	**10**	**186**	**544**
Total Volume	33	20	49	19	121	10	738	34	10	792	9	121	123	45	298	86	489	5	22	602	1813
% App. Total	27.3	16.5	40.5	15.7		1.3	93.2	4.3	1.3		3	40.6	41.3	15.1		14.3	81.2	0.8	3.7		
PHF	.516	.625	.817	.528	.703	.625	.883	.708	.625	.904	.750	.720	.809	.703	.768	.827	.820	.625	.550	.809	.833

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-5675, D4-3891
Counted:ER, MM
Weather:Clear

File Name : CalLeh PM
Site Code : 00000001
Start Date : 9/30/2008
Page No : 1

Groups Printed- Unshifted

	Lehua Street Southbound					California Avenue Westbound					Muliwai Avenue Northbound					California Avenue Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
04:00 PM	19	9	29	8	65	2	148	12	5	167	3	12	35	13	63	16	182	1	4	203	498
04:15 PM	17	4	24	2	47	5	161	8	3	177	3	21	43	9	76	15	188	2	6	211	511
04:30 PM	20	12	50	4	86	4	166	16	1	187	4	19	44	7	74	14	161	2	0	177	524
04:45 PM	15	6	26	1	48	2	128	15	5	150	4	20	49	11	84	22	147	3	4	176	458
Total	71	31	129	15	246	13	603	51	14	681	14	72	171	40	297	67	678	8	14	767	1991
05:00 PM	27	7	24	2	60	0	138	12	1	151	1	13	49	8	71	21	183	0	2	206	488
05:15 PM	23	7	23	3	56	3	157	16	7	183	2	7	42	9	60	15	145	0	0	160	459
05:30 PM	13	4	15	4	36	2	145	10	2	159	0	27	48	17	92	12	147	4	0	163	450
05:45 PM	20	4	15	10	49	5	148	13	6	172	2	8	48	13	71	11	147	1	6	165	457
Total	83	22	77	19	201	10	588	51	16	665	5	55	187	47	294	59	622	5	8	694	1854
Grand Total	154	53	206	34	447	23	1191	102	30	1346	19	127	358	87	591	126	1300	13	22	1461	3845
Apprch %	34.5	11.9	46.1	7.6		1.7	88.5	7.6	2.2		3.2	21.5	60.6	14.7		8.6	89	0.9	1.5		
Total %	4	1.4	5.4	0.9	11.6	0.6	31	2.7	0.8	35	0.5	3.3	9.3	2.3	15.4	3.3	33.8	0.3	0.6	38	

	Lehua Street Southbound					California Avenue Westbound					Muliwai Avenue Northbound					California Avenue Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:00 PM																					
04:00 PM	19	9	29	**8**	65	2	148	12	**5**	167	3	12	35	**13**	63	16	182	1	4	203	498
04:15 PM	17	4	24	2	47	**5**	161	8	3	177	3	**21**	43	9	76	15	**188**	2	**6**	**211**	511
04:30 PM	**20**	**12**	**50**	4	**86**	4	**166**	**16**	1	**187**	**4**	19	44	7	74	14	161	2	0	177	**524**
04:45 PM	15	6	26	1	48	2	128	15	5	150	4	20	**49**	11	**84**	**22**	147	**3**	4	176	458
Total Volume	71	31	129	15	246	13	603	51	14	681	14	72	171	40	297	67	678	8	14	767	1991
% App. Total	28.9	12.6	52.4	6.1		1.9	88.5	7.5	2.1		4.7	24.2	57.6	13.5		8.7	88.4	1	1.8		
PHF	.888	.646	.645	.469	.715	.650	.908	.797	.700	.910	.875	.857	.872	.769	.884	.761	.902	.667	.583	.909	.950

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-3891, D4-5675
Counted:ER, MM
Weather:Clear

File Name : CalCan AM
Site Code : 00000001
Start Date : 9/25/2008
Page No : 1

Groups Printed- Unshifted

	North Cane Street Southbound					California Avenue Westbound					Northbound	California Avenue Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
06:00 AM	14	1	12	0	27	0	131	16	0	147	0	10	24	0	1	35	209
06:15 AM	26	0	10	1	37	0	119	12	1	132	0	8	39	0	4	51	220
06:30 AM	23	0	21	4	48	0	135	30	1	166	0	13	39	0	4	56	270
06:45 AM	40	1	15	1	57	0	155	34	0	189	0	4	77	0	8	89	335
Total	103	2	58	6	169	0	540	92	2	634	0	35	179	0	17	231	1034
07:00 AM	60	0	21	3	84	0	148	41	1	190	0	9	115	0	3	127	401
07:15 AM	81	0	20	1	102	0	184	55	0	239	0	12	150	0	13	175	516
07:30 AM	80	0	27	1	108	0	190	54	0	244	0	13	160	0	3	176	528
07:45 AM	87	0	25	2	114	0	233	50	1	284	0	7	153	0	6	166	564
Total	308	0	93	7	408	0	755	200	2	957	0	41	578	0	25	644	2009
Grand Total	411	2	151	13	577	0	1295	292	4	1591	0	76	757	0	42	875	3043
Apprch %	71.2	0.3	26.2	2.3		0	81.4	18.4	0.3			8.7	86.5	0	4.8		
Total %	13.5	0.1	5	0.4	19	0	42.6	9.6	0.1	52.3	0	2.5	24.9	0	1.4	28.8	

	North Cane Street Southbound					California Avenue Westbound					Northbound	California Avenue Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 07:30 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 06:45 AM																	
06:45 AM	40	**1**	15	1	57	0	155	34	0	189	0	4	77	0	8	89	335
07:00 AM	60	0	21	**3**	84	0	148	41	**1**	190	0	9	115	0	3	127	401
07:15 AM	**81**	0	20	1	102	0	184	**55**	0	239	0	12	150	0	**13**	175	516
07:30 AM	80	0	**27**	1	**108**	0	**190**	54	0	**244**	0	**13**	**160**	0	3	**176**	**528**
Total Volume	261	1	83	6	351	0	677	184	1	862	0	38	502	0	27	567	1780
% App. Total	74.4	0.3	23.6	1.7		0	78.5	21.3	0.1			6.7	88.5	0	4.8		
PHF	.806	.250	.769	.500	.813	.000	.891	.836	.250	.883	.000	.731	.784	.000	.519	.805	.843

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-5675, D4-3891
Counted:MM, RY
Weather:Clear

File Name : CalCan PM
Site Code : 00000001
Start Date : 9/25/2008
Page No : 1

Groups Printed- Unshifted

	North Cane Street Southbound					California Avenue Westbound					Northbound	California Avenue Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
04:00 PM	54	0	30	0	84	0	133	30	1	164	0	45	182	0	9	236	484
04:15 PM	42	0	30	2	74	0	142	35	7	184	0	42	162	0	4	208	466
04:30 PM	37	0	35	0	72	0	100	19	1	120	0	54	177	0	6	237	429
04:45 PM	44	0	11	1	56	0	111	26	0	137	0	39	150	0	0	189	382
Total	177	0	106	3	286	0	486	110	9	605	0	180	671	0	19	870	1761
05:00 PM	41	0	22	3	66	0	134	23	3	160	0	37	165	0	2	204	430
05:15 PM	32	0	24	4	60	0	118	21	2	141	0	41	142	0	7	190	391
05:30 PM	37	0	21	0	58	0	118	16	8	142	0	39	183	0	4	226	426
05:45 PM	43	0	17	4	64	0	117	17	8	142	0	41	161	0	10	212	418
Total	153	0	84	11	248	0	487	77	21	585	0	158	651	0	23	832	1665
Grand Total	330	0	190	14	534	0	973	187	30	1190	0	338	1322	0	42	1702	3426
Apprch %	61.8	0	35.6	2.6		0	81.8	15.7	2.5			19.9	77.7	0	2.5		
Total %	9.6	0	5.5	0.4	15.6	0	28.4	5.5	0.9	34.7	0	9.9	38.6	0	1.2	49.7	

	North Cane Street Southbound					California Avenue Westbound					Northbound	California Avenue Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:00 PM																	
04:00 PM	**54**	0	30	0	**84**	0	133	30	1	164	0	45	**182**	0	**9**	236	**484**
04:15 PM	42	0	30	**2**	74	0	**142**	**35**	**7**	**184**	0	42	162	0	4	208	466
04:30 PM	37	0	**35**	0	72	0	100	19	1	120	0	**54**	177	0	6	**237**	429
04:45 PM	44	0	11	1	56	0	111	26	0	137	0	39	150	0	0	189	382
Total Volume	177	0	106	3	286	0	486	110	9	605	0	180	671	0	19	870	1761
% App. Total	61.9	0	37.1	1		0	80.3	18.2	1.5			20.7	77.1	0	2.2		
PHF	.819	.000	.757	.375	.851	.000	.856	.786	.321	.822	.000	.833	.922	.000	.528	.918	.910

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-5676
Counted:TO
Weather:Clear

File Name : CenCan AM
Site Code : 00000001
Start Date : 9/25/2008
Page No : 1

Groups Printed- Unshifted

	North Cane Street Southbound					Westbound	North Cane Street Northbound					Center Street Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
06:00 AM	0	19	3	1	23	0	3	19	0	0	22	2	0	6	7	15	60
06:15 AM	0	31	3	3	37	0	3	15	0	0	18	2	0	4	5	11	66
06:30 AM	0	39	3	10	52	0	6	35	0	0	41	3	0	5	7	15	108
06:45 AM	0	44	5	5	54	0	5	31	1	0	37	3	0	5	3	11	102
Total	0	133	14	19	166	0	17	100	1	0	118	10	0	20	22	52	336
07:00 AM	0	63	2	7	72	0	8	41	0	0	49	3	0	2	8	13	134
07:15 AM	0	85	2	3	90	0	6	56	0	0	62	6	0	2	6	14	166
07:30 AM	0	81	3	3	87	0	2	58	0	0	60	6	0	8	1	15	162
07:45 AM	0	83	4	4	91	0	12	65	0	0	77	10	0	14	7	31	199
Total	0	312	11	17	340	0	28	220	0	0	248	25	0	26	22	73	661
Grand Total	0	445	25	36	506	0	45	320	1	0	366	35	0	46	44	125	997
Apprch %	0	87.9	4.9	7.1			12.3	87.4	0.3	0		28	0	36.8	35.2		
Total %	0	44.6	2.5	3.6	50.8	0	4.5	32.1	0.1	0	36.7	3.5	0	4.6	4.4	12.5	

	North Cane Street Southbound					Westbound	North Cane Street Northbound					Center Street Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 07:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	0	63	2	**7**	72	0	8	41	0	0	49	3	0	2	**8**	13	134
07:15 AM	0	**85**	2	3	90	0	6	56	0	0	62	6	0	2	6	14	166
07:30 AM	0	81	3	3	87	0	2	58	0	0	60	6	0	8	1	15	162
07:45 AM	0	83	**4**	4	**91**	0	**12**	**65**	0	0	**77**	**10**	0	**14**	7	**31**	**199**
Total Volume	0	312	11	17	340	0	28	220	0	0	248	25	0	26	22	73	661
% App. Total	0	91.8	3.2	5			11.3	88.7	0	0		34.2	0	35.6	30.1		
PHF	.000	.918	.688	.607	.934	.000	.583	.846	.000	.000	.805	.625	.000	.464	.688	.589	.830

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-5676
Counted:TO
Weather:Clear

File Name : CenCan PM
Site Code : 00000001
Start Date : 9/25/2008
Page No : 1

Groups Printed- Unshifted

	North Cane Street Southbound					Westbound	North Cane Street Northbound					Center Street Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
04:00 PM	0	76	4	8	88	0	8	67	0	0	75	11	0	11	11	33	196
04:15 PM	0	64	5	10	79	0	10	72	0	0	82	3	0	4	9	16	177
04:30 PM	0	61	4	8	73	0	10	62	0	0	72	9	0	11	10	30	175
04:45 PM	0	46	3	2	51	0	8	56	0	0	64	6	1	8	0	15	130
Total	0	247	16	28	291	0	36	257	0	0	293	29	1	34	30	94	678
05:00 PM	0	56	5	6	67	0	7	54	0	0	61	4	0	9	5	18	146
05:15 PM	0	47	1	3	51	0	6	55	0	0	61	5	0	8	5	18	130
05:30 PM	0	51	4	3	58	0	8	47	0	1	56	6	0	7	0	13	127
05:45 PM	0	55	1	9	65	0	7	51	0	0	58	3	0	7	8	18	141
Total	0	209	11	21	241	0	28	207	0	1	236	18	0	31	18	67	544
Grand Total	0	456	27	49	532	0	64	464	0	1	529	47	1	65	48	161	1222
Apprch %	0	85.7	5.1	9.2			12.1	87.7	0	0.2		29.2	0.6	40.4	29.8		
Total %	0	37.3	2.2	4	43.5	0	5.2	38	0	0.1	43.3	3.8	0.1	5.3	3.9	13.2	

	North Cane Street Southbound					Westbound	North Cane Street Northbound					Center Street Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:00 PM																	
04:00 PM	0	**76**	4	8	**88**	0	8	67	0	0	75	**11**	0	**11**	**11**	**33**	**196**
04:15 PM	0	64	**5**	**10**	79	0	**10**	**72**	0	0	**82**	3	0	4	9	16	177
04:30 PM	0	61	4	8	73	0	10	62	0	0	72	9	0	11	10	30	175
04:45 PM	0	46	3	2	51	0	8	56	0	0	64	6	**1**	8	0	15	130
Total Volume	0	247	16	28	291	0	36	257	0	0	293	29	1	34	30	94	678
% App. Total	0	84.9	5.5	9.6			12.3	87.7	0	0		30.9	1.1	36.2	31.9		
PHF	.000	.813	.800	.700	.827	.000	.900	.892	.000	.000	.893	.659	.250	.773	.682	.712	.865

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-5676
Counted:TO
Weather:Clear

File Name : LehCen AM TO
Site Code : 00000001
Start Date : 9/30/2008
Page No : 1

Groups Printed- Unshifted

	Lehua Street Southbound					Center Street Westbound					Lehua Street (LT Into FHB Parking Lot) Northbound					First Hawaiian Bank Parking Lot (Exit From FHB Parking Lot) Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
06:00 AM	5	11	0	2	18	4	0	3	2	9	2	17	9	0	28	3	0	1	2	6	61
06:15 AM	4	8	0	0	12	0	0	2	4	6	0	25	3	0	28	0	0	1	1	2	48
06:30 AM	9	11	0	5	25	2	0	6	8	16	0	22	7	0	29	1	1	1	0	3	73
06:45 AM	2	13	0	4	19	2	0	4	4	10	0	22	14	0	36	1	0	2	2	5	70
Total	20	43	0	11	74	8	0	15	18	41	2	86	33	0	121	5	1	5	5	16	252
07:00 AM	7	14	0	2	23	4	0	4	3	11	2	29	8	0	39	1	0	1	1	3	76
07:15 AM	10	18	0	1	29	4	0	8	4	16	1	39	21	0	61	0	0	1	1	2	108
07:30 AM	18	29	0	2	49	1	0	8	5	14	0	39	21	0	60	0	0	0	0	0	123
07:45 AM	13	28	0	4	45	8	0	12	4	24	3	41	38	0	82	0	0	2	3	5	156
Total	48	89	0	9	146	17	0	32	16	65	6	148	88	0	242	1	0	4	5	10	463
Grand Total	68	132	0	20	220	25	0	47	34	106	8	234	121	0	363	6	1	9	10	26	715
Apprch %	30.9	60	0	9.1		23.6	0	44.3	32.1		2.2	64.5	33.3	0		23.1	3.8	34.6	38.5		
Total %	9.5	18.5	0	2.8	30.8	3.5	0	6.6	4.8	14.8	1.1	32.7	16.9	0	50.8	0.8	0.1	1.3	1.4	3.6	

	Lehua Street Southbound					Center Street Westbound					Lehua Street (LT Into FHB Parking Lot) Northbound					First Hawaiian Bank Parking Lot (Exit From FHB Parking Lot) Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 07:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	7	14	0	2	23	4	0	4	3	11	2	29	8	0	39	**1**	0	1	1	3	76
07:15 AM	10	18	0	1	29	4	0	8	4	16	1	39	21	0	61	0	0	1	1	2	108
07:30 AM	**18**	**29**	0	2	**49**	1	0	8	**5**	14	0	39	21	0	60	0	0	0	0	0	123
07:45 AM	13	28	0	**4**	45	**8**	0	**12**	4	**24**	**3**	**41**	**38**	0	**82**	0	0	**2**	**3**	**5**	**156**
Total Volume	48	89	0	9	146	17	0	32	16	65	6	148	88	0	242	1	0	4	5	10	463
% App. Total	32.9	61	0	6.2		26.2	0	49.2	24.6		2.5	61.2	36.4	0		10	0	40	50		
PHF	.667	.767	.000	.563	.745	.531	.000	.667	.800	.677	.500	.902	.579	.000	.738	.250	.000	.500	.417	.500	.742

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-5676
Counted:TO
Weather:Clear

File Name : LehCen PM TO
Site Code : 00000001
Start Date : 9/30/2008
Page No : 1

Groups Printed- Unshifted

	Lehua Street Southbound					Center Street Westbound					Lehua Street Northbound					First Hawaiian Bank Parking Lot (Exit From FHB Parking Lot) Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
04:00 PM	7	40	3	4	54	13	0	12	3	28	1	31	8	0	40	2	1	4	1	8	130
04:15 PM	2	36	1	2	41	13	0	13	0	26	5	37	3	0	45	2	0	4	5	11	123
04:30 PM	5	42	5	1	53	33	0	12	0	45	4	39	5	0	48	13	1	13	0	27	173
04:45 PM	6	35	1	2	44	9	0	6	5	20	3	45	7	0	55	1	0	3	0	4	123
Total	20	153	10	9	192	68	0	43	8	119	13	152	23	0	188	18	2	24	6	50	549
05:00 PM	4	45	0	4	53	11	0	4	2	17	3	40	5	0	48	4	2	2	6	14	132
05:15 PM	5	36	1	1	43	15	0	8	3	26	2	34	3	0	39	1	0	5	0	6	114
05:30 PM	5	31	1	3	40	3	0	12	5	20	3	35	5	0	43	0	0	5	0	5	108
05:45 PM	5	31	0	6	42	7	0	9	3	19	1	28	4	0	33	1	0	2	6	9	103
Total	19	143	2	14	178	36	0	33	13	82	9	137	17	0	163	6	2	14	12	34	457
Grand Total	39	296	12	23	370	104	0	76	21	201	22	289	40	0	351	24	4	38	18	84	1006
Apprch %	10.5	80	3.2	6.2		51.7	0	37.8	10.4		6.3	82.3	11.4	0		28.6	4.8	45.2	21.4		
Total %	3.9	29.4	1.2	2.3	36.8	10.3	0	7.6	2.1	20	2.2	28.7	4	0	34.9	2.4	0.4	3.8	1.8	8.3	

	Lehua Street Southbound					Center Street Westbound					Lehua Street Northbound					First Hawaiian Bank Parking Lot (Exit From FHB Parking Lot) Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:15 PM																					
04:15 PM	2	36	1	2	41	13	0	**13**	0	26	**5**	37	3	0	45	2	0	4	5	11	123
04:30 PM	5	42	**5**	1	**53**	**33**	0	12	0	**45**	4	39	5	0	48	**13**	1	**13**	0	**27**	**173**
04:45 PM	**6**	35	1	2	44	9	0	6	**5**	20	3	**45**	**7**	0	**55**	1	0	3	0	4	123
05:00 PM	4	**45**	0	**4**	53	11	0	4	2	17	3	40	5	0	48	4	**2**	2	**6**	14	132
Total Volume	17	158	7	9	191	66	0	35	7	108	15	161	20	0	196	20	3	22	11	56	551
% App. Total	8.9	82.7	3.7	4.7		61.1	0	32.4	6.5		7.7	82.1	10.2	0		35.7	5.4	39.3	19.6		
PHF	.708	.878	.350	.563	.901	.500	.000	.673	.350	.600	.750	.894	.714	.000	.891	.385	.375	.423	.458	.519	.796

APPENDIX B

LEVEL OF SERVICE DEFINITIONS

LEVEL OF SERVICE DEFINITIONS

LEVEL-OF-SERVICE CRITERIA FOR SIGNALIZED INTERSECTIONS

Level of Service (LOS) for signalized intersections is defined in terms of delay, which is a measure of driver discomfort, frustration, fuel consumption, and increased travel time. Specifically, level-of-service (LOS) criteria are stated in terms of the average control delay per vehicle, typically a 15-min analysis period. The criteria are given in the following table.

Table 1: Level-of-Service Criteria for Signalized Intersections

Level of Service	Control Delay per Vehicle (sec/veh)
A	≤10.0
B	>10.0 and ≤20.0
C	>20.0 and ≤35.0
D	>35.0 and ≤55.0
E	>55.0 and ≤80.0
F	>80.0

Delay is a complex measure and depends on a number of variables, including the quality of progression, the cycle length, the green ratio, and the v/c ratio for the lane group.

Level of Service A describes operations with low control delay, up to 10 sec per vehicle. This level of service occurs when progression is extremely favorable and most vehicles arrive during the green phase. Many vehicles do not stop at all. Short cycle lengths may tend to contribute to low delay values.

Level of Service B describes operations with control delay greater than 10 and up to 20 sec per vehicle. This level generally occurs with good progression, short cycle lengths, or both. More vehicles stop than with LOS A, causing higher levels of delay.

Level of Service C describes operations with control delay greater than 20 and up to 35 sec per vehicle. These higher delays may result from only fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level. Cycle failure occurs when a given green phase does not serve queued vehicles and overflows occur. The number of vehicles stopping is significant at this level, though many still pass through the intersection without stopping.

Level of Service D describes operations with control delay greater than 35 and up to 55 sec per vehicle. At level of service D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high v/c ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

"Highway Capacity Manual," Transportation Research Board, 2000.

Level of Service E describes operation with control delay greater than 55 and up to 80 sec per vehicle. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are frequent.

Level of Service F describes operations with control delay in excess of 80 sec per vehicle. This level, considered to be unacceptable to most drivers, often occurs with oversaturation, that is, when arrival flow rates exceed the capacity lane groups. It may also occur at high v/c ratios with many individual cycle failures. Poor progression and long cycle lengths may also contribute significantly to high delay levels.

"Highway Capacity Manual," Transportation Research Board, 2000.

LEVEL OF SERVICE DEFINITIONS

LEVEL-OF-SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS

Level of Service (LOS) criteria are given in Table 1. As used here, control delay is defined as the total elapsed time from the time a vehicle stops at the end of the queue to the time required for the vehicle to travel from the last-in-queue position to the first-in-queue position, including deceleration of vehicles from free-flow speed to the speed of vehicles in the queue.

The average total delay for any particular minor movement is a function of the service rate or capacity of the approach and the degree of saturation. If the degree of saturation is greater than about 0.9, average control delay is significantly affected by the length of the analysis period.

Table 1: Level-of-Service Criteria for Unsignalized Intersections

Level of Service	Average Control Delay (Sec/Veh)
A	≤10.0
B	>10.0 and ≤15.0
C	>15.0 and ≤25.0
D	>25.0 and ≤35.0
E	>35.0 and ≤50.0
F	>50.0

"Highway Capacity Manual," Transportation Research Board, 2000.

APPENDIX C

CAPACITY ANALYSIS CALCULATIONS
EXISTING PEAK HOUR TRAFFIC ANALYSIS

HCS+: Signalized Intersections Release 5.3

Analyst:
Agency: WOC
Date: 10/28/2008
Period: AM Peak
Project ID:
E/W St: California Ave

Inter.:
Area Type: All other areas
Jurisd:
Year : Existing

N/S St: Lehua St

SIGNALIZED INTERSECTION SUMMARY

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	0	2	0	0	2	0	0	1	0	0	1	1
LGConfig		LTR			LTR			LTR			LT	R
Volume	86	489	5	10	738	34	9	121	123	33	20	49
Lane Width		12.0			12.0			12.0			12.0	12.0
RTOR Vol			1			3			12			5

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left	A				NB	Left	A			
Thru	A					Thru	A			
Right	A					Right	A			
Peds						Peds				
WB Left	A				SB	Left	A			
Thru	A					Thru	A			
Right	A					Right	A			
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right				
Green	43.0						37.0			
Yellow	4.0						4.0			
All Red	1.0						1.0			

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
LTR	1089	2279	0.65	0.48	19.2	B	19.2	B
Westbound								
LTR	1591	3330	0.54	0.48	17.0	B	17.0	B
Northbound								
LTR	712	1733	0.43	0.41	19.4	B	19.4	B
Southbound								
LT	565	1374	0.13	0.41	16.6	B	16.4	B
R	651	1583	0.09	0.41	16.3	B		

Intersection Delay = 18.1 (sec/veh) Intersection LOS = B

HCS+: Signalized Intersections Release 5.3

Analyst:
Agency: WOC
Date: 10/28/2008
Period: PM Peak
Project ID:
E/W St: California Ave

Inter.:
Area Type: All other areas
Jurisd:
Year : Existing

N/S St: Lehua St

SIGNALIZED INTERSECTION SUMMARY

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	0	2	0	0	2	0	0	1	0	0	1	1
LGConfig		LTR			LTR			LTR			LT	R
Volume	67	678	8	13	603	51	14	72	171	71	31	129
Lane Width		12.0			12.0			12.0			12.0	12.0
RTOR Vol			1			5			17			13

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left	A				NB	Left	A			
Thru	A					Thru	A			
Right	A					Right	A			
Peds						Peds				
WB Left	A				SB	Left	A			
Thru	A					Thru	A			
Right	A					Right	A			
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right				
Green	42.0						38.0			
Yellow	4.0						4.0			
All Red	1.0						1.0			

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
LTR	1302	2790	0.63	0.47	19.1	B	19.1	B
Westbound								
LTR	1531	3280	0.48	0.47	16.7	B	16.7	B
Northbound								
LTR	706	1673	0.39	0.42	18.3	B	18.3	B
Southbound								
LT	522	1236	0.28	0.42	17.3	B	17.1	B
R	668	1583	0.25	0.42	17.0	B		

Intersection Delay = 17.9 (sec/veh) Intersection LOS = B

HCS+: Signalized Intersections Release 5.3

Analyst:	Inter.:
Agency: WOC	Area Type: All other areas
Date: 10/28/2008	Jurisd:
Period: AM Peak	Year : Existing
Project ID:	
E/W St: California Ave	N/S St: N. Cane St

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	2	0	0	2	0	0	0	0	1	0	1
LGConfig	L	T			TR					L		R
Volume	38	502			677	184				261		83
Lane Width	12.0	12.0			12.0					12.0		12.0
RTOR Vol						18						8

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left	A				NB	Left				
Thru	A					Thru				
Right						Right				
Peds						Peds				
WB Left					SB	Left	A			
Thru	A					Thru				
Right	A					Right	A			
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right				
Green	42.0						38.0			
Yellow	4.0						4.0			
All Red	1.0						1.0			

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	176	377	0.28	0.47	15.6	B		
T	1655	3547	0.39	0.47	15.8	B	15.8	B
Westbound								
TR	1606	3442	0.60	0.47	18.4	B	18.4	B
Northbound								
Southbound								
L	747	1770	0.43	0.42	18.8	B		
							18.2	B
R	668	1583	0.14	0.42	16.1	B		

Intersection Delay = 17.4 (sec/veh) Intersection LOS = B

HCS+: Signalized Intersections Release 5.3

Analyst:	Inter.:
Agency: WOC	Area Type: All other areas
Date: 10/28/2008	Jurisd:
Period: PM Peak	Year : Existing
Project ID:	
E/W St: California Ave	N/S St: N. Cane St

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	2	0	0	2	0	0	0	0	1	0	1
LGConfig	L	T			TR					L		R
Volume	180	671			486	110				177		106
Lane Width	12.0	12.0			12.0					12.0		12.0
RTOR Vol						11						11

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left	A				NB	Left				
Thru	A					Thru				
Right						Right				
Peds						Peds				
WB Left					SB	Left	A			
Thru	A					Thru				
Right	A					Right	A			
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right				
Green	45.5						34.5			
Yellow	4.0						4.0			
All Red	1.0						1.0			

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	313	620	0.63	0.51	20.1	C		
T	1793	3547	0.41	0.51	14.0	B	15.3	B
Westbound								
TR	1748	3457	0.40	0.51	13.9	B	13.9	B
Northbound								
Southbound								
L	678	1770	0.31	0.38	19.7	B	19.3	B
R	607	1583	0.19	0.38	18.6	B		

Intersection Delay = 15.5 (sec/veh) Intersection LOS = B

HCS+: Unsignalized Intersections Release 5.3

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.: WOC
Date Performed: 10/27/2008
Analysis Time Period: AM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Existing
Project ID:
East/West Street: Center Street
North/South Street: Lehua Street
Intersection Orientation: NS   Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1 L	2 T	3 R	4 L	5 T	6 R
Volume		154	88	48	89	
Peak-Hour Factor, PHF		0.74	0.74	0.73	0.73	
Hourly Flow Rate, HFR		208	118	65	121	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		2	0	0	2	
Configuration		T	TR	LT	T	
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume	8		12			
Peak Hour Factor, PHF	0.61		0.61			
Hourly Flow Rate, HFR	13		19			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		65		32				
C(m) (vph)		1230		675				
v/c		0.05		0.05				
95% queue length		0.17		0.15				
Control Delay		8.1		10.6				
LOS		A		B				
Approach Delay				10.6				
Approach LOS				B				

HCS+: Unsignalized Intersections Release 5.3

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.: WOC
Date Performed: 10/27/2008
Analysis Time Period: PM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Existing
Project ID:
East/West Street: Center Street
North/South Street: Lehua Street
Intersection Orientation: NS Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		176	20	17	158	
Peak-Hour Factor, PHF		0.89	0.89	0.88	0.88	
Hourly Flow Rate, HFR		197	22	19	179	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		2	0	0	2	
Configuration		T	TR	LT	T	
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	66		35			
Peak Hour Factor, PHF	0.56		0.56			
Hourly Flow Rate, HFR	117		62			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		19		179				
C(m) (vph)		1348		708				
v/c		0.01		0.25				
95% queue length		0.04		1.01				
Control Delay		7.7		11.8				
LOS		A		B				
Approach Delay				11.8				
Approach LOS				B				

HCS+: Unsignalized Intersections Release 5.3

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.: WOC
Date Performed: 10/28/2008
Analysis Time Period: AM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Existing
Project ID:
East/West Street: Center St
North/South Street: N. Cane St
Intersection Orientation: NS
Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street:	Northbound			Southbound		
Movement	1 L	2 T	3 R	4 L	5 T	6 R
Volume	28	220			312	11
Peak-Hour Factor, PHF	0.81	0.81			0.93	0.93
Hourly Flow Rate, HFR	34	271			335	11
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	2			2	0
Configuration	LT	T			T	TR
Upstream Signal?		No			No	

Minor Street:	Westbound			Eastbound		
Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume				10		14
Peak Hour Factor, PHF				0.53		0.53
Hourly Flow Rate, HFR				18		26
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes				1		1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT					L		R
v (vph)	34					18		26
C(m) (vph)	1210					457		869
v/c	0.03					0.04		0.03
95% queue length	0.09					0.12		0.09
Control Delay	8.1					13.2		9.3
LOS	A					B		A
Approach Delay							10.9	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.3

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.: WOC
Date Performed: 10/28/2008
Analysis Time Period: PM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Existing
Project ID:
East/West Street: Center St
North/South Street: N. Cane St
Intersection Orientation: NS   Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1 L	2 T	3 R	4 L	5 T	6 R
Volume	36	257			247	16
Peak-Hour Factor, PHF	0.89	0.89			0.82	0.82
Hourly Flow Rate, HFR	40	288			301	19
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	2			2	0
Configuration	LT	T			T	TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume				29		34
Peak Hour Factor, PHF				0.73		0.73
Hourly Flow Rate, HFR				39		46
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes				1		1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT					L		R
v (vph)	40					39		46
C(m) (vph)	1237					461		884
v/c	0.03					0.08		0.05
95% queue length	0.10					0.28		0.16
Control Delay	8.0					13.5		9.3
LOS	A					B		A
Approach Delay							11.2	
Approach LOS							B	

APPENDIX D

CAPACITY ANALYSIS CALCULATIONS
PROJECTED YEAR 2010 PEAK HOUR TRAFFIC
ANALYSIS WITHOUT PROJECT

HCS+: Signalized Intersections Release 5.3

Analyst:
Agency: WOC
Date: 10/28/2008
Period: AM Peak
Project ID:
E/W St: California Ave

Inter.:
Area Type: All other areas
Jurisd:
Year : Year 2010 Without Project

N/S St: Lehua St

SIGNALIZED INTERSECTION SUMMARY

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	0	2	0	0	2	0	0	1	0	0	1	1
LGConfig		LTR			LTR			LTR			LT	R
Volume	89	509	5	10	768	35	9	126	128	34	21	51
Lane Width		12.0			12.0			12.0			12.0	12.0
RTOR Vol			1			4			13			5

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left	A				NB	Left	A			
Thru	A					Thru	A			
Right	A					Right	A			
Peds						Peds				
WB Left	A				SB	Left	A			
Thru	A					Thru	A			
Right	A					Right	A			
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right				
Green	44.0						36.0			
Yellow	4.0						4.0			
All Red	1.0						1.0			

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
LTR	1096	2242	0.67	0.49	19.1	B	19.1	B
Westbound								
LTR	1628	3331	0.55	0.49	16.5	B	16.5	B
Northbound								
LTR	694	1734	0.46	0.40	20.4	C	20.4	C
Southbound								
LT	544	1361	0.13	0.40	17.2	B	17.1	B
R	633	1583	0.10	0.40	16.9	B		

Intersection Delay = 18.1 (sec/veh) Intersection LOS = B

HCS+: Signalized Intersections Release 5.3

Analyst:
Agency: WOC
Date: 10/28/2008
Period: PM Peak
Project ID:
E/W St: California Ave

Inter.:
Area Type: All other areas
Jurisd:
Year : Year 2010 Without Project
N/S St: Lehua St

SIGNALIZED INTERSECTION SUMMARY

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	0	2	0	0	2	0	0	1	0	0	1	1
LGConfig		LTR			LTR			LTR			LT	R
Volume	70	705	8	14	627	53	15	75	178	74	32	134
Lane Width		12.0			12.0			12.0			12.0	12.0
RTOR Vol			1			5			17			13

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left	A				NB	Left	A			
Thru	A					Thru	A			
Right	A					Right	A			
Peds						Peds				
WB Left	A				SB	Left	A			
Thru	A					Thru	A			
Right	A					Right	A			
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right				
Green	43.0						37.0			
Yellow	4.0						4.0			
All Red	1.0						1.0			

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
LTR	1312	2747	0.65	0.48	18.9	B	18.9	B
Westbound								
LTR	1560	3265	0.49	0.48	16.3	B	16.3	B
Northbound								
LTR	687	1670	0.41	0.41	19.2	B	19.2	B
Southbound								
LT	488	1186	0.31	0.41	18.3	B	18.0	B
R	651	1583	0.27	0.41	17.7	B		

Intersection Delay = 17.9 (sec/veh) Intersection LOS = B

HCS+: Signalized Intersections Release 5.3

Analyst:
Agency: WOC
Date: 10/28/2008
Period: AM Peak
Project ID:
E/W St: California Ave

Inter.:
Area Type: All other areas
Jurisd:
Year : Year 2010 Without Project

N/S St: N. Cane St

SIGNALIZED INTERSECTION SUMMARY

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	1	2	0	0	2	0	0	0	0	1	0	1
LGConfig	L	T			TR					L		R
Volume	40	522			704	191				271		86
Lane Width	12.0	12.0			12.0					12.0		12.0
RTOR Vol						19						9

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left	A				NB Left				
Thru	A				Thru				
Right					Right				
Peds					Peds				
WB Left					SB Left	A			
Thru	A				Thru				
Right	A				Right	A			
Peds					Peds				
NB Right					EB Right				
SB Right					WB Right				
Green	42.0					38.0			
Yellow	4.0					4.0			
All Red	1.0					1.0			

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	163	350	0.31	0.47	16.1	B		
T	1655	3547	0.40	0.47	15.9	B	15.9	B
Westbound								
TR	1606	3442	0.62	0.47	18.7	B	18.7	B
Northbound								
Southbound								
L	747	1770	0.45	0.42	19.0	B		
							18.3	B
R	668	1583	0.14	0.42	16.1	B		

Intersection Delay = 17.7 (sec/veh) Intersection LOS = B

HCS+: Signalized Intersections Release 5.3

Analyst:
Agency: WOC
Date: 10/28/2008
Period: PM Peak
Project ID:
E/W St: California Ave

Inter.:
Area Type: All other areas
Jurisd:
Year : Year 2010 Without Project

N/S St: N. Cane St

SIGNALIZED INTERSECTION SUMMARY

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	1	2	0	0	2	0	0	0	0	1	0	1
LGConfig	L	T			TR					L		R
Volume	187	698			505	114				184		110
Lane Width	12.0	12.0			12.0					12.0		12.0
RTOR Vol						11						11

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left	A				NB	Left				
Thru	A					Thru				
Right						Right				
Peds						Peds				
WB Left					SB	Left	A			
Thru	A					Thru	A			
Right	A					Right	A			
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right				
Green	46.0						34.0			
Yellow	4.0						4.0			
All Red	1.0						1.0			

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	306	599	0.66	0.51	21.7	C		
T	1813	3547	0.42	0.51	13.8	B	15.5	B
Westbound								
TR	1766	3456	0.41	0.51	13.8	B	13.8	B
Northbound								
Southbound								
L	669	1770	0.33	0.38	20.2	C	19.8	B
R	598	1583	0.20	0.38	19.0	B		

Intersection Delay = 15.6 (sec/veh) Intersection LOS = B

HCS+: Unsignalized Intersections Release 5.3

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.: WOC
Date Performed: 10/27/2008
Analysis Time Period: AM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2010 Without Project
Project ID:
East/West Street: Center Street
North/South Street: Lehua Street
Intersection Orientation: NS Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		160	92	50	93	
Peak-Hour Factor, PHF		0.74	0.74	0.73	0.73	
Hourly Flow Rate, HFR		216	124	68	127	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		2	0	0	2	
Configuration		T	TR	LT	T	
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	8		12			
Peak Hour Factor, PHF	0.61		0.61			
Hourly Flow Rate, HFR	13		19			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		68		32				
C(m) (vph)		1216		661				
v/c		0.06		0.05				
95% queue length		0.18		0.15				
Control Delay		8.1		10.7				
LOS		A		B				
Approach Delay				10.7				
Approach LOS				B				

HCS+: Unsignalized Intersections Release 5.3

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.: WOC
Date Performed: 10/27/2008
Analysis Time Period: PM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2010 Without Project
Project ID:
East/West Street: Center Street
North/South Street: Lehua Street
Intersection Orientation: NS   Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1 L	2 T	3 R	4 L	5 T	6 R
Volume		183	21	18	164	
Peak-Hour Factor, PHF		0.89	0.89	0.88	0.88	
Hourly Flow Rate, HFR		205	23	20	186	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		2	0	0	2	
Configuration		T	TR	LT	T	
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume	69		36			
Peak Hour Factor, PHF	0.56		0.56			
Hourly Flow Rate, HFR	123		64			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		20		187				
C(m) (vph)		1337		695				
v/c		0.01		0.27				
95% queue length		0.05		1.10				
Control Delay		7.7		12.1				
LOS		A		B				
Approach Delay				12.1				
Approach LOS				B				

HCS+: Unsignalized Intersections Release 5.3

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.: WOC
Date Performed: 10/28/2008
Analysis Time Period: AM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2010 Without Project
Project ID:
East/West Street: Center St
North/South Street: N. Cane St
Intersection Orientation: NS Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street:	Approach	Northbound			Southbound		
	Movement	1	2	3	4	5	6
		L	T	R	L	T	R
Volume		29	229			324	11
Peak-Hour Factor, PHF		0.81	0.81			0.93	0.93
Hourly Flow Rate, HFR		35	282			348	11
Percent Heavy Vehicles		2	--	--		--	--
Median Type/Storage		Undivided			/		
RT Channelized?							
Lanes		0	2			2	0
Configuration		LT	T			T	TR
Upstream Signal?			No			No	

Minor Street:	Approach	Westbound			Eastbound		
	Movement	7	8	9	10	11	12
		L	T	R	L	T	R
Volume					10		15
Peak Hour Factor, PHF					0.53		0.53
Hourly Flow Rate, HFR					18		28
Percent Heavy Vehicles					2		2
Percent Grade (%)			0			0	
Flared Approach:	Exists?/Storage				/		/
Lanes					1		1
Configuration					L		R

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT					L		R
v (vph)	35					18		28
C(m) (vph)	1196					442		861
v/c	0.03					0.04		0.03
95% queue length	0.09					0.13		0.10
Control Delay	8.1					13.5		9.3
LOS	A					B		A
Approach Delay							11.0	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.3

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.: WOC
Date Performed: 10/28/2008
Analysis Time Period: PM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2010 Without Project
Project ID:
East/West Street: Center St
North/South Street: N. Cane St
Intersection Orientation: NS   Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street:	Approach	Northbound			Southbound		
	Movement	1 L	2 T	3 R	4 L	5 T	6 R
Volume		37	267			257	17
Peak-Hour Factor, PHF		0.89	0.89			0.82	0.82
Hourly Flow Rate, HFR		41	300			313	20
Percent Heavy Vehicles		2	--	--		--	--
Median Type/Storage		Undivided			/		
RT Channelized?							
Lanes		0	2			2	0
Configuration		LT	T			T	TR
Upstream Signal?			No			No	

Minor Street:	Approach	Westbound			Eastbound		
	Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume					30		35
Peak Hour Factor, PHF					0.73		0.73
Hourly Flow Rate, HFR					41		47
Percent Heavy Vehicles					2		2
Percent Grade (%)			0			0	
Flared Approach:	Exists?/Storage			/			/
Lanes					1		1
Configuration					L		R

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT					L		R
v (vph)	41					41		47
C(m) (vph)	1223					447		877
v/c	0.03					0.09		0.05
95% queue length	0.10					0.30		0.17
Control Delay	8.0					13.9		9.3
LOS	A					B		A
Approach Delay							11.4	
Approach LOS							B	

APPENDIX E

CAPACITY ANALYSIS CALCULATIONS
PROJECTED YEAR 2010 PEAK HOUR TRAFFIC
ANALYSIS WITH PROJECT

HCS+: Signalized Intersections Release 5.3

Analyst:
Agency: WOC
Date: 10/28/2008
Period: AM Peak
Project ID:
E/W St: California Ave

Inter.:
Area Type: All other areas
Jurisd:
Year : Year 2010 With Project

N/S St: Lehua St

SIGNALIZED INTERSECTION SUMMARY

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	0	2	0	0	2	0	0	1	0	0	1	1
LGConfig		LTR			LTR			LTR			LT	R
Volume	121	509	5	10	776	35	9	126	128	34	21	56
Lane Width		12.0			12.0			12.0			12.0	12.0
RTOR Vol			1			4			13			6

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left	A				NB	Left	A			
Thru	A					Thru	A			
Right	A					Right	A			
Peds						Peds				
WB Left	A				SB	Left	A			
Thru	A					Thru	A			
Right	A					Right	A			
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right				
Green	45.0						35.0			
Yellow	4.0						4.0			
All Red	1.0						1.0			

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
LTR	1021	2041	0.76	0.50	21.5	C	21.5	C
Westbound								
LTR	1665	3329	0.54	0.50	15.8	B	15.8	B
Northbound								
LTR	674	1733	0.48	0.39	21.2	C	21.2	C
Southbound								
LT	532	1368	0.14	0.39	17.9	B	17.8	B
R	616	1583	0.11	0.39	17.6	B		

Intersection Delay = 18.8 (sec/veh) Intersection LOS = B

HCS+: Signalized Intersections Release 5.3

Analyst:	Inter.:
Agency: WOC	Area Type: All other areas
Date: 10/28/2008	Jurisd:
Period: PM Peak	Year : Year 2010 With Project
Project ID:	
E/W St: California Ave	N/S St: Lehua St

SIGNALIZED INTERSECTION SUMMARY

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	0	2	0	0	2	0	0	1	0	0	1	1
LGConfig		LTR			LTR			LTR			LT	R
Volume	92	705	8	14	635	53	15	75	178	74	32	146
Lane Width		12.0			12.0			12.0			12.0	12.0
RTOR Vol			1			5			17			15

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left	A				NB	Left	A			
Thru	A					Thru	A			
Right	A					Right	A			
Peds						Peds				
WB Left	A				SB	Left	A			
Thru	A					Thru	A			
Right	A					Right	A			
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right				
Green	44.0						36.0			
Yellow	4.0						4.0			
All Red	1.0						1.0			

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
LTR	1232	2521	0.71	0.49	19.9	B	19.9	B
Westbound								
LTR	1596	3264	0.49	0.49	15.6	B	15.6	B
Northbound								
LTR	668	1670	0.43	0.40	20.0-	B	20.0-	B
Southbound								
LT	468	1170	0.32	0.40	19.0	B	18.8	B
R	633	1583	0.30	0.40	18.6	B		

Intersection Delay = 18.3 (sec/veh) Intersection LOS = B

HCS+: Signalized Intersections Release 5.3

Analyst:
Agency: WOC
Date: 10/28/2008
Period: AM Peak
Project ID:
E/W St: California Ave

Inter.:
Area Type: All other areas
Jurisd:
Year : Year 2010 With Project

N/S St: N. Cane St

SIGNALIZED INTERSECTION SUMMARY

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	1	2	0	0	2	0	0	0	0	1	0	1
LGConfig	L	T			TR					L		R
Volume	40	522			704	211				275		94
Lane Width	12.0	12.0			12.0					12.0		12.0
RTOR Vol						19						9

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left	A				NB	Left				
Thru	A					Thru				
Right						Right				
Peds						Peds				
WB Left					SB	Left	A			
Thru	A					Thru				
Right	A					Right	A			
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right				
Green	42.0						38.0			
Yellow	4.0						4.0			
All Red	1.0						1.0			

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	156	334	0.33	0.47	16.3	B		
T	1655	3547	0.40	0.47	15.9	B	16.0	B
Westbound								
TR	1602	3433	0.64	0.47	19.0	B	19.0	B
Northbound								
Southbound								
L	747	1770	0.46	0.42	19.0	B	18.4	B
R	668	1583	0.16	0.42	16.2	B		

Intersection Delay = 17.9 (sec/veh) Intersection LOS = B

HCS+: Signalized Intersections Release 5.3

Analyst:	Inter.:
Agency: WOC	Area Type: All other areas
Date: 10/28/2008	Jurisd:
Period: PM Peak	Year : Year 2010 With Project
Project ID:	
E/W St: California Ave	N/S St: N. Cane St

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	2	0	0	2	0	0	0	0	1	0	1
LGConfig	L	T			TR					L		R
Volume	187	698			505	117				200		118
Lane Width	12.0	12.0			12.0					12.0		12.0
RTOR Vol						11						12

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left	A				NB	Left				
Thru	A					Thru				
Right						Right				
Peds						Peds				
WB Left					SB	Left	A			
Thru	A					Thru	A			
Right	A					Right	A			
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right				
Green	46.0						34.0			
Yellow	4.0						4.0			
All Red	1.0						1.0			

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	305	596	0.67	0.51	21.9	C		
T	1813	3547	0.42	0.51	13.8	B	15.5	B
Westbound								
TR	1765	3454	0.41	0.51	13.8	B	13.8	B
Northbound								
Southbound								
L	669	1770	0.36	0.38	20.5	C		
							20.0-	B
R	598	1583	0.21	0.38	19.1	B		

Intersection Delay = 15.7 (sec/veh) Intersection LOS = B

HCS+: Unsignalized Intersections Release 5.3

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.: WOC
Date Performed: 10/27/2008
Analysis Time Period: AM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2010 With Project
Project ID:
East/West Street: Center Street
North/South Street: Lehua Street
Intersection Orientation: NS   Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		177	107	50	93	
Peak-Hour Factor, PHF		0.74	0.74	0.73	0.73	
Hourly Flow Rate, HFR		239	144	68	127	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		2	0	0	2	
Configuration		T	TR	LT	T	
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	13		12			
Peak Hour Factor, PHF	0.61		0.61			
Hourly Flow Rate, HFR	21		19			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
Lanes	0		0			
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		68		40				
C(m) (vph)		1172		591				
v/c		0.06		0.07				
95% queue length		0.18		0.22				
Control Delay		8.3		11.5				
LOS		A		B				
Approach Delay				11.5				
Approach LOS				B				

HCS+: Unsignalized Intersections Release 5.3

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.: WOC
Date Performed: 10/28/2008
Analysis Time Period: AM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2010 With Project
Project ID:
East/West Street: Center St
North/South Street: N. Cane St
Intersection Orientation: NS Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	49	229			332	20
Peak-Hour Factor, PHF	0.81	0.81			0.93	0.93
Hourly Flow Rate, HFR	60	282			356	21
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	2			2	0
Configuration	LT	T			T	TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				10		19
Peak Hour Factor, PHF				0.53		0.53
Hourly Flow Rate, HFR				18		35
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes				1		1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT					L		R
v (vph)	60					18		35
C(m) (vph)	1178					395		853
v/c	0.05					0.05		0.04
95% queue length	0.16					0.14		0.13
Control Delay	8.2					14.5		9.4
LOS	A					B		A
Approach Delay							11.1	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.3

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.: WOC
Date Performed: 10/28/2008
Analysis Time Period: PM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2010 With Project
Project ID:
East/West Street: Center St
North/South Street: N. Cane St
Intersection Orientation: NS Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	40	267			265	26
Peak-Hour Factor, PHF	0.89	0.89			0.82	0.82
Hourly Flow Rate, HFR	44	300			323	31
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	2			2	0
Configuration	LT	T			T	TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				30		51
Peak Hour Factor, PHF				0.73		0.73
Hourly Flow Rate, HFR				41		69
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes				1		1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT					L		R
v (vph)	44					41		69
C(m) (vph)	1201					432		865
v/c	0.04					0.09		0.08
95% queue length	0.11					0.31		0.26
Control Delay	8.1					14.2		9.5
LOS	A					B		A
Approach Delay							11.3	
Approach LOS							B	

APPENDIX F

CAPACITY ANALYSIS CALCULATIONS
PROJECTED YEAR 2018 PEAK HOUR TRAFFIC
ANALYSIS WITH PROJECT AND PARKING STRUCTURE

HCS+: Signalized Intersections Release 5.3

Analyst:
Agency: WOC
Date: 10/28/2008
Period: AM Peak
Project ID:
E/W St: California Ave

Inter.:
Area Type: All other areas
Jurisd:
Year : Year 2010 With Project
With Parking Structure
N/S St: Lehua St

SIGNALIZED INTERSECTION SUMMARY

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	0	2	0	0	2	0	0	1	0	0	1	1
LGConfig	DefL	TR			LTR			LTR			LT	R
Volume	175	550	5	11	837	38	10	136	138	37	23	66
Lane Width	12.0	12.0			12.0			12.0			12.0	12.0
RTOR Vol			1			4			14			7

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left	A				NB	Left	A			
Thru	A					Thru	A			
Right	A					Right	A			
Peds						Peds				
WB Left	A				SB	Left	A			
Thru	A					Thru	A			
Right	A					Right	A			
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right				
Green	53.5						26.5			
Yellow	4.0						4.0			
All Red	1.0						1.0			

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
DefL	266	448	0.80	0.59	32.0	C		
TR	1106	1861	0.61	0.59	12.6	B	17.3	B
Westbound								
LTR	1982	3335	0.49	0.59	10.7	B	10.7	B
Northbound								
LTR	510	1731	0.68	0.29	31.7	C	31.7	C
Southbound								
LT	343	1165	0.23	0.29	24.4	C	24.1	C
R	466	1583	0.17	0.29	23.8	C		

Intersection Delay = 17.1 (sec/veh) Intersection LOS = B

HCS+: Unsignalized Intersections Release 5.3

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.: WOC
Date Performed: 10/28/2008
Analysis Time Period: AM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2010 With Project With Parking Structure
Project ID:
East/West Street: Center St
North/South Street: N. Cane St
Intersection Orientation: NS   Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	83	247			357	29
Peak-Hour Factor, PHF	0.81	0.81			0.93	0.93
Hourly Flow Rate, HFR	102	304			383	31
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	2			2	0
Configuration	LT	T			T	TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				12		21
Peak Hour Factor, PHF				0.53		0.53
Hourly Flow Rate, HFR				22		39
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes				1		1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT					L		R
v (vph)	102					22		39
C(m) (vph)	1141					314		832
v/c	0.09					0.07		0.05
95% queue length	0.29					0.23		0.15
Control Delay	8.5					17.3		9.5
LOS	A					C		A
Approach Delay							12.3	
Approach LOS							B	

HCS+: Unsignalized Intersections Release 5.3

TWO-WAY STOP CONTROL SUMMARY

Analyst:
Agency/Co.: WOC
Date Performed: 10/28/2008
Analysis Time Period: PM Peak
Intersection:
Jurisdiction:
Units: U. S. Customary
Analysis Year: Year 2010 With Project With Parking Structure
Project ID:
East/West Street: Center St
North/South Street: N. Cane St
Intersection Orientation: NS
Study period (hrs): 1.00

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1 L	2 T	3 R	4 L	5 T	6 R
Volume	49	288			286	28
Peak-Hour Factor, PHF	0.89	0.89			0.82	0.82
Hourly Flow Rate, HFR	55	323			348	34
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	2			2	0
Configuration	LT	T			T	TR
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume				38		82
Peak Hour Factor, PHF				0.73		0.73
Hourly Flow Rate, HFR				52		112
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes				1		1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT					L		R
v (vph)	55					52		112
C(m) (vph)	1173					391		849
v/c	0.05					0.13		0.13
95% queue length	0.15					0.46		0.46
Control Delay	8.2					15.6		9.9
LOS	A					C		A
Approach Delay							11.7	
Approach LOS							B	

Appendix E

Compilation of Pre-Consultation Responses

August-September 2005

Environmental Assessment

Wahiawa Transit Center & Park and Ride
TMK: 7-4-006:002 & portion of 7-4-006:012
956 California Avenue, Wahiawa, O`ahu, Hawai`i

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 3RD FLOOR
HONOLULU, HAWAII 96813
Phone: (808) 523-4529 • Fax: (808) 523-4730 • Internet: www.co.honolulu.hi.us

JM

MUFI HANNEMANN
MAYOR

EDWARD Y. HIRATA
DIRECTOR

August 5, 2005

Dear Sir or Madam:

Subject: Letter of Consultation
Draft Environmental Assessment for Wahiawa Transit Center & Park and Ride, T.M.K. 7-4-006: 002 and 7-04-006: por. 012

We are preparing a Draft Environmental Assessment (DEA) for the Wahiawa Transit Center & Park and Ride Facility in Wahiawa, Oahu, Hawaii. A brief description of the proposed project is attached for your review and comment. Please advise if there are any issues regarding the proposed facility that should be addressed or if you have concerns that require more discussion in the DEA.

We look forward to receiving your comments on or before August 19, 2005.

If you require additional information or have any other questions, please do not hesitate to call Jennifer Wakazuru-Kim of AM Partners at 526-2828, extension 240.

Sincerely,

EDWARD Y. HIRATA
Director

Attachment: Project Summary

Government and Public Interest Agencies (OEQC List)

Sandra Lee Kunimoto, Director
Department of Agriculture
State of Hawaii
1428 South King Street
Honolulu, HI 96814

UHM Water Resource Research Center
Holmes Hall, Room 283
2540 Dole Street
Honolulu, HI 96822

Russ Saito, Comptroller
Department of Accounting &General Services
P.O. Box 119
Honolulu, HI 96810

Region IX Administrator, US EPA
75 Hawthorne Street
San Francisco, CA 94105

Major General Robert Lee, Adjutant General
Department of Defense
State of Hawaii
3949 Diamond Head Road
Honolulu, HI 96816-4495

Manager, EPA -- PICO
300 Ala Moana Boulevard, # 1302
Honolulu, HI 96850

Department of Planning & Permitting
City & County of Honolulu
650 South King Street
Honolulu, HI 96813

Superintendent of Education.
Hawaii Department of Education
P.O. Box 2360
Honolulu, HI 96804

Directorate of Facilities Engineering
U.S. Army Support Command Hawaii
Attn: Environmental Management Office
Fort Shafter, HI 96858-5000

Department of Environmental Services
City & County of Honolulu
650 South King Street
Honolulu, HI 96813

Micah Kane, Chair
Hawaiian Homes Commission
Department of Hawaiian Home Lands
P.O. Box 1879
Honolulu, HI 96805

Department of Parks & Recreation
City & County of Honolulu
650 South King Street
Honolulu, HI 96813

Chiyome Fukino, MD, Director
Department of Health
State of Hawaii
Environmental Planning Office
P.O. Box 3378
Honolulu, HI 96801

State Conservationist
Resources Conservation Service
U.S. Dept. of Agriculture
P.O. Box 50004
Honolulu, HI 96850

Department of Facility Maintenance
City & County of Honolulu
650 South King Street
Honolulu, HI 96813

Peter Young, Director
Department of Land & Natural Resources
State of Hawaii
P.O. Box 621
Honolulu, HI 96809

Commander & Division Engineer
U.S. Army Corps of Engineers
Pacific Ocean Division
Building 230
Fort Shafter, HI 96858-5440

State Historic Preservation Officer
Dept. of Land & Natural Resources
601 Kamokila Blvd., Rm. 555
Kapolei, HI 96707

Commander, U.S. Coast Guard
14th Coast Guard District
300 Ala Moana Boulevard
Honolulu, HI 96850

Fire Chief, CCH Fire Dept.
3375 Koapaka St., Suite H425
Honolulu, HI 96819

Ted Liu, Director
Department of Business, Economic
Development & Tourism
P.O. Box 2359
Honolulu, HI 96804

Pacific Islands Administrator
Department of the Interior
Fish & Wildlife Services
300 Ala Moana Blvd., Rm. 3108
Honolulu, HI 96813

Department of Business, Economic
Development & Tourism
Energy, Resources & Technology Division
235 South Beretania Street, 5th Floor
Honolulu, HI 96813

District Chief
Department of the Interior
US Geological Survey
677 Ala Moana Boulevard, Room 415
Honolulu, HI 96813-5412

Police Chief, CCH Police Dept.
801 South Beretania Street
Honolulu, HI 96813

Director, Environmental Health
American Lung Association
245 North Kukui Street
Honolulu, HI 96817

Rodney K. Haraga
Department of Transportation
State of Hawaii
869 Punchbowl Street
Honolulu, HI 96813

Hawaiian Electric Company
P.O. Box 2750
Honolulu, HI 96740

Office of Planning
State of Hawaii
235 South Beretania Street, 6th Floor
Honolulu, HI 96813

Administrator, Office of Hawaiian Affairs
711 Kapiolani Boulevard, Suite 1250
Honolulu, HI 96813

UHM Environmental Center
2550 Campus Road, Crawford 317
Honolulu, HI 96822

Chief Engineer, Board of Water Supply
630 South Beretania Street
Honolulu, HI 96813

P1120292

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawai'i 96850

In Reply Refer To:
1-2-2005-SP-350

SEP 14 2005

05 SEP 15 P1:38

Mr. Edward Y. Hirata
Director
Department of Transportation Services
City and County of Honolulu
650 South King Street, 3rd Floor
Honolulu, HI 96813

Dear Mr. Hirata:

Thank you for your letter dated August 5, 2005, requesting a list of threatened and endangered species that may occur in the vicinity of the project area near the corner of California Avenue and North Cane Street in Wahiawā on the island of O'ahu. We received your letter on August 8, 2005. The proposed project is to construct a transit center and park-and-ride facility in Wahiawā. We understand that this project involves Federal funds, but the source of these funds is not identified in your letter.

We reviewed the information you provided and pertinent information in our files, including data compiled by the Hawai'i Natural Heritage Program. To the best of our knowledge, no federally listed or proposed threatened or endangered species, or proposed or designated critical habitat occur on the proposed project site.

We appreciate your efforts to conserve endangered species. If you have questions, please contact Assistant Field Supervisor Gina Shultz (phone: 808/792-9400; fax: 808/792-9581).

Sincerely,

Patrick Leonard

Patrick Leonard
Field Supervisor

TAKE PRIDE IN AMERICA

LINDA LINGLE
GOVERNOR

RUSS K. SAITO
COMPTROLLER

KATHERINE H. THOMSON
DEPUTY COMPTROLLER

STATE OF HAWAII

DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES

P.O. BOX 119, HONOLULU, HAWAII 96810

(P1225.5)

AUG 17 2005

Mr. Edward Y. Hirata, Director
Department of Transportation Services
City and County of Honolulu
650 South King Street, 3rd Floor
Honolulu, Hawaii 96813

Dear Mr. Hirata:

Subject: Wahiawa Civic Center
Wahiawa Court Facility, Civic Center and Transit Center
Letter of Consultation for Draft Environmental Assessment
TMK: 7-4-006:002 and 7-4-006: por. 012
DAGS Job No. 12-21-7100

We have reviewed the project summary of the Draft Environmental Assessment (DEA) for the Wahiawa Transit Center & Park and Ride Facility attached to your letter of August 5, 2005.

The DEA still does not address our concerns regarding our parking requirements as addressed in our letter of August 9, 2005 (P)1223.5 (attached).

Accordingly, please revise the Memorandum of Agreement to include your plan to satisfy the Wahiawa Judiciary Court Facility and Civic Center parking requirements.

If you have any questions, please call me at 586-0400 or have your staff call Mr. Allen Yamanoba of the Public Works Division at 586-0488.

Sincerely,

for RUSS K. SAITO
State Comptroller

Attachment
c: Ms. Jennifer Wakazuru-Kim, AM Partners
Mr. Dennis Chen, Judiciary w/CCH letter
Mr. Lloyd Maki, DAGS-PW w/CCH letter

P1117074

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

STRATEGIC INDUSTRIES DIVISION
235 S. Beretania Street, 5th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

LINDA LINGLE, GOVERNOR
THEODORE E. LIU, DIRECTOR
MARK ANDERSON, DEPUTY DIRECTOR

Tel: (808) 587-3812
Fax: (808) 586-2536

05 AUG 22 08:32

August 18, 2005

Mr. Edward Y. Hirata, Director
Department of Transportation Services
City and County of Honolulu
650 South King Street, Third Floor
Honolulu, Hawaii 96813

Dear Mr. Hirata:

Re: Letter of Consultation
Draft Environmental Assessment for Wahiawa Transit Center & Park and Ride

This is in response to your letter of August 5, 2005. Thank you for the opportunity to provide comments on matters that we believe should be addressed in the Draft Environmental Assessment (EA) for the Wahiawa Transit Center & Park and Ride. The project will provide a transit facility and parking for bus passengers. The facility should make transit use more convenient to residents of the area and contribute to reduction of gasoline use by commuters and others. We believe it would be useful for the following areas to be addressed in the EA: 1. Energy saving design practices and technologies and 2. Recycling and recycled-content products.

1. **Energy saving design practices and technologies.** First, we recommend that your Department consult with the Hawaiian Electric Company, which, as you know, offers rebates for demand side management programs applied to new construction. There are a number of energy efficiency measures that could earn rebates for this facility. Other measures may not necessarily earn rebates, but they will result in energy savings and reduce operating costs to the City and County. Some of the methods and technologies that could be considered, as appropriate, include:

- Minimize east- and west-facing glass;
- Use natural ventilation to increase comfort of occupants and supplement with ceiling fans, if required;
- Maximize use of natural lighting without heat gain;
- Use high efficiency lighting;
- Use insulation/radiant barrier for an equivalent R-19 value in ceiling;

- Use solar water heating; and
- Use landscaping for dust control and to minimize heat gain to area.

In addition, your Department may want to evaluate the potential for using building integrated photovoltaics (BIPV) as the roof of the structure. Such a rooftop structure will provide shade to parked automobiles, and could provide net metered electricity to the HECO grid after meeting the transit center's own electricity needs, and potentially reducing electricity costs.

2. **Recycling and recycled-content products.** We recommend the following actions to maximize the use of recycling and recycled and content products:

- Develop a job-site recycling plan for construction and recycle as much construction and demolition waste as possible;
- Incorporate provisions for recycling into the project;
- Include a collection system and space for bins for recyclables; and
- Specify and use products with recycled content such as: steel, concrete aggregate fill, drywall, carpet, and glass tile.

We are attaching a summary of our *Hawaii Commercial Building Guidelines for Energy Efficiency* (available at http://www.archenergy.com/library/general/hawaiigl/. We would also like to refer you to our online sustainability guidelines at http://www.hawaii.gov/dbedt/ert/rebuild/pdfs/momisustainable.pdf.

If you need clarification of any of the above, please contact Carilyn Shon, Energy Branch Manager, at 587-3810 or email cshon@dbedt.hawaii.gov.

Sincerely,

Maurice H. Kaya
Chief Technology Officer
Energy Program Administrator

Attachment

STATE OF HAWAII
DEPARTMENT OF EDUCATION

'05 SEP 2 P1:16

OFFICE OF THE SUPERINTENDENT

September 1, 2005

The Honorable Edward Y. Hirata, Director
Department of Transportation Services
City and County of Honolulu
650 South King Street, 3rd Floor
Honolulu, Hawaii 96813

Dear Mr. Hirata:

Subject: Early Consultation on Wahiawa Transit Center
Wahiawa, Oahu, TMK: 7-4-6:002 and por. 012

The Department of Education (DOE) is responding to your request for any issues or concerns regarding plans for a Transit Center in Wahiawa, prior to the publication of a Draft Environmental Assessment (DEA).

The DOE has two facilities in the neighborhood of the proposed Transit Center. The closest is the High Core Program at 801 Center Street. The Central District Annex is located at 1136 California Avenue. The DOE concerns are focused on how the Transit Center plans will impact any long-term plans for the Wahiawa Civic Center and how the Transit Center might impact traffic on California Avenue.

The DOE would like to see the DEA discuss the plans for an improved Wahiawa Civic Center within the block bounded by Lehua Avenue, North Cane Street, California Avenue, and Center Street. Does the Transit Center indicate the end of any plans for improvements to and additional uses of the entire block?

The DEA should also include a detailed traffic impact analysis. Employees of the DOE who work in Wahiawa are faced with heavy traffic along California Avenue. A discussion of how cars would be routed from California Avenue into the Transit Center parking off of Center Street is needed. It appears that traffic volume along California Avenue has peaks during school drop-off and pick-up times in addition to the standard peak traffic hours of a community that commutes a long distance.

AN AFFIRMATIVE ACTION AND EQUAL OPPORTUNITY EMPLOYER

#1,116295

LINDA LINGLE
GOVERNOR
STATE OF HAWAII

STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS
P.O. BOX 1879
HONOLULU, HAWAII 96805

MICAH A. KANE
CHAIRMAN
HAWAIIAN HOMES COMMISSION

BEN HENDERSON
DEPUTY TO THE CHAIRMAN

KAULANA H. PARK
EXECUTIVE ASSISTANT

RECEIVED

'05 AUG 15 A10:41

August 10, 2005

Mr. Edward Y. Hirata, Director
Department of Transportation Services
City and County of Honolulu
650 South King Street, Third Floor
Honolulu, Hawaii 96813

Dear Mr. Hirata:

Thank you for the opportunity to participate in the early consultation process on the proposed "Wahiawa Transit Center and Park and Ride Facility" located in Central Oahu in preparation of a draft environmental assessment report. The Department of Hawaiian Home Lands has no comments to offer.

Should you have any questions, please call the Planning Office at (808) 586-3836.

Aloha and mahalo,

for
Micah A. Kane, Chairman
Hawaiian Homes Commission

LINDA LINGLE
GOVERNOR

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

RODNEY K. HARAGA
DIRECTOR

Deputy Directors
BRUCE Y. MATSUI
BARRY FUKUNAGA
BRENNON T. MORIOKA
BRIAN H. SEKIGUCHI

IN REPLY REFER TO:
STP 8.1873

September 1, 2005

Mr. Edward Y. Hirata
Director
Department of Transportation Services
City and County of Honolulu
650 South King Street, 3rd Floor
Honolulu, Hawaii 96813

Dear Mr. Hirata:

Subject: Wahiawa Transit Center and Park & Ride Facility
Letter of Consultation, Draft Environmental Assessment

Thank you for providing us an advance notice and summary of the subject proposed transit project in Wahiawa. We are supportive of your agency's efforts to improve transportation and commuter services.

The proposed project itself is not expected to have a significant direct impact on our highways, but depending on projected rider volume, commuter use, and transit schedules, the project may cause a change to present traffic flowing on and off our highway when the transit facility is implemented. We anticipate that a traffic study will be part of the environmental assessment. We would appreciate receiving copies of the assessment report when it is finalized and will defer our comments until we have had an opportunity to review the assessment report.

We appreciate the notification on the transit project.

Very truly yours,

Rodney Haraga

RODNEY K. HARAGA
Director of Transportation

c: AM Partners (Jennifer Wakazuru-Kim)

The Honorable Edward Y. Hirata
Page 2
September 1, 2005

The DOE appreciates the opportunity to offer early comments on your proposed plans. If you have any questions, please call Rae Loui, Assistant Superintendent of the Office of Business Services, at 586-3444 or Heidi Meeker of the Facilities Development Branch at 733-4862.

Very truly yours,

Patricia Hamamoto

Patricia Hamamoto
Superintendent

PH:hy

cc: Rae Loui, Asst. Supt., OBS
Patricia Park, CAS, Leilehua/Mililani/Waialua Complex Area
Betty Mow, CAS, Aiea/Moanalua/Radford Complex Area

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

HRD05/1981

August 15, 2005

Edward Y. Hirata
Director
Department of Transportation Services
City and County of Honolulu
650 South King Street, 3rd Floor
Honolulu, HI 96813

RE: Request for consultation on an environmental assessment preparation notice for the Wahiawa Transit Center & Park and Ride Facility, Wahiawa, Oah'u; TMKs: 7-4-006:002 and portion of :012

Dear Edward Hirata,

The Office of Hawaiian Affairs (OHA) is in receipt of your August 5, 2005, request for comments on the above-referenced proposal, which would allow for the building of a Transit Center housing 8 bus bays with respective passenger waiting areas, a restroom, storage closets, parking stalls and a clock tower. OHA offers the following comments.

We request that you contact local cultural practitioners to assure that construction of what could become a tall building with additional parking levels, as well as the currently planned clock tower, does not impinge upon any sight lines and view planes between heiau or other culturally significant sites.

OHA further requests assurances that should iwi kupuna or Native Hawaiian cultural or traditional deposits be found during ground disturbance or excavation, work will cease, and the appropriate agencies will be contacted pursuant to applicable law.

Edward Hirata
August 15, 2005
Page 2

Thank you for the opportunity to comment, and we look forward to the chance to review the forthcoming Draft Environmental Assessment. If you have further questions or concerns, please contact Heidi Guth at 594-1962 or e-mail her at heidig@oha.org.

Sincerely,

Clyde W. Nāmu'o
Administrator

CC: ✓ Jennifer Wakazuru-Kim
AM Partners, Inc.
1100 Alakea Street, Suite 800
Honolulu, HI 96813

Jennifer Wakazuru

From: General
Sent: Wednesday, August 17, 2005 3:55 PM
To: Jennifer Wakazuru
Subject: FW: DEA- Pre-consultation for Wahiawa Transit Cneter, Attn: Jennifer Wakazuru-Kim

-----Original Message-----
From: Jiacai Liu [mailto:JLiu@eha.health.state.hi.us]
Sent: Wednesday, August 17, 2005 3:38 PM
To: General
Subject: DEA- Pre-consultation for Wahiawa Transit Cneter, Attn: Jennifer Wakazuru-Kim

Dear Ms. Wakazuru-Kim,

Thank you for allowing us to review the subject project. We offer Standard Comments at: http://www.state.hi.us/health/environmental/env-planning/landuse/landuse.html or clicking (Standard Comments) for the EA pre-consultation.

We are looking forward to seeing the DEA and please send the doccument to our office at:

Environmental Planning Office
Department of Health
919 Ala Moana Blvd., Room 312
Honolulu, Hawaii 96814

Thank you.

Jiacai Liu
Land Use Review Coordinator
Environmental Planning Office /DOH
(808) 586-4346

PT117765

DEPARTMENT OF PARKS & RECREATION
CITY AND COUNTY OF HONOLULU
1000 Uluohia Street, Suite 305, Kapolei, Hawaii 96707
Phone: (808) 692-5561 • Fax: (808) 692-5131
Website: www.honolulu.gov

MUFI HANNEMANN
MAYOR

RECEIVED
05 AUG 25 P5:13
DIRECTOR'S OFFICE
DEPT OF TRANSPORTATION SERVICES

LESTER K. C. CHANG
DIRECTOR

DANA L. TAKAHARA-DIAS
DEPUTY DIRECTOR

IN REPLY REFER TO:

August 18, 2005

TO: EDWARD Y. HIRATA, DIRECTOR
DEPARTMENT OF TRANSPORTATION SERVICES

FROM: LESTER K.C. CHANG, DIRECTOR

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT
WAHIAWA TRANSIT CENTER & PARK AND RIDE
TMK: 7-4-006:002 AND 7-04-006: POR. 12

Thank you for the opportunity to comment on your notice of the preparation of the Draft Environmental Assessment relating to the Wahiawa Transit Park and Ride.

The Department of Parks and Recreation has no comment on the project and as it will not affect any of our programs or facilities, you are invited to remove us as a consulted party to the balance of the environmental review process.

Should you have any questions, please contact Mr. John Reid, Planner, at 692-5454.

LESTER K.C. CHANG
Director

LKCC:vn (115385)

DEPARTMENT OF PLANNING AND PERMITTING
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 7TH FLOOR • HONOLULU, HAWAII 96813
TELEPHONE: (808) 523-4432 • FAX: (808) 527-6743
DEPT. INTERNET: www.honoluludpp.org • INTERNET: www.honolulu.gov

MUFI HANNEMANN
MAYOR

HENRY ENG, FAICP
DIRECTOR

DAVID K. TANOUE
DEPUTY DIRECTOR

07 11764

August 22, 2005

2005/ELOG-1835 (MH)

05 AUG 23 A9:11 RECEIVED

TO: EDWARD Y. HIRATA, DIRECTOR
DEPARTMENT OF TRANSPORTATION SERVICES

FROM: HENRY ENG, FAICP, DIRECTOR
DEPARTMENT OF PLANNING AND PERMITTING

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT FOR THE WAHIAWA TRANSIT CENTER & PARK AND RIDE, TMK 7-4-006:002 AND 7-4-006: POR. OF 012

In response to your request for comments of August 5, 2005, we have reviewed the proposed project and have the following comments to offer:

1. The Draft Environmental Assessment (DEA), as well as the Final Environmental Assessment (FEA), should include a section with a discussion on how the proposed project is consistent with the objectives, policies, and guidelines of the General Plan and the Central Oahu *Sustainable* Communities Plan.

2. Regarding the Public Infrastructure Map for Central Oahu, the symbol for the subject project was placed on the Public Infrastructure Map for Central Oahu as Public Infrastructure Map Symbol Number 031 via adoption of Resolution No. 03-63, CD1 on March 19, 2003.

3. Public uses and structures qualify for waivers under Section 21-2.130 of the Land Use Ordinance.

4. Since the Department of Accounting and General Services (DAGS) is currently designing the court facility for the Judiciary and will require TMK 7-4-006:002 for parking for the court facility and the existing civic center, we strongly suggest that the Department of Transportation Services consult/work with the DAGS to see how a collaborated design could include the proposed project, which would complement the State's projects/efforts by efficiently transporting people to the Wahiawa Civic Center/Court facility.

5. An assessment of the anticipated impacts to traffic on Center Street and California Avenue should be conducted.

6. Adequate vehicular sight distance to pedestrians and other vehicles should be provided and maintained at all driveways.

7. Construction plans for all work within or affecting City streets should be submitted for review. Traffic control plans during construction should also be submitted, as required.

8. Please discuss the project plan for landscaping.

9. Please discuss how this project complements this civic and commercial area of Wahiawa and how it is consistent with the Wahiawa Urban Design Plan.

10. The addition of an elevator in the passenger loading area may help the safe movement of people using the facility.

Should you have any questions, please contact Matt Higashida of our staff at 527-6056.

HE:mh

P:\DivFunction\Ea-eis\2005\DEA for Wahiawa Transit Center & Park and Ride.doc

PTD-114742

FIRE DEPARTMENT
CITY AND COUNTY OF HONOLULU
3375 KOAPAKA STREET, SUITE H425 • HONOLULU, HAWAII 96819-1869
TELEPHONE: (808) 831-7761 • FAX: (808) 831-7750 • INTERNET: www.honolulu.gov/hfd

MUFI HANNEMANN
MAYOR

ATTILIO K. LEONARDI
FIRE CHIEF

JOHN CLARK
DEPUTY FIRE CHIEF

RECEIVED
'05 AUG 17 P2:52
DIRECTOR'S OFFICE
DEPT OF
TRANSPORTATION SERVICES

August 16, 2005

TO: EDWARD Y. HIRATA, DIRECTOR
DEPARTMENT OF TRANSPORTATION SERVICES

FROM: ATTILIO K. LEONARDI, FIRE CHIEF

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT
WAHIAWA TRANSIT CENTER & PARK AND RIDE
TAX MAP KEY: 7-4-006: 002 AND PORTION OF 012

We received your letter dated August 5, 2005, requesting our review and comments on the above-mentioned project.

The Honolulu Fire Department has no objections to the above-mentioned project.

Should you have any questions, please call Battalion Chief Lloyd Rogers of our Fire Prevention Bureau at 831-7778.

Attilio K. Leonardi

ATTILIO K. LEONARDI
Fire Chief

AKL/DL:jl

PTD-11652

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843

RECEIVED
'05 AUG 16 P2:08
DIRECTOR'S OFFICE
DEPT OF
TRANSPORTATION SERVICES

August 15, 2005

TO: EDWARD Y. HIRATA, DIRECTOR
DEPARTMENT OF TRANSPORTATION SERVICES

FROM: HERBERT H. MINAKAMI, INTERIM MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

SUBJECT: YOUR LETTER OF AUGUST 5, 2005, ON THE DRAFT ENVIRONMENTAL ASSESSMENT FOR WAHIAWA TRANSIT CENTER & PARK AND RIDE, TMK: 7-4-06:2,12

The existing water system is presently adequate to accommodate the proposed transit center and park and ride.

The availability of water will be confirmed when the building permit is submitted for our approval. When water is made available, the applicant will be required to pay our Water System Facilities Charges for resource development, transmission, and daily storage.

The proposed development is subject to Board of Water Supply cross-connection control and backflow prevention requirements prior to issuance of the Building Permit Application.

If you have any questions, please contact Joseph Kaakua at 748-5442.

PT 116198

POLICE DEPARTMENT
CITY AND COUNTY OF HONOLULU
801 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96813 - AREA CODE (808) 529-3111
http://www.honolulupd.org
www.honolulu.gov

BOISSE P. CORREA
CHIEF

DEPUTY CHIEFS

RECEIVED
'05 AUG 12 P4:23

OUR REFERENCE BS-KP

August 11, 2005

TO: EDWARD Y. HIRATA, DIRECTOR
DEPARTMENT OF TRANSPORTATION SERVICES

FROM: BOISSE P. CORREA, CHIEF OF POLICE
HONOLULU POLICE DEPARTMENT

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT FOR WAHIAWA TRANSIT CENTER AND PARK AND RIDE, TAX MAP KEY: 7-4-006: 002 AND 7-4-006: 012 (PORTION)

Thank you for the opportunity to review and comment on the subject project.

This project should have no significant impact on the facilities or operations of the Honolulu Police Department.

If there are any questions, please call Major Michael Thomas of District 2 at 621-3725 or Mr. Brandon Stone of the Executive Bureau at 529-3644.

BOISSE P. CORREA
Chief of Police

By Karl Godsey
KARL GODSEY
Assistant Chief of Police
Support Services Bureau

Serving and Protecting with Aloha

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 3RD FLOOR
HONOLULU, HAWAII 96813
Phone: (808) 523-4529 • Fax: (808) 523-4730 • Internet: www.co.honolulu.hi.us

MUFI HANNEMANN
MAYOR

EDWARD Y. HIRATA
DIRECTOR

ALFRED A. TANAKA, P.E.
DEPUTY DIRECTOR

August 24, 2005

The Honorable Russ K. Saito
State Comptroller
Department of Accounting and General Services
State of Hawaii
P.O. Box 119
Honolulu, Hawaii 96810

Dear Mr. Saito:

Subject: Wahiawa Civic Center
Wahiawa Court Facility, Civic Center, and Transit Center
Memorandum of Agreement
DAGS Job No. 12-21-7100

Thank you for your letter dated August 9, 2005, regarding the subject Memorandum of Agreement (MOA).

The MOA was forwarded without addressing the parking requirements for the future Wahiawa Court Facility and Civic Center because it was agreed at a meeting on July 26, 2005, with your staff, that it would be in the State's best interest to insert the appropriate language. We have, however, revised the MOA to address the concerns which were voiced during the meeting.

You will note that the total number of parking spaces has been lowered to 58 due to code requirements.

Our consultant, at our request, recently reviewed the layout of stalls and has determined that the total count of parking spaces possible with a four-story expansion would be 222. As you know, they are currently in the process of conducting a geotechnical survey.

If you have any questions, please contact James Burke of the Public Transit Division at 523-4138.

Sincerely,

EDWARD Y. HIRATA
Director

Attachments

c: The Honorable Robert Bunda, Senator
The Honorable Marcus Oshiro, Representative
The Honorable Donovan Dela Cruz, Council Chair
Mr. Toru Hamayasu, Chief, DTS Planning Division
Mr. Dennis Chen, Judiciary
Mr. Lloyd Maki, DAGS-PWD PMB

Appendix F

Compilation of Review Comments to the Draft Environmental Assessment

Published in November 5, 2005

Environmental Assessment

Wahiawa Transit Center & Park and Ride
TMK: 7-4-006:002 & portion of 7-4-006:012
956 California Avenue, Wahiawa, O`ahu, Hawai`i

LINDA LINGLE
GOVERNOR OF HAWAII

GENEVIEVE SALMONSON
DIRECTOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
235 SOUTH BERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186
E-mail: oeqc@health.state.hi.us

November 8, 2005

Alfred Tanaka
Department of Transportation Services
650 South King St. 3rd floor
Honolulu, Hawaii 96813

Attn: Jolie Yee

Dear Mr. Tanaka:

Subject: Draft Environmental Assessment (EA)
Wahiawa Transit Center and Park & Ride

We have the following comments to offer:

Two-sided pages: In order to reduce bulk and save on paper, please print on both sides of the pages in the final document.

Traffic Impacts: How will impacts to traffic be mitigated during the construction phase?

Paving: Hawaii Revised Statutes 103D-407 requires the use of recycled glass in paving materials whenever possible. Will this be done?

Landscaping: Is any landscaping planned besides retention of trees on site? HRS 103D-408 requires the use of native Hawaiian flora whenever and wherever possible.

Consultations: Consultation with the community is required. Please consult with local community groups, allowing them sufficient time to review the EA and submit comments. If trees are to be relocated, consult with The Outdoor Circle about this. Document all contacts in the final EA and include copies of any correspondence.

Terminology: Section 4.3.4 uses the term "pulse system." In the final EA define this term.

Permits and approvals: The draft EA states that all "applicable reviews and approvals" will be secured from regulating agencies. In the final EA list them, along with the status of each.

If you have any questions call Nancy Heinrich at 586-4185.

Sincerely,

Genevieve Salmonson

GENEVIEVE SALMONSON
Director

c: Jennifer Wakazuru-Kim, AM Partners

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 3RD FLOOR
HONOLULU, HAWAII 96813
Phone: (808) 523-4529 • Fax: (808) 523-4730 • Internet: www.co.honolulu.hi.us

MUFI HANNEMANN
MAYOR

MELVIN N. KAKU
ACTING DIRECTOR

ALFRED A. TANAKA, P.E.
DEPUTY DIRECTOR

April 21, 2006

Ms. Genevieve Salmonson, Director
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

Dear Ms. Salmonson:

Subject: Wahiawa Transit Center & Park and Ride
Draft Environmental Assessment (DEA)

Thank you for your comments dated November 8, 2005, regarding the Draft Environmental Assessment (DEA) of the subject project. All comments will be included in the Final Environmental Assessment (FEA) to be submitted to Hawaii's Office of Environmental Quality Control.

In response to your concerns and comments to the Draft Environmental Assessment we offer the following statements:

1. Two-sided pages: We will accommodate your request to print the final document on both sides of the pages to reduce bulk and save on paper.

2. Traffic Impacts: A Traffic Management Plan will be provided for each aspect of the construction that will determine which adjacent streets will be closed off, and the mitigation measures to reduce the impacts. The Traffic Management Plan will also provide mitigation measures to minimize impacts on pedestrian traffic and will also include provisions that will allow the uninterrupted use of the existing cross walks.

3. Paving: Hawaii Revised Statutes (HRS) 103D-407 requires the use of recycled glass in paving materials whenever possible. Paving will be in accordance with the City and County of Honolulu's standards. Recycled glass can be used as a sub base but not the wearing surface; recycled glass will be allowed in that application but not required.

4. Landscaping: Hawaii Revised Statutes (HRS) 103D-408 requires the use of native Hawaiian flora whenever and wherever possible. We are aware of these requirements, however no new landscaping will be provided.

One of the trees on site that needs relocation is a street tree located within the sidewalk area and is therefore under the purview of the Department of Parks and Recreation (DPR). If and when this project reaches the stage where we have an agreement with the landowner, the State of Hawaii, regarding the use of the land, then DPR will provide an official decision regarding the relocation of this tree. The other tree that was slated for relocation is no longer there.

5. Consultations: The community has been continuously consulted on this project. At the regular meeting of the Wahiawa Neighborhood Board on January 28, 2002, the board voted unanimously to support the project. In any event, the FEA will document all contacts and will include copies of any correspondence.

6. Terminology: The term "pulse system" will be defined in the FEA.

7. Permits and approvals: The FEA will list the permits and approvals along with the status of each.

The Final Environmental Assessment (FEA) will be amended to address the concerns and comments discussed in your letter.

Should you have any additional questions or comments, please don't hesitate to contact James Burke, Chief, Public Transit Division at 523-4138.

Sincerely,

Melvin N. Kaku

MELVIN N. KAKU
Acting Director

LINDA LINGLE
GOVERNOR

RUSS K. SAITO
COMPTROLLER

KATHERINE H. THOMASON
DEPUTY COMPTROLLER

(P)1285.5

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P.O. BOX 119, HONOLULU, HAWAII 96810

DEC -8 2005

Mr. Alfred A. Tanaka, Acting Director
Department of Transportation Services
City and County of Honolulu
650 South King Street, 3rd Floor
Honolulu, Hawaii 96813

Dear Mr. Tanaka:

Subject: Wahiawa Transit Center and Park & Ride
Draft Environmental Assessment

Thank you for the opportunity to review the Draft Environmental Assessment for the Wahiawa Transit Center and Park & Ride. A Memorandum of Agreement (MOA) is being prepared by the City and County of Honolulu, Department of Transportation Services which will accommodate 342 parking stalls for the Wahiawa Court Facility (WCF), and the future new Civic Center to comply with the State Land Use Ordinance requirements. We await receiving and agreeing to the MOA so we can continue with the design of the WCF. In addition, please coordinate parking needs for the current user of the Civic Center site during construction of the transit center.

If you have any questions, please call me 586-0400 or have your staff call Mr. Allen Yamanoha of the Public Works Division at 586-0488.

Sincerely,

Russ K. Saito

RUSS K. SAITO
State Comptroller

c: Council Chair Donovan Dela Cruz
Senate President Robert Bunda
✓Ms. Jennifer Wakazuru-Kim, AM Partners Inc.
Ms. Genevieve Salmonson, OEQC
Mr. James Burke, CCH-DTS
Mr. Dennis Chen, Judiciary
Mr. Lloyd Maki, DAGS-PWD, PMB

jy

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 3RD FLOOR
HONOLULU, HAWAII 96813
Phone: (808) 523-4529 • Fax: (808) 523-4730 • Internet: www.co.honolulu.hi.us

MUFI HANNEMANN
MAYOR

MELVIN N. KAKU
ACTING DIRECTOR

ALFRED A. TANAKA, P.E.
DEPUTY DIRECTOR

March 20, 2006

The Honorable Russ K. Saito
State Comptroller
Department of Accounting
and General Services
State of Hawaii
P.O. Box 119
Honolulu, HI 96810

Dear Mr. Saito:

Subject: Memorandum of Agreement for Wahiawa Transit Center

We are transmitting the revised Memorandum of Agreement for your review and approval. Revisions have been made in accordance with our understanding of the meeting on November 8, 2005.

Please contact me at 523-4125 with any questions or concerns you may have regarding this transmittal.

Sincerely,

Melvin N. Kaku

MELVIN N. KAKU
Acting Director

Enclosure