Appendix A
Public Notices

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their issue during an open portion of this meeting or at a future meeting. The Director, in consultation with the Panel Chairperson, may allot time for members of the public to present their issues for review and discussion by the Panel.

Dated: January 14, 2014.

Aaron Siegel,

Alternate OSD Federal Register Liaison Officer, Department of Defense.

[FR Doc. 2014–00867 Filed 1–16–14; 8:45 am]

BILLING CODE 5001–06–P

DEPARTMENT OF DEFENSE

Department of the Air Force

[Docket ID: USAF–2014–0001]

Proposed Collection; Comment Request

AGENCY: Department of Defense/ Department of the Air Force/ Headquarters, HQ AFPC/DPFF, Airman & Family Division.

ACTION: Notice.

SUMMARY: In compliance with Section 3506(c)(2)(A) of the *Paperwork Reduction Act of 1995,* the Department of the Air Force announces a proposed public information collection and seeks public comment on the provisions thereof. Comments are invited on: Whether the proposed collection of information is necessary for the proper performance of the functions of the agency, including whether the information shall have practical utility; the accuracy of the agency's estimate of the burden of the proposed information collection; ways to enhance the quality, utility, and clarity of the information to be collected; and ways to minimize the burden of the information collection on respondents, including through the use of automated collection techniques or other forms of information technology.

DATES: Consideration will be given to all comments received by March 18, 2014.

ADDRESSES: You may submit comments, identified by docket number and title, by any of the following methods:

- Federal eRulemaking Portal: *http://www.regulations.gov.* Follow the instructions for submitting comments.
- Mail: Federal Docket Management System Office, 4800 Mark Center Drive, East Tower, Suite 02G09, Alexandria, VA 22350–3100.

Instructions: All submissions received must include the agency name, docket number and title for this **Federal Register** document. The general policy for comments and other submissions from members of the public is to make these submissions available for public viewing on the Internet at *http://www.regulations.gov* as they are received without change, including any personal identifiers or contact information.

Any associated form(s) for this collection may be located within this same electronic docket and downloaded for review/testing. Follow the instructions at *http://www.regulations.gov* for submitting comments. Please submit comments on any given form identified by docket number, form number, and title.

FOR FURTHER INFORMATION CONTACT: To request more information on this proposed information collection or to obtain a copy of the proposal and associated collection instruments, please write to the HQ AFPC/DPFF, Airman & Family Division, 550 C Street West, JBSA Randolph AFB, TX 78150, ATTN: Mr. Patrick Woodworth or call 210–565–3280.

SUPPLEMENTARY INFORMATION: *Title; Associated Form; and OMB Number:* Air Force Family Integrated Results & Statistical Tracking (AFFIRST) automated system; OMB Control Number 0701–0070.

Needs and Uses: The information collection requirement is necessary to record demographic information on Airman & Family Readiness Center (A&FRC) customers, results of the customer's visits, determine customer needs, service plan, referrals, workshop attendance and other related A&FRC activities and services accessed by the customer. Data is used to determine the effectiveness of A&FRC activities and services (results management) as well as collect and provide return on investment data to leadership. Information is compiled for statistical reporting to base, major commands, Headquarters United States Air Force, Department of Defense and Congress.

Affected Public: Individuals or households.

Annual Burden Hours: 15.

Number of Respondents: 60.

Responses per Respondent: 1.

Average Burden per Response: 15 minutes.

Frequency: On occasion.

Respondents are A&FRC customers who seek services from A&FRC. A&FRC employees enter customer demographic/ service delivery information into AFFIRST per Air Force Instruction 36–3009, Airman and Family Readiness Centers, paragraphs 3.13.1–3.13.3.

Dated: January 14, 2014.

Aaron Siegel,

Alternate OSD Federal Register, Liaison Officer, Department of Defense.

[FR Doc. 2014–00848 Filed 1–16–14; 8:45 am]

BILLING CODE 5001–05–P

DEPARTMENT OF DEFENSE

Department of the Army

Preparation of Environmental Impact Statement for the Lease of Army Land at Schofield Barracks, Oahu, Hawaii for the Construction and Operation of a Biofuel-Capable Power Generation Plant

AGENCY: Department of the Army, DoD.

ACTION: Notice of intent.

SUMMARY: The Department of the Army notifies interested parties of its intent to prepare a Joint Environmental Impact Statement (EIS) for the proposed lease of Army land at Schofield Barracks to the Hawaiian Electric Company (''Hawaiian Electric'') for the construction and operation on that land of a 50-megawatt (MW) biofuel-capable power generation plant. This EIS is designed to meet the requirements of both the National Environmental Policy Act (NEPA) and the Hawaii Environmental Policy Act (HEPA) as a matter of efficiency and cooperation with the State's decision-making process. The decision makers, the Department of the Army and the Hawaii Department of Land and Natural Resources, will use the analysis in the EIS to determine the potential effects of implementing the proposed action and alternatives. The Army also intends to integrate this NEPA process with the consultation and public participation requirements of Section 106 of the National Historic Preservation Act.

ADDRESSES: Written comments on the scope of the EIS or a request to be added to the EIS distribution list may be submitted as follows: Email to *sgspcomments@tetratech.com;* Facsimile (fax) to 703–385–6007 (Attention: SGSP EIS); U.S. mail to Melissa DeSantis, Tetra Tech, Inc. (Attention: SGSP EIS, 10306 Eaton Place, Suite 340, Fairfax VA 22030).

FOR FURTHER INFORMATION CONTACT: For more information on the Army's proposed action, please contact Mr. Doug Waters, Army Energy Initiatives Task Force. Mr. Waters can be reached by phone at 703–601–0511, Monday through Friday from 8:00 a.m. to 5:00 p.m. eastern, or by email at *douglas.s.waters.civ@mail.mil.* For general information about the Army NEPA process, please contact the Public

Affairs Office of the Army Environmental Command at 210–466–1590 or 1–855–846–3940 (toll free), or by email at *usarmy.jbsa.aex.mbx@mail.mil.*

SUPPLEMENTARY INFORMATION: The Army's proposed action, referred to as the Schofield Generating Station Project (SGSP), is a lease of 10.3 acres of land and a related 2.5 acre interconnection easement on Schofield Barracks to Hawaiian Electric, as well Hawaiian Electric's construction, ownership, operation, and maintenance of a 50 MW biofuel-capable power generation plant and 46-kilovolt subtransmission line.

The SGSP would be a source of renewable power that would provide an energy security service to Schofield Barracks, Wheeler Army Airfield, and Field Station Kunia if loss of service occurs from the normal sources of electricity supporting these installations. Any electricity produced from renewable biofuels would also help achieve the Army goals of producing renewable energy on Army-owned real property.

The SGSP would benefit Hawaiian Electric and the residents of Oahu. It would provide a quick-starting facility to help maintain grid stability; provide a facility at a higher elevation and away from coastlines; provide a physically secure facility on a military installation; and makes progress toward the Hawaii Renewable Portfolio Standard.

The SGSP would operate on a mix of biofuel and diesel, as required to meet Hawaiian Electric's Renewable Portfolio Standard and the Army's renewable energy goals, and may help sustain a local demand for biofuels. Since the SGSP would be multi-fuel capable, it would be able to run on a combination of fuels as necessary to ensure operations are economically viable and can continue under adverse operating conditions.

The EIS will assess the potential for direct, indirect, and cumulative effects on the human, natural, and cultural environment and identify mitigation measures for any adverse effects.

The EIS will examine two alternative operating scenarios for the proposed action. Under the first scenario, the SGSP would run approximately six hours per day, and consume up to eight million gallons of fuel per year. Under the second scenario, the SGSP would operate seven days a week and 24 hours per day, and would consume up to 31.5 million gallons of fuel per year.

The EIS will analyze a No Action Alternative, as prescribed by the Council on Environmental Quality (CEQ) regulations, to serve as the baseline against which the proposed action and alternatives are compared. Under this alternative, the SGSP would not be built. The EIS process will also examine whether there are additional reasonable alternatives that could meet the needs of both the Army and Hawaiian Electric.

Key resources of concern, for which potentially significant impacts could occur, include air quality, traffic, and stormwater. The Army is preparing supporting studies for those resources.

The Department of the Army encourages all interested members of the public, as well as federal, state, and local agencies to participate in the scoping process for the preparation of this EIS. Interested members may participate in scoping meetings, submit written comments, or both. Written comments will be accepted within a 45-day period following the publication of the Notice of Intent (NOI) in the **Federal Register**. Scoping meetings will be held on the Island of Oahu, Hawaii during the first week of February 2014. Notification of the locations and times for the meetings will be published in the *Honolulu Star-Advertiser.*

Brenda S. Bowen,

Army Federal Register Liaison Officer.

[FR Doc. 2014–00888 Filed 1–16–14; 8:45 am]

BILLING CODE 3710–08–P

DEPARTMENT OF DEFENSE

Department of the Navy

Reopening and Extending the Public Comment Period for the Notice of Intent To Prepare an Environmental Impact Statement for EA–18G Growler Airfield Operations at Naval Air Station Whidbey Island, Washington

AGENCY: Department of the Navy, DoD.

ACTION: Notice.

SUMMARY: The Department of the Navy (DoN) is reopening and extending the public scoping period for the notice of intent to prepare an Environmental Impact Statement (EIS) for EA–18G Growler Airfield Operations at Naval Air Station (NAS) Whidbey Island, Washington. This notice announces an extension of the public scoping period until January 31, 2014.

FOR FURTHER INFORMATION CONTACT: EA–18G EIS Project Manager (Code EV21/SS); Naval Facilities Engineering Command (NAVFAC) Atlantic, 6506 Hampton Boulevard, Norfolk, Virginia 23508.

SUPPLEMENTARY INFORMATION: On September 5, 2013 (78 FR 54635), the DoN published a notice of intent to prepare an EIS for EA–18G Growler Airfield Operations at NAS Whidbey Island, Washington and also announced public scoping meetings. DoN provided a 120-day public scoping period which ended on January 3, 2014. The original public scoping period was intended to avoid any complications or delays that could result from government shutdowns and the end of the calendar year.

This notice announces an extension of the public scoping period until January 31, 2014. Scoping comments may be submitted in writing to the EA–18G EIS Project Manager (Code EV21/SS); Naval Facilities Engineering Command (NAVFAC) Atlantic, 6506 Hampton Boulevard, Norfolk, Virginia 23508, or electronically via the project Web site (*http://www.whidbeyeis.com*). All written comments must be postmarked or received (online) by January 31, 2014, to ensure they become part of the official record.

Dated: January 14, 2014.

N.A. Hagerty-Ford,

Commander, Office of the Judge Advocate General, U.S. Navy, Federal Register Liaison Officer.

[FR Doc. 2014–00876 Filed 1–16–14; 8:45 am]

BILLING CODE 3810–FF–P

DEPARTMENT OF EDUCATION

National Board for Education Sciences; Meeting

AGENCY: Institute of Education Sciences, U.S. Department of Education.

ACTION: Notice of an open meeting.

SUMMARY: This notice sets forth the schedule and proposed agenda of an upcoming meeting of the National Board for Education Sciences (NBES). The notice also describes the functions of the Committee. Notice of this meeting is required by Section 10(a) (2) of the Federal Advisory Committee Act and is intended to notify the public of their opportunity to attend the meeting.

DATES: January 31, 2014.

Time: 8:30 a.m. to 4:30 p.m. Eastern Standard Time

ADDRESSES: 80 F Street NW., Large Board Room, Washington, DC 20001

FOR FURTHER INFORMATION CONTACT: Ellie Pelaez, 555 New Jersey Avenue NW., Room 600 E, Washington, DC 20208; phone: (202) 219–0644; fax: (202) 219–1402; email: *Ellie.Pelaez@ed.gov.*

SUPPLEMENTARY INFORMATION: The National Board for Education Sciences is authorized by Section 116 of the Education Sciences Reform Act of 2002

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ESTHER KIA'AINA
FIRST DEPUTY

WILLIAM M. TAM
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
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KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

OFFICE OF CONSERVATION AND COASTAL LANDS
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

REF: OCCL: AJR

Schofield Generating Station Project

DEC 23 2013
DEC 23 P1:56
FILE COPY
JAN 08 2014

Herman Tuiolosega, Acting Director
Office of Environmental Quality Control
Department of Health, State of Hawai'i
235 S. Beretania St., Rm. 702
Honolulu, HI 96813

SUBJECT: **ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE (EISPN) FOR THE PROPOSED SCHOFIELD GENERATING STATION PROJECT**
Wahiawā District, Island of Oahu
TMKs: (1) 77001001, 002; (1) 73001001, 002, 006, 007, 008, 009, 011, 012, 013, 019, 022 & 024; (1) 76001001 & 006; (1) 94012001, 003 & 011

Dear Mr. Tuiolosega,

With this letter, the Department of Land and Natural Resources (DLNR) hereby transmits the environmental impact statement preparation notice (EISPN) for the proposed Schofield Generating Station Project (SGSP) situated on TMK(s): *(1) 77001001, 002; (1) 73001001, 002, 006, 007, 008, 009, 011, 012, 013, 019, 022 & 024; (1) 76001001 & 006; (1) 94012001, 003 & 011*, in the Wahiawā District on the Island of Oahu for publication in the next available edition of the Office of Environmental Quality Control (OEQC) Environmental Notice (EN).

We understand that publication of the EISPN in the Environmental Notice will initiate a 30-day public consultation period for parties to comment on the action and to request to become consulted parties in the preparation of the Draft Environmental Impact Statement (DEIS).

Enclosed is a completed OEQC publication form, two (2) copies of the EISPN, and PDF file of the same, and an electronic copy of the publication form in MS Word. Simultaneous with this letter, we have submitted the summary of the proposed land use in a text file by electronic mail to your office.

If there are any questions please contact Alex J. Roy, M.Sc. of the Office of Conservation and Coastal Lands at 808-587-0316.

Sincerely,

William J. Aila, Jr., Chairperson
Department of Land and Natural Resources

CC: *Ian C. Hirokawa - DLNR*
Hawaiian Electric Company, Attn: Jack Shriver
Tetra Tech, Inc., Attn: John Bock

Attachments: *OEQC Publication form (1 hard copy)*
EISPN (2 hard copies)
1 CD/R w/ PDF of EISPN and MSWord Document of OEQC Publication Form

APPLICANT ACTIONS

SECTION 343-5(C), HRS

PUBLICATION FORM (JANUARY 2013 REVISION)

Project Name: Schofield Generating Station Project (SGSP)

Island: O'ahu

District: Wahiawā

TMK: (1) 77001001, 002; (1) 73001001, 002, 006, 007, 008, 009, 011, 012, 013, 019, 022 & 024; (1) 76001001 & 006; (1) 94012001, 003 & 011

'13 DEC 23 P1:57

Permits/Approvals:

a. Easements for use of State lands - DLNR
b. Conservation District authorization - OCCL
c. Air Permit (Covered Source and Prevention of Significant Deterioration) – EPA/DOH
d. Notice of Proposed Construction or Alteration - FAA
e. Decision and Order - PUC
f. Excavation Permit - Army
g. Site Plan Review - Army
h. Hazardous Waste Generator ID number (construction and operation)
i. Spill Prevention, Control, and Countermeasure Plan (construction and operation)
j. Equipment and Materials Handling, including materials disposal - DOT
k. Energy Information Administration registration
l. NPDES for storm water (construction and operation)
m. Variance for noise during construction
n. Emergency and Hazardous Chemical Inventory
o. Airport Hazard Area Zone Permit
p. Pressure Vessel Installation Permit
q. Street Usage Permit - DOT
r. Use and Occupancy Agreement (UOA) – DOT
s. Approval to Cross State Water – Army Corps of Engineers
t. Building Permit

Approving Agency: State of Hawai'i Department of Land and Natural Resources
1151 Punchbowl St., Room 131, Honolulu, HI 96813
Attn: William Aila, Chairperson
(808) 587-0400

Applicant: Hawaiian Electric Company
820 Ward Ave
Honolulu, HI 96814
Attn: Jack Shriver
(808) 543-4088

Consultant: Tetra Tech, Inc.
1999 Harrison St. Ste. 500, Oakland, CA 94612
Attn: John Bock
(510) 302-6249

Status (check one only):

__DEA-AFNSI — Submit the proposing agency notice of determination/transmittal on agency letterhead, a hard copy of DEA, a completed OEQC publication form, along with an electronic word processing summary and a PDF copy (you may send both summary and PDF to oeqchawaii@doh.hawaii.gov); a 30-day comment period ensues upon publication in the periodic bulletin.

__FEA-FONSI — Submit the proposing agency notice of determination/transmittal on agency letterhead, a hard copy of the FEA, an OEQC publication form, along with an electronic word processing summary and a PDF copy (send both summary and PDF to oeqchawaii@doh.hawaii.gov); no comment period ensues upon publication in the periodic bulletin.

__FEA-EISPN — Submit the proposing agency notice of determination/transmittal on agency letterhead, a hard copy of the FEA, an OEQC publication form, along with an electronic word processing summary and PDF copy (you may send both summary and PDF to oeqchawaii@doh.hawaii.gov); a 30-day consultation period ensues upon publication in the periodic bulletin.

X Act 172-12 EISPN — Submit the proposing agency notice of determination on agency letterhead, an OEQC publication form, and an electronic word processing summary (you may send the summary to oeqchawaii@doh.hawaii.gov). NO environmental assessment is required and a 30-day consultation period upon publication in the periodic bulletin.

__DEIS — The proposing agency simultaneously transmits to both the OEQC and the accepting authority, a hard copy of the DEIS, a completed OEQC publication form, a distribution list, along with an electronic word processing summary and PDF copy of the DEIS (you may send both the summary and PDF to oeqchawaii@doh.hawaii.gov); a 45-day comment period ensues upon publication in the periodic bulletin.

__FEIS — The proposing agency simultaneously transmits to both the OEQC and the accepting authority, a hard copy of the FEIS, a completed OEQC publication form, a distribution list, along with an electronic word processing summary and PDF copy of the FEIS (you may send both the summary and PDF to oeqchawaii@doh.hawaii.gov); no comment period ensues upon publication in the periodic bulletin.

__ Section 11-200-23 Determination — The accepting authority simultaneously transmits its determination of acceptance or nonacceptance (pursuant to Section 11-200-23, HAR) of the FEIS to both OEQC and the proposing agency. No comment period ensues upon publication in the periodic bulletin.

__Section 11-200-27 Determination — The accepting authority simultaneously transmits its notice to both the proposing agency and the OEQC that it has reviewed (pursuant to Section 11-200-27, HAR) the previously accepted FEIS and determines that a supplemental EIS is not required. No EA is required and no comment period ensues upon publication in the periodic bulletin.

__Withdrawal (explain)

Summary (Provide proposed action and purpose/need in less than 200 words. Please keep the summary brief and on this one page):

The proposed action is the granting of a lease and easement of Army land on Schofield Barracks, and granting of an easement and conservation district authorization to cross state land, to Hawaiian Electric for the construction, ownership, operation, and maintenance of a 50 MW biofuel-capable power generation plant (the Schofield Generating Station or SGS) and sub-transmission line to connect the plant to the Hawaiian Electric grid.

For Hawaiian Electric, the SGSP would provide a quick-starting facility to help maintain grid stability and compensate for increasing network penetration by variable power generation, such as wind and solar; provide a facility at a higher elevation and away from coastlines, which contributes to grid reliability and continuity if a natural disaster occurs; provide a physically secure facility on a military installation, contributing to grid continuity of operation in cases of a manmade threat; and make progress towards the State Renewable Portfolio Standards.

For the Army the SGSP would provide energy security for its three installations if loss of service occurs from the normal sources of electricity supporting these installations. It would also to help achieve the Army goals of producing renewable energy on Army-owned real property and increasing installation use of electricity from renewable energy sources.

Notice of Intent to Prepare an Environmental Impact Statement for the Schofield Generating Station Project (SGSP)

APPLICANT:
Hawaiian Electric Company, Inc.
P.O. Box 3978
Honolulu, HI 96812-3978
Contact: Jack Shriver, (808) 543-4088

APPROVING AGENCY:
Department of Land and Natural Resources
1151 Punchbowl St., Room 131
Honolulu, HI 96813
Contact: William Aila, Chairperson (808) 587-0400

DATES:

All comments on this notice will be considered if received or postmarked on or before February 22, 2014.

All comments received are a part of the public record. All personal identifying information (for example, name, address, etc.) voluntarily submitted by the commenter may be publicly accessible. Do not submit confidential business information or otherwise sensitive or protected information.

ADDRESSES:

Please submit copies of your comments to both DLNR and the EIS Consultant (Tetra Tech, Inc). Please send comments with the subject line of *SGSP EISPN* and include your email address if possible. Transmission of comments to DLNR must be via U.S. Mail to DLNR at the address below, as DLNR will only accept comments via mail:

Department of Land and Natural Resources
1151 Punchbowl St., Room 131
Honolulu, HI 96813
Attention: William Aila, Chairperson

Transmission of comments to Tetra Tech, Inc may be via any of the means listed below (email, fax, or U.S. Mail). However, attachments to electronic comments will be accepted in Microsoft Word, Excel, WordPerfect, or Adobe PDF file formats only:

Email: sgspcomments@tetratech.com.

Facsimile (fax): 703-385-6007 (Attention: SGSP EISPN).

U.S. Mail: Melissa DeSantis, Tetra Tech, Inc. (Attention: SGSP EISPN, 10306 Eaton Place, Suite 340, Fairfax VA 22030).

Your comments will be forwarded to the Applicant (Hawaiian Electric).

FOR FURTHER INFORMATION CONTACT:

For more information on the project, please contact Mr. Jack Shriver, Senior Engineer, Generation Project Development, Hawaiian Electric Company. Mr. Shriver can be reached by phone at (808) 543-4088, Monday through Friday from 8:00 a.m. to 5:00 p.m. (Hawai'i Standard Time), or by email at jack.shriver@hawaiianelectric.com.

BRIEF DESCRIPTION OF PROPOSED ACTION

Overview of the Proposed Action

The proposed action, referred to as the Schofield Generating Station Project (SGSP) consists of the following:

- The U.S. Army's lease of 10.3 acres of land, and the related granting of a 2.5 acre interconnection easement, on Schofield Barracks and Wheeler Army Airfield to the Hawaiian Electric Company, Inc. (Hawaiian Electric).

- The State of Hawaiʻi Department of Land and Natural Resources granting of a 1.28 acre easement and a 0.7 acre conservation district authorization allowing for the construction of a 46 kV electrical power transmission line between the SGSP site and the existing Wahiawa Substation.

- Hawaiian Electric's construction, ownership, operation, and maintenance of a 50 megawatt capacity biofuel-capable power generation plant and 46 kilovolt sub-transmission line required to connect the Schofield Generating Station to the Hawaiian Electric grid. Hawaiian Electric would be the sole owner of the plant and the electrical power transmission facilities.

Figure 1 shows the location of the SGSP site relative to other existing uses in the region. The drawing reproduced in Figure 2 depicts the conceptual layout of facilities that comprise the SGSP. Figure 3 depicts the conceptual alignment of the electrical power transmission facilities that would link the proposed project to Hawaiian Electric's existing electrical power transmission and distribution system.

The lease of federal property would be under the authority of 10 United States Code (USC) 2667, "Leases: non-excess property of military departments." The easement on federal property would be under the authority of 10 USC 2668, "Easements for rights-of-way." The easement over State land would be as provided for under §171-95, Hawaiʻi Revised Statutes (HRS). The conservations district use authorization would be pursuant to Chapter 183C, HRS, and related regulations. The proposed facilities would be constructed and operated in accordance with all applicable laws and regulations.

Purpose of and Need for the Proposed Action

The purpose of the project is to meet the common needs of Hawaiian Electric and the U.S. Army Garrison—Hawaii for secure, reliable, and renewable power generation.

Hawaiian Electric would operate the SGSP as a peaking/cycling unit to meet load and reliability requirements of the Oʻahu grid; as such, under normal conditions, it would serve all Hawaiian Electric customers. The SGSP would benefit Hawaiian Electric and the residents of Oʻahu in a number of ways. The six biofuel-capable reciprocating engine-generator sets would add 50 MW of firm, utility-owned renewable energy capacity to the Oʻahu electrical grid. These load-following/peaking/cycling generating units are quick starting, which makes them particularly helpful for maintaining grid stability as the amount of power from variable renewable sources (wind and solar) increases over time. In short, they complement, rather than compete with, other existing and anticipated renewable energy sources in the system. The SGSP would benefit Hawaiian Electric's system in other ways as well: (i) its location away from the coastline protects it from natural disasters that could affect many of the electrical power sources on the island; (ii) its

ability to provide power directly to Wheeler Army Airfield (a FEMA designated relief airfield and Hawaii National Guard site) will enhance disaster relief capacity on Oahu; (iii) its central Oʻahu location places it closer to users who are now relatively far from generating sources, thereby enhancing grid stability and reducing power restoration times for the Wahiawa community in the event of an outage; (iv) its position within a guarded military installation reduces its exposure to man-made threats.; and (v) its use of renewable biofuels will contribute to State Renewable Portfolio Standard goals.

The proposed action meets two needs for the Army. The SGSP would be a source of renewable power that would enhance energy security for Schofield Barracks, Wheeler Army Airfield, and Field Station Kunia if loss of service occurs from the normal sources of electricity supporting these installations. It would also help achieve the Army goals of producing renewable energy on Army-owned real property.

The Schofield Generating Station would operate on a mix of biofuel and diesel as required to meet Hawaiian Electric's Renewable Portfolio Standards and the US Army's renewable energy goals, as well as sustain a local demand for biofuels. Being multi-fuel capable, it would be able to run on a combination of fuels as necessary to ensure operations are economically viable and can continue under adverse operating conditions.

As the penetration of as-available energy resources, particularly solar photovotaics, increases on Hawaiian Electric's grid, the load curve is expected to change in two ways. Firstly, during daylight hours when photovoltaic production is high total energy demand served by the grid's firm generation sources is likely to be reduced. This effect is expected to create a short morning peak (before the sun rises) for the firm generation sources, and a more pronounced evening peak (after sunset and coincident with peak total demand) for the firm generation sources. Secondly, as the proportion of power and energy provided by wind and solar increases, the effects of clouds and wind variability will have a correspondingly larger impact on grid stability throughout the day.

Schofield Generating Station's combination of quick-starting, flexible, and high efficiency capabilities would combine traditional definitions of "cycling" and "peaking" units, and would instead meet both of these needs as a peaking/cycling station. As such, it would allow the grid to accommodate more fluctuating renewable energy than would otherwise be the case. Accordingly, the EIS will analyze an intermittent operating scenario in which the facility would operate at loads that vary between maximum continuous output (all six engines operating at full load) and minimum load (one engine operating at roughly 50 percent load), for up to 2,200 hours per year (approximately six (6) hours/day). If it were operated in such a fashion, it would consume up to eight (8) million gallons of fuel per year.

If demand increases, operations of other generating facilities decline, and/or future renewable resources do not develop, full-time (rather than intermittent) operation could become a viable operating scenario. As the SGSP would be permitted to operate 7 days a week and 24 hours per day, this EIS will also analyze the impacts of full (100%) operation as a reasonably foreseeable upper bound of effects. Under full operation, each engine would operate 8,760 hours per year, and the SGS would use up to 31.5 million gallons of fuel (a combination of biofuels and fossil fuels) per year.

The agreement under which the SGSP would be constructed and operated would, under certain conditions such as sustained outages or security threats, give the Army "first call" on the electrical energy it produces, and the included transmission facilities would allow the power it produces to be "islanded" to give priority to the Army facilities. SGSP will also shorten the time required to restore

power to the Wahiawa community, and have the capability and capacity to start up other Hawaiian Electric generation units at Waiau Power Plant, expediting the restoration of the grid in the event of an island-wide outage. The 50 MW firm power capacity of the SGSP is sufficient to meet the three Army installations' peak electrical power requirements for all operational needs, administrative functions, logistics, and quality of life functions, thereby providing energy security for the installations if power from the normal source of electricity supporting these Army installations (i.e., the Hawaiian Electric island-wide grid) is interrupted. Thus, the proposed action would help to ensure that the Army's critical national security and first response missions can be carried on even when the island wide utility grid has been compromised.

DETERMINATION & REASONS SUPPORTING DETERMINATION:

The Department of the Army has determined that the SGSP is an action that is subject to the National Environmental Policy Act (NEPA), as amended, the Council on Environmental Quality (CEQ) NEPA regulations (40 CFR Parts 1500 through 1508), and the Department of the Army's NEPA implementing procedures (32 CFR Part 651). It has further determined that it will prepare an environmental impact statement for the proposed undertaking.

The Department of Land and Natural Resources has determined that the SGSP is an action subject to Chapter 343 and has further determined that an environmental impact statement should be prepared. Hawaiian Electric's proposal calls for construction of a new 6-mile long overhead 46 kV sub-transmission line that would allow power from the SGSP to be delivered to the existing Hawaiian Electric 46 kV system. A segment of that route passes over State lands. The granting of the easement for that land constitutes use of State land that is subject to Chapter 343, and Hawai'i Administrative Rules §11-200.

In accordance with § 343-5(h), HRS, because this action is subject to both the NEPA and to Chapter 343, the Army, the Department of Land and Natural Resources and Hawaiian Electric are cooperating to reduce duplication between federal and state requirements by preparing joint environmental impact statement documents with concurrent public review.

In 2012, the State Legislature enacted Act 172, allowing the Chapter 343 process to begin with preparation of an environmental impact statement preparation notice (EISPN) rather than a draft environmental assessment (DEA) in cases where the agency determines that an EIS is likely to be required. This brings the law into alignment with NEPA, which has always allowed for the preparation of an EIS if a Federal agency believes that the action may have a significant impact on the environment.

It is the Army's and DLNR's experience that actions with the size and scope of the SGSP have the potential to have significant environmental effects and benefit from the public review that is provided by the EIS process; therefore, they have decided to prepare an EIS without the preparation of an EA. The Army expects to initiate the EIS scoping process in January 2014 with publication of a Notice of Intent in the Federal Register coinciding with publication of the EISPN.

The Joint Federal/State EIS will examine in detail the potential beneficial and adverse effects of implementing the proposed lease/easement action and the construction/operation of the SGSP. The EIS will assess the potential for direct, indirect, and cumulative effects on the human, natural, and cultural environment and identify mitigation measures for adverse effects.

The EIS will also report the effects of a No Action Alternative as prescribed by federal and state regulations to serve as the baseline against which the proposed action and alternatives are analyzed. Under the No Action Alternative, the Army would not execute the lease/easement, DLNR

would not grant the easement, and Hawaiian Electric would not construct the electrical power generation and transmission facilities. Under normal conditions, Hawaiian Electric would continue to use existing electrical generation facilities, fuels, and grid assets to supply power to its customers, including the Army. During periods when the grid is unable to provide power to the three Army installations, they would rely on their existing fossil fuel-powered backup generators. Because those existing units are able to provide less than 10 percent of the amount needed, the vast majority of the activities on the installations would be interrupted until normal power is restored.

Finally, in accordance with NEPA and Chapter 343 requirements, the EIS will also discuss whether or not there are additional reasonable alternatives that could meet the purpose of the project and the needs of both the Army and Hawaiian Electric. If such alternatives are found to exist through the scoping process, they will be considered in the EIS.

The EIS will evaluate the full range of potential environmental, cultural, and socioeconomic impacts associated with implementing the proposed action and alternatives, including short-term impacts associated with construction. The following impact categories have been tentatively identified for consideration in the EIS:

- Cultural and historical resources (including Native Hawaiian resources).
- Air quality (including climate change and greenhouse gas emissions).
- Water resources (including floodplain, wetlands, and stormwater management).
- Geology and soils.
- Land use.
- Biological resources (including threatened and endangered species, special status species, and related sensitive resources).
- Traffic and transportation.
- Airspace management.
- Public health and safety.
- Noise.
- Hazardous materials and waste management.
- Visual resources.
- Socioeconomics.
- Environmental justice (disproportionately high and adverse impacts to minority and low-income populations).
- Protection of children (from environmental health risks and safety hazards).
- Utilities and infrastructure.

The Army and Hawaiian Electric anticipate that they will conduct several studies in support of the environmental impact statement. These include:

(i) a traffic study to analyze the potential impacts to traffic flow during construction and operation along Kunia Road and within Schofield Barracks;
(ii) an air quality impact study evaluating the effects of constructing and operating the SGSP;
(iii) a stormwater characterization study for the SGSP site;
(iv) a Phase I cultural resources survey on the SGSP and transmission line properties; and
(v) a separate Cultural Impact Assessment (CIA) as required by HRS Chapter 343.

GOVERNMENT AGENCIES RESPONSIBLE FOR APPROVALS:

The EIS will be jointly approved by the Commander of the US Army Garrison—Hawaii and the Department of Land and Natural Resources.

Figure 1 Location of the Proposed Action.

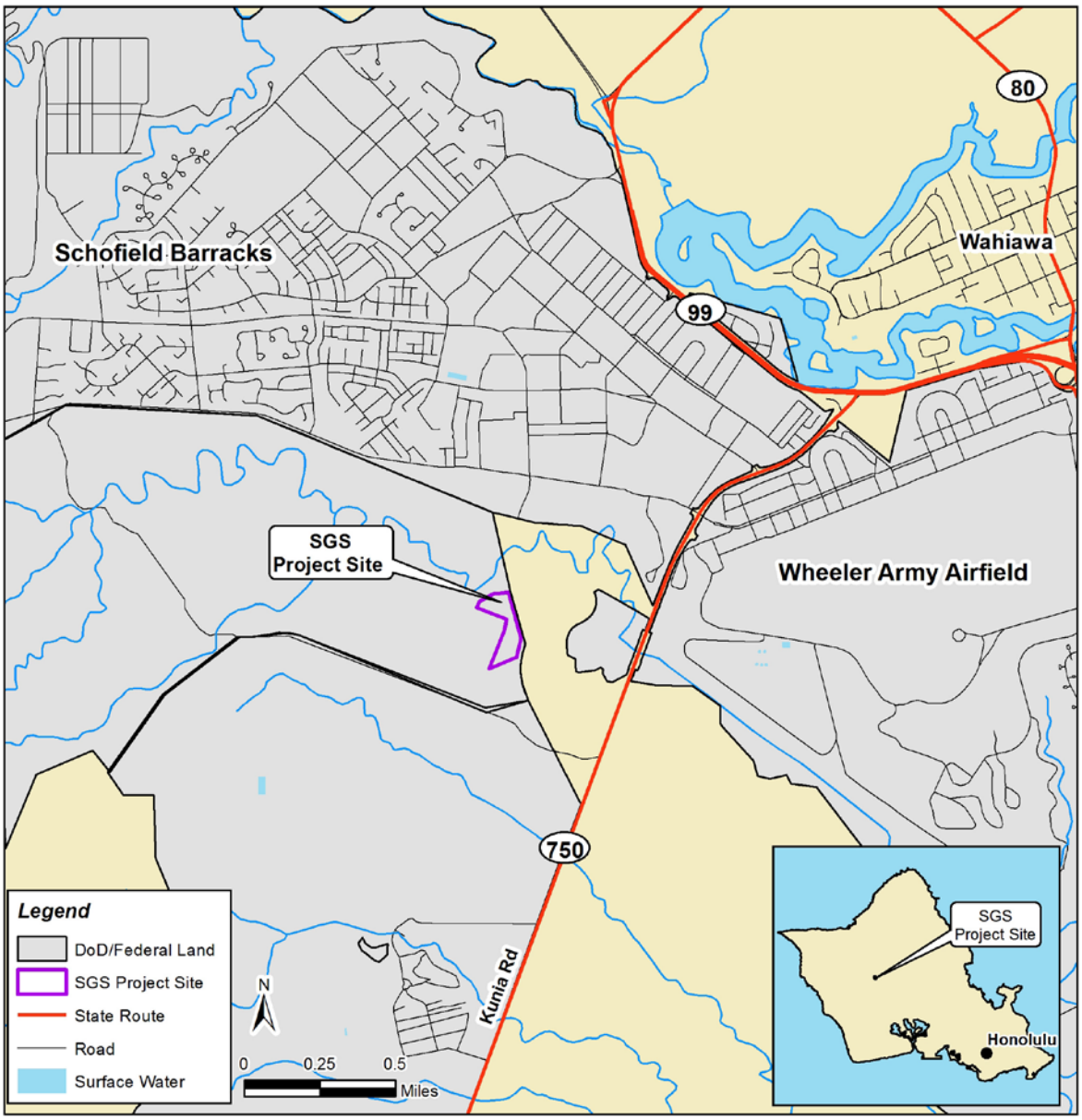


Figure 2 Conceptual Layout of the Proposed Schofield Generating Station.

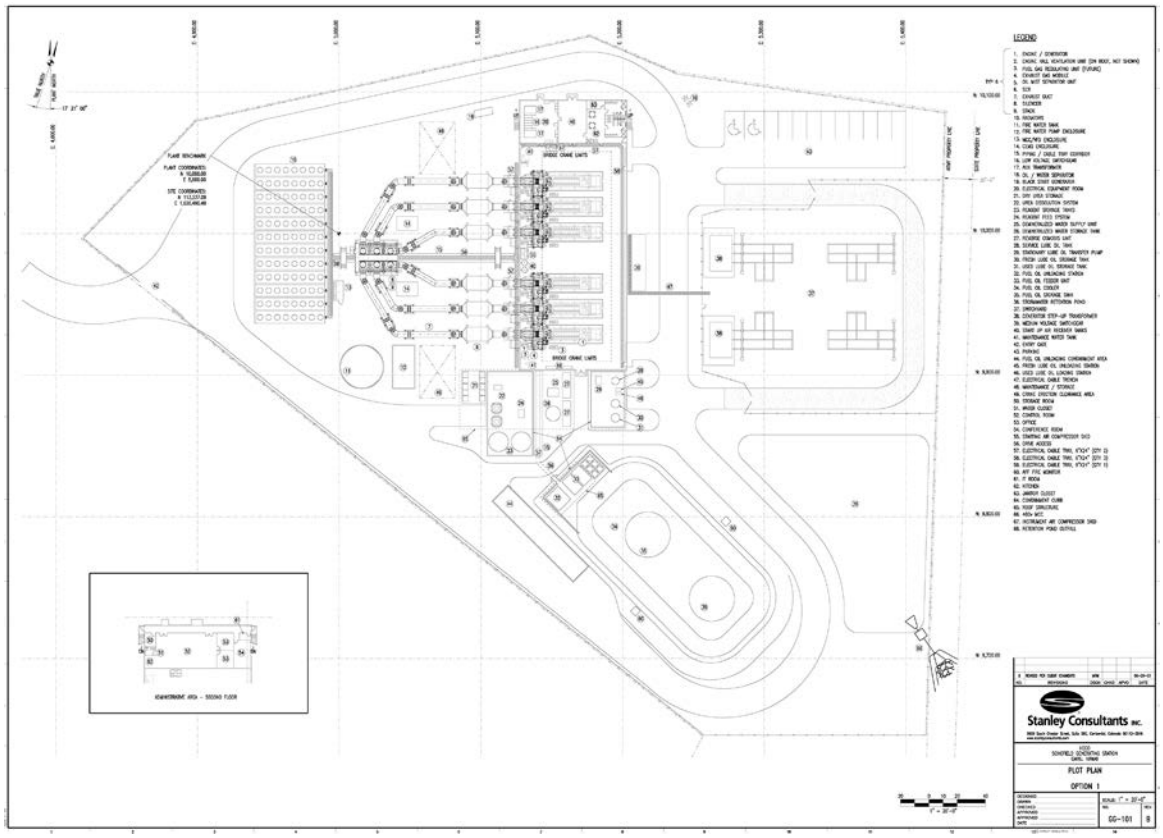
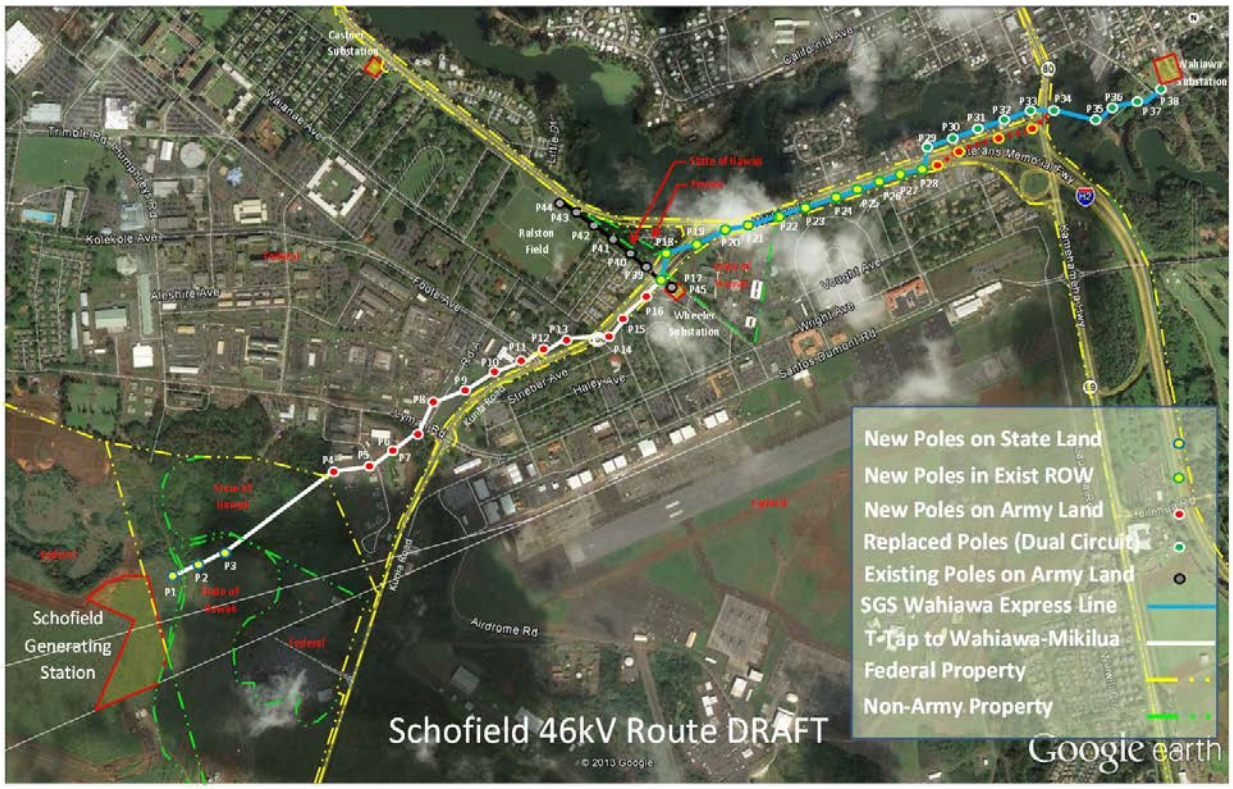


Figure 3 Conceptual Alignment of the Proposed 46 kV Transmission Facilities



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Description

Public Scoping Meetings for Schofield Generating Station Project Environmental Impact Statement The Department of the Army and Hawaiian Electric Company, Inc. seek public input on the scope of topics to be studied in a joint federal and state Environmental Impact Statement for the construction and operation of a biofuel-capable power plant at Schofield Barracks, City and County of Honolulu, Oahu. Hawaiian Electric would build the proposed Schofield Generating Station Project on land at Schofield Barracks that the Army would make available under a lease. Public meetings will be held on the island of Oahu: February 5, 2014 6:30-9:00 p.m. Mililani Mauka Elementary School Cafeteria 95-1111 Makaikai Street Mililani, HI 96789 February 6, 2014 6:30-9:00 p.m. Wahiawa District Park Recreation Center 1129 Kilani Avenue Wahiawa, HI 96786 The presentation will begin at 7:00 p.m. Public comments will be taken immediately following the presentation. If you require a sign language or Native Hawaiian language interpreter at either meeting, please contact Amber Siegel at 703-385-2597 no later than January 27, 2014. Please leave a message if you reach her voicemail. Comments submitted during a 45-day period beginning January 17 and ending March 2, 2014, will be used to help define the scope of the EIS. For more information on the comment process, the EIS, and the proposed project please visit http://www.garrison.hawaii.army.mil/schofieldplant/default.html. For questions regarding the public information process and meetings, please contact U.S. Army Garrison- Hawaii Public Affairs at 808-656-3152. (SA591962 1/17/14)

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Release number: 2014-01-01
Jan. 17, 2014

FOR IMMEDIATE RELEASE

Army to study potential biofuel-capable power plant on Schofield

SCHOFIELD BARRACKS, Hawaii — The Army invites the public to provide input on the scope of a future Environmental Impact Statement (EIS) for the construction and operation of a 50-megawatt biofuel-capable power generation plant, here.

The Schofield Generating Station Project (SGSP) would be a source of renewable power that would benefit the Hawaiian Electric Company ("Hawaiian Electric") and Oahu residents by supplying power to the islandwide grid during normal operations.

The SGSP would also provide an energy security service for Schofield Barracks, Wheeler Army Airfield and Field Station Kunia by serving as a backup source of power, should loss of service occur from the normal electricity sources supporting these installations. Electricity produced from renewable biofuels at the SGSP would help the Army achieve its renewable energy goals.

The EIS will study the impacts of developing the SGSP on existing land at Schofield Barracks. The Army would lease 10.3 acres to Hawaiian Electric and grant a related 2.5 acre interconnection easement on Schofield's South Range, west of Kunia Road. Hawaiian Electric would construct, own, operate and maintain the power generation plant. A 46-kilovolt subtransmission line would be built to connect the SGSP to the Hawaiian Electric grid. Air quality, traffic and storm water are among the key resources that will be studied. More information is available in the Notice of Intent published in the *Federal Register* or online at www.garrison.hawaii.army.mil/schofieldplant/.

Interested members of the public, as well as federal, state and local agencies, are invited to participate in the scoping process by helping to identify possible alternatives, potential environmental impacts, and key issues of concern to be analyzed in the EIS.

During the 45-day scoping period, which runs Jan. 17 to March 2, the community can participate in public scoping meetings; submit written comments; or both. The scoping meetings will be held the first week of February, as follows:

Feb. 5
6:30–9 p.m.
Mililani Mauka Elementary School Cafeteria
95-1111 Makaikai St.
Mililani, HI 96789

Feb. 6
6:30–9 p.m.
Wahiawa District Park Recreation Center
1129 Kilani Ave.
Wahiawa, HI 96786

- MORE -

PLANT 2-2-2

The meetings will start with informational display viewing at 6:30 p.m., followed by an overview presentation at 7 p.m., and an oral comment period from 7:30-9 p.m.

In addition to the meetings, individuals can submit written comments via the following: 1) Email sgspcomments@tetratech.com; 2) Fax 703-385-6007 (Attention: SGSP EIS); 3) Mail to Melissa DeSantis, Tetra Tech, Inc. (Attention SGSP EIS, 10306 Eaton Place, Suite 340, Fairfax, VA 22030). Written comments should be sent or postmarked no later than March 2.

For questions regarding the scoping process and meetings, please contact U.S. Army Garrison-Hawaii Public Affairs at (808) 656-3152.

– 30 –

Appendix B
Scoping Comments

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NOI COMMENTS

PUBLIC SCOPING MEETING

FOR THE

PROPOSED SCHOFIELD GENERATING STATION PROJECT

ENVIRONMENTAL IMPACT STATEMENT

Thursday, February 6, 2014

Wahiawa District Park Recreation Center

1129 Kilani Avenue

Wahiawa, Hawaii 96786

7:00 - 9:30 p.m.

REPORTER'S TRANSCRIPT

OF PUBLIC COMMENTS

BEFORE: ELSIE TERADA, CSR NO. 437

Certified Shorthand Reporter

WALTER BENAVITZ: On behalf of the Wahiawa Community and Business Association, the WCBA, and myself and with my background, we support and I support the Schofield Generating Station Project for all the reasons stated in the Project Fact Sheet that was provided to us. We support the military's wisdom and their experience with Wahiawa Community and protecting the environment, protecting the ohana. This project is going to help Wahiawa and it will help Hawaii. So, again, on behalf of the WCBA, we support, we officially support this project.

-oOo-

C E R T I F I C A T E

STATE OF HAWAII)
) SS.
CITY AND COUNTY OF HONOLULU)

I, Elsie Terada, Certified Shorthand Reporter, Certificate No. 437, for the State of Hawaii, hereby certify:

The foregoing transcript is a true and correct copy of the original transcript of the proceedings taken before me as therein stated.

Dated this 28th day of February, 2014, in Honolulu, Hawaii.

_____

ELSIE TERADA, CSR NO. 437

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

February 27, 2014

Mr. Doug Waters
Army Energy Initiatives Task Force – 8th Floor
Department of the Army
2530 Crystal Drive
Arlington, VA 22202

Ms. Melissa DeSantis
Tetra Tech, Inc.
ATTN: SGSP EIS
10306 Eaton Place, Suite 340
Fairfax, VA 22030

Subject: Notice of Intent to Prepare a Joint Environmental Impact Statement for the Lease of Army Land at Schofield Barracks, Oahu, Hawaii for the Construction and Operation of a Biofuel-Capable Power Generation Plant

Dear Mr. Waters and Ms. DeSantis:

The U.S. Environmental Protection Agency has reviewed the Notice of Intent to Prepare a Joint Environmental Impact Statement for the lease of Army land at Schofield Barracks for the Construction and Operation of a Biofuel-Capable Power Generation Plant, Oahu, Hawaii. Our comments are provided pursuant to the National Environmental Policy Act, Council on Environmental Quality regulations (40 CFR Parts 1500-1508) and our NEPA review authority under Section 309 of the Clean Air Act.

To assist in the scoping process for this project, we have identified several issues for your attention in the preparation of the Joint EIS. We appreciate the opportunity to review this NOI and are available to discuss our comments. Please send one hard copy of the Draft EIS and one CD ROM copy to this office at the same time it is officially filed with our Washington D.C. Office. If you have any questions, please contact me at (415) 972-3545.

Sincerely,

Ann McPherson
Environmental Review Section, ENF-4-2

Enclosure: EPA's Detailed Comments

US EPA DETAILED COMMENTS ON THE NOTICE OF INTENT TO PREPARE A JOINT ENVIRONMENTAL IMPACT STATEMENT FOR THE LEASE OF ARMY LAND AT SCHOFIELD BARRACKS FOR THE CONSTRUCTION AND OPERATION OF A BIOFUEL-CAPABLE POWER GENERATION PLANT, OAHU, HAWAII, FEBRUARY 27, 2014

Project Description

The U.S. Department of the Army intends to prepare a Joint Environmental Impact Statement for the lease of Army land at Schofield Barracks for the construction and operations of a 50-megawatt biofuel-capable power generation plant. The proposed Schofield Generating Station Project (SGSP) will be a source of renewable power that would provide energy security service to Schofield Barracks, Wheeler Army Airfield, and Field Station Kunia in the event that service is loss from normal sources supporting these facilities. In addition, the SGSP would provide Hawaiian Electric Company with a quick-starting facility to help maintain grid stability that would be located in a secure location at a higher elevation and away from coastlines. The SGSP would operate on a mix of biofuel and diesel and be able to run on a combination of fuels, as necessary. The proposed action will include the lease of 10.3 acres of land and the granting of a 2.5 acre interconnection easement for the 46-kilovolt subtransmission line.

Purpose and Need

The Draft Environmental Impact Statement should include a clear description of the project purpose and need, including why the Army is undertaking the proposed action and what objectives are intended to be met (40 CFR 1502.13). The purpose and need statement should clearly define the scope of proposed actions that the DEIS will describe and assess for environmental effects.

> *Recommendation:*
> The purpose and need should be a clear, objective statement of the rationale for the proposed project. The DEIS should discuss the proposed project in the context of the larger energy market that this project would serve and discuss how the project will assist the state and the Army in meeting their renewable energy portfolio standards and goals.

Alternatives Analysis

The National Environmental Policy Act requires evaluation of reasonable alternatives, including those that may not be within the jurisdiction of the lead agency (40 CFR Section 1502.14(c)). A robust range of alternatives will include options for avoiding significant environmental impacts. The DEIS should provide a clear discussion of the reasons for the elimination of alternatives which were not evaluated in detail. Reasonable alternatives should include, but are not necessarily limited to, alternative sites, capacities, and technologies. The alternatives analysis should describe the approach used to identify environmentally sensitive areas and the process that was used to designate them in terms of sensitivity.

The environmental impacts of the proposal and alternatives should be presented in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decision maker and the public (40 CFR 1502.14). The potential environmental impacts of each alternative should be quantified to the greatest extent possible (e.g., acres of wetlands impacted, tons per year of emissions produced).

The U. S. Environmental Protection Agency strongly encourages the Army and other interested parties to pursue the siting of renewable energy projects on disturbed, degraded, and contaminated sites, including permanently fallow or abandoned agricultural lands.

Recommendations:
The DEIS should describe how each alternative was developed, how it addresses each project objective, and how it will be implemented.

The alternatives analysis should include a discussion of potential sites, capacities, and generating technologies and describe the benefits associated with the proposed technology.

The DEIS should identify the type, source, and quantity of biofuel that will be utilized in the SGSP.

The DEIS should describe the potential direct, indirect and cumulative impacts of the alternatives on all environmental resources in the project area.

The DEIS should clearly describe the rationale used to determine whether impacts of an alternative are significant or not. Thresholds of significance should be determined by considering the context and intensity of an action and its effects (40 CFR 1508.27).

The DEIS should provide a clear discussion of the reasons for the elimination of alternatives which were not evaluated in detail.

The DEIS should describe the current condition of the land selected for the proposed project, discuss whether the land is classified as disturbed, and describe to what extent that land could be used for other purposes, including agricultural use, into the future.

Air Quality

The DEIS should provide a detailed discussion of ambient air conditions (baseline or existing conditions), National Ambient Air Quality Standards, criteria pollutant nonattainment areas, and potential air quality impacts of the project for each fully evaluated alternative. A description of current and proposed activities and their impacts on air quality, including indirect and cumulative impacts, should be included. The DEIS should provide the estimated air emissions (tons per year) from the proposed project for criteria pollutants, including emissions from all construction, operation, and maintenance activities and vehicle traffic. Such an evaluation is necessary to assure compliance with State and Federal air quality regulations, and to disclose the potential impacts from temporary or cumulative degradation of air quality.

Recommendations:
The DEIS should provide a detailed discussion of ambient air conditions, NAAQS, and criteria pollutant nonattainment areas in the vicinity of the project.

The DEIS should estimate emissions of criteria pollutants from the proposed project and discuss the timeframe for release of these emissions over the lifespan of the project. The DEIS should describe and estimate emissions from potential construction activities, as well as proposed mitigation measures to minimize these emissions.

The DEIS should specify emission sources by pollutant from mobile sources, stationary sources, and ground disturbance. This source specific information should be used to identify appropriate mitigation measures and areas in need of the greatest attention.

Below are specific recommendations on New Source Review, Title V Operating Permits, and Construction Emissions.

New Source Review (NSR) Construction Permit Program

New major stationary sources of air pollution and major modifications to sources are required by the Clean Air Act to obtain an air pollution permit before commencing construction. This process is called New Source Review and is required whether the major source or modification is planned for an area where the NAAQS are exceeded (nonattainment areas) or an area where air quality is acceptable (attainment and unclassifiable areas).

Permits for sources in attainment areas are referred to as Prevention of Significant Deterioration air quality permits, while permits for sources located in nonattainment areas are referred to as nonattainment permits. The entire program, including both PSD and NAA permit reviews, is referred to as the NSR program and is established in Parts C and D of Title I of the CAA. Based upon an area's attainment/nonattainment designations and a proposed project's anticipated criteria pollutant emission rates, a project may require both a PSD and NAA permit.

Recommendation:
The DEIS should discuss if NSR program permits will be required for the biofuel-capable power generation plant proposed for construction in the leased areas. The DEIS should describe the permitting process and the information that must be addressed in the permits.

Title V Operating Permit

Title V of the CAA requires all new major sources and some minor sources of air pollution to apply for an operating permit within 12 months of commencing operation. When granted, the permit includes all air pollution requirements that apply to the source, including emissions limits and monitoring, record keeping, and reporting requirements. It also requires that the source report its compliance status with respect to permit conditions to the agency that issued the permit, and if the permit is issued by a state or local agency, reports should also be submitted to the EPA.

Recommendation:
The DEIS should indicate if Title V operating permits will be required for the biofuel-capable power plant proposed to be constructed in the leased areas. If so, it should describe which agency will issue the operating permit and should describe the permitting process, including opportunities for public involvement.

Construction Emissions Mitigation

The DEIS should describe and estimate air emissions from potential construction and maintenance activities, as well as proposed mitigation measures to minimize those emissions. The EPA recommends an evaluation of the following measures to reduce emissions of criteria air pollutants and hazardous air pollutants (air toxics).

Recommendations:

- *Specify Emission Sources* – The DEIS should specify the emission sources by pollutant from mobile sources, stationary sources, and ground disturbance. This source specific information should be used to identify appropriate mitigation measures and areas in need of the greatest attention.

- *Construction Emissions Mitigation Plan* – The DEIS should include a Construction Emissions Mitigation Plan. In addition to all applicable local, state, or federal requirements, the EPA recommends that the following mitigation measures be included in the Construction Emissions Mitigation Plan in order to reduce impacts associated with emissions of particulate matter and other toxics from construction-related activities:

  - *Fugitive Dust Source Controls:* The DEIS should identify the need for a Fugitive Dust Control Plan and how that plan will comply with Hawaii requirements for control of fugitive dust emissions. We recommend that the plan include these general commitments:
    - Stabilize heavily used unpaved construction roads with a non-toxic soil stabilizer or soil weighting agent that will not result in loss of vegetation, or increase other environmental impacts.
    - During grading use water, as necessary, on disturbed areas in construction sites to control visible plumes.
    - Limit speeds to 25 miles per hour on stabilized unpaved roads as long as such speeds do not create visible dust emissions. Limit speeds to 10 miles per hour or less on unpaved areas within construction sites on unstabilized (and unpaved) roads. Post visible speed limit signs at construction site entrances.
    - Inspect and wash construction equipment vehicle tires, as necessary, so they are free of dirt before entering paved roadways, if applicable.
    - Provide gravel ramps of at least 20 feet in length at tire washing/cleaning stations, and ensure construction vehicles exit construction sites through treated entrance roadways, unless an alternative route has been approved by appropriate lead agencies, if applicable.
    - Use sandbags or equivalent effective measures to prevent run-off to roadways in construction areas adjacent to paved roadways. Ensure consistency with the project's Storm Water Pollution Prevention Plan, if such a plan is required for the project.
    - Sweep the first 500 feet of paved roads exiting construction sites, other unpaved roads en route from the construction site, or construction staging areas whenever dirt or runoff from construction activity is visible on paved roads, or at least twice daily (less during periods of precipitation).

- Stabilize disturbed soils (after active construction activities are completed) with a non-toxic soil stabilizer, soil weighting agent, or other approved soil stabilizing method.
- Cover or treat soil storage piles with appropriate dust suppressant compounds and disturbed areas that remain inactive for longer than 10 days. Provide vehicles (used to transport solid bulk material on public roadways and that have potential to cause visible emissions) with covers. Alternatively, sufficiently wet and load materials onto the trucks in a manner to provide at least one foot of freeboard.
- Use wind erosion control techniques (such as windbreaks, water, chemical dust suppressants, and/or vegetation) where soils are disturbed in construction, access and maintenance routes, and materials stock pile areas. Keep related windbreaks in place until the soil is stabilized or permanently covered with vegetation.

- *Mobile and Stationary Source Controls:*
  - If practicable, lease new, clean equipment meeting the most stringent of applicable Federal[1] or State Standards. In general, commit to the best available emissions control technology. Tier 4 engines should be used for project construction equipment to the maximum extent feasible.[2]
  - Where Tier 4 engines are not available, use construction diesel engines with a rating of 50 hp or higher that meet, at a minimum, the Tier 3 California Emission Standards for Off-Road Compression-Ignition Engines,[3] unless such engines are not available.
  - Where Tier 3 engine is not available for off-road equipment larger than 100 hp, use a Tier 2 engine, or an engine equipped with retrofit controls to reduce exhaust emissions of nitrogen oxides and diesel particulate matter to no more than Tier 2 levels.
  - Consider using electric vehicles, natural gas, biodiesel, or other alternative fuels during construction and operation phases to reduce the project's criteria and greenhouse gas emissions.
  - Plan construction scheduling to minimize vehicle trips.
  - Limit idling of heavy equipment to less than 5 minutes and verify through unscheduled inspections.
  - Maintain and tune engines per manufacturer's specifications to perform at EPA certification levels, prevent tampering, and conduct unscheduled inspections to ensure these measures are followed.

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[1] EPA's website for nonroad mobile sources is http://www.epa.gov/nonroad/.

[2] Diesel engines < 25 hp rated power started phasing in Tier 4 Model Years in 2008. Larger Tier 4 diesel engines will be phased in depending on the rated power (e.g., 25 hp - <75 hp: 2013; 75 hp - < 175 hp: 2012-2013; 175 hp - < 750 hp: 2011 - 2013; and ≥ 750 hp 2011- 2015).

[3] as specified in California Code of Regulations, Title 13, section 2423(b)(1)

- *Administrative controls:*
    - Develop construction traffic and parking management plan that maintains traffic flow and plan construction to minimize vehicle trips.
    - Identify any sensitive receptors in the project area, such as children, elderly, and infirmed, and specify the means by which you will minimize impacts to these populations (e.g. locate construction equipment and staging zones away from sensitive receptors and building air intakes).
    - Include provisions for monitoring fugitive dust in the fugitive dust control plan and initiate increased mitigation measures to abate any visible dust plumes.

Greenhouse Gases and Climate Change

Scientific evidence supports the concern that continued increases in greenhouse gas emissions resulting from human activities will contribute to climate change. Global warming is caused by emissions of carbon dioxide and other heat-trapping gases. On December 7, 2009, the EPA determined that emissions of GHGs contribute to air pollution that "endangers public health and welfare" within the meaning of the CAA. Potential impacts from climate change could include the following changes: poor air quality; more severe heat; increased wildfires; shifting vegetation; declining forest productivity; water shortages; agricultural damage from heat, pests, pathogens, and weeds; and rising sea levels resulting in shrinking beaches and increased coastal flooding.

Recommendations:
The DEIS should describe the type and annual amount (in tons per year) of GHG gas emissions that will be emitted from the Proposed project.

The DEIS should consider how climate change could potentially influence the proposed project and assess how the projected impacts could be exacerbated by climate change.

The DEIS should quantify and disclose the anticipated climate change *benefits* of bio-fuel-capable power generation. We suggest quantifying GHG emissions from different types of generating facilities and comparing these values.

The DEIS should describe how GHG emissions could be reduced for the proposed Project.

<u>Emergency Planning and Community Right-to-Know Act and CAA §112(r)</u>

The DEIS should evaluate the need for compliance with CAA §112(r) and, as applicable, Emergency Planning and Community Right-to-Know Act § 303, 311, & 312.

Recommendation:
The DEIS should discuss compliance with CAA §112(r), EPCRA §§ 303, 311, and 312.

Water Resources

Geographic Extent of Waters of the United States

The Army should coordinate with the U.S. Army Corps of Engineers to determine if the proposed project requires a Section 404 permit under the Clean Water Act. Section 404 regulates the discharge of dredged or fill material into waters of the United States (WUS), including wetlands and other *special aquatic sites*. The DEIS should describe all WUS that could be affected by the project alternatives, and include maps that clearly identify all such waters within the project area. The discussion should include acreages and channel lengths, habitat types, values and functions of these waters. The EPA recommends that the Army include a jurisdictional delineation for all WUS in accordance with the 1987 *Corps of Engineers Wetlands Delineation Manual* and the December 2006 *Arid West Region Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region*. A jurisdictional delineation will confirm the presence or absence of WUS in the project area and help determine whether or not the proposed project would require a Section 404 permit.

If a permit is required, the EPA will review the project for compliance with *Federal Guidelines for Specification of Disposal Sites for Dredged or Fill Materials* (40 CFR 230), promulgated pursuant to Section 404(b)(1) of the CWA. Pursuant to 40 CFR 230, any permitted discharge into WUS must be the *least environmentally damaging practicable alternative* available to achieve the project purpose. The DEIS should include an evaluation of the project alternatives in this context in order to demonstrate the project's compliance with the 404(b)(1) Guidelines. If, under the proposed project, dredged or fill material would be discharged into WUS, the DEIS should discuss alternatives to avoid those discharges.

> *Recommendation:*
> The Army should consult with the USACE to determine if there are jurisdictional waters of the U.S present at the project site. If jurisdictional waters of the U.S. are determined to be on the project site, the DEIS should include a final determination of the extent of waters of the United States at the project site and address any other relevant requirements, pursuant to the CWA Section 404 (b)(1).

Clean Water Act Section 303(d)
The CWA requires States to develop a list of impaired waters that do not meet water quality standards, establish priority rankings, and develop action plans, called Total Maximum Daily Loads, to improve water quality.

> *Recommendation:*
> The DEIS should provide information on CWA Section 303(d) impaired waters in the project area, if any, and efforts to develop and revise TMDLs. The DEIS should describe existing restoration and enhancement efforts for those waters, how the proposed project will coordinate with on-going protection efforts, and any mitigation measures that will be implemented to avoid further degradation of impaired waters.

Water Supply and Water Quality

Public drinking water supplies and/or their source areas often exist in many watersheds. Source water is water from streams, rivers, lakes, springs, and aquifers that is used as a supply of drinking water. Source water areas are delineated and mapped by the state for each federally-regulated public water system. The 1996 amendments to the Safe Drinking Water Act require federal agencies to protect sources of drinking water for communities. Therefore, the EPA recommends that the DEIS identify:

> *Recommendations:*
> The DEIS should discuss the amount of water needed for construction and operations of the proposed Project, describe where this water will be obtained, and fully evaluate the environmental impacts associated with using the selected water supply.
>
> The DEIS should describe surface water features in the project area, and address the effects of project construction on hydrologic features in the project study area.
>
> The DEIS should address the potential effects of project discharges, if any, on surface water quality. Specific discharges should be identified and potential effects of discharges on designated beneficial uses of affected waters should be analyzed. If the facility is a zero discharge facility, the DEIS should disclose the amount of process water that would be disposed of onsite and explain methods of onsite containment.
>
> The DEIS should include a description of all water conservation measures that will be implemented to reduce water demands. Project designs should maximize conservation measures.
>
> The DEIS should fully disclose potential beneficial and/or adverse direct, indirect and cumulative effects to surface and groundwater quality and quantity, wetlands, and aquatic ecosystems.

Stormwater Considerations

The DEIS should describe the original (natural) drainage patterns in the project locale, as well as the drainage patterns of the area during project operations. Also, the DEIS should identify whether any components of the proposed project are within a 50 or 100-year floodplain. The DEIS should note that, under the CWA, any construction project disturbing a land area of one or more acres requires a construction stormwater discharge permit.

> *Recommendations:*
> The DEIS should document the project's consistency with applicable stormwater permitting requirements. Requirements of a stormwater pollution prevention plan should be reflected, as appropriate, in the DEIS.
>
> The DEIS should discuss specific mitigation measures that may be necessary or beneficial in reducing adverse impacts to water quality and aquatic resources.

Biological Resources, Habitat and Wildlife

The DEIS should clearly describe direct, indirect, and cumulative impacts to wildlife and habitat and measures to avoid, minimize, and mitigate for these impacts. The DEIS should identify all petitioned and listed threatened and endangered species and critical habitat that might occur within the project area. The document should identify and quantify which species or critical habitat might be directly, indirectly, or cumulatively affected by each alternative and mitigate impacts to these species. Emphasis should be placed on the protection and recovery of species due to their status or potential status under the federal or state Endangered Species Act.

Recommendations:
Identify all petitioned and listed threatened and endangered species and critical habitat that might occur within the project area. Identify and quantify which species or critical habitat might be directly, indirectly, or cumulatively affected by each alternative.

Discuss design and management measures to minimize adverse impacts to wildlife and native and rare plants.

Discuss how the proposed action would comply with ESA requirements, including any necessary ESA Section 7 consultation efforts with the U.S. Fish and Wildlife Service. Any relevant documents associated with the ESA Section 7 consultation process, including Biological Assessments and Biological Opinions, should be summarized and included in an appendix.

Analysis of impacts and mitigation on covered species should include baseline conditions of habitats and populations of the covered species.

If the applicant is to acquire compensation lands, the location(s) and management plans for these lands should be discussed in the DEIS. Specify, in the DEIS, provisions that will ensure habitat selected for compensatory mitigation will be protected in perpetuity.

The DEIS should describe the ROW vegetation management techniques to be used and potential associated environmental impacts, especially if mechanical methods or herbicides are to be used.

The DEIS should provide detailed information on any proposed fencing design and placement, and its potential effects on drainage systems on the project site. Fencing proposed for this project should meet appropriate hydrologic, wildlife protection and movement, and security performance standards.

Invasive Species

Executive Order 13112, *Invasive Species* (February 3, 1999), mandates that federal agencies take actions to prevent the introduction of invasive species, provide for their control, and minimize the economic, ecological, and human health impacts that invasive species cause. Executive Order 13112 also calls for the restoration of native plants and tree species. We encourage alternative management practices that limit herbicide use.

Recommendations:
The DEIS should include an invasive plant management plan to monitor and control noxious weeds. If herbicides or pesticides will be used to manage vegetation, the DEIS should disclose the projected quantities and types of chemicals.

If the proposed project will entail new landscaping, the DEIS should describe how the project will meet the requirements of Executive Order 13112.

Section 106 of the National Historic Preservation Act

Section 106 of the National Historic Preservation Act, 16 U.S.C. § 470f, requires federal agencies to take into account the effects of their undertakings on historic properties and provide the Advisory Council on Historic Preservation a reasonable opportunity to comment on those undertakings. The ACHP has issued the regulations implementing Section 106, 36 CFR Part 800, "Protection of Historic Properties." The NHPA requires that, in carrying out the requirements of Section 106, each federal agency must consult with any Native Hawaiian organization that attaches religious and cultural significance to historic properties that may be affected by the agency's undertakings.

Recommendation:
The DEIS should describe the process and outcome of Section 106 consultation between the Army and any Native Hawaiian organization that has shown an interest in the covered activities within the project area, issues that were raised (if any), and how those issues were addressed in the selection of the proposed alternative.

Environmental Justice and Impacted Communities

The interagency Memorandum of Understanding on Environmental Justice and Executive Order 12898 (August 4, 2011) and the Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (February 11, 1994) directs federal agencies to identify and address disproportionately high and adverse human health or environmental effects on minority and low-income populations, allowing those populations a meaningful opportunity to participate in the decision-making process. Guidance[4] by CEQ clarifies the terms low-income and minority population (which includes American Indians) and describes the factors to consider when evaluating disproportionately high and adverse human health effects.

Recommendation:
The DEIS should include an evaluation of environmental justice populations within the geographic scope of the project. If such populations exist, the DEIS should address the potential for disproportionate adverse impacts to minority and low-income populations, and the approaches used to foster public participation by these populations. Assessment of the projects

[4] Environmental Justice Guidance under the National Environmental Policy Act, Appendix A (Guidance for Federal Agencies on Key Terms in Executive Order 12898), CEQ, December 10, 1997.

impact on minority and low-income populations should reflect coordination with those affected populations.

Document existing human health and environmental risks to which people in the project area are exposed under the "affected environment."

Health Impacts/Children's Health

The DEIS should include a discussion of any health impacts associated with the project. Executive Order (EO) 13045, *Protection of Children from Environmental Health Risks and Safety Risks* (April 21, 1997), directs each Federal agency, to the extent permitted by law and appropriate, to make it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children, and to ensure that its policies, programs, activities, and standards address these risks. The EO recognizes that some physiological and behavioral traits of children render them more susceptible and vulnerable than adults to environmental health and safety risks. Children may have a higher exposure level to contaminants because they generally eat more food, drink more water, and have higher inhalation rates relative to their size. Children also exhibit behaviors such as spending extensive amounts of time in contact with the ground and frequently putting their hands and objects in their mouths that can also lead to much higher exposure levels to environmental contaminants. In addition, a child's neurological, immunological, digestive, and other bodily systems are also potentially more susceptible to exposure related health effects. It has been well established that lower levels of exposure can have a negative toxicological effect in children as compared to adults, and childhood exposures to contaminants can have long-term negative health effects. Examples include life-long neurological deficits resulting from exposure to lead, mercury and other metals, and the increased susceptibility to particulate matter and other asthma triggers in the environment.

We recommend that the DEIS assess children's potential exposures and susceptibilities to pollutants of concern. When identifying pollutants, consider whether they pose a particular hazard to children's health (for example, PM_{10}, dust, heavy metals, or air pollution from near construction or roadway exposures). Describe the relevant demographics of affected populations and focus exposure assessments on children who are likely to be present in the project area. Discuss baseline health conditions by obtaining and discussing relevant, publicly available health data/records for the populations of concern, including data on existing asthma rates and asthma severity among children in the project area. If relevant, discuss impacts and consider exposure to children from mobile source air pollutants from project construction and operations. Children are believed to be especially vulnerable due to higher relative doses of air pollution, smaller diameter airways, and more active time spent outdoors and closer to ground-level sources of vehicle exhaust. Identify children's proximity to project emission sources, including transportation corridors and construction sites.

Noise Impacts

The DEIS should include an assessment of noise levels from construction, maintenance and operation of the proposed Project. Decibel levels should be evaluated as should the effects of noise levels on a variety of species, as well as effects on sensitive receptors, residences, recreational users and property values.

Hazardous Materials/Hazardous Waste/Solid Waste

The DEIS should address potential direct, indirect and cumulative impacts of hazardous waste from construction and operation. The document should identify projected hazardous waste types and volumes, and expected storage, disposal, and management plans. It should address the applicability of state and federal hazardous waste requirements. Appropriate mitigation should be evaluated, including measures to minimize the generation of hazardous waste (i.e., hazardous waste minimization). Alternate industrial processes using less toxic materials should be evaluated as mitigation. This potentially reduces the volume or toxicity of hazardous materials requiring management and disposal as hazardous waste.

Cumulative and Indirect Impacts

The cumulative impacts analysis should provide the context for understanding the magnitude of the impacts of the alternatives by analyzing the impacts of other past, present, and reasonably foreseeable projects or actions and then considering those cumulative impacts in their entirety (CEQ's Forty Questions, #18). The DEIS should clearly identify the resources that may be cumulatively impacted, the time over which impacts are going to occur, and the geographic area that will be impacted by the proposed projects. The DEIS should focus on resources of concern – those resources that are "at risk" and/or are significantly impacted by the proposed projects, before mitigation. In the introduction to the *Cumulative Impacts Section*, identify which resources are analyzed, which ones are not, and why. For each resource analyzed, the DEIS should:

- Identify the current condition of the resource as a measure of past impacts.
- Identify the trend in the condition of the resource as a measure of present impacts.
- Identify all on-going, planned, and reasonably foreseeable projects in the study area that may contribute to cumulative impacts.
- Identify the future condition of the resource based on an analysis of impacts from reasonably foreseeable projects or actions added to existing conditions and current trends.
- Assess the cumulative impacts contribution of the proposed alternatives to the long-term health of the resource.
- Identify opportunities to avoid and minimize impacts, including working with other entities.

As an indirect result of providing additional power, it can be anticipated that these projects will allow for development and population growth to occur in those areas that receive the generated electricity.

Recommendations:
The DEIS should describe the reasonably foreseeable future land use and associated impacts that will result from the additional power supply. The document should provide an estimate of the amount and likely location of growth, and the biological and environmental resources at risk.

The DEIS should consider the cumulative impacts associated with multiple large-scale renewable energy projects proposed in the Hawaiian Islands and the potential impacts on various resources including: water supply, covered species, and habitat.

DEPARTMENT OF THE ARMY
HONOLULU DISTRICT, US ARMY CORPS OF ENGINEERS
FT. SHAFTER, HAWAII 96858

March 7, 2014

Regulatory Office

Ms. Melissa DeSantis
Tetra Tech, Inc.
Attention: SGSP EIS
10306 Eaton Place, Suite 340
Fairfax, Virginia 22030

Dear Ms. DeSantis:

In a letter dated January 9, 2014, the U.S. Army Corps of Engineers (Corps) was invited to participate in an interagency scoping meeting for the preparation of a joint federal and state environmental impact statement (EIS) for the proposed construction and operation of a biofuel-capable power plant located at Schofield Barracks, Island of Oahu, Hawaii. The invitation letter included a draft copy of the then yet-to-be published notice of intent (NOI) to prepare an EIS pursuant to the National Environmental Policy Act (NEPA) as well as scoping materials prepared by the State of Hawaii Department of Land and Natural Resources (DLNR) pursuant to Chapter 343, Hawaii Revised Statutes. Corps file number POH-2014-00018-SAM has been assigned to this action, which you should refer to in all future correspondence with my office on this project.

While my staff was unable to attend the February 4, 2014 interagency scoping meeting, we have reviewed the NOI that was published in the Federal Register on January 17, 2014 (79 FR 3187). In response to the NOI, I offer the following scoping comments for your consideration.

Given the relative proximity of the proposed Schofield Generating Station Project (SGSP) to the Waikele Stream and other aquatic resources that may occur within the Department of the Army's NEPA scope of analysis, I request the EIS identify all potential waters of the United States (U.S.), including wetlands and streams (perennial, intermittent, and ephemeral) that could be directly or indirectly affected by your proposed action. In doing so, a wetlands ecologist or other qualified scientist should conduct a literature search and review, perform a field reconnaissance assessment, and survey the project area to identify, characterize, and map all aquatic resource features. The boundaries of any adjacent wetlands should be delineated using the Corps 1987 *Wetlands Delineation Manual* and the *Hawaii and Pacific Islands Regional Supplement to the Corps of Engineers Wetland Delineation Manual* (ERDC, 2012). Streams should also be inventoried and mapped, including the demarcation of an observed ordinary high water mark, if one exists, to help establish the lateral limits of potential Corps regulatory jurisdiction.

In addition to identifying the physical location and characteristics of aquatic resources, we recommend the application of the *Hawaii Stream Visual Assessment Protocol* (NRCS, 1998; 2001) or other appropriate peer-reviewed methodology to assess the condition (quality) of streams that flow through or near the action area.

As you formulate alternatives to the proposed action and evaluate the direct, indirect, and cumulative effects on the human environment as compared to the No Action alternative, all practicable steps should be taken to avoid and minimize adverse impacts to the aquatic environment. At this early planning stage, the SGSP footprint of disturbance and any ancillary project features, such as new or improved access roads and parking facilities, should be designed and located in areas that would avoid direct and indirect adverse effects to aquatic resources. Similarly, construction-related elements, including, but not limited to, staging areas, temporary access roads, haul roads, stockpile areas, and disposal sites should be sited in areas where aquatic features and other sensitive environmental resources do not exist.

If jurisdictional aquatic resources our determined by the Corps to occur within the project area and cannot be practicably avoided, activities that would discharge fill material into waters of the U.S. will require Corps authorization under Section 404 of the Clean Water Act (33 USC 1344). In some cases, if the regulated activity(s) results in minimal adverse impact on the aquatic environment and meets the terms and conditions of our 2012 nationwide permits (NWPs), a relatively expedient permit decision can be made. However, if the regulated activity(s) and associated impacts to waters of the U.S. do not meet the terms and conditions of our NWPs or other general permits, then an individual permit (IP) would be required. In the latter scenario, the applicant (i.e., Hawaiian Electric Company) would need to demonstrate to the Corps that its preferred alternative is the least environmentally damaging practicable alternative in accordance with U.S. Environmental Protection Agency's Section 404(b)(1) Guidelines ("Guidelines"). Accordingly, if it appears that the proposed action would require an IP, I recommend that as the U.S. Army and DLNR move forward with the joint federal and state EIS, that pre-application consultations take place with my office to ensure the NEPA alternatives analysis is adequate and robust enough to comply with the substantive requirements of the Guidelines, including, but not limited to, an on- and off-site alternatives analysis. Towards this end, it would also be prudent for the Corps to become a cooperating agency on the EIS based upon our jurisdiction by law and special expertise.

Furthermore, in the event unavoidable adverse impacts to waters of the U.S. would result from the proposed action, the applicant will need to propose compensatory mitigation to offset the loss of aquatic resource functions. If no third-party compensatory mitigation options are available (e.g., Corps-approved mitigation bank or in-lieu fee program), then applicant must develop a permittee-responsible mitigation

plan that follows the requirements set forth in the Corps' 2008 *Compensatory Mitigation for Losses of Aquatic Resources Final Rule* (73 FR 19594).

Lastly, in acknowledging the U.S. Army's NEPA lead agency role and responsibility to comply with all applicable federal laws and regulations for the proposed SGSP, the Corps would rely upon the U.S. Army's consultations with other federal and state agencies (e.g., U.S. Fish and Wildlife Service, DLNR, and State Historic Preservation Officer) in fulfilling our independent federal responsibilities under the same federal laws and regulations for the issuance of a Corps permit decision, assuming a Section 404 permit were to be required. Such laws and regulations include, but would not be limited to, Section 7 of the Endangered Species Act, Fish and Wildlife Coordination Act, and Section 106 of the National Historic Preservation Act

I appreciate the opportunity to comment and look forward to engaging in the NEPA process, as appropriate and based upon the extent of our regulatory scope of analysis. If you have any questions, please contact Susan A. Meyer at (808) 835-4599 or at susan.a.meyer@usace.army.mil.

Sincerely,

George P. Young, P.E.
Chief, Regulatory Office

Copy Furnished:
Mr. Doug Waters, Department of the Army, Army Energy Initiatives Task Force

Siegel, Amber

From: Jean Public <[redacted]>
Sent: Saturday, January 18, 2014 3:53 PM
To: DIV.SGSP Comments; DOUGLAS.S.WATERS.CIV@MAIL.MIL; USARY.JBSA.AEX.MBX@MAIL.MIL; PRESIDENT@WHITEHOUSE.GOV; SPEAKERBOEHNER@MALI.HOUSE.GOV; AMERICANVOICES@MAIL.HOUSE.GOV; scoop@huffingtonpost.com; jungaro@gannett.com
Subject: Fw: PUBLIC COMMENT ON FEDERAL REGISTER i want solar or wind - no biofuel which takes more eneergy to make than it gives - biofuel is an energy waster

BIOFUEL HAS BEEN A BIG SCAM ON THE PEOPLE OF THE USA. MOST BIOFUELS ARE SHUTTING DOWN. THEY TAKE SO MUCH ENERGY TO MAKE THE BIOFUEL THAT THEY TAKE MORE ENERGY THAN THEY EVER GIVE YOU. WHOSE BRIGHT IDEA WAS THIS AWFUL IDEA?

I THINK SOLAR OR WIND WOULD BE A BETTER CHOICE. SOLAR OF COURSE IS THE BEST. WATER POWER? ALSO. THIS IS SO MUCH BETTER THAN THIS BIOFUEL STUPIDITY. SHUT DOWN THIS AWFUL SCAM ON THE TAXPAEYRS OF THE USA. THIS PROJECT IDEA STINKS AND DESERVES A GRADE OF F MINUS. JEAN PUBLIC PLEASE RECEIPT.

WHY BIOFUEL WHICH TAKES SO MUCH ENERGY TO RUN?

On Friday, January 17, 2014 8:07 AM, "[redacted]> wrote:
Federal Register Volume 79, Number 12 (Friday, January 17, 2014)]
[Notices]
[Pages 3187-3188]
From the Federal Register Online via the Government Printing Office [http://www.gpo.gov/]

[FR Doc No: 2014-00888]

DEPARTMENT OF DEFENSE

Department of the Army

Preparation of Environmental Impact Statement for the Lease of Army Land at Schofield Barracks, Oahu, Hawaii for the Construction and Operation of a Biofuel-Capable Power Generation Plant

AGENCY: Department of the Army, DoD.

ACTION: Notice of intent.

SUMMARY: The Department of the Army notifies interested parties of its intent to prepare a Joint Environmental Impact Statement (EIS) for the proposed lease of Army land at Schofield Barracks to the Hawaiian Electric Company (``Hawaiian Electric'') for the construction and operation on that land of a 50-megawatt (MW) biofuel-capable power

generation plant. This EIS is designed to meet the requirements of both the National Environmental Policy Act (NEPA) and the Hawaii Environmental Policy Act (HEPA) as a matter of efficiency and cooperation with the State's decision-making process. The decision makers, the Department of the Army and the Hawaii Department of Land and Natural Resources, will use the analysis in the EIS to determine the potential effects of implementing the proposed action and alternatives. The Army also intends to integrate this NEPA process with the consultation and public participation requirements of Section 106 of the National Historic Preservation Act.

ADDRESSES: Written comments on the scope of the EIS or a request to be added to the EIS distribution list may be submitted as follows: Email to sgspcomments@tetratech.com; Facsimile (fax) to 703-385-6007 (Attention: SGSP EIS); U.S. mail to Melissa DeSantis, Tetra Tech, Inc. (Attention: SGSP EIS, 10306 Eaton Place, Suite 340, Fairfax VA 22030).

FOR FURTHER INFORMATION CONTACT: For more information on the Army's proposed action, please contact Mr. Doug Waters, Army Energy Initiatives Task Force. Mr. Waters can be reached by phone at 703-601-0511, Monday through Friday from 8:00 a.m. to 5:00 p.m. eastern, or by email at douglas.s.waters.civ@mail.mil. For general information about the Army NEPA process, please contact the Public

[[Page 3188]]

Affairs Office of the Army Environmental Command at 210-466-1590 or 1-855-846-3940 (toll free), or by email at usarmy.jbsa.aex.mbx@mail.mil.

SUPPLEMENTARY INFORMATION: The Army's proposed action, referred to as the Schofield Generating Station Project (SGSP), is a lease of 10.3 acres of land and a related 2.5 acre interconnection easement on Schofield Barracks to Hawaiian Electric, as well Hawaiian Electric's construction, ownership, operation, and maintenance of a 50 MW biofuel-capable power generation plant and 46-kilovolt subtransmission line.

The SGSP would be a source of renewable power that would provide an energy security service to Schofield Barracks, Wheeler Army Airfield, and Field Station Kunia if loss of service occurs from the normal sources of electricity supporting these installations. Any electricity produced from renewable biofuels would also help achieve the Army goals of producing renewable energy on Army-owned real property.

The SGSP would benefit Hawaiian Electric and the residents of Oahu. It would provide a quick-starting facility to help maintain grid stability; provide a facility at a higher elevation and away from coastlines; provide a physically secure facility on a military installation; and makes progress toward the Hawaii Renewable Portfolio Standard.

The SGSP would operate on a mix of biofuel and diesel, as required to meet Hawaiian Electric's Renewable Portfolio Standard and the Army's renewable energy goals, and may help sustain a local demand for biofuels. Since the SGSP would be multi-fuel capable, it would be able to run on a combination of fuels as necessary to ensure operations are economically viable and can continue under adverse operating conditions.

The EIS will assess the potential for direct, indirect, and cumulative effects on the human, natural, and cultural environment and identify mitigation measures for any adverse effects.

The EIS will examine two alternative operating scenarios for the proposed action. Under the first scenario, the SGSP would run approximately six hours per day, and consume up to eight million gallons of fuel per year. Under the second scenario, the SGSP would

operate seven days a week and 24 hours per day, and would consume up to 31.5 million gallons of fuel per year.

The EIS will analyze a No Action Alternative, as prescribed by the Council on Environmental Quality (CEQ) regulations, to serve as the baseline against which the proposed action and alternatives are compared. Under this alternative, the SGSP would not be built. The EIS process will also examine whether there are additional reasonable alternatives that could meet the needs of both the Army and Hawaiian Electric.

Key resources of concern, for which potentially significant impacts could occur, include air quality, traffic, and stormwater. The Army is preparing supporting studies for those resources.

The Department of the Army encourages all interested members of the public, as well as federal, state, and local agencies to participate in the scoping process for the preparation of this EIS. Interested members may participate in scoping meetings, submit written comments, or both. Written comments will be accepted within a 45-day period following the publication of the Notice of Intent (NOI) in the Federal Register. Scoping meetings will be held on the Island of Oahu, Hawaii during the first week of February 2014. Notification of the locations and times for the meetings will be published in the Honolulu Star-Advertiser.

Brenda S. Bowen,
Army Federal Register Liaison Officer.
[FR Doc. 2014-00888 Filed 1-16-14; 8:45 am]
BILLING CODE 3710-08-P

Siegel, Amber

From: Robert Hennkens <[redacted]>
Sent: Tuesday, February 04, 2014 11:52 PM
To: DIV.SGSP Comments
Cc: Governor Neil Abercrombie
Subject: Schofield Barracks - Carbontech comment about the proposed bio energy generator on the Army Base, proposed by HECO.
Attachments: Scouping Comments for Fuel Requirements for the Schofield Barracks Army Base on Oahu.pdf; Carbontech Global Business Card.pdf

Please add our comment concerning the the scouping period as suggested by Ms Amy L. Bugala of Schofield Barracks to the catalog of recommendations proposed for the 50 mWh-REA steam powered bio generator. Our comment provide the only practical solution to the 325,000 tons of combustion fuel required to operate the large bio generator with grid quality on a dispatchable around-the clock basis. Our recommendations are socially noble, perpetually sustainable, nearly environmentally inert, eliminate much of the organic landfill wastes on all of the Island Counties, has the economic benefits of producing all of the fuel from organic waste streams that do not have to be imported, are persistent and readily available on the five Island Counties. In addition CT Fuel and BHLF if selected as the energy resource will assure that the bio generator emissions will be in compliance with the Hawaiian Mandate for mWh-REAs. The CO2 from emissions can be captured and used in adjoining greenhouses that can easily be a major component to help the thousands of Wounded Warriors. We will provide copies of the machinery and process patents and disclosures. And we will provide complete resumes of the individuals selected to manage the organic resource program and logistics, construction and operation of the CT Fuel and BHLF facilities, provide competent and professional training and management, provide patented equipment, processes, and independent combustion emission analysis. The resumes of all listed as managers and operation directors can also be provided on request. The CT Fuel facilities can commence to be operational and producing standardized size, weight, and btu fuel inventory for storage in Intermodal Containers within six months.
Also it is possible for our Carbontech Cooperative, Inc. member Mountain Cogeneration, Incorporated to bid at the pleasure of HECO for the bio generator, CO2 capture, and water recycling components that are optimum operating with CT Fuel. MCCI has constructed and operated over 100 bio fueled facilities since 1964. MCCI currently has plans and components for a 49.1mW-REA faceplate bio generation facility, and also has plans and components for twin 22.5 mW-REA faceplate plans and components available to bid and commence construction once permits are granted.
Thank you for entering our comment. Robert G. Hennkens

Robert G. Hennkens Cell 520 808 2123

AVELIS Biotechnologies
Carbontech Cooperative
Organic Energy Transfer
SAMMS Technologies

Carbontech Global

P.O. Box 65466 Tucson, Arizona 85728
520 577 6990 carbontechglobal@gmail.com

OUR MISSION IS SIMPLY TO MAKE SOMETHING OUT OF NOTHING, SUSTAINABLY

New Water, New Cultivars, New Soils, New Foods, New Forage, New Fibers, New Energy, New Housing,
Less Carbon Emissions, Clean Atmosphere, Better Biodiversity, Perpetually Sustainable Living

January 31, 2014

PROPOSAL: TO USE MULTIPLE ORGANIC WASTE STREAMS FROM THE FIVE ISLAND COUNTIES OF HAWAII TO PRODUCE 325,000 ANNUAL TONS OF GREEN AND PERPETUALLY SUSTAINABLE GREEN SOLID AND/OR LIQUID HYDROCARBON FUEL FOR EMPLOYMENT AS ENERGY RESOURCE TO POWER A HAWAII ELECTRIC COMPANY (HECO) 50 MW ELECTRIC BIO GENERATOR THAT SUPPORTS A LONG-TERM POWER PURCHASE AGREEMENT PROVIDED BY THE UNITED STATES ARMY BASE FACILITIES AT OAHU, HAWAII, AND HAWAII'S RENEWABLE ENERGY MANDATE.

Eight Page Scoping Project Narrative and Slides Presented by:

Carbontech Cooperative, Inc. , P.O. Box 65466, Tucson, Arizona 85728
Telephone: 520 577 6990 Email Carbontechglobal@gmail.com
Project coordinator: Robert G. Hennkens Cell: 520 808 2123 Email: rhennkens@gmail.com

Orientation: The Army Assistant Secretary of Installations, Energy, and the Environment has declared that the Army has land and it wants energy financed and generated by private organizations globally on its land to provide distributed secure, perpetually sustainable, and environmentally sensitive sources of on-site vital electricity to complete its missions. A project is proposed by Hawaii Electric Company (HECO) to generate 50 mW – REA of grid quality electricity on a continuous around the clock dispatch-able basis to principally serve electricity requirements of the United States Army Base Facilities at Oahu, Hawaii. And when not used by the Army, will revert to HECO's electricity grid.

IP: Carbontech Cooperative, Inc. members have patents and disclosures for technologies to produce Carbontech Composite (CT) solid fuel and CT Bio Hydrocarbon Liquid Fuel (BHLF) to fuel the proposed steam-powered bio generation system.

Technology Brief: CT and BHLF are unique perpetually sustainable, substantially environmentally inert, and socially noble non-food or water-based energy resources. CT and hot BHLF plasma will fire and co-fire a combustion boiler and steam powered generator(s). Hot BHLF plasma co-fired with bio diesel will provide bio energy to direct fire engine(s) to torque a generator. CT and BHLF are produced exclusively from persistently occurring waste organics that are readily available and have no-value what-so-ever. The solid and liquid fuels are to be processed by cookie-cutter CT mills and Organic Energy Transfer (OET) bio reactor facilities on each of the five Hawaiian County Islands. CT and OET technologies are good neighbors. The combined facilities use no water acids or enzymes; and produce no odors or black smoke. The combined facilities require five acres for infrastructure, building(s) outdoor and indoor processes, roadways and infrastructure at each site. A rail spur provides convenience but is not required. A permanent or temporary seaport facility is required on each Island where facilities are located. CT Fuel and BHLF facilities may be sited together or separately and may be sited on a county landfill or other brown field location under the EPA exemption for Renewable Energy Facilities.

Intent to Prepare Environment Impact Statement for Schofield Barracks Project Announced

SCHOFIELD BARRACKS, Hawaii (January 17, 2014) The Army invites the public to provide comments on the scope of an Environmental Impact Statement (EIS) for the construction and operation of a 50 MW biofuel-capable power generation plant at Schofield Barracks, City and County of Honolulu, O'ahu. Written comments to the EIS can be submitted during the 45-day scoping period from January 8 to February 22, 2014. Scoping meetings will be held at:

February 5, 2014 6:30–9:00 PM
Mililani Makua Elementary School Cafeteria
95-1111 Makaikai St.
Mililani, HI 96789

February 6, 2014 6:30–9:00 PM
Wahiawa District Park Recreation Center
1139a Kilani Avenue
Wahiawa, HI 96786

The Schofield Generating Station Project (SGSP) would be a source of renewable power that would provide energy security for Schofield Barracks, Wheeler Army Airfield, and Field Station Kunia if loss of service occurs from the normal sources of electricity supporting these installations. The SGSP would also benefit the Hawaiian Electric Company (HECO) and the residents of Oahu by supplying power to the island-wide grid during normal operations.
The EIS will study the impacts of developing the SGSP on existing land at Schofield Barracks. The Army would lease 10.3 acres to HECO and grant a related 5-acre interconnection easement on South Range, Schofield Barracks. HECO would construct, own, operate, and maintain the power generation plant. A 46-kilovolt subtransmission line would be built to connect the SGSP to the HECO grid. Key resources of concern, for which potentially significant impacts could occur, include air quality, traffic, and storm water. More information can be found in the Notice of Intent (NOI) published in the Federal Register.
All interested members of the public, as well as Federal, state, and local agencies are invited to participate in the scoping process for the preparation of this EIS by participating in scoping meetings, submitting written comments, or both. The scoping process will help identify possible alternatives, potential environmental impacts, and key issues of concern to be analyzed in the EIS.

U.S.ARMY

ENERGY INITIATIVES TASK FORCE
Securing Army installations with energy that is clean, reliable and affordable

U.S. Army Energy Initiatives Task Force

June 19, 2013

From: Katherine Hammack, Assistant Secretary of the Army for Installations, Energy and Environment
To: Qualified Finance and Contractor Resources

Subject: We are facing interesting times.

The Honorable Katherine Hammack, Assistant Secretary of the Army for Installations, Energy and Environment (ASA IE&E).

We are living in interesting times. Today, the Department of Defense faces multiple threats and non-traditional challenges, all of which jeopardize our future security environment.

Lt. Gen. Mary Legere, the Army's senior intelligence officer, reports that the key defining element of the complex, future operating environment will be the "lack of Governance or Rule of Law." Driving this break down in governance will be an increasing, worldwide demand for scarce resources. Rising oil prices and scarcity of water driven by increasing demand; cultural and demographic conflicts, and political unrest in several regions; unstable weather conditions, and the effects of climate change; will create increased global tensions and worsen our future security environment.

The Army's ability to accomplish our mission on a global scale depends on secure, uninterrupted access to power and energy. With today's volatile energy market, the long-standing assumption that the Army will have unlimited availability of affordable fossil fuels is no longer valid. We must become more flexible, and adaptable, in obtaining necessary energy supplies.

Due to the need for expansive maneuver areas, Army installations are typically isolated and at the end of utility lines. By constructing renewable energy projects, the Army increases its energy security, reduces vulnerability in the event of power outages, and reduces utility bills that are increasing much faster than inflation.

While we may use appropriated funding and performance contracting for smaller renewable energy projects, the Army recognizes it must take a different partnership path if it is going to develop the large-scale projects it requires to meet our energy security needs. The Army's goal is to have 25 percent of our power requirements generated by renewable energy sources by 2025, and, very importantly, to have that power consumed on our installations.

To address these issues and to comply with Congressional and Presidentially-directed mandates for energy consumption and alternate energy production (NDAA of 2007, 2010, Energy Policy Act 2005, and Executive Order 13514) the Secretary of the Army established the Energy Initiatives Task Force on September 15, 2011. The EITF leverages private-sector financing and expertise to gain access to up-front capital investments in return for a long-term power purchase agreement.

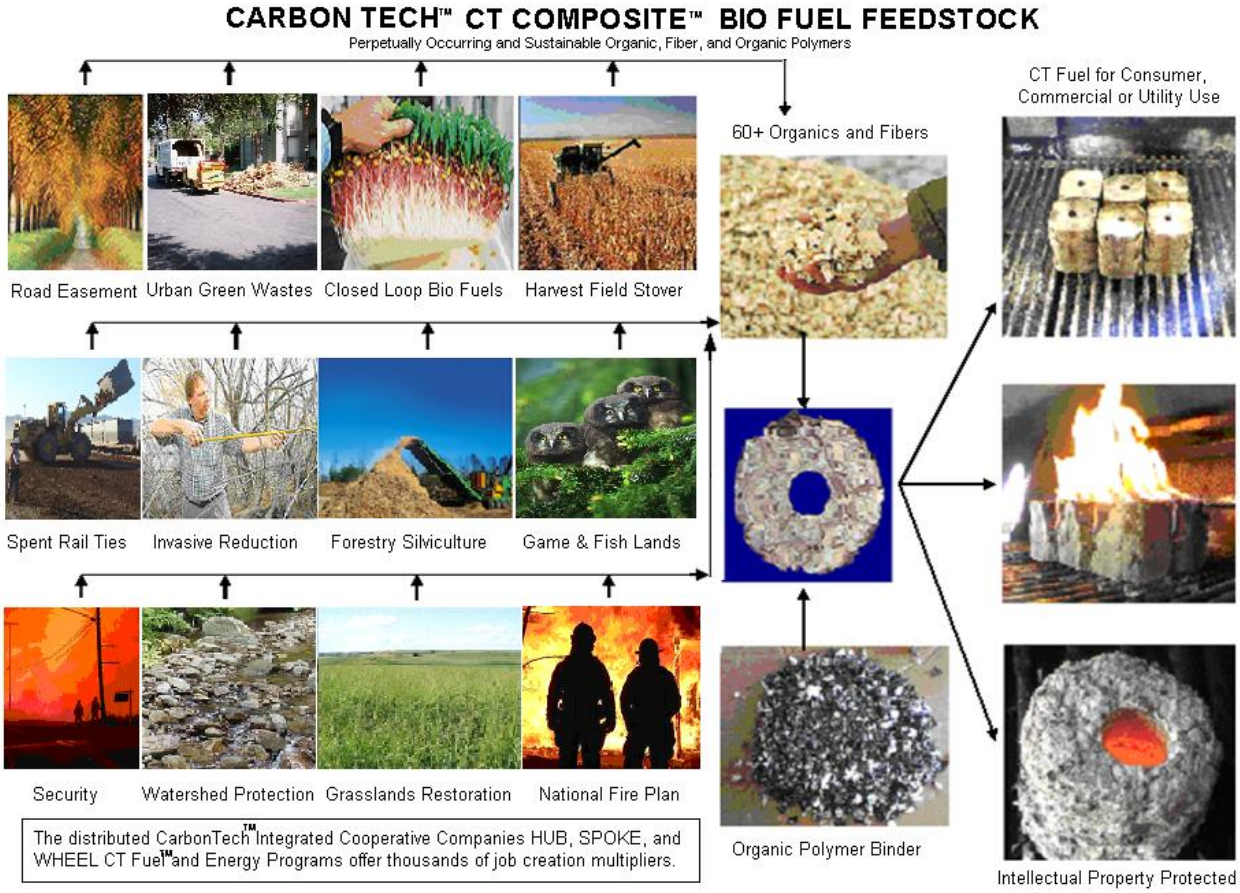
To support the EITF, the U.S. Army Corps of Engineers initiated the first of its kind, Multiple Award Task Order Contract, or MATOC, to identify a pre-approved list of project developers in four technology areas: wind, solar, geothermal electricity, and energy/biomass. The total contract ceiling across all four technologies is $7 billion, and allows for maximum flexibility for use by other military Services.

These energy initiatives are part of a broader effort to take an integrated approach to achieving Net Zero energy, waste, and water across all Army communities. The Army's Net Zero Installation initiative involves 17 pilot installations that serve as test beds for new design approaches as well as technological and non-technological solutions striving to reach Net Zero in one or more of these areas by 2020. We expect Army installations to serve as models of sustainability that minimize resource competition with local communities, have lower operating costs, and offer a better quality of life for our soldiers and their families.

The Army is collaboratively managing its Energy and Sustainability efforts at an enterprise level that leverages the best practices of industry, academia, and the other military Services. We offer a model of successful public-private partnerships. We are achieving all of this while enhancing our energy security and strengthening our ability to perform our mission in an increasingly complex and challenging global environment.

Army Strong!

HAWAII - KAUAI - MAUI - MOLOKAI - OAHU
Hawaii Bioenergy Master Plan
Volume 1
State of Hawaii
Department of Business Economic Development and Tourism
University of Hawaii
December 2009
Infrastructure – CT Fuel to 50 mW bio gemerator


CARBON TECH™ CT COMPOSITE™ BIO FUEL FEEDSTOCK
Perpetually Occurring and Sustainable Organic, Fiber, and Organic Polymers
Road Easement
Urban Green Wastes
Closed Loop Bio Fuels
Harvest Field Stover
60+ Organics and Fibers
CT Fuel for Consumer, Commercial or Utility Use
Spent Rail Ties
Invasive Reduction
Forestry Silviculture
Game & Fish Lands
Security
Watershed Protection
Grasslands Restoration
National Fire Plan
Organic Polymer Binder
Intellectual Property Protected
The distributed CarbonTech™ Integrated Cooperative Companies HUB, SPOKE, and WHEEL CT Fuel™ and Energy Programs offer thousands of job creation multipliers.

QUICK SUMMARY
CARBONTECH COMPOSITE SOLID FUEL (CT FUEL) AND BIO HYDROCARBON LIQUID FUEL (BHLF)

FEEDSTOCK: CT Fuel requires no specific new cultivars or GMO crops. The process exclusively employs perpetually renewable, persistent, and readily available organic waste feed stocks available on each of the five Hawaiian County Islands described in the 997 page document HAWAII BIOENERGY MASTER PLAN VOLUME 1. Waste organics include materials such as orchard, forest, woodlands, grasslands, game and fish lands, and watershed thinning under auspices of the National Fire Plan and NEPA; Invasive species such as eucalyptus, abeceda, guinea grass, and sugar cane (use the sugar for ethanol plastics) residue; agriculture harvest field stover and bagasse (including GMO crops); palm fronds and cactus urban green wastes; food contaminated non-recyclable paper and cardboard; pre-landfill construction and demolition wood; and clean non-toxic plastic.

COMBUSTION: CT Fuel is a specific shape and size to substantially reduce the difficulties of storage, conveyor feed and pre-combustion characteristics of most biomass fuel. It has high combustion values of 11,500 to 12,000 btu's per pound. This is nearly double the btu value of most raw woody biomass with consistent moisture range of 8% to 12% that is substantially less than bone-dry raw wood. Less water in any fuel equals fewer btu's required to flash the water and more btu's for torque-energy. More btus per pound = less fuel required for the same work-duty job. Less fuel combusted = less emission release. CT Fuel contains no ancient carbon monoxide and carbon dioxide, only trace amounts of sulfur, inorganic metals, and $\pm$ 2% nitrogen. The modern biology of the feedstock and high thermal value results in carbon neutral, very low Hazardous Atmospheric Pollutants, Polycyclic Aromatic Hydrocarbons, and trace amounts of sub-micron 10 particulates (black smoke) from combustion emission to air or water. Ash from combustion is $\pm$ 2% and is substantially sanitary. The ash may be used for soil amendment or in composting. This is in stark contrast to ancient organic fossil fuels that are a composite of biomass and algae combined with volcanic and other natural toxins in the atmosphere, land, and water at the time the organics were forced under the earth's surface and compressed under great heat and pressure, in the absence of oxygen to form coal, petroleum oil, and natural gas. The ancient greenhouse gases and toxic elements are released at combustion.

BHLF: Is the cellulosic hydrocarbon liquid produced from CT Fuel and other organic wastes such as cooking oils, animal fats and greases, cattle manure and chicken litter. The liquid is 100% soluble in petroleum crude oil, and has the aromatic and chemical characteristics of West Texas Light Intermediate Crude Oil. It may be used to co-fired with any fossil fuel, as asphalt binder, refined in any petroleum refinery, or injected with hydrogen to produce green gasoline and green diesel fuel. The Organic Energy Transfer facilities are cookie-cutter in machinery and facility, to employ 12,000 tons of CT Fuel per year.

Each cookie-cutter identical CT Fuel line produces four (4) tons of green CT Fuel from a wide variety of organic wastes. This plant has four lines that can produce sixteen (16) tons per hour or 128 tons per eight hour shift X 350 days = 44, 800 tons per year. One plant sited on Kauai, Molokai and Maui, 2 plants sited on Hawaii, and 3 plants sited on Oahu =

Each 12,000 CT Fuel ton per year Bio Reactor will convert CT Fuel & other organics to a liquid 100% soluble in fossil crude with characteristics and aromatic values of West Texas Intermediate Light Sweet Crude

358,400 tons of CT Fuel per year, enough to meet the projected requirements of the proposed 50 mW-REA HECO/Oahu Army Facilities around the clock bio generators needs of 325,000 tons per year. CT Fuel adoption will also substantially reduce organic landfill wastes that average around 63% nationally, and most likely higher in the Hawaiian Islands due to the tourist industry. It will also satisfy Hawaii's Renewable Energy Attributes (REAs) for reduction of five gases CO, CO2, Lead, Sulfur Dioxides, and Nitrous Oxides, Hazardous Atmospheric Pollutants (PM10), and Polycyclic Aromatic Hydrocarbons (ethanol, etc.), and heavy metals such as lead and mercury water pollutants. CO2 can be collected from combustion in the bio generator and delivered to greenhouses that may be considered for the Wounded Warrior program. Combustion of CT Fuel and related BHLF is considered carbon neutral. Either fuel type resists pre-combustion and is delivered to combustion without the normal difficulties with raw organic resource. Combustion produces no bottom ash that requires toxic landfill. The ash from combustion is +2% and more towards the 1% range in the patent disclosure tests, is substantially sanitary and may be used as a powerful natural fertilizer for soil amendment. Adoption of CT Fuel will provide forty direct jobs, and one hundred or more indirect green collar family-wage jobs with a projected economic multiplier potential of $5 for each $1invested….annually. CT Fuel can be stored in Intermodal Containers for years if necessary. It is so dense at over 80,000 psi that water does not invade the fuel so the many idled sugar cane barges with sea-going tugs can provide efficient inter-County Island transportation from islands or landfills on Oahu to the bio generator by tug, rail, and trailer. Patents and disclosures are available for information.

Projected Carbontech Cooperative personnel to manage and coordinate the cooperative management of the full with prime responsibility per county for CT Fuel and BHLF Hawaiian Island waste organic resource program to support the HECO 50 mW-REA bio generator long-term program:

OAHU - Rich Alsup: Cal Pomona Structural Engineering, University of Alaska Fairbanks - Indigenous Anthropology, Sheldon-Jackson College – Forestry, Owner/operator J & R Forestry, work - Hilton Hotels and Suites, Los Angeles. U.S. Army Special Forces (Ret.) stationed at Schofield Barracks, Oahu, Hawaii.

MAUI- Brad Dreadfulwater: US Marine Corps, Staff Academy Leadership School, U.S. National Forest Service – Advanced Timber Cruiser, Wild lands Fire Fighter, Level 2 Law Enforcement, Tree Management and Planting, Stream and Watershed Restoration, Organic Layouts for Fuel Reduction, Machinery Mastication. U.S. Marine Corps (Honorable Discharge), Certified Helicopter Avionics and Ground Radio Transmission. Member of the Cherokee Nation of Oklahoma.

MOLOKAI – Steve Hall: US Air Force, Founder Carbontech Cooperative, Inc., Owner and operator of Environmental Forest Solutions, Grow-Fast, Western Renewable Fuels, and the Eagar, Arizona Small Business Incubator and Bio Generation Facility, Hall Trucking Company, and Operates Landfill Restoration. Experienced with key personnel on Molokai and proponent of all-natural agriculture.

KAUAI – Kai and John Hoff: Kai, owner and operator of Paradise Landscaping on Kauai.
John, owner and operator of NuSun Energy and Bed and Breakfast on Kauai. Both active proponents of the renewal of Kauai and the Hawaiian Islands. US Coast Guard Reserve – John.

HAWAII – Bob Hennkens: Oklahoma State Univ, - Agriculture, Washington Univ, Embry-Riddle Aeronautical Univ, Univ of Arizona ChemE and Adjunct, Tenneco Mgmt Institute, Farm Equipment Mfg Assn, American Chianina Assn, Trustee McKendree College, Dir. Magna Bank Holdings, Founder MegaBank Holding, development in Asia, CIF States of the former Soviet Union, Ecuador, and Mexico. Vice Chair FLC.org), founder Carbontech Cooperative, Inc., plan-for-sustainability Hawaii's solid-waste programs – 2481. Director Development Buffalo Soldiers Monument Committee, Fort Leavenworth, Kansas, Conversational Spanish, U.S. Coast Guard Reserve.

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Bob Shatz, Capital Structure, Founding Member Carbontech Global, former VP Nomura Securities.
Bob Campos, Construction, Founding Member Carbontech Cooperative, owner Campos Construction Co.
Ronald Larzalier, Forestry, owner Apache Land Restoration, Apache 8 Wildfire fighters, fluent in Apache.
Ing. Luis Carlos-Cruz, Professional Engineer, Fluent in Spanish.

Melissa DeSantis ATTN: SGSP Comments
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10306 Eaton Place, Suite 340
Fairfax, VA 22030
sgspcomments@tetratech.com

Ronald Gunderson
[redacted]

Reference: Public Scoping Comments Schofield Generating Station Project (SGSP)

To Whom It May Concern

I attended the public hearing in Mililani, HI on 5 Feb as a private citizen and have several comments concerning the Schofield Generating Station Project concerning Air Quality, Noise, Public Health and Safety, Utilities and Infrastructure, water resources and other concerns.

Water resources for cooling of the generation plant power is provided by water yet the public briefing did not discuss if the water cooling was a self contained system. The rate of usage at 7 gal per min would require a huge amount of water if not a self contained system. If the system is not self contained the water is being taken from the ground at 7 gal per min and where is the excess flowing. This is a huge drag on the ground water and waste water system. If the water cooling system is a contained system, in the event of a spillage or break, what is the containment to avoid contamination of the ground water aquifer? This is a public health and safety issue that must be addressed to avoid any contamination of the ground water aquifer?

Noise generation from the operating plant was not discussed yet the location of the plant near large communities on the military base and outside is a major concern.

Primary source fuel for the power generation plant is bio-fuel. The power plant is also capable of using various alternate liquid fuels such as diesel oil. Bio-fuel as a primary fuel source should not be considered, it is weather dependent for growing, costly, takes away from the food supply and is not a highly sought fuel making it costly. HECO should be discussing the use of liquid natural gas as a primary fuel for this power generation plant. Liquid natural gas is the planned primary fuel in the future to be used at the main generating plants in the next few years and should be the primary fuel for this generation plant. LNG is less expensive than oil and bio-fuel, and would provide HECO with a single source of fuel. Containment of LNG is much less expensive and spillage or line breakage would not contaminate the ground water system. Small bio-fuel and oil spills can contaminate the entire ground water system causing a water shortage on the whole island. The military does not have a good record of reporting spills in a timely manner, evidence of the last spill at the large fuel tanks in Pearl Harbor where over 20,000 gallons were spilled before it was discovered and higher contamination is being found in the island ground water supply system. This is a public health and safety issue that must be addressed to avoid any contamination of the ground water aquifer with the use of any bio-fuel or diesel oil.

Air Quality is is reduced by the use of a bio-fuel or diesel oil for power of the generating plant. Liquid natural gas should be the preferred fuel as it burns cleaner, is less costly, and much more plentiful with vast amounts of US resources.

The briefing mentioned that the military would have first source to power in the event of an emergency and yet when asked what type of emergency, how much energy for what duration, to what locations and on whose order, the reply was the military leadership. This is not a suitable reply. HECO needs to define and write out in detail the contingencies and other factors to include facilities to be powered. Military national security requirements and communications already have alternate power sources so just why and where does Schofield need this power must to be defined.

The briefing did not provide a great amount of detail on what national security and disaster response conditions that Wheeler AAF would provide that the generation plant . Wheeler AAF may be a FEMA disaster site based on its location and supports the Hawaii Army National Guard , however based on news reports the Hawaii Army National Guard is moving in the next few years and the airfield is much too small with a 6500 foot runway and small footprint size to consider as an offload base of large and heavy jet aircraft. Wheeler AAF does not have runway aligned landing system and any use by large heavy aircraft would have a significant impact on the safety of the surrounding communities . The location of Wheeler AAF between two mountain ranges within 5 to 10 miles at 4 to 5000 feet in elevation above field elevation creates a hazardous condition that is even more compounded at night. Wheeler AAF does not have the required open space for parking of several large aircraft or equipment to unload several large aircraft. If the site is intended only for rotary wing aircraft than it is more than suitable, however it would only require a tower to control aircraft and it already has an alternate power source in case of emergencies. Lighting of the runway and taxiway would not be required in an emergency and at night rotary wing aircraft are mostly using night vision aids that would preclude the use of lights on the airfield surface. Lighting of the ramp for offload is already limited so portable generator lights would have to be brought in with their own generator source.

Utilities and Infrastructure will require a major upgrade by building the generation plant so far from the substation to which connected. The briefing did not provide why building a private power plant on federal military installation land would be beneficial or the associated costs or savings based on building on a federal installation. The building of a private power generation plant on federal land should be a last resort and not based on some unknown security requirement. HECO can provide their own security and should whether on a military installation or not. The plant will require a fence and gate in either location. The federal government and military commanders can restrict usage and entrance to the facility at their will if located on a military installation. See latest NEWS releases where US supreme court has given base commanders control over easement and leased land. This appears to be a way of least resistance for HECO to use the federal military land via a least agreement at little cost and provide first usage to the military and pay for the power upgrades to Schofield and still have to pay for power lines to the power substation many miles away and subvert Oahu land use requirements by using federal military land.

This is not a win for Oahu or the public. HECO and the Oahu public is left holding the price tag and schofield is out very little. Schofield does not pay private customer rates but rather a much lower commercial business rates and should not be getting special consideration. There are no national security issues and if there were the federal government should be paying and not HECO and the Oahu public. The plan to use bio-fuel is ill conceived when HECO has stated that LNG is the fuel of the future and is less costly, more efficient, and cleaner burning. HEO should procure the land at or near the substation to reduce the power lines and infrastructure required and build an LNG electrical generation plant.

NEIL ABERCROMBIE
GOVERNOR

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February 28, 2014

VIA U.S. MAIL AND E-MAIL

Melissa DeSantis
Tetra Tech, Inc.
Attention: SGSP EIS
10306 Eaton Place, Suite 340
Fairfax, Virginia 22030
sgspcomments@tetratech.com

Re: Preparation of Environmental Impact Statement for the Lease of Army Land at Schofield Barracks, Oahu, Hawaii for the Construction and Operation of a Biofuel-Capable Power Generation Plant

Dear Ms. DeSantis:

The Hawaii Department of Business, Economic Development, and Tourism ("DBEDT") submits the following comments in response to the Department of the Army's ("Army") Notice of Intent[1] to prepare a Joint Environmental Impact Statement ("Joint EIS") for the proposed lease of Army land and easement at Schofield Barracks to the Hawaiian Electric Company, Inc. ("HECO") for the construction and operation of a 50-megawatt ("MW") biofuel-capable power generation plant and 46-kilovolt subtransmission line, the Schofield Generating Station Project ("Project").

DBEDT acknowledges the Army's need for energy security for the Schofield Barracks, Wheeler Army Airfield, and Field Station Kunia, and DBEDT is committed to working with the Army, HECO, the State of Hawaii's Department of Land and Natural Resources' ("DLNR"), and other interested stakeholders during the National Environmental Policy Act ("NEPA") and Hawaii Environmental Policy Act ("HEPA") process to ensure a successful and reasonable outcome. DBEDT thus requests to be added to the EIS distribution list.

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1 Department of the Army, *Preparation of Environmental Impact Statement for the Lease of Army Land at Schofield Barracks, Oahu, Hawaii for the Construction and Operation of a Biofuel-Capable Power Generation Plant*, Notice of Intent, 79 Fed. Reg. 3187 (January 17, 2014) ("Notice").

DBEDT's comments herein are guided by Hawaii's clean energy policy, which has a significant influence on the State's economic and environmental well-being. Based on that perspective there are other considerations that should be accounted for and other alternatives that should be explored as part of the Joint EIS. Such alternatives would better serve Hawaii's and the Army's mutual interests in reducing consumption of petroleum-based generation and in exploring other clean energy options that would reliably and cost-effectively promote Hawaii's and the Army's energy security.

I. Comments

A. Building Petroleum-based Electricity Generation is Contrary to Hawaii's Energy Policy and is Not in the Public Interest in Hawaii

Based on its interests and statutory obligation to reach and exceed Hawaii's clean energy targets, DBEDT is concerned with the characterization of this Project as one that would "make progress toward the Hawaii Renewable Portfolio Standard [("RPS")]."[2] Of primary concern is the fact that diesel is proposed to be an integral part of the fuel mix.[3] Building a diesel-based electricity generation unit is contrary to meeting Hawaii's RPS mandate, which requires each electric utility company that sells electricity for consumption in Hawaii to establish a RPS of forty per cent of its net electricity sales by December 31, 2030.[4] Both DLNR and DBEDT are charged with facilitating the private sector's development of renewable energy projects by supporting the private sector's attainment of the RPS.[5]

Moreover, Hawaii and the United States Department of Energy's partnership—the Hawaii Clean Energy Initiative—is aimed at attaining independence from Hawaii's detrimental reliance on fossil fuels.[6] DBEDT submits that using diesel to operate the Project would be a step backwards for Hawaii from an energy policy and environmental perspective. DBEDT also notes that there is insufficient clarity at this time as to the extent of the proposed reliance on diesel versus biofuels in all of the scenarios proposed for consideration.[7]

DBEDT further notes that the intent to use diesel for the Project was not stated in support of HECO's application to the Hawaii Public Utilities Commission ("Hawaii PUC") for waiver from the Hawaii PUC's Framework for Competitive Bidding.[8] There, HECO claimed that a waiver

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2 Notice at 3188.

3 State of Hawaii Department of Land and Natural Resources Environmental Impact Statement Preparation Notice for the Proposed Schofield Generating Station Project (December 23, 2013)("DLNR EISPN") at 3:13-15.

4 H.R.S. § 269-92 (Renewable Portfolio Standards).

5 H.R.S. § 196-41 (State Support for achieving Renewable Portfolio Standards).

6 *See* http://www.hawaiicleanenergyinitiative.org/about; *cf.* 2009 H.B. 1464, Act 155.

7 DLNR EISPN at 3:13-15 ("The Schofield Generating Station would operate on a mix of biofuel and diesel as required to meet Hawaiian Electric's Renewable Portfolio Standards . . . .").

8 *See I/M/O the Application of Hawaiian Electric Co. for Approval of Application for Waiver from the Framework for Competitive Bidding*, Decision and Order No. 30522, Hawaii PUC Docket No. 2011-0386 at 7 (August 1, 2012) ("Waiver Order") at 5 (noting that by Decision and Order No. 23121, filed on December 8,

for the Project was appropriate "since the utility is seeking to acquire power from a non-fossil fuel (biofueled) facility to meet the governmental objective of energy security for the military."[9] The Hawaii PUC generally found that the Project meets the criteria for a waiver under Section II.A.3 of the Competitive Bidding Framework,[10] and specifically found that the "Project will be addressing a critical governmental objective, in which the fuel source is renewable, which is consistent with Sections II.A.3.c.(iii) and II.A.3.c(iv) of the Framework."[11] In addition, the HECO Companies' 2013 IRP Report and Action Plan[12] did not indicate that the Project would rely on diesel fuel. Rather, the Report stated that the Project "would more efficiently consume 3,000,000 gallons/year of biodiesel . . . ."[13]

In addition to raising concerns pertaining to State energy policy, reliance on petroleum-based fuels raises concerns regarding price, energy security, and environmental impacts.[14] As such, DBEDT is concerned that the Project as currently proposed would not support the State's efforts to redefine Hawaii's energy future.

B. Other Alternatives that Would Foster the State's and Army's Interests Should be Considered

DBEDT believes the State of Hawaii's goals are consistent with the goals of the Army Energy Initiatives Task Force, which serves as the central management office for partnering with Army installations to implement cost-effective, large-scale renewable energy projects, such as the

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2006, in Hawaii PUC Docket No. 03-0372, "the commission adopted the Framework to govern competitive bidding as a mechanism for acquiring new energy generation in Hawaii. Under the Framework, competitive bidding is the required mechanism for acquiring a future generation resource or a block of generation resources, subject to certain conditions and exceptions.").

9 *I/M/O the Application of Hawaiian Electric Co. for Approval of Application for Waiver from the Framework for Competitive Bidding,* Application for Waiver, Hawaii PUC Docket No. 2011-0386 at 7 (filed December 27, 2011). *See also* Waiver Order at 7 (noting the same).

10 We note that the Waiver Order underscored certain provisions in Part II.A.3 of the Competitive Bidding Framework that HECO had argued in support the request for waiver. One such provision was Part II.A.3.b.(iv), which provides that a circumstance when competitive bidding may not be appropriate includes "when competitive bidding will impede or create a disincentive for the achievement of [Integrated Resource Planning ("IRP")] goals, renewable energy portfolio standards or other government objectives and policies". Waiver Order at 5-6.

11 *Id.* at 10. Sections II.A.3.c(iii) pertains to "the acquisition of power from a non-fossil fuel facility (such as a waste-to-energy facility) that is being installed to meet a governmental objective;" and II.A.3.c(iv) pertains to "the acquisition of power supplies needed to respond to an emergency situation." *Id.* at 7.

12 Hawaiian Electric Companies' 2013 IRP Report and Action Plan, Hawaii PUC Docket No. 2012-0036 (filed June 28, 2013) (hereinafter "IRP Report"). HECO has two subsidiaries, Hawaii Electric Light Company, Inc. ("HELCO") and Maui Electric Company, Limited ("MECO"). DBEDT refers to the three companies collectively as the "HECO Companies."

13 *Id.* at ES-13.

14 Biofuels Study Final Report to the Legislature In Accordance with Act 203, Session Laws of Hawaii, 2011, State of Hawaii Dept. of Business, Economic Development & Tourism (December 2012) at i. This report is available at: http://files.hawaii.gov/dbedt/annuals/2012/2012-biofuels-study-act-203.pdf.

Project.[15] This Task Force seeks to ensure that favorable project sites move to completion and that the Army achieves its renewable energy goal of deploying one gigawatt of renewable energy by 2025. Incorporating oil-based fuels as part of this Project would run counter to this goal. The DLNR EISPN states that the purpose of the Project is to meet the common needs of Hawaiian Electric and the U.S. Army Garrison—Hawaii for secure, reliable, and renewable power generation.[16] Building petroleum-based electricity generation units is not part of a clear generation scheme that: 1) promotes and maximizes the use of locally produced renewable energy; and 2) increases fuel diversity by moving away from oil-based options.

The State of Hawaii has an interest in diversifying its energy portfolio and leveraging our international status as a clean energy test bed. Hawaii is fortunate to have ample access to natural resources, including the sun, wind, ocean, bioenergy, and geothermal resources.[17] Additionally, the State has numerous additional options to enhance fuel diversity that are consistent with DBEDT's support for an "all of the above" strategy to accomplish these goals. For instance, cost competitive liquefied natural gas ("LNG") could play a limited, transitional role in the power generation market.[18] LNG, rather than the more expensive diesel, could provide generation for peak load demand. There is currently a surplus of natural gas in our country, evidenced by the proposed export terminals at Cove Point, MD, Sabine Pass, TX, and the Gulf of Mexico, among others.[19] The United States Department of Energy has been approving LNG terminal export licenses, thus expanding the use of LNG. These successful examples of LNG integration suggest a positive potential for the use of LNG to meet Hawaii's demand for cleaner energy and a more diverse supply.

Consistent with the goals of the Army Energy Initiatives Task Force, natural gas can be used in combination with renewables to solve intermittency and improve energy reliability.[20] This type of strategy would help the Army meet its three driving principles of energy security, mandates, and economic benefits.[21]

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15 http://www.armyeitf.com/.

16 DLNR EISPN at 2:29-30.

17 *See* State of Hawaii Energy Resources Coordinator's Annual Report 2013 at 9 (providing Hawaii renewable energy generation by resource). This report is available at: http://files.hawaii.gov/dbedt/annuals/2013/2013-erc.pdf.

18 HECO noted in its IRP Report, "[f]or the fuel-burning generation fleet (existing and future), LNG may be the lowest-cost fuel, and to the benefit of customers, may be substantially lower cost than ultra-low-sulfur diesel (ULSD). The use of ULSD may be necessary to comply with more stringent environmental regulations, and LNG would be an attractive alternative to more expensive ULSD." IRP Report at ES-19.

19 http://www.ferc.gov/industries/gas/indus-act/lng/lng-proposed-potential.pdf.

20 Energy Initiatives Task Force, Collaboration for Energy Security, slide 14 (February 7, 2014), *available at* http://energyoutlook.naseo.org/Data/Sites/3/presentations/Simpson.pdf.

21 *Id.* at slide 15. The Army must satisfy multiple renewable energy mandates under Section 203 of the Energy Policy Act of 2005, Executive Order 13514, the National Defense Authorization Act of 2007, and President Obama's Climate Action Plan. *See* http://army-energy.hqda.pentagon.mil/renewable/renewable.asp (summarizing targets under the Energy Policy Act of 2005 and the National Defense Authorization Act of 2007); *see also* Executive Order 13514 – Federal Leadership in Environmental, Energy, and Economic Performance, http://energy.gov/eere/femp/downloads/executive-order-13514-federal-leadership-environmental-

While the Project has the primary stated purpose of grid stability to compensate for an anticipated increase in variable power generation from solar and wind resources, other mitigation strategies should be studied. Variable power generation can be mitigated by employing a host of techniques to enable quick start other than by using diesel generators. For instance, energy storage systems, ancillary services, or demand response methods could be employed to mitigate any loss of biofuel inputs. Other mitigation measures may include better management of certain HECO baseload units on Oahu.[22] The addition or conversion of combined-cycle units may also be evaluated. Furthermore, since the Project is a quick start resource, studies could be conducted to determine if a battery energy storage system ("BESS") system could offer the desired back-up to the biofuel generators, just as a BESS offers operating reserves in the Maui grid.[23] According to HECO, its stated quick load pick-up is a 3-second window and sufficient capacity must be available to restore system frequency.[24] Has a study been conducted to demonstrate that the Project's quick start generators can sufficiently restore system frequency without the use of BESS or demand response?

In accordance with the State's renewable energy policies and HECO's own IRP, the Project should take into account a holistic view of the Oahu system. Such an approach should consider not only variable generation equipment capabilities but also utility equipment and operating practices.[25] Furthermore, while the policy goal of the Energy Initiatives Task Force is to increase the use of renewable energy, its other stated aim is to increase such use in a fiscally prudent manner, taking into account life-cycle cost-effectiveness.[26] Accordingly, any mitigation measures such as the Project's quick start resource should fit into a holistic, grid-wide strategy to cost effectively mitigate variable power.

As is evident from the above discussion, DBEDT understands that the Army is open to the consideration of other options for the Project that would meet its objects of procuring reliable, cost-effective and renewable energy, and DBEDT supports that effort. To reach that end, however, DBEDT believes it is important to understand how this Project fits with other ongoing developments to facilitate a cumulative understanding of the environmental, economic and policy impacts of this Project. As such, DBEDT discusses some of the various considerations that should be accounted in this process below.

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energy-and-economic-0; *see also* President Obama's Climate Action Plan: http://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf. The Army's own goal is to deploy one gigawatt of renewable energy by 2025. http://www.armyeitf.com/.

22 *See* Hawaii Solar Integration Study: Executive Summary, National Renewable Energy Laboratory (June 2013) at 3, available at http://www.nrel.gov/docs/fy13osti/57215.pdf.

23 *Id.*

24 *See* Operating Reserves and Variable Generation, National Renewable Energy Laboratory (August 2011) at 47, available at http://www.nrel.gov/docs/fy11osti/51978.pdf.

25 *See generally*, Hawaii Solar Integration Study: Executive Summary, National Renewable Energy Laboratory at 3.

26 *See* Memorandum re: Energy Goal Attainment Responsibility Policy for Installations, Department of the Army, Assistant Secretary of the Army (Installations, Energy and Environment (August 24, 2012) at 3.

C. *Other Proceedings, Developments and Considerations Should Inform the Review of the Project*

The Project is proposed to be operated to "meet load and reliability requirements" of the Oahu grid, and to help maintain "grid stability as the amount of power from variable renewable sources (wind and solar) increases over time."[27] The Project is also proposed as one that would "complement, rather than compete with, other existing and anticipated renewable energy sources in the system."[28] Moreover, the various operating scenarios proposed depend on factors such as whether "demand increases, operations of other generating facilities decline, and/or future renewable resources do not develop."[29] Given that these claimed benefits and scenarios are dependent on various other ongoing developments and factors, DBEDT believes it would be imprudent to consider the Project and the various alternatives in a vacuum. It is also clear that environmental reviews require an expansive view of options and impacts. The following are some of the developments and Hawaii proceedings that could inform the need, cost-effectiveness, environmental impacts and composition of the Project.

This process could be informed by the Reliability Standards Working Group ("RSWG") proceeding in Hawaii PUC Docket No. 2011-0206, which was established to determine how to facilitate the increased use of renewable energy in the islands without compromising grid reliability. The RSWG concluded its work on January 24, 2013. The Independent Facilitator submitted a Final Report on March 13, 2013 and the PUC's selected Technical Review Committee submitted its Report to the Commission in May 2013. The effort of the RSWG resulted in work products and other studies that reflected technical review and recommendations on various factors involved in the consideration, such as ancillary services that can maintain system reliability and better integrate intermittent renewable resources, generation interconnection standard improvements, and methods to reduce renewable generation curtailments.[30] Some recommendations included the initiation of further proceedings. The implementation of the recommendations in those work products and further proceedings would likely influence factors of relevance to the Project's structure and alternative scenarios, such as the enhancement of grid stability, the ability of the system to accommodate new future renewables resources and the likelihood of their development.

Moreover, DBEDT believes that an important consideration is how this Project fits within HECO's overall generation mix. HECO's IRP Report could impact considerations such as load requirements, grid stability, and even the overall cost-impact of the proposed options.[31] In its

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[27] DLNR EISPN at 2:31-38.

[28] *Id.* at 2:38-39.

[29] *Id.* at 3:35-37.

[30] RSWG Independent Facilitator's Final Report, Hawaii PUC Docket No. 2011-0206 (dated March 17, 2013) at 19.

[31] *See Instituting a Proceeding to Investigate Proposed Amendments to the Framework for Integrated Resource Planning*, Decision and Order, Hawaii PUC Docket No. 2009-0108 (March 14, 2011), Revised Framework at Section II.A ("The goal of integrated resource planning is to develop an Action Plan that governs how the utility will meet energy objectives and customer energy needs consistent with state energy policies and goals, while

IRP Report, HECO noted that its first area of focus was to "make every effort to eliminate the dependency on imported oil for power generation."[32] HECO noted that this would involve deactivation or decommissioning of older, oil-fired steam generators, procuring or developing low-cost, fast track utility-scale renewable energy resources, and converting existing generating units to cost effective renewable and lower carbon fuels, including biomass, biofuels, and LNG.[33] Some of the relevant actions proposed for HECO in the IRP Report may impact the consideration of the Project's composition and use. For instance, the IRP Report noted that "[i]f Honolulu units 8 and 9 are deactivated in 2014 and reactivated in 2017, and Waiau units 3 and 4 are deactivated in 2017, CT-1 converted to combined cycle in 2017, Schofield added in 2017, Honolulu decommissioned or retired in 2018, and no other decommissioning of the remaining firm capacity resources, the IRP scenario analysis indicates that there is a possibility of very limited new capacity need after that."[34] This statement appears to be relevant as to the appropriate fuel mix and the consideration of the six hours a day versus twenty-four hours a day scenarios as well as the No Action Alternative described in the Notice.[35] In this regard, DBEDT notes that its view on the various scenarios and No Action Alternative will be guided by a holistic perspective consistent with Hawaii's clean energy policies. Once again, it is important to offer the State's perspective that moving away from oil-based generation is critical to our future.

Other questions that are raised include whether the IRP's proposal to convert HECO's CIP CT-1 located in Campbell Industrial Park from a simple-cycle combustion turbine operating on biodiesel, to a combined-cycle combustion turbine/steam turbine should serve as guidance for the Project or whether HECO could use the biodiesel that currently serves CIP CT-1 to serve the Project.[36] In this regard, HECO noted in its IRP Report that the cost of using biofuels would also be a factor.[37] Additionally, in the Waiver Order, the Hawaii PUC "direct[ed] HECO to address

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providing safe and reliable utility service at reasonable cost, through the development of Resource Plans and Scenarios of possible futures that provide a broader long-term perspective."). In the IRP Docket, DBEDT commented that the PUC should acknowledge the shortcoming in the IRP Report, accept rather than approve the HECO Companies' IRP Report, require the HECO Companies to file for approval prior to implementing specific actions contained in the IRP Action Plans, and establish specific expedited procedures to develop Action Plans that advance the State's clean energy goals. *See, e.g.*, *I/M/O Regarding Integrated Resource Planning*, the Dept. of Business, Economic Development, and Tourism's Reply Comments to Statements of Position in Response to Order No. 31443, Hawaii PUC Docket No. 2012-0036 (filed October 10, 2013) at 3.

32 IRP Report at ES-6.

33 *Id.*

34 *Id.* at 18-35.

35 Notice at 3188. *See also* DLNR EISPN at 3:26-34; 4:44-5:7.

36 *See* IRP Report at 19-6 to 19-7 (where HECO stated, "With the conversion of CIP CT-1 to combined cycle and adding the capability to burn ULSD and/or LNG with approval of the Commission, the biodiesel that would have been consumed at CIP CT-1 could then be used at this Schofield Generating Station. The Schofield Generating Station is designed to operate at a heat rate (i.e., fuel efficiency) approximately equivalent to that for CIP CT-1 in a combined cycle mode, and approximately twice as efficient as CIP CT-1 in a simple cycle mode. If the biodiesel originally intended for CIP CT-1 were to be deployed at the Schofield Generating Station it would contribute to the Companies' attainment of RPS.").

37 *Id.* at 19-6 (where HECO claimed, "if biodiesel prices are high in the future, a fuel switch to a lower price fuel, such as ULSD or LNG, would be more cost effective. Under a future with lower cost biodiesel, keeping CIP CT-1 on biodiesel is the best option.").

in any subsequent application relating to the Project, the reasonableness of exclusively using biofuels for the Project."[38] DBEDT acknowledges the PUC's concerns with the potential cost impacts and also recognizes that biofuels may serve well in the power generation market through existing contracts, such that other options from the "all-of-the-above" strategy may also need to be explored. The mix of biofuels and diesel as proposed for this Project could impact the provision of cost-effective, reliable and clean energy to the Army and other ratepayers within the State. DBEDT requests that HECO and the Army take these factors into account as they consider next steps for studying this Project.[39] As noted above, we are concerned that an unlimited reliance on oil-based diesel is inconsistent with Hawaii's statutes, Hawaii clean energy policy and direction from the Army.

HECO also asserted in the IRP Report that the electrical output from the Project "will normally supply power to all Oahu customers through the Oahu electrical grid. However, during outages that meet the criteria specified in an operating agreement with the Army, [Project] output will be "islanded" to serve only the Army facilities at Schofield Barracks, Wheeler Army Air Field, and Field Station Kunia."[40] There is a need for further information and study on the extent of the need for the facility by Oahu customers currently and to the extent other actions proposed in the IRP Report, technologies, rules, policies or procedures are implemented, including those stemming from the other proceedings discussed in these comments. Similarly, while the IRP Report asserted that the Project's attributes would "enable increased integration of intermittent renewable resources on the Oahu grid (and minimize the potential for energy curtailment,"[41] it is not clear the extent to which these benefits would be realized and how the other potential regulatory requirements discussed herein, among others, would provide similar benefits.

Another salient consideration for this Project is the State legislation and pending investigation into the viability of an inter-island cable.[42] DBEDT believes that the Oahu-Maui interisland marine electric transmission cable that is currently under investigation by the PUC is anticipated to facilitate greater renewable energy development that will displace current fossil generation and reduce the need to develop future fossil generation. Not only did DBEDT's economic analysis demonstrate that the benefits of the inter-island cable would outweigh the costs, DBEDT's analysis found that the inter-island cable would have other benefits such as increasing flexibility in siting new renewable generation, reducing curtailment of renewable generation and providing direct health benefits associated with reduced air emissions of filterable particulate matter,

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38 Waiver Order at 14, n.15.

39 DBEDT also concurs in the other items that the PUC found HECO would need to address in any subsequent application filed related to the Project, such as: (1) the scope and cost of the Project, including as to the size and capacity of the 50 MW Project; (2) whether HECO can provide cost containment for the Project to avoid ratepayers having to pay for cost overruns; and (3) whether reasonable alternatives to the Project were given adequate consideration during the development of the Project. *Id.* at 14-15.

40 IRP Report at 18-17.

41 *Id.* at ES-19.

42 H.R.S. §§ 269-131 to -135, *et seq.*

carbon dioxide, nitrogen oxides and sulfur dioxide.[43] DBEDT's analysis also found that connecting the Oahu and Maui electric systems with a high voltage direct current transmission cable would accommodate transmission of power and ancillary services in both directions and allow the two systems to operate in a coordinated fashion, which would improve the power system economics and reliability on both islands. The construction of such an inter-island cable could have a significant impact on the generation mix in Oahu. This in turn, could potentially reduce the risk of frequency of loss of service to the Army from the other sources of electricity.

Thus, DBEDT submits that the various considerations described above, among others, would have an impact on the Project and any future studies should be reviewed in context with those other developments.

D. It is Imperative to Balance Technical, Economic, Environmental, and Cultural Considerations in the Joint EIS

DBEDT appreciates that the Notice provides that the EIS is designed to meet NEPA and HEPA requirements, and that the Army is preparing supporting studies for key resources of concern include air quality, traffic and stormwater.[44] The DLNR EISPN also lists several impact categories that have been tentatively identified for consideration in the EIS.[45] DBEDT submits that it is imperative to balance technical, economic, environmental, and cultural considerations in the Joint EIS.[46] Although the DLNR EISPN identifies some of these concerns, the Joint EIS should fully address the following:

- Technical Considerations: DBEDT has raised some technical considerations above that should be explored in the Joint EIS. In addition, various statements in the DLNR EISPN require further support and study. For instance, the Project proponents should provide support for its statement that the Project would allow the grid to accommodate more fluctuating renewable energy than would otherwise be the case.[47] It is not clear what assumptions are being used (*e.g.*, high or low renewable penetration) in making this statement. The DLNR EISPN also describes two ways in which it expects the penetration of renewable resources to change the load curve.[48] Have the Project proponents completed a study to support these conclusions? If so, what inputs and assumptions were used?

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43 *I/M/O Public Utilities Comm'n Opening a Proceeding to Investigate Whether an Oahu-Maui Interisland Transmission System May Be in the Public Interest*, Initial Public Comments of the Dept. of Business, Economic Development and Tourism in Response to Order No. 31356, Hawaii PUC Docket No. 2013-0169 (filed September 9, 2013) at 6.

44 Notice at 3187-3188.

45 DLNR EISPN at 5:12-42.

46 *See* State of Hawaii Energy Resources Coordinator's Annual Report 2013 at 3 (explaining that the Abercrombie Administration has focused the next phase of Hawaii's energy transformation on five principles, including "[b]alancing technical, economic, environmental, and cultural considerations.").

47 DLNR EISPN at 3:28-29.

48 *Id.* at 3:18-25.

- Economic Considerations: The Army provides critical national security and first responder services. The continued and stable operation of those services is an important state interest.[49] At the same time, the Army has an interest in pursuing cost-effective solutions, and the Joint EIS should consider alternatives that will be more cost-effective for the Army and all other HECO ratepayers. This analysis should not be done in isolation but rather should consider multiple scenarios, such as high or low load forecasts, high or low renewable penetration, high or low biofuel prices, fuel diversity, etc. The Joint EIS should consider that significant price fluctuations in oil have had harmful effects on Hawaii's ability to meet its diversification goals and highly negative economic consequences. These fluctuations cost jobs, hurt businesses, and ultimately harm consumers, including military service members who live on Oahu. In addition, the DLNR EISPN makes claims that "since the [Project] would be multi-fuel capable, it would be able to run on a combination of fuels as necessary to ensure operations are economically viable and can continue under adverse operating conditions."[50] The Joint EIS should define "economically viable" and present the incremental cost of using biofuels versus other fuels for the generators to support its claim that the multi-fuel capability option is economically viable. The Joint EIS should consider the fluctuation of diesel prices over time[51] as well as the transportation costs of diesel as well.

- Environmental Concerns: The DLNR EISPN states that the six biofuel-capable reciprocating engine-generator sets would add 50 MW of firm, utility-owned renewable energy capacity to the Oahu electrical grid.[52] As discussed above, this claim ignores the fact that, as currently proposed, the Project would also rely on diesel. Reliance on diesel fuel, as opposed to cleaner and greener energy sources that would help control greenhouse gas emissions, does not advance Hawaii's and the Army's renewable goals.

- Cultural Concerns: The DLNR EISPN generally states that the EIS should consider cultural and historical resources (including Native Hawaiian resources), but does not specifically identify which resources will be impacted by the Project. Project proponents should coordinate with other agencies, including the Office of Hawaiian Affairs, the National Park Service, the Hawaii Island Burial Council, the State Historic Preservation Division, and the Historic Hawaii Foundation, among others, to determine which cultural and historical resources are of concern on the Schofield Barracks and Wheeler Army Airfield. The Joint EIS should take steps to ensure that historical, archaeological, and architectural sites are sufficiently protected. DBEDT appreciates the statement in the

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[49] DBEDT acknowledges the Army's assertion that the Project would provide an energy security service to Schofield Barracks, Wheeler Army Airfield and, and Field Station Kunia if loss of service occurs from the normal sources of electricity supporting these installations. Notice at 3188.

[50] DLNR EISPN at 5:15-17.

[51] Biofuels Study Final Report to the Legislature in Accordance with Act 2013, Session Laws of Hawaii, State of Hawaii, Department of Business, Economic Development & Tourism at 5 (December 2012) (showing that fuel oil prices paid by Hawaii's electric utilities have varied from $59/barrel up to $120/barrel from 2006-2011).

[52] DLNR EISPN at 2:34-35.

Notice providing that the Army intends to integrate the NEPA process with the consultation and public participation requirements of Section 106 of the National Historic Preservation Act.[53]

These considerations must not be viewed in isolation but rather the Joint EIS should balance these interests.

II. Conclusion

The concerns raised herein demonstrate that the Project as currently proposed would not be in the best interests of the State, the Army and other Hawaii ratepayers. As such, DBEDT supports review of other alternatives that would better serve the State's energy policy and the energy security and economic interests of the State and the Army and consideration of other developments, proceedings and other factors that would inform the review of the Project.

We appreciate the opportunity to provide these comments for use in the preparation of the Joint EIS and DBEDT formally requests to be added to the EIS distribution list. If you have any questions, please feel free to contact me at (808) 587-3812 or mark.b.glick@dbedt.hawaii.gov.

Sincerely,

Mark B. Glick
Energy Administrator

[53] Notice at 3187.

EISPN COMMENTS

HAWAII RENEWABLE RESOURCES, LLC

January 24, 2014

Mr. William Aila, Chairman
Department of Land and Natural Resources
1151 Punchbowl St., Room 131
Honolulu, HI 96813

Ms. Melissa DeSantis,
Tetra Tech, Inc.
10306 Eaton Place, Suite 340,
Fairfax VA 22030

Re: SGSP EISPN

Dear Mr. Aila and Ms. DeSantis:

Hawaii Renewable Resources (HRR) is in the process of receiving a long term lease and is committed to constructing an animal feed mill and biogas production facility to be located on State Department of Agriculture land (TMK No.: 9-4-012:01 and 9-4-012:03). This TMK is adjacent to the proposed site of the HECO Schofield Generating Station Project.

We have read the above-referenced EISPN with great interest because it directly impacts our operations. Our specific comments and concerns are detailed below for your consideration.

- The proposed power line easement and power poles P1 –P3 located on and across our TMK would withdraw essential land from our facility for production equipment and buildings.
- The operation of the SGSP will negatively impact the operation of our facility for processing agricultural products and foods into animal feeds and biogas.
- Access to our site will be more limited.

We request to be consulted with regard to the design and operating characteristics of the proposed SGSP. We would be happy to meet with appropriate personnel at your convenience and look forward to constructive discussions.

Sincerely,

Valentine Peroff

Valentine Peroff

cc: Scott Enright
Jimmy Nakatani

Mr. Valentine Peroff
Hawaii Renewable Resources, LLC
99-1324 Koaha Place
Aiea, Hawai'i 96701-3200

Subject: Schofield Generating Station Project:
Environmental Impact Statement Preparation Notice (EISPN)

Dear Mr. Peroff:

Thank you for your January 24th 2014 letter concerning the Environmental Impact Statement Preparation Notice (EISPN) for the Schofield Generating Project. With respect to the request for a meeting contained in the last paragraph of your letter, we would be happy to meet with you. However, as all of the issues that you indicated an interest in discussing have to deal with land that is owned by the State of Hawai'i, we believe that such a meeting should include representatives of the State Department of Agriculture and the State Department of Land and Natural Resources as well. Please call me at (808) 543-4088 and I will try to help set up a meeting time/place.

In addition to your more general request for consultation, your letter also contained several specific "bulleted" statements that we believe it best to address at this time. Those comments are reproduced below, followed by brief responses that I hope will be helpful going forward.

Comment:

> *The proposed power line easement and power poles P1 —P3 located on and across our TMK would withdraw essential land from our facility for production equipment and buildings.*

Response: The first paragraph of your letter states that: *"Hawaii Renewable Resources (HRR) is in the process of receiving a long term lease and is committed to constructing an animal feed mill and biogas production facility to be located on State Department of Agriculture land (TMK No.: 9-4-012:01 and 9-4-012:03)."*

Hawaiian Electric has been discussing its proposed project with State agencies for many months now but had not heard of any plans for construction of the facility you outlined in your letter. As soon as we received your remarks we contacted the Department of Land and Natural Resources Office of Conservation and Coastal Lands (DLNR/OCCL) who is handling the EIS process. OCCL in turn spoke with the asset manager in the Department of Agriculture (DoA) who responsible for this site. OCCL informed me that the DoA reported no lease application was on record for the TMK under discussion.

April 1, 2014

Comment:

The operation of the SGSP will negatively impact the operation of our facility for processing agricultural products and foods into animal feeds and biogas.

Response: Hawaiian Electric understands that you are concerned that the operation of the Schofield Generating Station might in some way adversely affect the viability of the operation that you are contemplating. However, as your letter provided no information about the design or operational characteristics of your facilities, it is impossible for us to understand how that might occur. Without such information, it is impossible to address them specifically in the environmental impact statement.

The EIS will, of course, discuss the potential effects on the existing environment of all of the elements that are part of the project. You will have the opportunity to offer your comments on the Draft Environmental Impact Statement (DEIS) during the public comment period.

Comment:

Access to our site will be more limited.

Response: As indicated earlier in this letter, your comments do not contain a physical description of your proposed facilities or of the way in which you propose to operate them. Without those, it is not possible to know what kind of "access limitations" may be of concern. Unless you are able to provide additional information we will not be able to address this concern in the DEIS.

If you have any questions or would like to discuss this further, please call me at (808) 543-4088.

Sincerely,

Jack Shriver
Senior Engineer,
Generation Project Development
Hawaiian Electric Company

cc: (via email only)
Mr. Alex Roy, Hawaii Department of Land and Natural Resources Office of Conservation and Coastal Lands
Ms. Stephanie Gardin, Office of Public Affairs, US Army Garrison—Hawaii
Mr. Doug Waters, US Army Energy Initiatives Task Force

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 11TH FLOOR
HONOLULU, HAWAII 96813
Phone: (808) 768-8480 • Fax: (808) 768-4567
Web site: www.honolulu.gov

KIRK CALDWELL
MAYOR

CHRIS T. TAKASHIGE, P.E., CCM
DIRECTOR

MARK YONAMINE, P.E.
DEPUTY DIRECTOR

February 5, 2014

Hawaiian Electric
P.O. Box 2750
Honolulu, Hawaii 96840

Attn: Jack Shriver

Dear Mr. Shriver:

Subject: Schofield Generating Station Project Environmental Impact Statement Preparation Notice (EISPN)

The Department of Design and Construction does not have any comments to offer on the preparation of the environmental impact statement preparation.

Thank you for the opportunity to review and comment. Should there be any questions, please contact me at 768-8480.

Sincerely,

for M. Yonamine

Chris T. Takashige, P.E., CCM
Director

CTT: cf (546289)

April 1, 2014

Mr. Chris T. Takashige, Director
Department of Design and Construction
City and County of Honolulu
650 South King Street, 11th Floor
Honolulu, Hawai'i 96813

Subject: Schofield Generating Station Project:
Environmental Impact Statement Preparation Notice (EISPN)

Dear Mr. Takashige:

Thank you for your February 5th 2014 letter concerning the Environmental Impact Statement Preparation Notice (EISPN) for the Schofield Generating Project. We appreciate the time that you and your staff spent reviewing the EISPN and responding.

We understand that you have no comments to offer at this time. If you have any questions or would like to discuss this further, please call me at (808) 543-4088.

Sincerely,

Jack Shriver
Senior Engineer,
Generation Project Development
Hawaiian Electric Company

cc: (via email only)
Mr. Alex Roy, Hawaii Department of Land and Natural Resources Office of Conservation and Coastal Lands
Ms. Stephanie Gardin, Office of Public Affairs, US Army Garrison—Hawaii
Mr. Doug Waters, US Army Energy Initiatives Task Force

POLICE DEPARTMENT

CITY AND COUNTY OF HONOLULU

801 SOUTH BERETANIA STREET · HONOLULU, HAWAII 96813
TELEPHONE: (808) 529-3111 · INTERNET: www.honolulupd.org

KIRK CALDWELL
MAYOR

LOUIS M. KEALOHA
CHIEF

DAVE M. KAJIHIRO
MARIE A. McCAULEY
DEPUTY CHIEFS

OUR REFERENCE EO-WS

January 29, 2014

Mr. William J. Aila, Jr., Chairperson
Office of Conservation and Coastal Lands
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

Dear. Mr. Aila:

This is in response to letters from Mr. Jack Shriver of the Hawaiian Electric Company (dated January 8, 2014) and Ms. Amanda Simpson of the Energy Initiatives Task Force, Department of the Army (dated January 9, 2014), requesting comments on the Environmental Impact Statement Preparation Notice for the proposed Schofield Generating Station project located in Wahiawa.

The Honolulu Police Department (HPD) has no major concerns at this time regarding the project. However, there may be concerns with traffic issues in the area of the Schofield Barracks' Lyman Gate during the construction phase. The HPD would like to be consulted when the environmental impact statement is published to reassess the project's impact on police operations.

If there are any questions, please contact Acting Major Larry Lawson of District 2 (Wahiawa) at 723-8703 or via e-mail at llawson@honolulu.gov.

Sincerely,

LOUIS M. KEALOHA
Chief of Police

By Rl K. Mag

RANDAL K. MACADANGDANG
Assistant Chief
Support Services Bureau

cc: Mr. Jack Shriver, Hawaiian Electric Company
Ms. Melissa DeSantis, Tetra Tech, Inc.

April 1, 2014

Mr. Louis M. Kealoha, Chief of Police
Honolulu Police Department
City and County of Honolulu
801 South Beretania Street
Honolulu, Hawai'i 96813

Subject: Schofield Generating Station Project:
Environmental Impact Statement Preparation Notice (EISPN)

Dear Chief Kealoha:

Thank you for your January 29th 2014 letter (Ref. EO-WS) to the State of Hawai'i Department of Land and Natural Resources (DLNR) concerning the Environmental Impact Statement Preparation Notice (EISPN) for the Schofield Generating Project. Because Hawaiian Electric is the applicant seeking the Department's approval for the proposed project, DLNR has asked that we respond.

Let me begin by saying that we are grateful for the time that you and your staff spent reviewing the EISPN and responding. We appreciate your confirmation that the Honolulu Police Department (HPD) does not have any major concerns regarding the project at this time.

As you pointed out, traffic may be a concern, and the Draft Environmental Impact Statement (DEIS) for the Schofield Generating Station Project will address the effect that the proposed project will have on traffic in the vicinity of the Lyman Gate entrance to Schofield Barracks and elsewhere during the construction phase of the proposed project. It will also discuss the effect that the construction and operation of the proposed facility is likely to have on police operations.

Hawaiian Electric will provide a copy of the forthcoming DEIS to your department for additional review and comment as soon as it becomes available.

In the meantime, if you have any questions or would like to discuss this further, please call me at (808) 543-4088.

Sincerely,

Jack Shriver
Senior Engineer,
Generation Project Development
Hawaiian Electric Company

cc: (via email only)
Mr. Alex Roy, Hawaii Department of Land and Natural Resources Office of Conservation and Coastal Lands
Ms. Stephanie Gardin, Office of Public Affairs, US Army Garrison—Hawaii
Mr. Doug Waters, US Army Energy Initiatives Task Force
Acting Major Larry Lawson, Honolulu Police Department, District 2

HISTORIC HAWAI'I FOUNDATION
1974 ► 2014

January 29, 2014

Hawaiian Electric, Co.
ATTN: Jack Shriver, Project Management
PO Box 2750
Honolulu, HI 96840-0001

RE: Schofield Generating Station Project (SGSP) Environmental Impact Statement Preparation Notice (EISPN)

Dear Mr. Shriver:

Thank you for referring the above project to Historic Hawai'i Foundation for pre-assessment consultation, review and comment. Since 1974, Historic Hawai'i Foundation (HHF) has been a statewide leader for historic preservation. HHF's mission is to preserve and encourage the preservation of Hawaii's historic buildings, sites, objects and communities.

The proposed project consists of three elements including the Hawaiian Electric Company's construction, maintenance, ownership, and operation of a power plant located at Schofield with a transmission line to the existing Wahiawā Substation. The other elements include the lease of the land for the power plant from the Army to Hawaiian Electric, as well as an easement for the transmission line. Additionally the Department of Land and Natural Resources will also grant an easement and conservation district authorization for the remaining portion of the transmission line.

Hawaiian Electric provided Historic Hawai'i Foundation with an Environmental Impact Statement Preparation Notice which included correspondence from Hawaiian Electric with attachments including DLNR EISPN for SGSP, ARMY NOI for SGSP, and Notice for Public Scoping Meetings. HHF understands that the Department of the Army determined the proposed project is subject to the National Environmental Policy Act. Furthermore, the Department of Land and Natural Resources determined the proposed project is subject to HRS Chapter 343 and that an Environmental Impact Statement (EIS) should be prepared. As noted in the EISPN, the EIS will evaluate the potential environmental, cultural, and socioeconomic impacts of the proposed project including the cultural and historic resources (including Native Hawaiian Resources).

HHF would like to remain a participant in the consultation process for both the EIS and Section 106 consultation under the National Historic Preservation Act. Please include our organization in further correspondence.

Thank you for the opportunity to comment.

Very truly yours,

Kiersten Faulkner

Kiersten Faulkner, AICP
Executive Director

680 Iwilei Road, Suite 690 / Honolulu, Hawai'i 96817 / Tel (808) 523-2900 / Fax (808)523-0800
Email preservation@historichawaii.org / Web www.historichawaii.org

April 1, 2014

Ms. Kiersten Faulkner, Executive Director
Historic Hawai'i Foundation
680 Iwilei Road, Suite 690
Honolulu, Hawai'i 96817

Subject: Schofield Generating Station Project:
Environmental Impact Statement Preparation Notice (EISPN)

Dear Ms. Faulkner:

Thank you for your January 29, 2014, letter concerning the Environmental Impact Statement Preparation Notice (EISPN) for the Schofield Generating Project. We appreciate the time that you and your staff spent reviewing the EISPN and preparing your response.

As you requested in your letter, we will include Historic Hawai'i Foundation in the consultation process and include you in further correspondence.

If you have any questions or would like to discuss this further, please call me at (808) 543-4088.

Sincerely,

Jack Shriver
Senior Engineer,
Generation Project Development
Hawaiian Electric Company

cc: (via email only)
Mr. Alex Roy, Hawaii Department of Land and Natural Resources Office of Conservation and Coastal Lands
Ms. Stephanie Gardin, Office of Public Affairs, US Army Garrison—Hawaii
Mr. Doug Waters, US Army Energy Initiatives Task Force

Neil Abercrombie
GOVERNOR OF HAWAII

Gary L. Gill
DEPUTY DIRECTOR OF HEALTH

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

RECEIVED
OFFICE OF CONSERVATION
AND COASTAL LANDS

2014 JAN 29 P 2: 43

DEPT. OF LAND &
NATURAL RESOURCES
STATE OF HAWAII

In reply, please refer to:
File: EHA/HEER Office
14-030-JIN

January 23, 2014

Mr. Alex J. Roy
Department of Land and Natural Resources
Office of Conservation and Coastal Lands
Kalanimoku Building Room 131
1151 Punchbowl Street
Honolulu, HI 96809

Facility/Site: Schofield Generation Station Project

Subject: Comments for ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE (EISPN) FOR THE PROPOSED SCHOFIELD GENERATION STATION PROJECT

Dear Mr. Roy:

The Hawaii Department of Health (HDOH) Hazard Evaluation and Emergency Response (HEER) Office has reviewed the above referenced document and has the following comments:

The proposed site for the Schofield Generation Station Project crosses the Schofield Military installation across areas known for multiple petroleum and other chemical releases. Many of these areas have been investigated and cleaned up or being managed safely on site. DOH recommends the developer work with closely with the Army to identify areas where ground disturbing activities may impact areas of historic soil or groundwater contamination. Information gathered from the Army and their inventory of areas with Land Use Controls may be used to identify areas of known contamination. These data can then be used to develop an Environmental Hazard Management Plan for Construction Activities to protect worker safety, ensure proper management of contaminated soils and ensure the long term protection of both human health and the environment during any soil disturbing activities.

The HDOH kindly asks that you address the above comments prior to beginning construction of the project. Should you have any questions, please contact me at 586-0958 or at jordan.nakagawa@doh.hawaii.gov.
Sincerely,

Jordan Nakagawa, Project Manager
Site Discovery, Assessment, and Remediation Section
Hazard Evaluation and Emergency Response Office

C: Environmental Planning Office

April 1, 2014

Mr. Jordan Nakagawa, Project Manager
Site Discovery, Assessment, and Remediation Section
Hazard Evaluation and Emergency Response Office
Department of Health
State of Hawai'i
P.O. Box 3378
Honolulu, Hawai'i 96801-3378
jordan.nakagawadoh.hawaii.gov

Subject: Schofield Generating Station Project: Environmental Impact Statement Preparation Notice (EISPN)

Dear Mr. Nakagawa:

Thank you for your January 23rd 2014 letter (Reference EHA/HEER Office 14-030-JIN) to the State of Hawai'i Department of Land and Natural Resources (DLNR) concerning the Environmental Impact Statement Preparation Notice (EISPN) for the Schofield Generating Project. Because Hawaiian Electric is the applicant seeking approval for the proposed project, DLNR has asked that we respond.

We appreciate the information you provided regarding past releases of petroleum and other chemicals at Schofield Barracks. Hawaiian Electric has carefully coordinated its plans with the Army to ensure that ground-disturbing activities related to the Schofield Generating Station Project do not impact areas of historic soil or groundwater contamination, and we will further assess the site to confirm there is no contamination. If any contamination is found, we will follow approved environmental hazard management procedures throughout the construction phase of the project, thereby protecting worker safety, ensuring proper management of contaminated soils, and protecting both human health and the environment during all soil-disturbing activities.

If you have any questions or would like to discuss this further, please call me at (808) 543-4088.

Sincerely,

Jack Shriver
Senior Engineer,
Generation Project Development
Hawaiian Electric Company

cc: (via email only)
Mr. Alex Roy, Hawaii Department of Land and Natural Resources Office of Conservation and Coastal Lands
Ms. Stephanie Gardin, Office of Public Affairs, US Army Garrison—Hawaii
Mr. Doug Waters, US Army Energy Initiatives Task Force

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

GARY L. GILL
ACTING DIIRECTOR OF HEALTH

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

RECEIVED
BUREAU OF CONSERVATION
AND COASTAL LANDS
2014 JAN 29 P 2:47
DEPT. OF LAND &
NATURAL RESOURCES
STATE OF HAWAII

In reply, please refer to:
File:

14-015
EISPN SGSP

January 27, 2014

Mr. Alex J. Roy
Department of Land and Natural Resources
Office of conservation and Coastal Lands
P.O. Box 621
Honolulu, Hawaii

Dear Mr. Roy:

SUBJECT: Environmental Impact Statement Preparation Notice for the Proposed Schofield Generating Station Project, Wahiawa District, Island of Oahu

The Department of Health (DOH), Environmental Planning Office (EPO), acknowledges receipt of your document through the Office of Environmental Quality's "The Environmental Notice" dated January 8, 2014. Thank you for allowing us to review and comment on the subject document. The document was routed to DOH's Clean Air Branch, Clean Water Branch, Indoor R& Radiological Health Branch, Solid and Hazardous Waste Branch, and the Hazard Evaluation & Emergency Response Office. They will provide specific comments to you if necessary. EPO recommends that you review the Standard Comments found on our website: http://health.hawaii.gov/epo/home/landuse-planning-review-program.
You are required to adhere to all Standard Comments specifically applicable to this application.

EPO suggests that you examine the many sources available on strategies to support the sustainable and healthy design of communities and buildings, including the:
State of Hawaii, Office of Planning: www.planning.hawaii.gov and the new 2013 ORMP;
U.H., School of Ocean and Earth Science and Technology: www.soest.hawaii.edu;
U.S. Health and Human Services: www.hhs.gov/about/sustainability;
U.S. Environmental Protection Agency's sustainability programs: www.epa.gov/sustainability;
U.S. Green Building Council's LEED program: www.usgbc.org/leed; and
International Well Building Standard: http://delosliving.com

The DOH encourages everyone to apply these sustainability strategies and principles early in the planning and review of projects. We also request that for future projects you consider conducting a Health Impact Assessment (HIA). More information is available at: www.cdc.gov/healthyplaces/hia.htm. We request you share all of this information with others to increase community awareness on sustainable, innovative, inspirational, and healthy community design.

We request electronic response confirming receipt of this letter and any other letters you receive from DOH in regards to this project. Please email: epo@doh.hawaii.gov. We anticipate that our letter(s) and your electronic response(s) will be included in the final document. If you have any questions, please contact me at (808) 586-4337 or laura.mcintyre@doh.hawaii.gov

Mahalo,

Laura Leialoha Phillips McIntyre, AICP
Program Manager, Environmental Planning Office

April 1, 2014

Ms. Laura Leialoha Phillips McIntyre, Program Manager
Environmental Planning Office
Department of Health
State of Hawai'i
P.O. Box 3378
Honolulu, Hawai'i 96801-3378

Subject: Schofield Generating Station Project:
Environmental Impact Statement Preparation Notice (EISPN)

Dear Ms. McIntyre:

Thank you for your January 27, 2014, letter (Reference 14-015 EISPN SGSP) to the State of Hawai'i Department of Land and Natural Resources (DLNR) concerning the Environmental Impact Statement Preparation Notice (EISPN) for the Schofield Generating Project. Because Hawaiian Electric is the applicant seeking approval for the proposed project, DLNR has asked that we respond.

Hawaiian Electric appreciates your routing the EISPN to the Clean Air Branch, Clean Water Branch, Indoor and Radiological Health Branch, Solid and Hazardous, Waste Branch, and the Hazard Evaluation and Emergency Response Office. We will respond to their separate comments as appropriate. The company is familiar with the "Standard Comments" found on the Department of Health's website, and it will make sure that those that apply are addressed in the Draft Environmental Impact Statement (DEIS). The company and its partners attempt to follow sustainable design strategies wherever possible, including those described in the sources you list. Moreover, in accordance with NEPA guidelines the forthcoming Draft Environmental Impact Statement (DEIS) will evaluate the potential for health effects as a part of the overall environmental impact review process.

We will provide you with a copy of the DEIS when it becomes available. In the meantime, if you have any questions or would like to discuss this further, please call me at (808) 543-4088.

Sincerely,

Jack Shriver
Senior Engineer,
Generation Project Development
Hawaiian Electric Company

cc: (via email only)
Mr. Alex Roy, Hawaii Department of Land and Natural Resources Office of Conservation and Coastal Lands
Ms. Stephanie Gardin, Office of Public Affairs, US Army Garrison—Hawaii
Mr. Doug Waters, US Army Energy Initiatives Task Force
Department of Health (DOH), Environmental Planning Office (EPO)

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GARY L. GILL
ACTING DIRECTOR OF HEALTH

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

RECEIVED
OFFICE OF CONSERVATION
AND COASTAL LANDS
2014 JAN 28 A 9:57
DEPT. OF LAND &
NATURAL RESOURCES
STATE OF HAWAII

In reply, please refer to:
EMD/CWB

01078PCTM.14

January 24, 2014

Mr. Alex J. Roy
Department of Land and Natural Resources
Office of Conservation and Costal Lands
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Roy:

SUBJECT: Comments on the Environmental Impact Statement Preparation Notice (EISPN) for the Schofield Generating Station Project Waihiawa, Island of Oahu, Hawaii

The Department of Health (DOH), Clean Water Branch (CWB), acknowledges receipt of your letter, received December 23, 2013, requesting comments on your project. The DOH-CWB has reviewed the subject document and offers these comments. Please note that our review is based solely on the information provided in the subject document and its compliance with the Hawaii Administrative Rules (HAR), Chapters 11-54 and 11-55. You may be responsible for fulfilling additional requirements related to our program. We recommend that you also read our standard comments on our website at: http://health.hawaii.gov/epo/files/2013/10/CWB_Oct22.pdf

1. Any project and its potential impacts to State waters must meet the following criteria:

   a. Antidegradation policy (HAR, Section 11-54-1.1), which requires that the existing uses and the level of water quality necessary to protect the existing uses of the receiving State water be maintained and protected.

   b. Designated uses (HAR, Section 11-54-3), as determined by the classification of the receiving State waters.

   c. Water quality criteria (HAR, Sections 11-54-4 through 11-54-8).

2. National Pollutant Discharge Elimination System (NPDES) permit coverage is required for pollutant discharges into State surface waters and for certain situations involving storm water (HAR, Chapter 11-55).

   a. Discharges into Class 2 or Class A State waters can be covered under an NPDES general permit only if all of the NPDES general permit requirements are met. Please see the DOH-CWB website (http://health.hawaii.gov/cwb/) for the

NPDES general permits and instructions to request coverage.

b. All other discharges into State surface waters and discharges into Class 1 or Class AA State waters require an NPDES individual permit. To request NPDES individual permit coverage, please see the DOH-CWB forms website located at: http://health.hawaii.gov/cwb/site-map/clean-water-branch-home-page/forms/

c. NPDES permit coverage for storm water associated with construction activities is required if your project will result in the disturbance of one (1) acre or more of total land area. The total land area includes a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under a larger common plan of development or sale. NPDES permit coverage is required before the start of the construction activities.

   Land disturbance includes, but is not limited to clearing, grading, grubbing, uprooting of vegetation, demolition (even if leaving foundation slab), staging, stockpiling, excavation into pavement areas which go down to the base course, and storage areas (including areas on the roadway to park equipment if these areas are blocked off from public usage, grassed areas, or bare ground).

3. If your project involves work in, over, or under waters of the United States, it is highly recommend that you contact the Army Corp of Engineers, Regulatory Branch (Tel: 438-9258) regarding their permitting requirements.

   Pursuant to Federal Water Pollution Control Act [commonly known as the "Clean Water Act" (CWA)], Paragraph 401(a)(1), a Section 401 Water Quality Certification (WQC) is required for "[a]ny applicant for Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may **result** in any discharge into the navigable waters..." (emphasis added). The term "discharge" is defined in CWA, Subsections 502(16), 502(12), and 502(6); Title 40 of the Code of Federal Regulations, Section 122.2; and Hawaii Administrative Rules (HAR), Chapter 11-54.

4. Please note that all discharges related to the project construction or operation activities, whether or not NPDES permit coverage and/or Section 401 WQC are required, must comply with the State's Water Quality Standards. Noncompliance with water quality requirements contained in HAR, Chapter 11-54, and/or permitting requirements, specified in HAR, Chapter 11-55, may be subject to penalties of $25,000 per day per violation.

If you have any questions, please visit our website at: http://health.hawaii.gov/cwb, or contact the Engineering Section, CWB, at (808) 586-4309.

Sincerely,

ALEC WONG, P.E., CHIEF
Clean Water Branch

CTM:tg

c: DOH-EPO #14-015 [via email only]

April 1, 2014

Mr. Alec Wong, Chief
Clean Water Branch
Department of Health
State of Hawai'i
P.O. Box 3378
Honolulu, Hawai'i 96801-3378

Subject: Schofield Generating Station Project:
Environmental Impact Statement Preparation Notice (EISPN)

Dear Mr. Wong:

Thank you for your January 24th 2014 letter (Reference 01078PCTM.14) to the State of Hawai'i Department of Land and Natural Resources (DLNR) concerning the Environmental Impact Statement Preparation Notice (EISPN) for the Schofield Generating Project. Because Hawaiian Electric is the applicant seeking approval for the proposed project, DLNR has asked that we respond.

Hawaiian Electric understands that it must comply with the provisions of Hawai'i Administrative Rules §11-54 and 11-55, and appreciates the information you provided regarding antidegradation, designated uses, and water quality criteria. We recognize that National Pollutant Discharge Elimination System (NPDES) permit coverage is required for certain storm water discharges and anticipate that we will require one before proceeding with development of the approximately 10-acre site. We do not expect to undertake work that will require an Army Corps of Engineers permit or a Section 401 Water Quality Certification.

We will provide the Department copies of the Draft Environmental Impact Statement when it is available, and you will have an opportunity to provide additional comments at that time. If, in the meantime you have any questions or would like to discuss this further, please call me at (808) 543-4088.

Sincerely,

Jack Shriver
Senior Engineer,
Generation Project Development
Hawaiian Electric Company

cc: (via email only)
Mr. Alex Roy, Hawaii Department of Land and Natural Resources Office of Conservation and Coastal Lands
Ms. Stephanie Gardin, Office of Public Affairs, US Army Garrison—Hawaii
Mr. Doug Waters, US Army Energy Initiatives Task Force

United States Department of Agriculture

NRCS

Natural Resources Conservation Service
P.O. Box 50004 Rm. 4-118
Honolulu, HI 96850
808-541-2600

February 4, 2014

Tetra Tech, Inc.
Melissa DeSantis (SGSP EIS)
10306 Eaton Place, Ste. 340
Fairfax, VA 22030

Dear Ms. DeSantis,

Thank you for providing the United States Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS) the opportunity to review the status of lands that will be affected by the proposed construction of a biofuel-capable power generation plant on lease land within Schofield Barracks Military Reserve, Mililani, Hawaii. We confine our comments to issues within the purview of NRCS, specifically those related to soil properties that are typically used to assess the quality of land for agricultural uses.

Upon review of the provided Environmental Impact Statement Preparation Notice, we find that the soils within the project area – roughly 10 acres – are classified as "Prime Farmland if Irrigated" in the latest Soil Survey, available through the Web Soil Survey online database interface (http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm). Projects receiving federal funding and to be built on open land that is not considered within urbanized areas, such as this project area, are subject to the Farmland Protection Policy Act [FPPA, subtitle I of Title XV, Section 1539-1549 of the Agriculture and Food Act of 1981 (Public Law 97-98)] and will require that a USDA Form AD-1006 – Farmland Conversion Impact Rating – be completed as part of the Environmental Assessment process. A copy of this form and instructions are attached.

If you have any questions concerning the soils and related quality and suitability ratings for this project area, please contact Dr. Cynthia Stiles, Assistant State Soil Scientist, by phone (808) 541-2600 x129 or email cynthia.stiles@hi.usda.gov.

Sincerely,

Christine S. Clarke

Christine S. Clarke
Acting Director
Pacific Islands Area

Enclosure:

cc: Richard Patterson, District Conservationist, Aiea, Hawaii
Cynthia Stiles, Asst. State Soil Scientist, Honolulu, Hawaii

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request
Name Of Project	Federal Agency Involved
Proposed Land Use	County And State

PART II *(To be completed by NRCS)*		Date Request Received By NRCS	
Does the site contain prime, unique, statewide or local important farmland? *(If no, the FPPA does not apply -- do not complete additional parts of this form).*	Yes ☐ No ☐	Acres Irrigated	Average Farm Size
Major Crop*(s)*	Farmable Land In Govt. Jurisdiction Acres: %	Amount Of Farmland As Defined In FPPA Acres: %	
Name Of Land Evaluation System Used	Name Of Local Site Assessment System	Date Land Evaluation Returned By NRCS	

PART III *(To be completed by Federal Agency)*	Alternative Site Rating			
	Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly				
B. Total Acres To Be Converted Indirectly				
C. Total Acres In Site	0.0	0.0	0.0	0.0
PART IV *(To be completed by NRCS)* Land Evaluation Information				
A. Total Acres Prime And Unique Farmland				
B. Total Acres Statewide And Local Important Farmland				
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted				
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value				
PART V *(To be completed by NRCS)* Land Evaluation Criterion Relative Value Of Farmland To Be Converted *(Scale of 0 to 100 Points)*	0	0	0	0

PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(These criteria are explained in 7 CFR 658.5(b)*	Maximum Points				
1. Area In Nonurban Use					
2. Perimeter In Nonurban Use					
3. Percent Of Site Being Farmed					
4. Protection Provided By State And Local Government					
5. Distance From Urban Builtup Area					
6. Distance To Urban Support Services					
7. Size Of Present Farm Unit Compared To Average					
8. Creation Of Nonfarmable Farmland					
9. Availability Of Farm Support Services					
10. On-Farm Investments					
11. Effects Of Conversion On Farm Support Services					
12. Compatibility With Existing Agricultural Use					
TOTAL SITE ASSESSMENT POINTS	160	0	0	0	0
PART VII *(To be completed by Federal Agency)*					
Relative Value Of Farmland *(From Part V)*	100	0	0	0	0
Total Site Assessment *(From Part VI above or a local site assessment)*	160	0	0	0	0
TOTAL POINTS *(Total of above 2 lines)*	260	0	0	0	0

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? Yes ☐ No ☐

Reason For Selection:

(See Instructions on reverse side)

Form AD-1006 (10-83)

This form was electronically produced by National Production Services Staff

STEPS IN THE PROCESSING THE FARMLAND AND CONVERSION IMPACT RATING FORM

Step 1 – Federal agencies involved in proposed projects that may convert farmland, as defined in the Farmland Protection Policy Act (FPPA) to nonagricultural uses, will initially complete Parts I and III of the form.

Step 2 – Originator will send copies A, B and C together with maps indicating locations of site(s), to the Natural Resources Conservation Service (NRCS) local field office and retain copy D for their files. (Note: NRCS has a field office in most counties in the U.S. The field office is usually located in the county seat. A list of field office locations are available from the NRCS State Conservationist in each state).

Step 3 – NRCS will, within 45 calendar days after receipt of form, make a determination as to whether the site(s) of the proposed project contains prime, unique, statewide or local important farmland.

. Step '4 – In cases where farmland covered by the FPPA will be converted by the proposed project, NRCS field offices will complete Parts II, IV and V of the form.

Step 5 – NRCS will return copy A and B of the form to the Federal agency involved in the project. (Copy C will be retained for NRCS records).

Step 6 – The Federal agency involved in the proposed project will complete Parts VI and VII of the form.

Step 7 – The Federal agency involved in the proposed project will make a determination as to whether the proposed conversion is consistent with the FPPA and the agency's internal policies.

INSTRUCTIONS FOR COMPLETING THE FARMLAND CONVERSION IMPACT RATING FORM

Part I: In completing the "County And State" questions list all the local governments that are responsible for local land controls where site(s) are to be evaluated.

Part III: In completing item B (Total Acres To Be Converted Indirectly), include the following:

1. Acres not being directly converted but that would no longer be capable of being farmed after the conversion, because the conversion would restrict access to them.

2. Acres planned to receive services from an infrastructure project as indicated in the project justification (e.g. highways, utilities) that will cause a direct conversion.

Part VI: Do not complete Part VI if a local site assessment is used.

Assign the maximum points for each site assessment criterion as shown in § 658.5 (b) of CFR. In cases of corridor-type projects such as transportation, powerline and flood control, criteria #5 and #6 will not apply and will, be weighed zero, however, criterion #8 will be weighed a maximum of 25 points, and criterion #11 a maximum of 25 points.

Individual Federal agencies at the national level, may assign relative weights among the 12 site assessment criteria other than those shown in the FPPA rule. In all cases where other weights are assigned relative adjustments must be made to maintain the maximum total weight points at 160.

In rating alternative sites, Federal agencies shall consider each of the criteria and assign points within the limits established in the FPPA rule. Sites most suitable for protection under these criteria will receive the highest total scores, and sites least suitable, the lowest scores.

Part VII: In computing the "Total Site Assessment Points" where a State or local site assessment is used and the total maximum number of points is other than 160, adjust the site assessment points to a base of 160. Example: if the Site Assessment maximum is 200 points, and alternative Site "A" is rated 180 points:

$$\frac{\text{Total points assigned Site A}}{\text{Maximum points possible}} = \frac{180}{200} \times 160 = 144 \text{ points for Site "A."}$$

Site Assessment Scoring for the Twelve Factors Used in FPPA

The Site Assessment criteria used in the Farmland Protection Policy Act (FPPA) rule are designed to assess important factors other than the agricultural value of the land when determining which alternative sites should receive the highest level of protection from conversion to non agricultural uses.

Twelve factors are used for Site Assessment and ten factors for corridor-type sites. Each factor is listed in an outline form, without detailed definitions or guidelines to follow in the rating process. The purpose of this document is to expand the definitions of use of each of the twelve Site Assessment factors so that all persons can have a clear understanding as to what each factor is intended to evaluate and how points are assigned for given conditions.

In each of the 12 factors a number rating system is used to determine which sites deserve the most protection from conversion to non-farm uses. The higher the number value given to a proposed site, the more protection it will receive. The maximum scores are 10, 15 and 20 points, depending upon the relative importance of each particular question. If a question significantly relates to why a parcel of land should not be converted, the question has a maximum possible protection value of 20, whereas a question which does not have such a significant impact upon whether a site would be converted, would have fewer maximum points possible, for example 10.

The following guidelines should be used in rating the twelve Site Assessment criteria:

1. **How much land is in non-urban use within a radius of 1.0 mile from where the project is intended?**

More than 90 percent:	15 points
90-20 percent:	14 to 1 points
Less than 20 percent:	0 points

This factor is designed to evaluate the extent to which the area within one mile of the proposed site is non-urban area. For purposes of this rule, "non-urban" should include:

- Agricultural land (crop-fruit trees, nuts, oilseed)
- Range land
- Forest land
- Golf Courses
- Non paved parks and recreational areas
- Mining sites
- Farm Storage
- Lakes, ponds and other water bodies
- Rural roads, and through roads without houses or buildings
- Open space
- Wetlands
- Fish production
- Pasture or hayland

Urban uses include:

- Houses (other than farm houses)
- Apartment buildings
- Commercial buildings
- Industrial buildings
- Paved recreational areas (i.e. tennis courts)
- Streets in areas with 30 structures per 40 acres
- Gas stations

- Equipment, supply stores
- Off-farm storage
- Processing plants
- Shopping malls
- Utilities/Services
- Medical buildings

In rating this factor, an area one-mile from the outer edge of the proposed site should be outlined on a current photo; the areas that are urban should be outlined. For rural houses and other buildings with unknown sizes, use 1 and 1/3 acres per structure. For roads with houses on only one side, use one half of road for urban and one half for non-urban.

The purpose of this rating process is to insure that the most valuable and viable farmlands are protected from development projects sponsored by the Federal Government. With this goal in mind, factor S1 suggests that the more agricultural lands surrounding the parcel boundary in question, the more protection from development this site should receive. Accordingly, a site with a large quantity of non-urban land surrounding it will receive a greater
number of points for protection from development. Thus, where more than 90 percent of the area around the proposed site (do not include the proposed site in this assessment) is non-urban, assign 15 points. Where 20 percent or less is
non-urban, assign 0 points. Where the area lies between 20 and 90 percent non-urban, assign appropriate points from 14 to 1, as noted below.

Percent Non-Urban Land within 1 mile	**Points**
90 percent or greater	15
85 to 89 percent	14
80 to 84 percent	13
75 to 79 percent	12
70 to 74 percent	11
65 to 69 percent	10
60 to 64 percent	9
55 to 59 percent	8
50 to 54 percent	7
45 to 49 percent	6
40 to 44 percent	5
35 to 39 percent	4
30 to 24 percent	3
25 to 29 percent	2
21 to 24 percent	1
20 percent or less	0

2. How much of the perimeter of the site borders on land in non-urban use?

More than 90 percent:	I0 points
90 to 20 percent:	9 to 1 point(s)
Less than 20 percent:	0 points

This factor is designed to evaluate the extent to which the land adjacent to the proposed site is non-urban use. Where factor #1 evaluates the general location of the proposed site, this factor evaluates the immediate perimeter of the site. The definition of urban and non-urban uses in factor #1 should be used for this factor.

In rating the second factor, measure the perimeter of the site that is in non-urban and urban use. Where more than 90 percent of the perimeter is in non-urban use, score this factor 10 points. Where less than 20 percent, assign 0 points. If a road is next to the perimeter, class the area according to the

use on the other side of the road for that area. Use 1 and 1/3 acre per structure if not otherwise known. Where 20 to 90 percent of the perimeter is non-urban, assign points as noted below:

Percentage of Perimeter Bordering Land	Points
90 percent or greater	10
82 to 89 percent	9
74 to 81 percent	8
65 to 73 percent	7
58 to 65 percent	6
50 to 57 percent	5
42 to 49 percent	4
34 to 41 percent	3
27 to 33 percent	2
21 to 26 percent	1
20 percent or Less	0

3. How much of the site has been farmed (managed for a scheduled harvest or timber activity) more than five of the last ten years?

More than 90 percent:	20 points
90 to 20 percent:	19 to 1 point(s)
Less than 20 percent:	0 points

This factor is designed to evaluate the extent to which the proposed conversion site has been used or managed for agricultural purposes in the past 10 years.

Land is being farmed when it is used or managed for food or fiber, to include timber products, fruit, nuts, grapes, grain, forage, oil seed, fish and meat, poultry and dairy products.

Land that has been left to grow up to native vegetation without management or harvest will be considered as abandoned and therefore not farmed. The proposed conversion site should be evaluated and rated according to the percent, of the site farmed.

If more than 90 percent of the site has been farmed 5 of the last 10 years score the site as follows:

Percentage of Site Farmed	Points
90 percent or greater	20
86 to 89 percent	19
82 to 85 percent	18
78 to 81 percent	17
74 to 77 percent	16
70 to 73 percent	15
66 to 69 percent	14
62 to 65 percent	13
58 to 61 percent	12
54 to 57 percent	11
50 to 53 percent	10
46 to 49 percent	9
42 to 45 percent	8
38 to 41 percent	7
35 to 37 percent	6
32 to 34 percent	5
29 to 31 percent	4
26 to 28 percent	3

23 to 25 percent	2
20 to 22 percent percent or Less	1
Less than 20 percent	0

4. Is the site subject to state or unit of local government policies or programs to protect farmland or covered by private programs to protect farmland?

Site is protected:	20 points
Site is not protected:	0 points

This factor is designed to evaluate the extent to which state and local government and private programs have made efforts to protect this site from conversion.

State and local policies and programs to protect farmland include:

State Policies and Programs to Protect Farmland

1. Tax Relief:

   A. Differential Assessment: Agricultural lands are taxed on their agricultural use value, rather than at market value. As a result, farmers pay fewer taxes on their land, which helps keep them in business, and therefore helps to insure that the farmland will not be converted to nonagricultural uses.

      1. Preferential Assessment for Property Tax: Landowners with parcels of land used for agriculture are given the privilege of differential assessment.

      2. Deferred Taxation for Property Tax: Landowners are deterred from converting their land to nonfarm uses, because if they do so, they must pay back taxes at market value.

      3. Restrictive Agreement for Property Tax: Landowners who want to receive Differential Assessment must agree to keep their land in - eligible use.

   B. Income Tax Credits

   Circuit Breaker Tax Credits: Authorize an eligible owner of farmland to apply some or all of the property taxes on his or her farmland and farm structures as a tax credit against the owner's state income tax.

   C. Estate and Inheritance Tax Benefits

   Farm Use Valuation for Death Tax: Exemption of state tax liability to eligible farm estates.

2. "Right to farm" laws:

   Prohibits local governments from enacting laws which will place restrictions upon normally accepted farming practices, for example, the generation of noise, odor or dust.

3. Agricultural Districting:

   Wherein farmers voluntarily organize districts of agricultural land to be legally recognized geographic areas. These farmers receive benefits, such as protection from annexation, in exchange for keeping land within the district for a given number of years.

4. Land Use Controls: Agricultural Zoning.

Types of Agricultural Zoning Ordinances include:

A. Exclusive: In which the agricultural zone is restricted to only farm-related dwellings, with, for example, a minimum of 40 acres per dwelling unit.

B. Non-Exclusive: In which non-farm dwellings are allowed, but the density remains low, such as 20 acres per dwelling unit.

Additional Zoning techniques include:

A. Sliding Scale: This method looks at zoning according to the total size of the parcel owned. For example, the number of dwelling units per a given number of acres may change from county to county according to the existing land acreage to dwelling unit ratio of surrounding parcels of land within the specific area.

B. Point System or Numerical Approach: Approaches land use permits on a case by case basis.

LESA: The LESA system (Land Evaluation-Site Assessment) is used as a tool to help assess options for land use on an evaluation of productivity weighed against commitment to urban development.

C. Conditional Use: Based upon the evaluation on a case by case basis by the Board of Zoning Adjustment. Also may include the method of using special land use permits.

5. Development Rights:

A. Purchase of Development Rights (PDR): Where development rights are purchased by Government action.

Buffer Zoning Districts: Buffer Zoning Districts are an example of land purchased by Government action. This land is included in zoning ordinances in order to preserve and protect agricultural lands from non-farm land uses encroaching upon them.

B. Transfer of Development Rights (TDR): Development rights are transferable for use in other locations designated as receiving areas. TDR is considered a locally based action (not state), because it requires a voluntary decision on the part of the individual landowners.

6. Governor's Executive Order: Policy made by the Governor, stating the importance of agriculture, and the preservation of agricultural lands. The Governor orders the state agencies to avoid the unnecessary conversion of important farmland to nonagricultural uses.

7. Voluntary State Programs:

A. California's Program of Restrictive Agreements and Differential Assessments: The California Land Conservation Act of 1965, commonly known as the Williamson Act, allows cities, counties and individual landowners to form agricultural preserves and enter into contracts for 10 or more years to insure that these parcels of land remain strictly for agricultural use. Since 1972 the Act has extended eligibility to recreational and open space lands such as scenic highway corridors, salt ponds and wildlife preserves. These contractually restricted lands may be taxed differentially for their real value. One hundred-acre districts constitute the minimum land size eligible.

Suggestion: An improved version of the Act would state that if the land is converted after the contract expires, the landowner must pay the difference in the taxes between market value for the land and the agricultural tax value which he or she had been

paying under the Act. This measure would help to insure that farmland would not be converted after the 10 year period ends.

B. Maryland Agricultural Land Preservation Program: Agricultural landowners within agricultural districts have the opportunity to sell their development rights to the Maryland Land Preservation Foundation under the agreement that these landowners will not subdivide or develop their land for an initial period of five years. After five years the landowner may terminate the agreement with one year notice.

   As is stated above under the California Williamson Act, the landowner should pay the back taxes on the property if he or she decides to convert the land after the contract expires, in order to discourage such conversions.

C. Wisconsin Income Tax Incentive Program: The Wisconsin Farmland Preservation Program of December 1977 encourages local jurisdictions in Wisconsin to adopt agricultural preservation plans or exclusive agricultural district zoning ordinances in exchange for credit against state income tax and exemption from special utility assessment. Eligible candidates include local governments and landowners with at least 35 acres of land per dwelling unit in agricultural use and gross farm profits of at least $6.000 per year, or $18,000 over three years.

8. Mandatory State Programs:

A. The Environmental Control Act in the state of Vermont was adopted in 1970 by the Vermont State Legislature. The Act established an environmental board with 9 members (appointed by the Governor) to implement a planning process and a permit system to screen most subdivisions and development proposals according to specific criteria stated in the law. The planning process consists of an interim and a final Land Capability and Development Plan, the latter of which acts as a policy plan to control development. The policies are written in order to:

   - prevent air and water pollution;
   - protect scenic or natural beauty, historic sites and rare and irreplaceable natural areas; and
   - consider the impacts of growth and reduction of development on areas of primary agricultural soils.

B. The California State Coastal Commission: In 1976 the Coastal Act was passed to establish a permanent Coastal Commission with permit and planning authority The purpose of the Coastal Commission was and is to protect the sensitive coastal zone environment and its resources, while accommodating the social and economic needs of the state. The Commission has the power to regulate development in the coastal zones by issuing permits on a case by case basis until local agencies can develop their own coastal plans, which must be certified by the Coastal Commission.

C. Hawaii's Program of State Zoning: In 1961, the Hawaii State Legislature established Act 187, the Land Use Law, to protect the farmland and the welfare of the local people of Hawaii by planning to avoid "unnecessary urbanization". The Law made all state lands into four districts: agricultural, conservation, rural and urban. The Governor appointed members to a State Land Use Commission, whose duties were to uphold the Law and form the boundaries of the four districts. In addition to state zoning, the Land Use Law introduced a program of Differential Assessment, wherein agricultural landowners paid taxes on their land for its agricultural use value, rather than its market value.

D. The Oregon Land Use Act of 1973: This act established the Land Conservation and Development Commission (LCDC) to provide statewide planning goals and guidelines.

Under this Act, Oregon cities and counties are each required to draw up a comprehensive plan, consistent with statewide planning goals. Agricultural land preservation is high on the list of state goals to be followed locally.

If the proposed site is subject to or has used one or more of the above farmland protection programs or policies, score the site 20 points. If none of the above policies or programs apply to this site, score 0 points.

5. How close is the site to an urban built-up area?

The site is 2 miles or more from an urban built-up area	15 points
The site is more than 1 mile but less than 2 miles from an urban built-up area	10 points
The site is less than 1 mile from, but is not adjacent to an urban built-up area	5 points
The site is adjacent to an urban built-up area	0 points

This factor is designed to evaluate the extent to which the proposed site is located next to an existing urban area. The urban built-up area must be 2500 population. The measurement from the built-up area should be made from the point at which the density is 30 structures per 40 acres and with no open or non-urban land existing between the major built-up areas and this point. Suburbs adjacent to cities or urban built-up areas should be considered as part of that urban area.

For greater accuracy, use the following chart to determine how much protection the site should receive according to its distance from an urban area. See chart below:

Distance From Perimeter of Site to Urban Area	Points
More than 10,560 feet	15
9,860 to 10,559 feet	14
9,160 to 9,859 feet	13
8,460 to 9,159 feet	12
7,760 to 8,459 feet	11
7,060 to 7,759 feet	10
6,360 to 7,059 feet	9
5,660 to 6,359 feet	8
4,960 to 5,659 feet	7
4,260 to 4,959 feet	6
3,560 to 4,259 feet	5
2,860 to 3,559 feet	4
2,160 to 2,859 feet	3
1,460 to 2,159 feet	2
760 to 1,459 feet	1
Less than 760 feet (adjacent)	0

6. How close is the site to water lines, sewer lines and/or other local facilities and services whose capacities and design would promote nonagricultural use?

None of the services exist nearer than 3 miles from the site	15 points
Some of the services exist more than one but less than 3 miles from the site	10 points
All of the services exist within 1/2 mile of the site	0 points

This question determines how much infrastructure (water, sewer, etc.) is in place which could facilitate nonagricultural development. The fewer facilities in place, the more difficult it is to develop an area. Thus, if a proposed site is further away from these services (more than 3 miles distance away), the site should be awarded the highest number of points (15). As the distance of the parcel of land to services decreases, the number of points awarded declines as well. So, when the site is equal to or further than 1 mile but less than 3 miles away from services, it should be given 10 points. Accordingly, if this distance is 1/2 mile to less than 1 mile, award 5 points; and if the distance from land to services is less than 1/2 mile, award 0 points.

Distance to public facilities should be measured from the perimeter of the parcel in question to the nearest site(s) where necessary facilities are located. If there is more than one distance (i.e. from site to water and from site to sewer), use the average distance (add all distances and then divide by the number of different distances to get the average).

Facilities which could promote nonagricultural use include:

- Water lines
- Sewer lines
- Power lines
- Gas lines
- Circulation (roads)
- Fire and police protection
- Schools

7. **Is the farm unit(s) containing the site (before the project) as large as the average-size farming unit in the county? (Average farm sizes in each county are available from the NRCS field offices in each state. Data are from the latest available Census of Agriculture, Acreage of Farm Units in Operation with $1,000 or more in sales.)**

As large or larger:	10 points
Below average: Deduct 1 point for each 5 percent below the average, down to 0 points if 50 percent or more is below average	9 to 0 points

This factor is designed to determine how much protection the site should receive, according to its size in relation to the average size of farming units within the county. The larger the parcel of land, the more agricultural use value the land possesses, and vice versa. Thus, if the farm unit is as large or larger than the county average, it receives the maximum number of points (10). The smaller the parcel of land compared to the county average, the fewer number of points given. Please see below:

Parcel Size in Relation to Average County Size	Points
Same size or larger than average (I00 percent)	10
95 percent of average	9
90 percent of average	8
85 percent of average	7
80 percent of average	6
75 percent of average	5
70 percent of average	4
65 percent of average	3
60 percent of average	2
55 percent of average	1
50 percent or below county average	0

State and local Natural Resources Conservation Service offices will have the average farm size information, provided by the latest available Census of Agriculture data

8. If this site is chosen for the project, how much of the remaining land on the farm will become non-farmable because of interference with land patterns?

Acreage equal to more than 25 percent of acres directly converted by the project	10 points
Acreage equal to between 25 and 5 percent of the acres directly converted by the project	9 to 1 point(s)
Acreage equal to less than 5 percent of the acres directly converted by the project	0 points

This factor tackles the question of how the proposed development will affect the rest of the land on the farm The site which deserves the most protection from conversion will receive the greatest number of points, and vice versa. For example, if the project is small, such as an extension on a house, the rest of the agricultural land would remain farmable, and thus a lower number of points is given to the site. Whereas if a large-scale highway is planned, a greater portion of the land (not including the site) will become non-farmable, since access to the farmland will be blocked; and thus, the site should receive the highest number of points (10) as protection from conversion

Conversion uses of the Site Which Would Make the Rest of the Land Non-Farmable by Interfering with Land Patterns

Conversions which make the rest of the property nonfarmable include any development which blocks accessibility to the rest of the site Examples are highways, railroads, dams or development along the front of a site restricting access to the rest of the property.

The point scoring is as follows:

Amount of Land Not Including the Site Which Will Become Non-Farmable	Points
25 percent or greater	10
23 - 24 percent	9
21 - 22 percent	8
19 - 20 percent	7
17 - 18 percent	6
15 - 16 percent	5
13 - 14 percent	4
11 - 12 percent	3
9 - 11 percent	2
6 - 8 percent	1
5 percent or less	0

9. Does the site have available adequate supply of farm support services and markets, i.e., farm suppliers, equipment dealers, processing and storage facilities and farmer's markets?

All required services are available	5 points
Some required services are available	4 to 1 point(s)
No required services are available	0 points

This factor is used to assess whether there are adequate support facilities, activities and industry to keep the farming business in business. The more support facilities available to the agricultural

landowner, the more feasible it is for him or her to stay in production. In addition, agricultural support facilities are compatible with farmland. This fact is important, because some land uses are not compatible; for example, development next to farmland cam be dangerous to the welfare of the agricultural land, as a result of pressure from the neighbors who often do not appreciate the noise, smells and dust intrinsic to farmland. Thus, when all required agricultural support services are available, the maximum number of points (5) are awarded. When some services are available, 4 to 1 point(s) are awarded; and consequently, when no services are available, no points are given. See below:

Percent of Services Available	Points
100 percent	5
75 to 99 percent	4
50 to 74 percent	3
25 to 49 percent	2
1 to 24 percent	1
No services	0

10. Does the site have substantial and well-maintained on farm investments such as barns, other storage buildings, fruit trees and vines, field terraces, drainage, irrigation, waterways, or other soil and water conservation measures?

High amount of on-farm investment	20 points
Moderate amount of non-farm investment	19 to 1 point(s)
No on-farm investments	0 points

This factor assesses the quantity of agricultural facilities in place on the proposed site. If a significant agricultural infrastructure exists, the site should continue to be used for farming, and thus the parcel will receive the highest amount of points towards protection from conversion or development. If there is little on farm investment, the site will receive comparatively less protection. See-below:

Amount of On-farm Investment	Points
As much or more than necessary to maintain production (100 percent)	20
95 to 99 percent	19
90 to 94 percent	18
85 to 89 percent	17
80 to 84 percent	16
75 to 79 percent	15
70 to 74 percent	14
65 to 69 percent	13
60 to 64 percent	12
55 to 59 percent	11
50 to 54 percent	10
45 to 49 percent	9
40 to 44 percent	8
35 to 39 percent	7
30 to 34 percent	6
25 to 29 percent	5
20 to 24 percent	4
15 to 19 percent	3
10 to 14 percent	2
5 to 9 percent	1
0 to 4 percent	0

11. Would the project at this site, by converting farmland to nonagricultural use, reduce the support for farm support services so as to jeopardize the continued existence of these support services and thus, the viability of the farms remaining in the area?

Substantial reduction in demand for support services if the site is converted	10 points
Some reduction in demand for support services if the site is converted	9 to 1 point(s)
No significant reduction in demand for support services if the site is converted	0 points

This factor determines whether there are other agriculturally related activities, businesses or jobs dependent upon the working of the pre-converted site in order for the others to remain in production. The more people and farming activities relying upon this land, the more protection it should receive from conversion. Thus, if a substantial reduction in demand for support services were to occur as a result of conversions, the proposed site would receive a high score of 10; some reduction in demand would receive 9 to 1 point(s), and no significant reduction in demand would receive no points.

Specific points are outlined as follows:

Amount of Reduction in Support Services if Site is Converted to Nonagricultural Use	**Points**
Substantial reduction (100 percent)	10
90 to 99 percent	9
80 to 89 percent	8
70 to 79 percent	7
60 to 69 percent	6
50 to 59 percent	5
40 to 49 percent	4
30 to 39 percent	3
20 to 29 percent	2
10 to 19 percent	1
No significant reduction (0 to 9 percent)	0

12. Is the kind and intensity of the proposed use of the site sufficiently incompatible with agriculture that it is likely to contribute to the eventual conversion of the surrounding farmland to nonagricultural use?

Proposed project is incompatible with existing agricultural use of surrounding farmland	10 points
Proposed project is tolerable of existing agricultural use of surrounding farmland	9 to 1 point(s)
Proposed project is fully compatible with existing agricultural use of surrounding farmland	0 points

Factor 12 determines whether conversion of the proposed agricultural site will eventually cause the conversion of neighboring farmland as a result of incompatibility of use of the first with the latter. The more incompatible the proposed conversion is with agriculture, the more protection this site receives from conversion. Therefor-, if the proposed conversion is incompatible with agriculture, the site receives 10 points. If the project is tolerable with agriculture, it receives 9 to 1 points; and if the proposed conversion is compatible with agriculture, it receives 0 points.

CORRIDOR - TYPE SITE ASSESSMENT CRITERIA

The following criteria are to be used for projects that have a linear or corridor - type site configuration connecting two distant points, and crossing several different tracts of land. These include utility lines, highways, railroads, stream improvements, and flood control systems. Federal agencies are to assess the suitability of each corridor-type site or design alternative for protection as farmland along with the land evaluation information.

For Water and Waste Programs, corridor analyses are not applicable for distribution or collection networks. Analyses are applicable for transmission or trunk lines where placement of the lines are flexible.

(1) How much land is in nonurban use within a radius of 1.0 mile form where the project is intended?

(2) More than 90 percent	(3) 15 points
(4) 90 to 20 percent	(5) 14 to 1 point(s).
(6) Less than 20 percent	(7) 0 points

(2) How much of the perimeter of the site borders on land in nonurban use?

(3) More than 90 percent	(4) 10 point(s)
(5) 90 to 20 percent	(6) 9 to 1 points
(7) less than 20 percent	(8) 0 points

(3) How much of the site has been farmed (managed for a scheduled harvest or timber activity) more than five of the last 10 years?

(4) More than 90 percent	(5) 20 points
(6) 90 to 20 percent	(7) 19 to 1 point(s)
(8) Less than 20 percent	(9) 0 points

(4) Is the site subject to state or unit of local government policies or programs to protect farmland or covered by private programs to protect farmland?

Site is protected	20 points
Site is not protected	0 points

(5) Is the farm unit(s) containing the site (before the project) as large as the average - size farming unit in the County? (Average farm sizes in each county are available from the NRCS field offices in each state. Data are from the latest available Census of Agriculture, Acreage of Farm Units in Operation with $1,000 or more in sales.)

As large or larger	10 points
Below average deduct 1 point for each 5 percent below the average, down to 0 points if 50 percent or more below average	9 to 0 points

(6) If the site is chosen for the project, how much of the remaining land on the farm will become non-farmable because of interference with land patterns?

Acreage equal to more than 25 percent of acres directly converted by the project	25 points
Acreage equal to between 25 and 5 percent of the acres directly convened by the project	1 to 24 point(s)
Acreage equal to less than 5 percent of the acres directly converted by the project	0 points

(7) Does the site have available adequate supply of farm support services and markets, i.e., farm suppliers, equipment dealers, processing and storage facilities and farmer's markets?

All required services are available	5 points
Some required services are available	4 to 1 point(s)
No required services are available	0 points

(8) Does the site have substantial and well-maintained on-farm investments such as barns, other storage building, fruit trees and vines, field terraces, drainage, irrigation, waterways, or other soil and water conservation measures?

High amount of on-farm investment	20 points
Moderate amount of on-farm investment	19 to 1 point(s)
No on-farm investment	0 points

(9) Would the project at this site, by converting farmland to nonagricultural use, reduce the demand for farm support services so as to jeopardize the continued existence of these support services and thus, the viability of the farms remaining in the area?

Substantial reduction in demand for support services if the site is convened	25 points
Some reduction in demand for support services if the site is convened	1 to 24 point(s)
No significant reduction in demand for support services if the site is converted	0 points

(10) Is the kind and intensity of the proposed use of the site sufficiently incompatible with agriculture that it is likely to contribute to the eventual conversion of surrounding farmland to nonagricultural use?

Proposed project is incompatible to existing agricultural use of surrounding farmland	10 points
Proposed project is tolerable to existing agricultural use of surrounding farmland	9 to 1 point(s)
Proposed project is fully compatible with existing agricultural use of surrounding farmland	0 points

September 3, 2014

Mr. William Puckett, Acting Director
Natural Resources Conservation Service
U.S. Department of Agriculture
P.O. Box 50004 Rm 4-118
Honolulu, HI 96850

Subject: Schofield Generating Station Project (SGSP): Environmental Impact Statement Preparation Notice (EISPN)

Dear Mr. Puckett:

Thank you for your February 4, 2014 letter addressed to Ms. DeSantis of Tetra Tech concerning the subject EISPN for the SGSP. Hawaiian Electric Company and the U.S. Army are grateful for the time that you and your staff spent reviewing the EISPN and preparing your detailed comments.

We appreciate you informing us that the proposed Schofield Generating Station Project is subject to the Farmland Protection Policy Act (FPPA, subtitle I of Title XV, Section 1539-1549 of the Agriculture and Food Act of 1981 [Public Law 97-98]).

The 8.13-acre generating station site is a portion of the larger 1,402-acre Schofield Barracks South Range Acquisition Area (SRAA) that was assessed in the Stryker Brigade Combat Team (SBCT) EIS in 2004 (Tetra Tech 2004). As part of that NEPA process, the Army coordinated the conversion of the land from prime farmland to nonagricultural use with NRCS in light of the objectives and guidelines of the FPPA. The estimated 535 acres of what at that time was cultivated pineapple land was 0.67 percent of the total USDA-designated agricultural land on Oahu and 2.8 percent of the total area in pineapple production in the state (Tetra Tech 2004). The SBCT EIS concluded that the conversion on the entire South Range to nonagricultural use would not result in significant impacts.

Upon doing some research regarding the SBCT EIS Form AD-1006, the Army became aware that ratings had been prepared and the form completed for the entire SRAA range, but the process had never been finalized. In March 2014, Mr. David Howlett from the Army's Environmental Law Division contacted Dr. Cynthia Stiles, Assistant State Soil Scientist, about the situation and provided her with the rating form that was completed in 2003, but never finalized. Dr. Stiles reviewed the form and agreed with the ratings, but asked that the Army provide some narrative as to how the ratings were determined. The Army is currently in the process of finalizing the Form AD-1006 requirements for coordination with NRCS. Compliance with the FPPA will be addressed in the SGSP EIS.

If you have any questions or would like to discuss this further, please call me at (808) 543-4088, or if you have specific questions concerning the previous consultation for the SBCT EIS, please contact Lisa Graham with the U.S. Army Garrison, Hawai'i at (808) 656-3075.

Sincerely,

Jack Shriver
Senior Engineer
Generation Project Development
Hawaiian Electric Company

cc: (via email only)
Mr. Alex Roy, Hawaii Department of Land and Natural Resources Office of Conservation and Coastal Lands
Ms. Stephanie Gardin, Office of Public Affairs, US Army Garrison—Hawaii
Ms. Kathy Ahsing, US Army Energy Initiatives Task Force

DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
851 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF:

SEP 0 2 2014

Office of the Garrison Commander

Mr. William Puckett
Acting Director
USDA-Natural Resources Conservation Service
Pacific Islands Area State Office
P.O. Box 50004
Honolulu, Hawaii 96850-50004

Dear Mr. Puckett:

This letter and enclosed form is being sent to your office to complete consultation under Farmland Protection Policy Act (FFPA). When the 1,402-acre South Range Acquisition Area (SRAA) was assessed as part of the Army Transformation Environmental Impact Statement, the Army initiated consultation with Natural Resources Conservation Service (NRCS) under FPPA. Form AD-1006 was completed by NRCS in May of 2003 with a note in Part VII stating that the Army would complete the process once the Record of Decision was signed. From what NRCS and US Army Garrison, Hawaii (USAG-HI) found in the project archives, the process was never completed.

The Army was recently made aware of this oversight through correspondence from NRCS concerning another project in the SRAA. Mr. David Howlett for the Army's Environmental Law Division contacted Dr. Cynthia Stiles from NRCS in Honolulu. She reviewed the original rating from 2003 and agreed that it is still accurate. Enclosed is the revised AD-1006 with the rating information reviewed and provided by Dr. Stiles. USAG-HI is providing explanation for the site assessment criteria in Part VI and the reason for the site selection (Site A) in Part VII.

If you have any questions, please contact Ms. Lisa Graham, USAG-HI's National Environmental Policy Act Program Manager, at 808.656.3075 or lisa.m.graham52.civ@mail.mil.

Sincerely,

Richard A. Fromm
Colonel, US Army
Commanding

Enclosures

CF: Dr. Cynthia Stiles, USDA-Natural Resources Conservation Service, Pacific Islands Area State Office, P.O. Box 50004, Honolulu, Hawaii 96850-50004

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request 3/31/14
Name Of Project South Range Acquisition Area	Federal Agency Involved U.S. Army Garrison, Hawaii
Proposed Land Use Military Training	County And State Honolulu, Hawaii
PART II *(To be completed by NRCS)*	Date Request Received By NRCS

Does the site contain prime, unique, statewide or local important farmland? *(If no, the FPPA does not apply – do not complete additional parts of this form).*	Yes ☑ No ☐	Acres Irrigated 16303	Average Farm Size 91
Major Crop(s) Fallow	Farmable Land In Govt. Jurisdiction Acres: 151860 % 39	Amount Of Farmland As Defined In FPPA Acres: 94500 % 24	
Name Of Land Evaluation System Used State of Hawaii LESA	Name Of Local Site Assessment System None	Date Land Evaluation Returned By NRCS 3/31/14	

PART III *(To be completed by Federal Agency)*	Alternative Site Rating			
	Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly	1,402.0	100.0		
B. Total Acres To Be Converted Indirectly				
C. Total Acres In Site	1,402.0	100.0	0.0	0.0.
PART IV *(To be completed by NRCS)* Land Evaluation Information				
A. Total Acres Prime And Unique Farmland	535.0	84.0		
B. Total Acres Statewide And Local Important Farmland	252.0	3.0		
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted	0.8	0.1		
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value	33.0	15.0		
PART V *(To be completed by NRCS)* Land Evaluation Criterion Relative Value Of Farmland To Be Converted *(Scale of 0 to 100 Points)*	54	87	0	0

PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(These criteria are explained in 7 CFR 658.5(b)*	Maximum Points				
1. Area In Nonurban Use	15	15	15		
2. Perimeter In Nonurban Use	10	6	7		
3. Percent Of Site Being Farmed	20	6	20		
4. Protection Provided By State And Local Government	20	20	20		
5. Distance From Urban Builtup Area	15	0	0		
6. Distance To Urban Support Services	15	0	0		
7. Size Of Present Farm Unit Compared To Average	10	10	10		
8. Creation Of Nonfarmable Farmland	10	0	0		
9. Availability Of Farm Support Services	5	0	0		
10. On-Farm Investments	20	4	4		
11. Effects Of Conversion On Farm Support Services	10	0	0		
12. Compatibility With Existing Agricultural Use	10	0	0		
TOTAL SITE ASSESSMENT POINTS	160	61	76	0	0
PART VII *(To be completed by Federal Agency)*					
Relative Value Of Farmland *(From Part V)*	100	54	87	0	0
Total Site Assessment *(From Part VI above or a local site assessment)*	160	61	76	0	0
TOTAL POINTS *(Total of above 2 lines)*	260	115	163	0	0

Site Selected: A	Date Of Selection 7/7/04	Was A Local Site Assessment Used? Yes ■ No ☐

Reason For Selection:

Acquiring the full acreage in the South Range Acquisition Area partially cures the shortage of Army training lands in Hawaii, provides a buffer to incompatible development along the southern border of Schofield Barracks Military Reservation, and provides some additional safety zones for Wheeler Army Airfield's runway.

(See Instructions on reverse side) **Form AD-1006 (10-83)**

This form was electronically produced by National Production Services Staff

Justifications for NRCS Form AD-1006 scores assigned in Part VI

US Army Garrison, Hawaii

1. Area in Non-Urban Use: The South Range Acquisition Area (SRAA) receives the maximum 15 points as the entire area is non-urban.
2. Perimeter in Non-Urban Use: The SRAA receives the 6 points as the only a bit over 50% of the perimeter is adjacent to non-urban use areas including Honouliuli Preserve.
3. Percent of Corridor Being Farmed: The SRAA receives the 6 points as only 535 acres of the total area was is cultivate pineapple land.
4. Protection Provided By State and Local Government: The SRAA receives the highest score, 20 points, contain land designated Unique and Other Land.
5. Distance from Urban Buildup Area: The SRAA receives lowest score as it is adjacent to urban areas at Schofield Barracks Main Post and Wheeler Army Airfield.
6. Distance from Urban Support Services: The SRAA receives lowest score as it is adjacent to urban support services located at Schofield Barracks Main Post and Wheeler Army Airfield.
7. Size of Present Farm Unit Compared to Average: The SRAA received the maximum 10 points as the 535 acres was prime and local important farmland, which is much larger than the average farm size in the area.
8. Creation of Nonfarmable Farmland: The SRAA was given the minimum of zero points as the estimated 535 acres of cultivated pineapple land is .67 percent of the total USDA-designated agricultural land on Oahu and 2.8 percent of the total area in pineapple production in the state (USDA 2004).
9. Availability of Farm Support Services: All alignments were given the minimum zero points bi required services are available.
10. On-Farm Investments: All alignments get the 4 points score because it has a minimum amount of on-farm investment.
11. Effects of Conversion on Farm Support Services: The SRAA received the minimum of zero points as it would not reduce the demand for farm support services in the area.
12. Compatibility with Existing Agricultural Use: The SRAA received a score of zero points as the project will be fully compatible with existing agricultural use.

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843

February 11, 2014

KIRK CALDWELL, MAYOR

DUANE R. MIYASHIRO, Chairman
MAHEALANI CYPHER, Vice Chair
THERESIA C. McMURDO
ADAM C. WONG
DAVID C. HULIHEE

ROSS S. SASAMURA, Ex-Officio
GLENN M. OKIMOTO, Ex-Officio

ERNEST Y. W. LAU, P.E.
Manager and Chief Engineer

ELLEN E. KITAMURA, P.E.
Deputy Manager and Chief Engineer

Mr. Jack Shriver, Project Manager
Hawaiian Electric
P.O. Box 2750
Honolulu, Hawaii 96840-0001

Dear Mr. Shriver:

Subject: Your Letter Dated January 8, 2014 Requesting Comments on the Environmental Impact Statement Preparation Notice for the Schofield Generating Station Project – Tax Map Key: 7-7-001: 001, 002; 7-3-001:001, 002, 006, 007, 008, 009, 011, 012, 013, 019, 022, 024; 7-6-001; 7-6-001: 001, 006; 9-4-012: 001, 003, 011

Thank you for the opportunity to comment on the proposed generating project.

We do not have a water system in the vicinity of the proposed generating plant. Water service should be provided by the private water system in this area.

The construction drawings for the 46 kilovolt sub-transmission line should be submitted for our review.

If you have any questions, please contact Robert Chun at 748-5443.

Very truly yours,

ERNEST Y. W. LAU, P.E.
Manager and Chief Engineer

April 1, 2014

Mr. Ernest Y. W. Lau, P.E.
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, HI 96843

Subject: Schofield Generating Station Project:
Environmental Impact Statement Preparation Notice (EISPN)

Dear Mr. Lau:

Thank you for your February 11th 2014 letter concerning the Environmental Impact Statement Preparation Notice (EISPN) for the Schofield Generating Project. We appreciate the time that you and your staff spent reviewing the EISPN and preparing your response.

We are grateful for your confirmation that the City and County of Honolulu Board of Water Supply does not have a water system in the vicinity of the proposed generating plant. Hawaiian Electric anticipates that the relatively small amounts of water that would be used by the proposed project will be obtained from the Army water system that serves the area.

Hawaiian Electric will submit a building permit application for the proposed 46 kilovolt sub-transmission line. We understand that as part of the normal building permit application process, your agency will have an opportunity for review and approval at that time. We do not expect that there will be any conflict with your existing pipelines or other facilities. In the meantime, if you have any questions or would like to discuss this further, please call me at (808) 543-4088.

Sincerely,

Jack Shriver
Senior Engineer,
Generation Project Development
Hawaiian Electric Company

cc: (via email only)
Mr. Alex Roy, Hawaii Department of Land and Natural Resources Office of Conservation and Coastal Lands
Ms. Stephanie Gardin, Office of Public Affairs, US Army Garrison—Hawaii
Mr. Doug Waters, US Army Energy Initiatives Task Force

DEPARTMENT OF PARKS & RECREATION

CITY AND COUNTY OF HONOLULU

1000 Uluohia Street, Suite 309, Kapolei, Hawaii 96707
Phone: (808) 768-3003 • Fax: (808) 768-3053
Website: www.honolulu.gov

KIRK CALDWELL
MAYOR

TONI P. ROBINSON
DIRECTOR

JEANNE C. ISHIKAWA
DEPUTY DIRECTOR

February 13, 2014

Mr. Jack Shriver, Project Manager
Hawaiian Electric
P. O. Box 2750
Honolulu, Hawaii 96840-0001

Dear Mr. Shriver:

SUBJECT: Environmental Impact Statement Preparation Notice (EISPN)
Schofield Generating Station Project

Thank you for the opportunity to review and comment on the proposed Schofield Generating Station Project.

The Department of Parks and Recreation has no comment. As the proposed project will have no impact on any program or facility of the Department, you may remove us as a consulted party to the balance of the EIS process.

Should you have any questions, please contact Mr. John Reid, Planner at 768-3017.

Sincerely,

Toni P. Robinson

Toni P. Robinson
Director

TPR:jr
(546404)

April 1, 2014

Ms. Toni P. Robinson, Director
Department of Parks and Recreation
City and County of Honolulu
1000 Uluohia Street, Suite 309
Honolulu, Hawai'i 96707

Subject: Schofield Generating Station Project:
Environmental Impact Statement Preparation Notice (EISPN)

Dear Ms. Robinson:

Thank you for your February 13th 2014 letter concerning the Environmental Impact Statement Preparation Notice (EISPN) for the Schofield Generating Project. We appreciate the time that you and your staff spent reviewing the EISPN and responding.

We understand that the City and County of Honolulu Department of Parks and Recreation has no program or facility that it believes could be adversely affected by the proposed project. In accordance with your request, we will remove the agency from the list of parties to be consulted during the balance of the EIS process.

If in the future you have any questions or would like to discuss this further, please call me at (808) 543-4088.

Sincerely,

Jack Shriver
Senior Engineer,
Generation Project Development
Hawaiian Electric Company

cc: (via email only)
Mr. Alex Roy, Hawaii Department of Land and Natural Resources Office of Conservation and Coastal Lands
Ms. Stephanie Gardin, Office of Public Affairs, US Army Garrison—Hawaii
Mr. Doug Waters, US Army Energy Initiatives Task Force

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.honolulu.gov

KIRK CALDWELL
MAYOR

MICHAEL D. FORMBY
DIRECTOR

MARK N. GARRITY, AICP
DEPUTY DIRECTOR

TP1/14-546361R

February 12, 2014

Ms. Melissa DeSantis
Tetra Tech, Inc.
10306 Eaton Place, Suite 340
Fairfax, Virginia 22030

Attention: SGSP EIS

Dear Ms. DeSantis:

SUBJECT: Environmental Impact Statement Preparation Notice (EISPN) for the Lease of Army Land at Schofield Barracks, Oahu, Hawaii, for the Construction and Operation of a Biofuel-Capable Power Generation Plant; Wahiawa, Oahu, Hawaii

In response to Ms. Amanda Simpson's letter dated January 9, 2014, we have no comments to offer at this time.

Although, we did not attend the scoping meeting, we reserve further comment pending submission of the Environmental Impact Statement.

Thank you for the opportunity to review this matter. Should you have any further questions, please contact Michael Murphy of my staff at 768-8359.

Very truly yours,

Michael D. Formby
Director

cc: Ms. Amanda Simpson, Executive Director
Department of the Army, Energy Initiatives Task Force

April 1, 2014

Mr. Michael D. Formby, Director
Department of Transportation Services
City and County of Honolulu
650 South King Street, 3rd Floor
Honolulu, Hawai'i 96813

Subject: Schofield Generating Station Project:
Environmental Impact Statement Preparation Notice (EISPN)

Dear Ms. Robinson:

Thank you for your February 12th 2014 letter to Ms. Melissa DeSantis of Tetra Tech, Inc. (Reference TP1/14-546361R) concerning the Environmental Impact Statement Preparation Notice (EISPN) for the Schofield Generating Project. We appreciate the time that you and your staff spent reviewing the EISPN and preparing your letter.

We understand that the City and County of Honolulu Department of Transportation Services did not attend the scoping meeting and has no comments to offer at this time. We will provide a copy of the Draft Environmental Impact Statement to you for review and comment when it is available.

In the meantime, if you have any questions or would like to discuss the project further, please call me at (808) 543-4088.

Sincerely,

Jack Shriver
Senior Engineer,
Generation Project Development
Hawaiian Electric Company

cc: (via email only)
Mr. Alex Roy, Hawaii Department of Land and Natural Resources Office of Conservation and Coastal Lands
Ms. Stephanie Gardin, Office of Public Affairs, US Army Garrison—Hawaii
Mr. Doug Waters, US Army Energy Initiatives Task Force

NEIL ABERCROMBIE
GOVERNOR

RICHARD C. LIM
DIRECTOR

MARY ALICE EVANS
DEPUTY DIRECTOR

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

No. 1 Capitol District Building, 250 South Hotel Street, 5th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804
Web site: www.hawaii.gov/dbedt

Telephone: (808) 586-2355
Fax: (808) 586-2377

February 28, 2014

VIA U.S. MAIL

Department of Land and Natural Resources
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813
Attention: William Aila, Chairperson

VIA U.S. MAIL AND E-MAIL

Melissa DeSantis
Tetra Tech, Inc.
Attention: SGSP EISPN
10306 Eaton Place, Suite 340
Fairfax, Virginia 22030
sgspcomments@tetratech.com

Re: SGSP EISPN (Notice of Intent to Prepare an Environmental Impact Statement for the Schofield Generating Station Plant)

Dear Chair Aila and Ms. DeSantis:

The Hawaii Department of Business, Economic Development, and Tourism ("DBEDT") submits the following comments in response to the State of Hawaii's Department of Land and Natural Resources' ("DLNR") Environmental Impact Statement ("EIS") Preparation Notice ("EISPN" or "Notice") for the proposed Schofield Generating Station Project ("Project"). DBEDT acknowledges the Department of the Army's ("Army") need for energy security for the Schofield Barracks, Wheeler Army Airfield, and Field Station Kunia, DBEDT seeks to work as a consulted party and is committed to working with the Army, Hawaiian Electric Company, Inc. ("HECO"), DLNR, and other interested stakeholders during the EIS process to ensure a successful and reasonable outcome.

DBEDT's comments herein are guided by the State's clean energy policy, which has a significant influence on the State's economic and environmental well-being. Based on that perspective there

are other considerations that should be accounted for and other alternatives that should be explored. Such alternatives would better serve the State's and the Army's mutual interests in reducing consumption of petroleum-based generation and exploring other clean energy options that would reliably and cost-effectively promote Hawaii's energy security.

I. Comments

A. Building Petroleum-based Electricity Generation is Contrary to Hawaii's Energy Policy and is Not in the Public Interest in Hawaii

Based on its interests and statutory obligation to reach and exceed the State's clean energy targets, DBEDT is concerned with the characterization of this Project as one that would advance the State's renewable goals.[1] Of primary concern is the fact that diesel is proposed to be an integral part of the fuel mix.[2] Building a diesel-based electricity generation unit is contrary to meeting the State's Renewable Portfolio Standards ("RPS") mandate. This mandate requires each electric utility company that sells electricity for consumption in Hawaii to establish a RPS of forty per cent of its net electricity sales by December 31, 2030.[3] Both DLNR and DBEDT are charged with facilitating the private sector's development of renewable energy projects by supporting the private sector's attainment of the RPS.[4]

Moreover, the State and the United States Department of Energy's partnership—the Hawaii Clean Energy Initiative—is aimed at attaining independence from the State's detrimental reliance on fossil fuels.[5] While the Notice states that the "use of renewable biofuels will contribute to State [RPS] goals,"[6] DBEDT submits that using diesel to operate the Project would be a step backwards for Hawaii from an energy policy and environmental perspective. DBEDT also notes that there is insufficient clarity at this time as to the extent of the proposed reliance on diesel versus biofuels in all the scenarios proposed for consideration.[7]

DBEDT further notes that the intent to use diesel for the Project was not stated in support of HECO's application to the Hawaii Public Utilities Commission ("Hawaii PUC") for waiver from the Framework for Competitive Bidding.[8] There, HECO claimed that a waiver for the Project

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1 *See e.g.*, Notice at 2:34-35 (noting that "[t]he six biofuel-capable reciprocating engine-generator sets would add 50MW of firm, utility-owned renewable energy capacity" to the Oahu electrical grid).

2 *Id.* at 3:13-15.

3 H.R.S. § 269-92 (Renewable Portfolio Standards).

4 H.R.S. § 196-41 (State Support for achieving Renewable Portfolio Standards).

5 *See* http://www.hawaiicleanenergyinitiative.org/about; *cf.* 2009 H.B. 1464, Act 155.

6 Notice at 3:6-7.

7 *Id.* at 3:13-15 ("The Schofield Generating Station would operate on a mix of biofuel and diesel as required to meet Hawaiian Electric's Renewable Portfolio Standards . . . .").

8 *See I/M/O the Application of Hawaiian Electric Co. for Approval of Application for Waiver from the Framework for Competitive Bidding*, Decision and Order No. 30522, Hawaii PUC Docket No. 2011-0386 at 7 (August 1, 2012) ("Waiver Order") at 5 (noting that by Decision and Order No. 23121, filed on December 8, 2006, in Hawaii PUC Docket No. 03-0372, "the commission adopted the Framework to govern competitive

was appropriate "since the utility is seeking to acquire power from a non-fossil fuel (biofueled) facility to meet the governmental objective of energy security for the military."[9] The Hawaii PUC generally found that the Project meets the criteria for a waiver under Section II.A.3 of the Competitive Bidding Framework,[10] and specifically found that the "Project will be addressing a critical governmental objective, in which the fuel source is renewable, which is consistent with Sections II.A.3.c.(iii) and II.A.3.c(iv) of the Framework."[11] In addition, the HECO Companies' 2013 IRP Report and Action Plan[12] did not indicate that the Project would rely on diesel fuel. Rather, the Report stated that the Project "would more efficiently consume 3,000,000 gallons/year of biodiesel . . . ."[13]

In addition to raising concerns pertaining to State energy policy, reliance on petroleum-based fuels raises concerns regarding price, energy security, and environmental impacts.[14] As such, DBEDT is concerned that the Project as currently proposed would not support the State's efforts to redefine Hawaii's energy future.

B. *Other Alternatives that Would Foster the State's and Army's Interests Should be Considered*

DBEDT believes the State's goals are consistent with the goals of the Army Energy Initiatives Task Force, which serves as the central management office for partnering with Army installations to implement cost-effective, large-scale renewable energy projects, such as the Project.[15] This

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bidding as a mechanism for acquiring new energy generation in Hawaii. Under the Framework, competitive bidding is the required mechanism for acquiring a future generation resource or a block of generation resources, subject to certain conditions and exceptions.").

9 *I/M/O the Application of Hawaiian Electric Co. for Approval of Application for Waiver from the Framework for Competitive Bidding,* Application for Waiver, Hawaii PUC Docket No. 2011-0386 at 7 (filed December 27, 2011). *See also* Waiver Order at 7 (noting the same).

10 We note that the Waiver Order underscored certain provisions in Part II.A.3 of the Competitive Bidding Framework that HECO had argued would support the request for waiver. One such provision was Part II.A.3.b.(iv), which provides that a circumstance when competitive bidding may not be appropriate includes "when competitive bidding will impede or create a disincentive for the achievement of [Integrated Resource Planning ("IRP")] goals, renewable energy portfolio standards or other government objectives and policies". Waiver Order at 5-6.

11 *Id.* at 10. Sections II.A.3.c(iii) pertains to "the acquisition of power from a non-fossil fuel facility (such as a waste-to-energy facility) that is being installed to meet a governmental objective;" and II.A.3.c(iv) pertains to "the acquisition of power supplies needed to respond to an emergency situation." *Id.* at 7.

12 Hawaiian Electric Companies' 2013 IRP Report and Action Plan, Hawaii PUC Docket No. 2012-0036 (filed June 28, 2013) (hereinafter "IRP Report"). HECO has two subsidiaries, Hawaii Electric Light Company, Inc. ("HELCO") and Maui Electric Company, Limited ("MECO"). DBEDT refers to the three companies collectively as the "HECO Companies."

13 *Id.* at ES-13.

14 Biofuels Study Final Report to the Legislature In Accordance with Act 203, Session Laws of Hawaii, 2011, State of Hawaii Dept. of Business, Economic Development & Tourism (December 2012) at i. This report is available at: http://files.hawaii.gov/dbedt/annuals/2012/2012-biofuels-study-act-203.pdf.

15 http://www.armyeitf.com/.

Task Force seeks to ensure that favorable project sites move to completion and that the Army achieves its renewable energy goal of deploying one gigawatt of renewable energy by 2025. Incorporating oil-based fuels as part of this Project would run counter to this goal. The Notice states that the purpose of the Project is to meet the common needs of Hawaiian Electric and the U.S. Army Garrison—Hawaii for secure, reliable, and renewable power generation.[16] Building petroleum-based electricity generation units is not part of a clear generation scheme that: 1) promotes and maximizes the use of locally produced renewable energy; and 2) increases fuel diversity by moving away from oil-based options.

The State has an interest in diversifying its energy portfolio and leveraging our international status as a clean energy test bed. The State is fortunate to have ample access to natural resources, including the sun, wind, ocean, bioenergy, and geothermal resources.[17] Additionally, the State has numerous additional options to enhance fuel diversity that are consistent with DBEDT's support for an "all of the above" strategy to accomplish these goals. For instance, cost competitive liquefied natural gas ("LNG") could play a limited, transitional role in the power generation market.[18] LNG, rather than the more expensive diesel, could provide generation for peak load demand. There is currently a surplus of natural gas in our country, evidenced by the proposed export terminals at Cove Point, MD, Sabine Pass, TX, and the Gulf of Mexico, among others.[19] The federal Department of Energy has been approving LNG terminal export licenses, thus expanding the use of LNG. These successful examples of LNG integration suggest a positive potential for the use of LNG to meet Hawaii's demand for cleaner energy and a more diverse supply.

Consistent with the goals of the Army Energy Initiatives Task Force, natural gas can be used in combination with renewables to solve intermittency and improve energy reliability.[20] This type of strategy would help the Army meet its three driving principles of energy security, mandates, and economic benefits.[21]

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16 Notice at 2:29-30.

17 *See* State of Hawaii Energy Resources Coordinator's Annual Report 2013 at 9 (providing Hawaii renewable energy generation by resource). This report is available at: http://files.hawaii.gov/dbedt/annuals/2013/2013-erc.pdf.

18 HECO noted in its IRP Report, "[f]or the fuel-burning generation fleet (existing and future), LNG may be the lowest-cost fuel, and to the benefit of customers, may be substantially lower cost than ultra-low-sulfur diesel (ULSD). The use of ULSD may be necessary to comply with more stringent environmental regulations, and LNG would be an attractive alternative to more expensive ULSD." IRP Report at ES-19.

19 http://www.ferc.gov/industries/gas/indus-act/lng/lng-proposed-potential.pdf.

20 Energy Initiatives Task Force, Collaboration for Energy Security, slide 14 (February 7, 2014), *available at* http://energyoutlook.naseo.org/Data/Sites/3/presentations/Simpson.pdf.

21 *Id.* at slide 15. The Army must satisfy multiple renewable energy mandates under Section 203 of the Energy Policy Act of 2005, Executive Order 13514, the National Defense Authorization Act of 2007, and President Obama's Climate Action Plan. *See* http://army-energy.hqda.pentagon.mil/renewable/renewable.asp (summarizing targets under the Energy Policy Act of 2005 and the National Defense Authorization Act of 2007); *see also* Executive Order 13514 – Federal Leadership in Environmental, Energy, and Economic Performance, http://energy.gov/eere/femp/downloads/executive-order-13514-federal-leadership-environmental-energy-and-economic-0; *see also* President Obama's Climate Action Plan:

While the Project has the primary stated purpose of grid stability to compensate for an anticipated increase in variable power generation from solar and wind resources, other mitigation strategies should be studied. Variable power generation can be mitigated by employing a host of techniques to enable quick start other than by using diesel generators. For instance, energy storage systems, ancillary services, or demand response methods could be employed to mitigate any loss of biofuel inputs. Other mitigation measures may include better management of certain HECO baseload units on Oahu.[22] The addition or conversion of combined-cycle units may also be evaluated. Furthermore, since the Project is a quick start resource, studies could be conducted to determine if a battery energy storage system ("BESS") system could offer the desired back-up to the biofuel generators, just as a BESS offers operating reserves in the Maui grid.[23] According to HECO, its stated quick load pick-up is a 3-second window and sufficient capacity must be available to restore system frequency.[24] Has a study been conducted to demonstrate that the Project quick start generators can sufficiently restore system frequency without the use of BESS or demand response?

In accordance with the State's renewable energy policies and HECO's own IRP, the Project should take into account a holistic view of the Oahu system. Such an approach should consider not only variable generation equipment capabilities but also utility equipment and operating practices.[25] Furthermore, while the policy goal of the Energy Initiatives Task Force is to increase the use of renewable energy, its other stated aim is to increase such use in a fiscally prudent manner, taking into account life-cycle cost-effectiveness.[26] Accordingly, any mitigation measures such as the Project quick start resource should fit into a holistic, grid-wide strategy to cost-effectively mitigate variable power.

As is evident from the above discussion, DBEDT understands that the Army is open to the consideration of other options for the Project that would meet its objects of procuring reliable, cost-effective and renewable energy, and DBEDT supports that effort. To reach that end, however, DBEDT believes it is important to understand how this Project fits with other ongoing developments to facilitate a cumulative understanding of the environmental, economic and policy impacts of this Project. As such, DBEDT discusses some of the various considerations that should be accounted in this process below.

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http://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf. The Army's own goal is to deploy one gigawatt of renewable energy by 2025. http://www.armyeitf.com/.

22 *See* Hawaii Solar Integration Study: Executive Summary, National Renewable Energy Laboratory (June 2013) at 3, available at http://www.nrel.gov/docs/fy13osti/57215.pdf.

23 *Id.*

24 *See* Operating Reserves and Variable Generation, National Renewable Energy Laboratory (August 2011) at 47, available at http://www.nrel.gov/docs/fy11osti/51978.pdf.

25 *See generally*, Hawaii Solar Integration Study: Executive Summary, National Renewable Energy Laboratory at 3.

26 *See* Memorandum re: Energy Goal Attainment Responsibility Policy for Installations, Department of the Army, Assistant Secretary of the Army (Installations, Energy and Environment (August 24, 2012) at 3.

C. *Other Proceedings, Developments and Considerations Should Inform the Review of the Project*

The Project is proposed to be operated to "meet load and reliability requirements" of the Oahu grid, and to help maintain "grid stability as the amount of power from variable renewable sources (wind and solar) increases over time."[27] The Project is also proposed as one that would "complement, rather than compete with, other existing and anticipated renewable energy sources in the system."[28] Moreover, the various operating scenarios proposed depend on factors such as whether "demand increases, operations of other generating facilities decline, and/or future renewable resources do not develop."[29] Given that these claimed benefits and scenarios are dependent on various other ongoing developments and factors, DBEDT believes it would be imprudent to consider the Project and the various alternatives in a vacuum. It is also clear that environmental reviews require an expansive view of options and impacts. The following are some of the developments and proceedings that could inform the need, cost-effectiveness, environmental impacts and composition of the Project.

This process could be informed by the Hawaii PUC's Reliability Standards Working Group ("RSWG") proceeding in Hawaii PUC Docket No. 2011-0206, which was established to determine how to facilitate the increased use of renewable energy in the islands without compromising grid reliability. The RSWG concluded its work on January 24, 2013. The Independent Facilitator submitted a Final Report on March 13, 2013 and the PUC's selected Technical Review Committee submitted its Report to the Commission in May 2013. The effort of the RSWG resulted in work products and other studies that reflected technical review and recommendations on various factors involved in the consideration, such as ancillary services that can maintain system reliability and better integrate intermittent renewable resources, generation interconnection standard improvements, and methods to reduce renewable generation curtailments.[30] Some recommendations included the initiation of further proceedings. The implementation of the recommendations in those work products and further proceedings would likely influence factors of relevance to the Project's structure and alternative scenarios, such as the enhancement of grid stability, the ability of the system to accommodate new future renewables resources and the likelihood of their development.

Moreover, DBEDT believes that an important consideration is how this Project fits within HECO's overall generation mix. HECO's IRP Report could impact considerations such as load requirements, grid stability, and even the overall cost-impact of the proposed options.[31] In its

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[27] Notice at 2:31-38.

[28] *Id.* at 2:38-39.

[29] *Id.* at 3:35-37.

[30] RSWG Independent Facilitator's Final Report, Hawaii PUC Docket No. 2011-0206 (dated March 17, 2013) at 19.

[31] *See Instituting a Proceeding to Investigate Proposed Amendments to the Framework for Integrated Resource Planning*, Decision and Order, Hawaii PUC Docket No. 2009-0108 (March 14, 2011), Revised Framework at Section II.A ("The goal of integrated resource planning is to develop an Action Plan that governs how the utility will meet energy objectives and customer energy needs consistent with state energy policies and goals, while

IRP Report, HECO noted that its first area of focus was to "make every effort to eliminate the dependency on imported oil for power generation."[32] HECO noted that this would involve deactivation or decommissioning of older, oil-fired steam generators, procuring or developing low-cost, fast track utility-scale renewable energy resources, and converting existing generating units to cost effective renewable and lower carbon fuels, including biomass, biofuels, and LNG.[33] Some of the relevant actions proposed for HECO in the IRP Report may impact the consideration of the Project's composition and use. For instance, the IRP Report noted that "[i]f Honolulu units 8 and 9 are deactivated in 2014 and reactivated in 2017, and Waiau units 3 and 4 are deactivated in 2017, CT-1 converted to combined cycle in 2017, Schofield added in 2017, Honolulu decommissioned or retired in 2018, and no other decommissioning of the remaining firm capacity resources, the IRP scenario analysis indicates that there is a possibility of very limited new capacity need after that."[34] This statement appears to be relevant as to the appropriate fuel mix and the consideration of the six hours a day versus twenty-four hours a day scenarios, as well as the No Action Alternative described in the Notice.[35] In this regard, DBEDT notes that its view on the various scenarios and No Action Alternative will be guided by a holistic perspective consistent with Hawaii's clean energy policies. Once again, it is important to offer the State's perspective that moving away from oil-based generation is critical to our future.

Other questions that are raised include whether the IRP's proposal to convert HECO's CIP CT-1 located in Campbell Industrial Park from a simple-cycle combustion turbine operating on biodiesel, to a combined-cycle combustion turbine/steam turbine should serve as guidance for the Project or whether HECO could use the biodiesel that currently serves CIP CT-1 to serve the Schofield Project.[36] In this regard, HECO noted in its IRP Report that the cost of using biofuels would also be a factor.[37] Additionally, in the Waiver Order, the PUC "direct[ed] HECO to

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providing safe and reliable utility service at reasonable cost, through the development of Resource Plans and Scenarios of possible futures that provide a broader long-term perspective."). In the IRP Docket, DBEDT commented that the PUC should acknowledge the shortcoming in the IRP Report, accept rather than approve the HECO Companies' IRP Report, require the HECO Companies to file for approval prior to implementing specific actions contained in the IRP Action Plans, and establish specific expedited procedures to develop Action Plans that advance the State's clean energy goals. *See, e.g., I/M/O Regarding Integrated Resource Planning*, the Dept. of Business, Economic Development, and Tourism's Reply Comments to Statements of Position in Response to Order No. 31443, Hawaii PUC Docket No. 2012-0036 (filed October 10, 2013) at 3.

32 IRP Report at ES-6.

33 *Id.*

34 *Id.* at 18-35.

35 Notice at 3:26-34; 4:44-5:7.

36 *See* IRP Report at 19-6 to 19-7 (where HECO stated, "With the conversion of CIP CT-1 to combined cycle and adding the capability to burn ULSD and/or LNG with approval of the Commission, the biodiesel that would have been consumed at CIP CT-1 could then be used at this Schofield Generating Station. The Schofield Generating Station is designed to operate at a heat rate (i.e., fuel efficiency) approximately equivalent to that for CIP CT-1 in a combined cycle mode, and approximately twice as efficient as CIP CT-1 in a simple cycle mode. If the biodiesel originally intended for CIP CT-1 were to be deployed at the Schofield Generating Station it would contribute to the Companies' attainment of RPS.").

37 *Id.* at 19-6 (where HECO claimed, "if biodiesel prices are high in the future, a fuel switch to a lower price fuel, such as ULSD or LNG, would be more cost effective. Under a future with lower cost biodiesel, keeping CIP CT-1 on biodiesel is the best option.").

address in any subsequent application relating to the Project, the reasonableness of exclusively using biofuels for the Project."[38] DBEDT acknowledges the PUC's concerns with the potential cost impacts and also recognizes that biofuels may serve well in the power generation market through existing contracts, such that other options from the "all-of-the-above" strategy may also need to be explored. The mix of biofuels and diesel as proposed for this Project could impact the provision of cost-effective, reliable and clean energy to the Army and other ratepayers within the State. DBEDT requests that HECO and the Army take these factors into account as they consider next steps for studying this Project.[39] As noted above, we are concerned that an unlimited reliance on oil-based diesel is inconsistent with the State statutes, State clean energy policy and direction from the Army.

HECO also asserted in the IRP Report that the electrical output from the Project "will normally supply power to all Oahu customers through the Oahu electrical grid. However, during outages that meet the criteria specified in an operating agreement with the Army, [Project] output will be "islanded" to serve only the Army facilities at Schofield Barracks, Wheeler Army Air Field, and Field Station Kunia."[40] There is a need for further information and study on the extent of the need for the facility by Oahu customers currently and to the extent other actions proposed in the IRP Report, technologies, rules, policies or procedures are implemented, including those stemming from the other proceedings discussed in these comments. Similarly, while the IRP Report asserted that the Project's attributes would "enable increased integration of intermittent renewable resources on the Oahu grid (and minimize the potential for energy curtailment,"[41] it is not clear the extent to which these benefits would be realized and how the other potential regulatory requirements discussed herein, among others, would provide similar benefits.

Another salient consideration for this Project is the State legislation and pending investigation into the viability of an inter-island cable.[42] DBEDT believes that the Oahu-Maui interisland marine electric transmission cable that is currently under investigation by the PUC is anticipated to facilitate greater renewable energy development that will displace current fossil generation and reduce the need to develop future fossil generation. Not only did DBEDT's economic analysis demonstrate that the benefits of the inter-island cable would outweigh the costs, DBEDT's analysis found that the inter-island cable would have other benefits such as increasing flexibility in siting new renewable generation, reducing curtailment of renewable generation and providing direct health benefits associated with reduced air emissions of filterable particulate matter,

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38 Waiver Order at 14, n.15.

39 DBEDT also concurs in the other items that the PUC found HECO would need to address in any subsequent application filed related to the Project, such as: (1) the scope and cost of the Project, including as to the size and capacity of the 50 MW Project; (2) whether HECO can provide cost containment for the Project to avoid ratepayers having to pay for cost overruns; and (3) whether reasonable alternatives to the Project were given adequate consideration during the development of the Project. *Id.* at 14-15.

40 IRP Report at 18-17.

41 *Id.* at ES-19.

42 H.R.S. §§ 269-131 to -135, *et seq.*

carbon dioxide, nitrogen oxides and sulfur dioxide.[43] DBEDT's analysis also found that connecting the Oahu and Maui electric systems with a high voltage direct current transmission cable would accommodate transmission of power and ancillary services in both directions and allow the two systems to operate in a coordinated fashion, which would improve the power system economics and reliability on both islands. The construction of such an inter-island cable could have a significant impact on the generation mix in Oahu. This in turn, could potentially reduce the risk of frequency of loss of service to the Army from the other sources of electricity.

Thus, DBEDT submits that the various considerations described above, among others, would have an impact on the Project and any future studies should be reviewed in context with those other developments.

D. It is Imperative to Balance Technical, Economic, Environmental, and Cultural Considerations in the EIS

The EISPN lists several impact categories that have been tentatively identified for consideration in the EIS.[44] DBEDT submits that it is imperative to balance technical, economic, environmental, and cultural considerations in the EIS.[45] Although the Notice identifies some of these concerns, the EIS should fully address the following:

- Technical Considerations: DBEDT has raised some technical considerations above that should be explored by DLNR and the Project proponents. In addition, various statements in the Notice require further support and study. For instance, the Project proponents should provide support for the statement that the Project would allow the grid to accommodate more fluctuating renewable energy than would otherwise be the case.[46] It is not clear what assumptions are being used (*e.g.*, high or low renewable penetration) in making this statement. The Notice also describes two ways in which it expects the penetration of renewable resources to change the load curve.[47] Have the Project proponents completed a study to support these conclusions? If so, what inputs and assumptions were used?

- Economic Considerations: The Army provides critical national security and first responder services. The continued and stable operation of those services is an important state interest. At the same time, the Army has an interest in pursuing cost-effective

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43 *I/M/O Public Utilities Comm'n Opening a Proceeding to Investigate Whether an Oahu-Maui Interisland Transmission System May Be in the Public Interest*, Initial Public Comments of the Dept. of Business, Economic Development and Tourism in Response to Order No. 31356, Hawaii PUC Docket No. 2013-0169 (filed September 9, 2013) at 6.

44 Notice at 5:12-42.

45 *See* State of Hawaii Energy Resources Coordinator's Annual Report 2013 at 3 (explaining that the Abercrombie Administration has focused the next phase of Hawaii's energy transformation on five principles, including "[b]alancing technical, economic, environmental, and cultural considerations.").

46 Notice at 3:28-29.

47 *Id.* at 3:18-25.

solutions, and the Draft EIS should consider alternatives that will be more cost-effective for the Army and all other HECO ratepayers. This analysis should not be done in isolation but rather should consider multiple scenarios, such as high or low load forecasts, high or low renewable penetration, high or low biofuel prices, fuel diversity, etc. The Draft EIS should consider that significant price fluctuations in oil have had harmful effects on Hawaii's ability to meet its diversification goals and highly negative economic consequences. These fluctuations cost jobs, hurt businesses, and ultimately harm consumers, including military service members who live on Oahu. In addition, the Notice makes claims that "[b]eing multi-fuel capable, [the Project] would be able to run on a combination of fuels as necessary to ensure operations are economically viable and can continue under adverse operating conditions."[48] The Draft EIS should define "economically viable" and present the incremental cost of using biofuels versus other fuels for the generators to support its claim that the multi-fuel capability option is economically viable. The Draft EIS should consider the fluctuation of diesel prices over time[49] as well as the transportation costs of diesel as well.

- Environmental Concerns: The Notice states that the six biofuel-capable reciprocating engine-generator sets would add 50 MW of firm, utility-owned renewable energy capacity to the Oahu electrical grid.[50] As discussed above, this claim ignores the fact that, as currently proposed, the Project would also rely on diesel. Reliance on diesel fuel, as opposed to cleaner and greener energy sources that would help control greenhouse gas emissions, does not advance Hawaii's and the Army's renewable goals.

- Cultural Concerns: The Notice generally states that the EIS should consider cultural and historical resources (including Native Hawaiian resources), but does not specifically identify which resources will be impacted by the Project. The Project proponents should coordinate with other agencies, including the Office of Hawaiian Affairs, the National Park Service, the Hawaii Island Burial Council, the State Historic Preservation Division, and the Historic Hawaii Foundation, among others, to determine which cultural and historical resources are of concern on the Schofield Barracks and Wheeler Army Airfield. The Draft EIS should take steps to ensure that historical, archaeological, and architectural sites are sufficiently protected.

These considerations must not be viewed in isolation but rather the Draft EIS should balance these interests.

II. Conclusion

The concerns raised herein demonstrate that the Project as currently proposed would not be in the

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48 *Id.* at 5:15-17.

49 Biofuels Study Final Report to the Legislature in Accordance with Act 2013, Session Laws of Hawaii, State of Hawaii, Department of Business, Economic Development & Tourism at 5 (December 2012) (showing that fuel oil prices paid by Hawaii's electric utilities have varied from $59/barrel up to $120/barrel from 2006-2011).

50 Notice at 2:34-35.

best interests of the State, the Army and other Hawaii ratepayers. As such, DBEDT supports review of other alternatives that would better serve the State's energy policy and the energy security and economic interests of the State and the Army and consideration of other developments, proceedings and other factors that would inform the review of the Project.

We appreciate the opportunity to provide these comments for use in the preparation of the Joint EIS and DBEDT formally requests to be added to the EIS distribution list. If you have any questions, please feel free to contact me at (808) 587-3812 or mark.b.glick@dbedt.hawaii.gov.

Sincerely,

Mark B. Glick
Energy Administrator

October 2, 2014

Mr. Mark Glick, Energy Administrator
Department of Business, Economic Development & Tourism
State of Hawai'i
P.O. Box 2359
Honolulu, Hawai'i 96804

Subject: Schofield Generating Station Project:
Environmental Impact Statement Preparation Notice

Dear Mr. Glick:

Thank you for the Department of Business, Economic Development & Tourism's (DBEDT's) February 28, 2014, letter to the State of Hawai'i Department of Land and Natural Resources (DLNR) and Tetra Tech Inc. concerning the Environmental Impact Statement Preparation Notice (EISPN) for the Schofield Generating Project (Project). Because Hawaiian Electric is the applicant seeking approval for the proposed Project, DLNR has asked that we respond. Hawaiian Electric appreciates your input to the EIS process for this Project, and provides the following responses to your comments.

Comment A. "Building Petroleum-based Electricity Generation is Contrary to Hawai'i's Energy Policy and is Not in the Public Interest in Hawai'i"

Response: We appreciate your comments concerning the Hawai'i Renewable Portfolio Standard (RPS) and your concerns regarding the use of petroleum-based fuels. Please be assured that the Project is not a "diesel-based electricity generation unit." Rather, as clarified in our subsequent application filed with the Public Utilities Commission (PUC) as docket 2014-0113, the Project will use a minimum of 50% biofuel, and also consume a minimum of 3.5 million gallons of biofuel annually. It is this requirement that formed the basis of our statement that the Project will contribute to our ability to continue to meet or exceed the State RPS mandate. For the balance of its fuel needs, the Project could use additional biofuel (e.g, biogas or biodiesel), natural gas, or diesel if natural gas is not available.

In accordance with the requirements of National Environmental Policy Act (NEPA) and Hawai'i Revised Statutes (HRS) Chapter 343, the Draft EIS will provide greater detail concerning the mix of fuels under consideration consistent with purpose and need for the Project, and disclose the environmental impacts thereof. The importance of fuel mix and flexibility to this Project, in the context of broader energy policy considerations, is discussed in our PUC application (docket 2014-0113) and our Power Supply

Improvement Plan (PSIP) filed with the PUC on August 26, 2014 in docket 2011-0206, and will be more appropriately addressed in those proceedings.

Comment B. "Other Alternatives that Would Foster the State's and Army's Interests Should be Considered"

Response: We appreciate your comments concerning the advantages of enhancing fuel diversity and your "all of the above" strategy to accomplish these goals. In accordance with NEPA and HRS Chapter 343, the Draft EIS will provide information on strategies and alternatives that would support energy security, reliability, and increased integration of renewable generation, consistent with the purpose and need for the Project. Like you, Hawaiian Electric supports cost competitive liquefied natural gas (LNG), and has incorporated its use into the Project as a less expensive, cleaner fuel than diesel.

While the Draft EIS will review the environmental impacts of the proposed Project, how this Project fits in more broadly with other state- and system-wide energy initiatives that you mentioned is discussed in our PUC application for this Project and in our PSIP, and will be explored in those proceedings.

Comment C. "Other Proceedings, Developments and Considerations Should Inform the Review of the Project"

Response: We appreciate your comments regarding resources that may inform the Project. The Draft EIS will take into consideration any proceedings that are relevant to the purpose and need for this Project, and that are within the scope of this Draft EIS, as prescribed by NEPA and HRS Chapter 343. However, the primary purpose and focus of the Draft EIS will be to disclose the environmental impacts of the Project and available alternatives, so that those impacts may be considered by decision-makers in their later consideration of this Project.

Regarding the Reliability Standards Working Group and Integrated Resource Planning dockets that you reference, Hawaiian Electric has addressed the issues raised therein, many of which are consistent with your concerns, in our recently filed PSIP and Distributed Generation Interconnection Plan (filed 26, 2014 in docket 2011-0206).

Comment D. "It is Imperative to Balance Technical, Economic, Environmental, and Cultural Considerations in the Joint EIS"

Response: The purpose of both NEPA and HRS Chapter 343 is informed decision-making. With this in mind, the Draft EIS will describe the technical, economic,

environmental and cultural impacts of the Project and its alternatives. However, it is the purpose of environmental reviews to disclose the environmental impacts of a project, not to balance them. Consistent with this distinction, we have addressed in our PUC application for this Project the technical and economic concerns that you raised, and which we expect will be fully explored in the PUC proceedings. Your environmental and cultural concerns will be considered through the EIS process.

We will provide DBEDT copies of the Draft EIS when it is available, and you will have an opportunity to provide additional comments at that time. If, in the meantime you have any questions or would like to discuss this further, please call me at 543-4088.

Sincerely,

Jack Shriver
Senior Engineer,
Generation Project Development
Hawaiian Electric Company

copy: (via email only)
Mr. Alex Roy, Hawai'i Department of Land and Natural Resources Office of Conservation and Coastal Lands
Ms. Stephanie Gardin, Office of Public Affairs, US Army Garrison – Hawai'i
Ms. Kathy Ahsing, US Army Office of Energy Initiatives

NEIL ABERCROMBIE
GOVERNOR

GLENN M. OKIMOTO
DIRECTOR

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FORD N. FUCHIGAMI
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JADINE URASAKI

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

IN REPLY REFER TO:
DIR 0127
STP 8.1483

February 21, 2014

TO: THE HONORABLE WILLIAM J. AILA, JR., CHAIRPERSON
DEPARTMENT OF LAND AND NATURAL RESOURCES

FROM: GLENN M. OKIMOTO, PH.D.
DIRECTOR OF TRANSPORTATION

SUBJECT: SCHOFIELD GENERATING STATION PROJECT
ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE (EISPN)
TMK: (1) 7-7-001: 001, 002; 7-3-001:001, 002, 006-009, 011-013, 019, 022 and 024; 7-6-001:001 and 006; 9-4-012:001, 003 and 011

Our Department of Transportation's (DOT) comments on the subject project are as follows:

1. The project construction plans and other applicable plans/permits for work within the DOT State highway right-of-way must be submitted to the DOT Highways Division for review and approval.

2. A permit from the DOT Highways Division is required for the transport of oversize and/or overweight materials and equipment on State highway facilities.

If there are any questions, please contact Mr. Norren Kato of the DOT Statewide Transportation Planning Office at telephone number (808) 831-7976.

EKT:gm

c: Melissa DeSantis, Tetra Tech, Inc.
Jack Shriver, Hawaiian Electric Company

bc: HWY-P (w/incoming), STP (7-7-001-001)

April 1, 2014

Mr. Glenn M. Okimoto, Director
Department of Transportation
State of Hawai'i
869 Punchbowl Street
Honolulu, Hawai'i 96813-5097

Subject: Schofield Generating Station Project:
Environmental Impact Statement Preparation Notice (EISPN)

Dear Mr. Okimoto:

Thank you for your February 21st 2014 letter to the Department of Land and Natural Resources (Reference DIR 0127 STP 8.1483) concerning the Environmental Impact Statement Preparation Notice (EISPN) for the Schofield Generating Station Project. We appreciate the time that you and your staff spent reviewing the EISPN and preparing your letter. Because Hawaiian Electric is the applicant seeking approval for the proposed project, DLNR has asked that we respond.

Hawaiian Electric understands that it may be required to obtain a permit from the Highways Division of the State of Hawai'i Department of Transportation (DOT-Highways) for the transport of oversize and/or overweight vehicles. The company and/or its contractors will submit project construction plans and other applicable plans and permits that may be required for work within your Department's right-of-way to DOT-Highways for review and approval prior to commencement of construction activities. We will also provide a copy of the Draft Environmental Impact Statement to you for review and comment when it is available.

In the meantime, if you have any questions or would like to discuss the project further, please call me at (808) 543-4088.

Sincerely,

Jack Shriver
Senior Engineer,
Generation Project Development
Hawaiian Electric Company

cc: (via email only)
Mr. Alex Roy, Hawaii Department of Land and Natural Resources Office of Conservation and Coastal Lands
Ms. Stephanie Gardin, Office of Public Affairs, US Army Garrison—Hawaii
Mr. Doug Waters, US Army Energy Initiatives Task Force

Appendix C
Traffic Study

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Schofield Generating Station Project

FINAL

Traffic Study

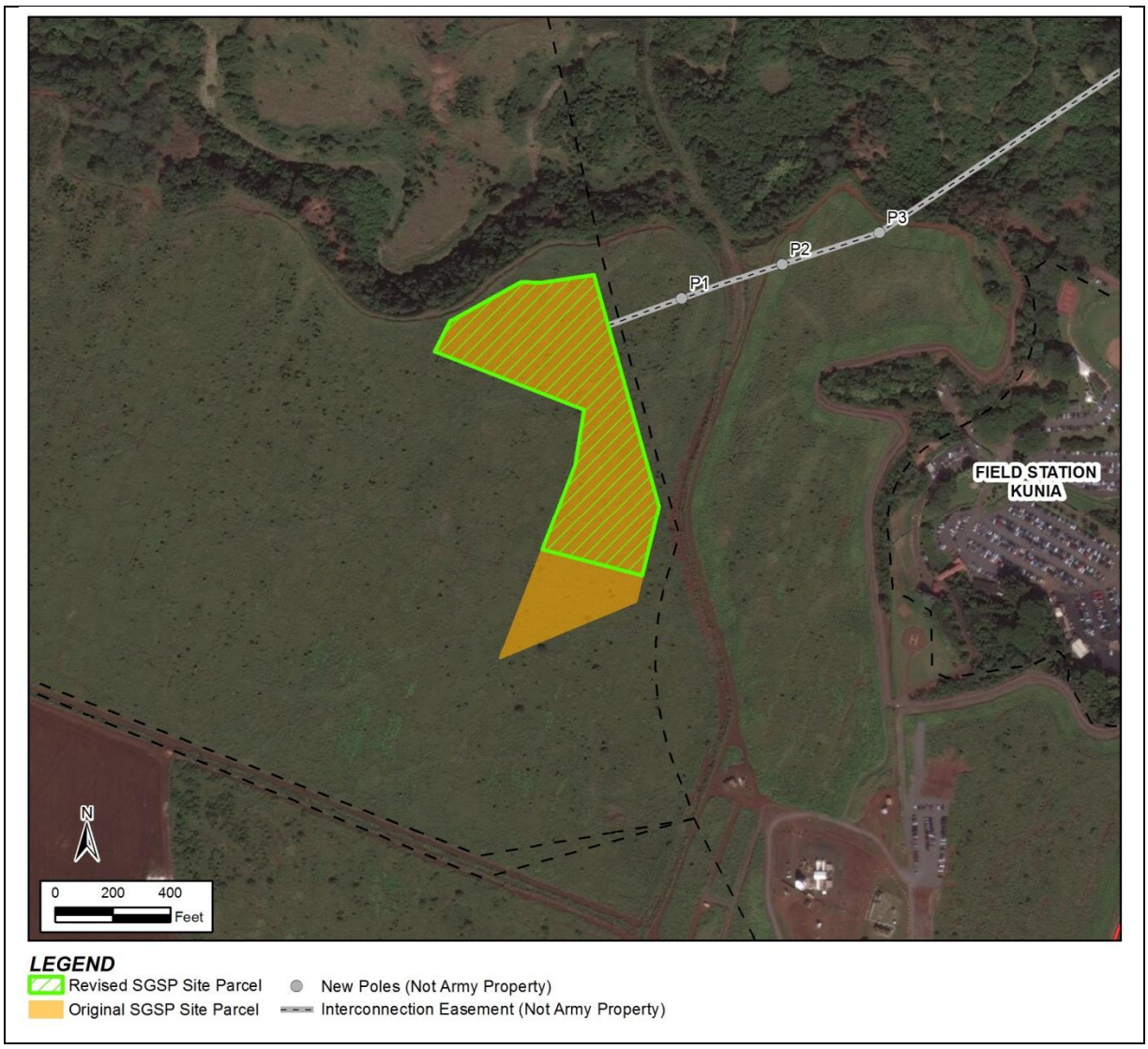
Prepared By
Tetra Tech, Inc.

May 2014

Errata

Prepared on June 4, 2014

After completing the Traffic Study in support of the Joint Environmental Impact Statement (EIS) for the Schofield Generating Station Project, the Army and Hawaiian Electric reduced the size of the parcel on which the generating station will be located from 10.31 acres to 8.13 acres. The map below shows the reduced parcel indicated by hatch marks. Please note that the maps and discussions within the report are based on the larger 10.31 parcel, and therefore do not match the parcel size discussed in the EIS. The reduction in parcel size does not necessitate the revision of Traffic Study because it does not materially change the findings of this report.



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EXECUTIVE SUMMARY

The U.S. Army Corps of Engineers is preparing an Environmental Impact Statement for the Schofield Generating Station Project (SGSP) at Schofield Barracks (SB), Hawaii. The purpose of the proposed action is to establish a stable, renewable source of power that provides energy security for SB, Wheeler Army Airfield (WAAF), and Field Station Kunia on the island of Oahu, Hawaii.

This study presents the results of the traffic impact analysis for the proposed biodiesel plant establishment. The focus of the study is the peak hour traffic impacts resulting from the construction and operation of the biodiesel facility.

Today Kunia Road traffic near SB experiences delays and congestion during peak hours. Grow The Army (GTA) Phase 1 is under construction and will be completed and fully occupied by 2017. Traffic on Kunia Road and Lyman Road will continue experiencing delays because future traffic growth will increase demand on the study area intersections.

The traffic volumes that will be generated by the construction and operation of the SGSP project on the roadway network are minimal. Comparing with the future No-Build scenario, the increase on average vehicle delays from construction traffic is less than 4 seconds per vehicle, and the effects from SGSP operations are negligible.

1. INTRODUCTION

This traffic study analyzes the effects of building and operating a power generating station on 10.31 acres at Schofield Barracks (SB). The Schofield generating station project (SGSP) consists of a 10.31-acre parcel (generating station parcel) and a 2.5-acre linear interconnection easement. The heavily overgrown, undeveloped generating station parcel was once used for growing pineapples and is situated along the eastern boundary of the South Range Acquisition Area. It is about a third of a mile south of Lyman Road, about half a mile west of Kunia Road, and about 150 feet north of the Grow the Army (GTA) construction offices that are accessed from Hauula Street. This site is adjacent to the GTA infrastructure facilities, which are currently under construction. The long-term access route will go through Lyman Road and the access road for the GTA infrastructure facilities in SB. ***Figure 1*** presents the project site location and traffic study intersections.

Figure 1: SGSP Site and Traffic Intersections Studied

The traffic study includes eight intersections on Kunia Road and Lyman Road as shown in ***Figure 1***. Of the eight intersections, six are signal controlled and two are stop sign controlled (Flagler Road and Maili Street intersections on Lyman Road).

This study will evaluate traffic operations for 2014 (current year) and 2017 (estimated year plant will become operational). The construction traffic impact will be evaluated for 2017. It is

anticipated that the Flagler Road and Lyman Road intersection will be improved to a signalized intersection before the plant becomes operational, and the Maili Street intersection will remain a stop sign-controlled intersection.

The operations of these intersections were evaluated for a typical weekday during AM and PM peak hours for the following scenarios:

- Existing 2014 AM and PM Peak Hour Traffic Operations
- 2017 No-Build AM and PM Peak Hour Traffic Operations
- 2017 Construction AM and PM Peak Hour Traffic Operations
- 2017 Build AM and PM Peak Hour Traffic Operations

2. EXISTING CONDITIONS

2.1 Street Network

Kunia Road (SR 750)

Kunia Road is State Route (SR) 750. It has no access control, and is not part of the National Highway System. The posted speed limit on Kunia Road is 35 miles per hour. At the north end, Kunia Road is a four-lane divided north-south major highway, and becomes a two-lane undivided roadway south of the Lyman Road intersection. At the north end, Kunia Road connects to SR 99 (Kamehameha Highway) with a signalized "T" intersection. Kunia Road, SR 99, and Highway (HI) 2 are three parallel roadways connecting the Pearl City/Waipahu area to Wahiawa, SB, and Wheeler Army Airfield (WAAF).

Most intersections on Kunia Road are signalized intersections within the study area. The three major intersections are SR 99, Foote Avenue, and Lyman Road (see ***Figure 2***). The Foote Avenue intersection is one of the two major gateways for SB. The Lyman Road intersection connects to two entrances—to the east is WAAF, and to the west is SB. There are sidewalks on the east side of Kunia Road from the Lyman Road intersection to the Wilikina Drive (SR 99) intersection. On the west end, sidewalk exits are only at the north end of Kunia Road. Utility poles are on the east side of Kunia Road, south of the study area, and cross to the west side south of Lyman Road. Roadway lighting poles are on both sides of Kunia Road north of the Lyman Road intersection.

Per the State of Hawaii, the 2009 Annual Average Daily Traffic (AADT) on Kunia Road in the study area is approximately 13,700 vehicles. The estimated 2014 AADT is approximately 15,400 vehicles.

Lyman Road

Lyman Road is a two-lane east-west roadway going through the SB post. It connects Kunia Road at the entrance gates to both SB and WAAF, and it extends to the west end of the SB post. There are administrative and storage facilities at the east portion of Lyman Road. At the west portion of Lyman Road, it connects mainly to military housing. Lyman Road connects to the GTA infrastructure facilities through the Mellichamp Road extension at the west end of Lyman Road. The facilities and roadways are under construction.

The Humphreys Road intersection is the only signalized intersection on Lyman Road on the post. There are plans to add signals to the Flagler Road intersection in the near future to address the increasing traffic volumes.

The traffic volumes vary along Lyman Road. A 2009 traffic count shows the weekday average daily traffic by the gate was more than14,400 vehicles per day, and decreased to less than 2,000 vehicles per day at the west end section.

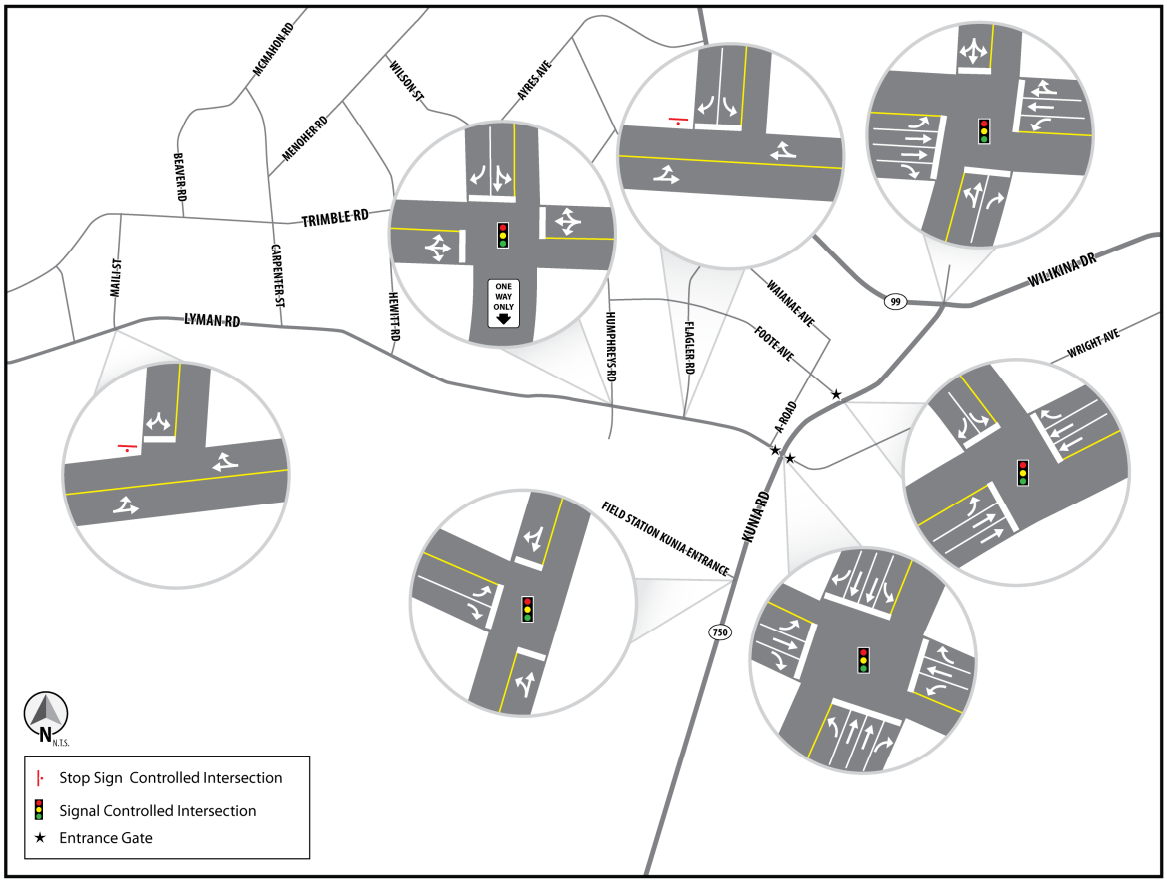


Figure 2. Existing Lane Channelization

2.2 Existing 2014 AM and PM Peak Hour Traffic Volumes

The peak hours observed on Lyman Road were 8:00 a.m.–10:00 a.m. for the morning and 4:00 p.m.–5:00 p.m. for the afternoon. The peak on Kunia Road (SR 750) is between 6:30 a.m.–8:30 a.m. and 3:30 p.m.–4:30 p.m. To capture the overall traffic peak for the study area, turn movement counts were conducted between 7:30 a.m. –9:30 a.m. and 3:30 p.m. –5:30 p.m. The turn movement volumes were then reviewed and balanced for all the study intersections to form the existing volumes.

Figure 3 shows the existing 2014 AM and PM peak hour traffic volumes and turning movement counts used as a baseline for this analysis. ***Appendix A*** provides traffic count data.

Kunia Road (SR 750) carries heavy traffic during AM and PM peak hours. The Kunia Road and Wilikina Drive (SR 99) intersection experiences long queues and delays during both AM and PM peak hours. The intersections at the Lyman Gate and Foot Avenue Gate entrances to the military installations have long cycles and delays.

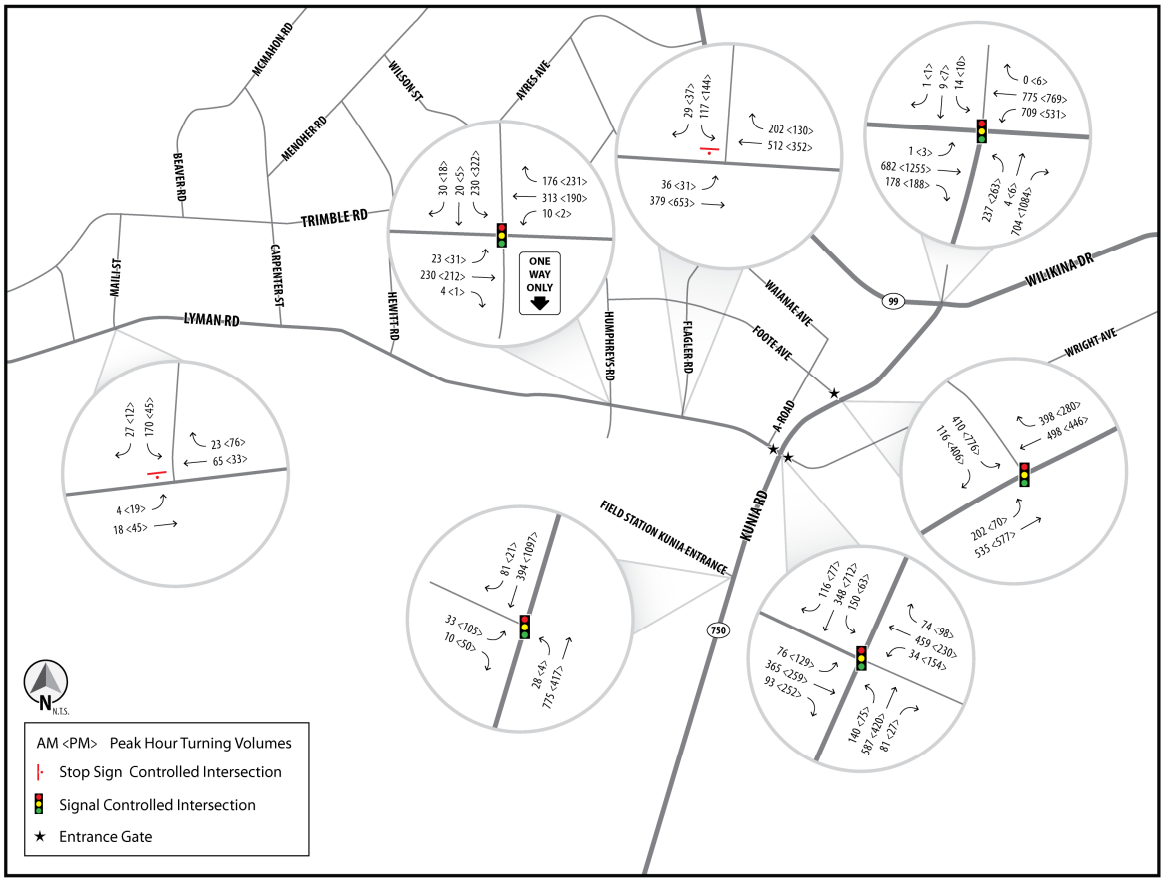


Figure 3. Existing 2014 Peak Hour Traffic Volumes

2.3 Existing 2014 AM and PM Peak Hour Traffic Operations

Trafficware's *Synchro 8* traffic modeling software was used to analyze traffic operations. Synchro is a traffic analysis software program that is based on methods outlined in the 2000 *Highway Capacity Manual* (HCM). The procedures measure the traffic flow obtained from traffic counts and future traffic forecasts to produce measures of effectiveness such as delay per vehicle, intersection level of service (LOS), and intersection queue length.

LOS, which ranges from LOS A to LOS F, is a tool to qualitatively measure the operational conditions of the traffic operations of the intersection. LOS A indicates the free-flow traffic with little or no delay, while LOS F indicates extreme conditions with lengthy delays. ***Appendix B*** provides an expanded definition of LOS.

Table 1 lists the results of the existing AM and PM peak hour traffic operations.

Table 1. Existing 2014 Peak Hour LOS and Average Delay (sec/veh) Summary

Evaluated Intersection	*Intersection Control*	*Existing AM Peak 2014 LOS*	*Existing PM Peak 2014 LOS*
Kunia Road & Wilikina Dr. (SR 99)	**Signalized**	**D** (44.1 sec/veh)	**D** (42.3 sec/veh)
Kunia Road & Foote Avenue	**Signalized**	**C** (33.1 sec/veh)	**C** (33.3 sec/veh)
Kunia Road & Lyman Road	**Signalized**	**D** (50.4 sec/veh)	**D** (38.3 sec/veh)
Kunia Road & Field Station Kunia Entrance	**Signalized**	**A** (6.6 sec/veh)	**B** (18.0 sec/veh)
Lyman Road & Flagler Road	**Stop Sign**	**F** (53.8 sec/veh)	**F** (83.9 sec/veh)
Lyman Road & Humphreys Road	**Signalized**	**B** (12.6 sec/veh)	**B** (11.0 sec/veh)
Lyman Road & Maili Street	**Stop Sign**	**B** (10.7 sec/veh)	**B** (10.3 sec/veh)

Note: sec/veh = seconds per vehicle.

Appendix C provides detailed LOS output reports from Synchro.

Most intersections operate at LOS D or better during both AM and PM peak hours for existing conditions, except the Lyman Road and Flagler Road intersection, which is LOS F. The Flagler Road intersection is stop sign controlled; therefore, the intersection LOS is determined by the average delays on Flagler Road. The delay indicates that it takes a long time for a vehicle on Flagler Road to find gaps in Lyman Road traffic. This supports the plan to add a traffic signal and other improvements at this location.

The Kunia Road and Wilikina Drive (SR 99) intersection suffers long queues and delays during both AM and PM peak hours, especially the Wilikina Drive westbound left turn to southbound Kunia Road movement. At this location the short left turn pocket on Wilikina Drive westbound is not long enough to hold the queuing at the intersection, and spills back into the inside through lane, which worsens the intersection operations.

The Kunia Road and Lyman Gate intersection has long delays and queues due to the large traffic demands and long signal cycles. The security check at the gate entrance also increases the delay and queues at this intersection.

3. FUTURE TRAFFIC VOLUME FORECASTING

It is anticipated that by the end of 2017 the project will be built and fully occupied. The 2017 forecasted traffic demand is comprised of three elements: (1) existing traffic, (2) background traffic growth between 2014 and 2017, and (3) forecasted project-generated traffic. The sum of all three results in the total forecasted traffic volumes for the built condition.

3.1 Background Traffic Growth

The background traffic consists of the future traffic incremental growth added to the existing traffic volumes. This traffic volume growth does not include the project or major developments in the project vicinity.

In determining the traffic growth rate, average daily traffic on Kunia Road was reviewed. The 2009 AADT on Kunia Road is approximately 13,700 vehicles in the study area. The estimated 2014 AADT is approximately 15,400 vehicles. This represents a 2.5 percent straight line annual growth from 2009 to 2014. The 2.5 percent straight line annual growth was used to project peak hour traffic volumes for both Kunia Road and Lyman Road intersections, and applied to existing traffic volumes to generate future background traffic. With limited information, this percentage growth rate represents a reasonable average for the purpose of establishing future background traffic levels. The actual growth rates experienced by the different intersections might be higher or lower than this average.

3.2 Grow The Army Project Traffic

GTA Phase 1 is under construction and will be completed and occupied before 2017. The project expands SB capacity and will generate new traffic volumes in the study area. The GTA traffic is not included in the background traffic growth. Per the Transportation Impact Analysis Report[1] completed by Feher & Peers Transportation Consultants in 2009, the total traffic generated by the GTA development are 690 inbound and 100 outbound vehicle trips during the AM peak hour, with the reverse (100 inbound trips and 690 outbound trips) occurring during the PM peak hour. 70 percent of personnel at the GTA site were assumed to originate from within the base during the AM peak hour, while 30 percent will travel through Lyman Gate. The majority of on-site personnel were expected to use Menoher Road, Carpenter Street, Trimble Road, and Mellichamp Road to get to the GTA site.

The GTA traffic study did not state how traffic was assigned on Kunia Road outside Lyman Gate. For the purpose of this study, the traffic assignment was assumed based on Lyman Gate AM peak hour traffic volume distributions— 45 percent of traffic to/from north on Kunia Road, and 55 percent traffic to/from south on Kunia Road.

[1] Final Transportation Impact Analysis: FY09 Grow the Army Project at Schofield Barracks, June 29, 2009

3.3 Estimated Construction Traffic

During construction, the site will be accessed through a temporary access road from Kunia Road south of the Field Station Kunia entrance signalized intersection. Construction is estimated to start in May 2016 and finish by June 2017.

Hawaiian Electric Company (Hawaiian Electric) and Quanta's estimates indicate that there will be two types of traffic impacts: (1) light personal and noncommercial traffic, and (2) commercial traffic.

Light personal and noncommercial traffic:

- Vehicles on-site and personnel vehicle impact – Average vehicles on-site during construction – Using 1.5 occupants per vehicle.
- Seventy-seven average vehicles will result in 62 noncommercial vehicles commuting daily from September 2016 to July 2017.
- Ninety-eight peak vehicles will result in 79 noncommercial vehicles commuting daily from December 2016 to June 2017.
- Both average and peak vehicles on site traffic was considered twice a day (6:00 a.m. – 8:00 a.m. and 4:00 p.m.–6:00 p.m. Monday through Saturday).

For the purpose of the traffic study, a single-occupant vehicle is assumed for the 98 peak vehicles to ensure the traffic volume is on the conservative side.

A portion of the construction traffic will come from the north on Kunia Road, with the other portion coming from the south. Only the traffic from the north will affect the intersections on Kunia Road within the study area. There will be no construction traffic impacts on Lyman Road intersections.

There is no information to determine the distribution of this construction traffic. For the purpose of this study, it was assumed that half of the traffic comes from the north on Kunia Road, and half comes from the south.

Commercial Traffic:

- Light, local commercial delivery traffic is defined as weighing between 5 – 8 tons class delivery vehicles from the local surrounding markets, and will range from five to seven deliveries a day starting in May 2016 and continuing through July 2017.
- Heavy loads, 10 tons and greater, will range from 3 to 4 loads a day starting in August 2016 and continuing through February 2017.
- Wide and permitted loads for heavy equipment (modules, Wärtsiläs, radiators, and the like) are planned between November 2016 and April 2017.

Hawaiian Electric will use the Barbers Point Harbor as the point of entry for major equipment. The vehicles will leave the port traveling southeast on Malakole Street (HI-95); make a left on Kalaeloa Boulevard (HI-95) to the entrance of HI-1 East; use exit 5 to go north on Kunia Road (HI-750) for approximately 5 miles; and then make a left on the unimproved construction road, entering the project site on the south end.

All commercial traffic will come from the south on Kunia Road and will not affect the studied intersections.

3.4 Project Operation Traffic

Upon project completion, the temporary access road will be closed. All traffic will access the site through the Lyman Gate and the newly built Mellichamp Road extension for GTA facilities.

Initial Fuel Delivery Traffic

Before normal operation begins, the facility fuel tanks need to be filled. According to Hawaiian Electric staff, initial fuel deliveries would occur on workdays at non-peak hours, and:

- Urea would require three 40-foot containers, one container per week.
- Fuel would be offloaded one truck at a time, and each truck will take an hour. Filling the the storage tanks will require 6 trucks per day and 60 fuel trucks over 2 weeks.
- Lube oil would require three trucks, one truck per day for 3 days.

Because the initial fueling delivery occurs during non-peak hours, peak hour traffic will be unaffected. Therefore, the initial fuel delivery traffic was not included in the traffic study.

Normal Operational Traffic

According to Hawaiian Electric staff, normal facility operation requires three shifts, and each shift has one operator and one supervisor. There will be one shift change during the AM peak hours, and no shift changes during the PM peak hours. There will also be an off-duty shift during the AM peak hours. It is assumed that all personnel will drive in a single-occupancy vehicle. This operation will generate six personal vehicles in the morning peak hours—four inbound and two outbound vehicles. For the purposes of this traffic study, it is assumed this traffic will be split equally on Kunia Road in the north and south directions.

It is anticipated that full operation of the facility might require a daily maximum of 26 delivery trucks for fuel/urea and other deliveries. These trucks would spread out evenly over the 24-hour period. For the purpose of the traffic study, it is assumed there will be two truck deliveries during AM peak hours and no truck delivery during PM peak hours.

Overall, the operational traffic is minor during the AM peak hours. There is no induced traffic during the PM peak hours. This traffic study, therefore, will only analyze the AM peak hours for the operation traffic volumes.

4. 2017 NO-BUILD TRAFFIC OPERATIONS

The Army is planning to add a traffic signal to the Flagler Road and Lyman Road intersection. It is assumed that this improvement will be constructed before 2017 and become part of the No-Build roadway network. The improvement will not change the roadway network capacity, and no traffic volume will be added to the network. ***Figure 4*** depicts the 2017 roadway intersection geometry.

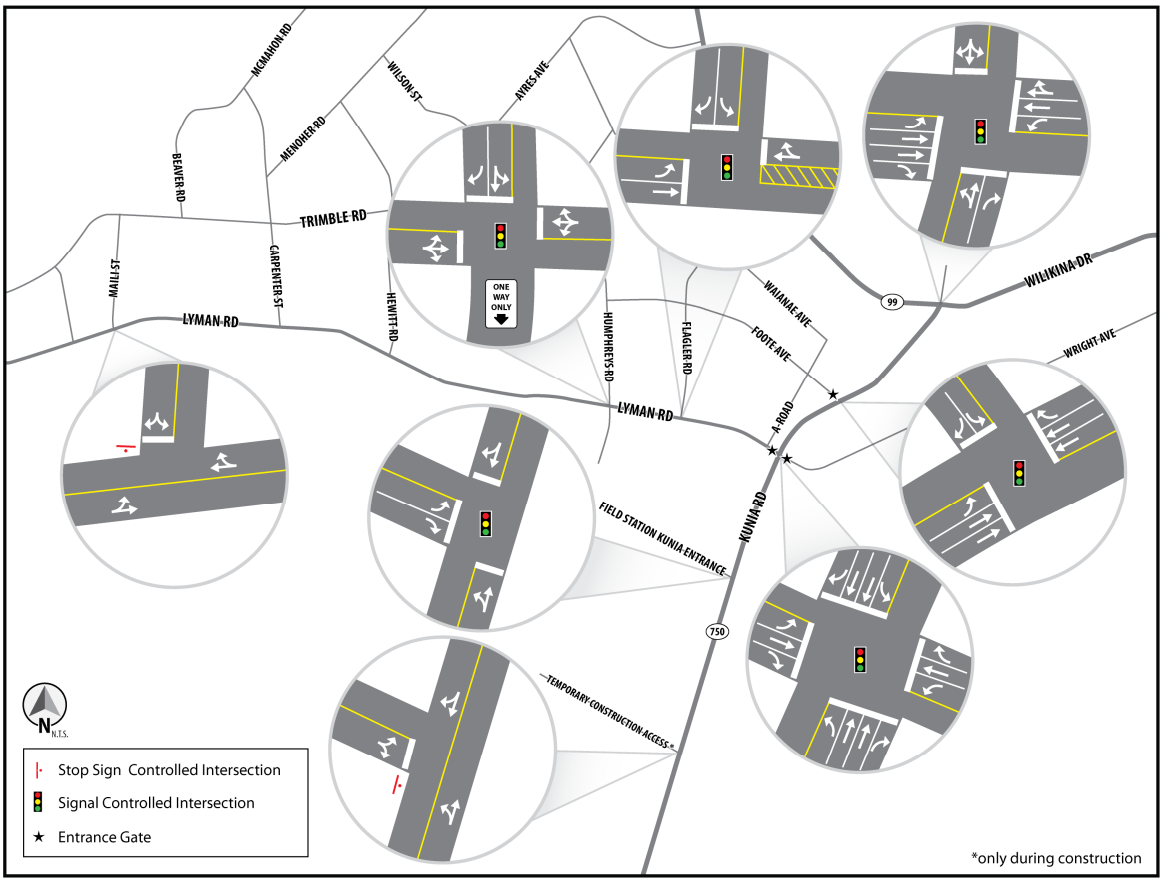


Figure 4. 2017 Intersection Channelization

The No-Build assumes the project will not be built. The construction for the GTA Phase 1 facilities will be finished and fully occupied before 2017. Therefore, the No-Build scenario will include traffic generated by GTA Phase 1 facilities. The 2017 No-Build scenario traffic comprises three elements: (1) existing traffic, (2) background traffic growth, and (3) GTA traffic. ***Figure 5*** shows the 2017 No-Build traffic volumes**.**

2017 No-Build Synchro models are based on the 2014 existing Synchro model. New traffic signal and intersection geometric improvements are added at Flagler Road and Lyman Road per design plans. The geometric and network data for the rest of the network was not modified.

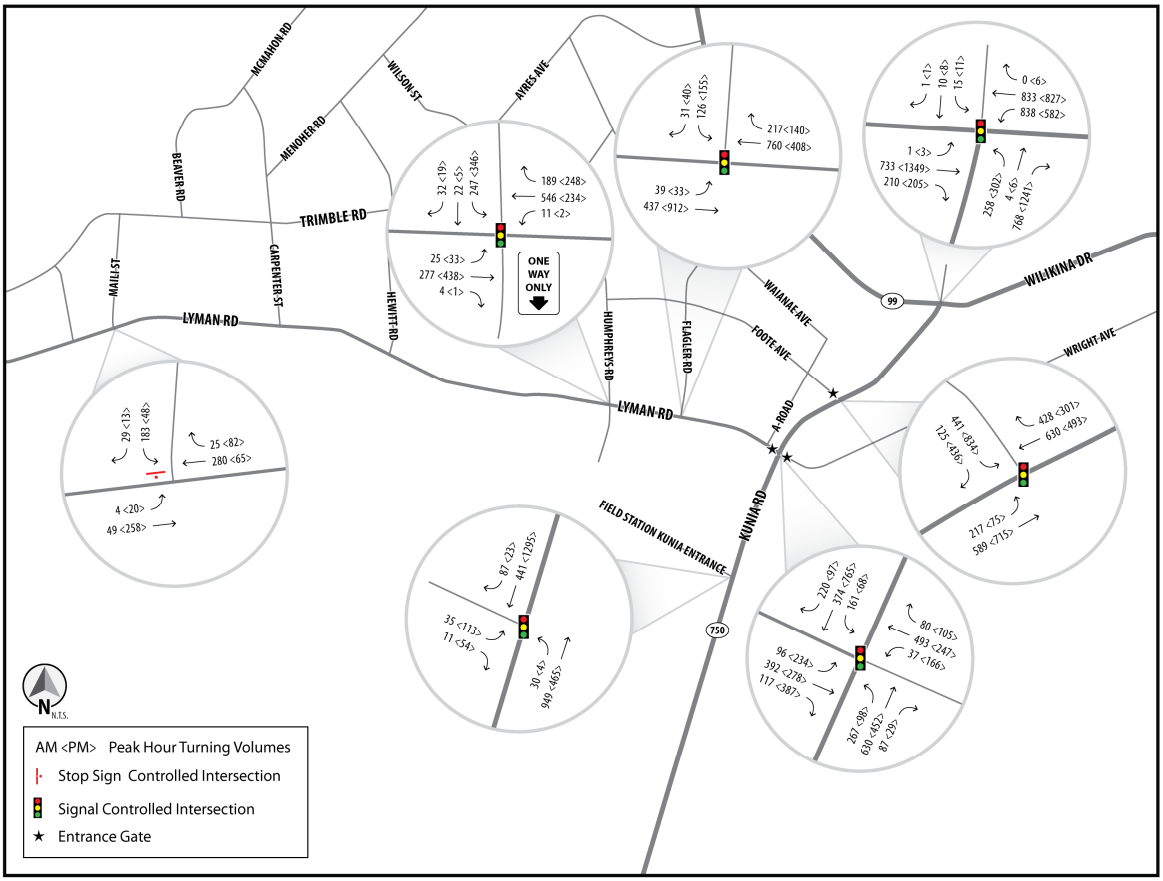


Figure 5. 2017 No-Build Peak Hour Traffic Volumes

Trafficware's *Synchro 8* was used to conduct the traffic operations analysis for the 2017 No-Build AM and PM peak hour scenario. ***Table 2*** lists the analysis results of the 2017 No-Build AM and PM peak hour traffic operations.

Appendix C provides detailed LOS output reports from Synchro.

The GTA facility generates significant traffic volumes in the study area. The Wilikina Drive / Kunia Road and Lyman Road / Kunia Road intersections operate in LOS E during the AM peak hours and LOS D during the PM peak hours. Long queues will be formed on all three legs of the Wilikina Drive and Kunia Road intersection. The Lyman Road and Kunia Road intersection would also have a longer queue. The Kunia Road northbound left turn queue will be longer than the available storage during AM peak hours, and spill back onto the through lane.

The new traffic signal at the Flagler Road and Lyman Road intersection will significantly improve traffic operations. The intersection is anticipated to operate at LOS C during 2017 No-Build AM peak hours and LOS B during PM peak hours.

The rest of the intersections operate at LOS D or better for both AM and PM peak hours in the 2017 No-Build scenario.

Table 2. 2017 No-Build Peak Hour LOS and Average Delay (sec/veh) Summary

Evaluated Intersection	*Intersection Control*	*2017 AM Peak*	*2017 PM Peak*
		LOS (Avg. Delay)	*LOS (Avg. Delay)*
Kunia Road & Wilikina Dr. (SR 99)	**Signalized**	**E** (61.0 sec/veh)	**D** (54.6 sec/veh)
Kunia Road & Foote Avenue	**Signalized**	**D** (36.2 sec/veh)	**D** (41.8 sec/veh)
Kunia Road & Lyman Road	**Signalized**	**E** (60.0 sec/veh)	**D** (51.9 sec/veh)
Kunia Road & Field Station Kunia Entrance	**Signalized**	**A** (7.6 sec/veh)	**D** (35.8 sec/veh)
Lyman Road & Flagler Road	**Signalized**	**C** (24.2 sec/veh)	**B** (13.1 sec/veh)
Lyman Road & Humphreys Road	**Signalized**	**C** (20.2 sec/veh)	**B** (14.7 sec/veh)
Lyman Road & Maili Street	**Stop Sign**	**C** (15.5 sec/veh)	**B** (14.4 sec/veh)

Note: sec/veh = seconds per vehicle.

5. TRAFFIC OPERATIONS DURING CONSTRUCTION

It is anticipated that by the end of 2017 the project will be built and fully occupied. 2017 is the construction and opening year for the project. The 2017 forecasted traffic demand during construction is comprised of four elements: (1) existing traffic, (2) background traffic growth, (3) GTA traffic, and (4) construction traffic. ***Figure 6*** shows the 2017 construction traffic volumes**.**

It is assumed that all construction traffic will access the site via a temporary construction access on Kunia Road south of the Field Station Kunia entrance intersection, and that all construction traffic will come from outside of the post. Construction, therefore, would only affect traffic on Kunia Road. The intersections inside the SB post will not be affected, and the operations will be the same as the No-Build operation.

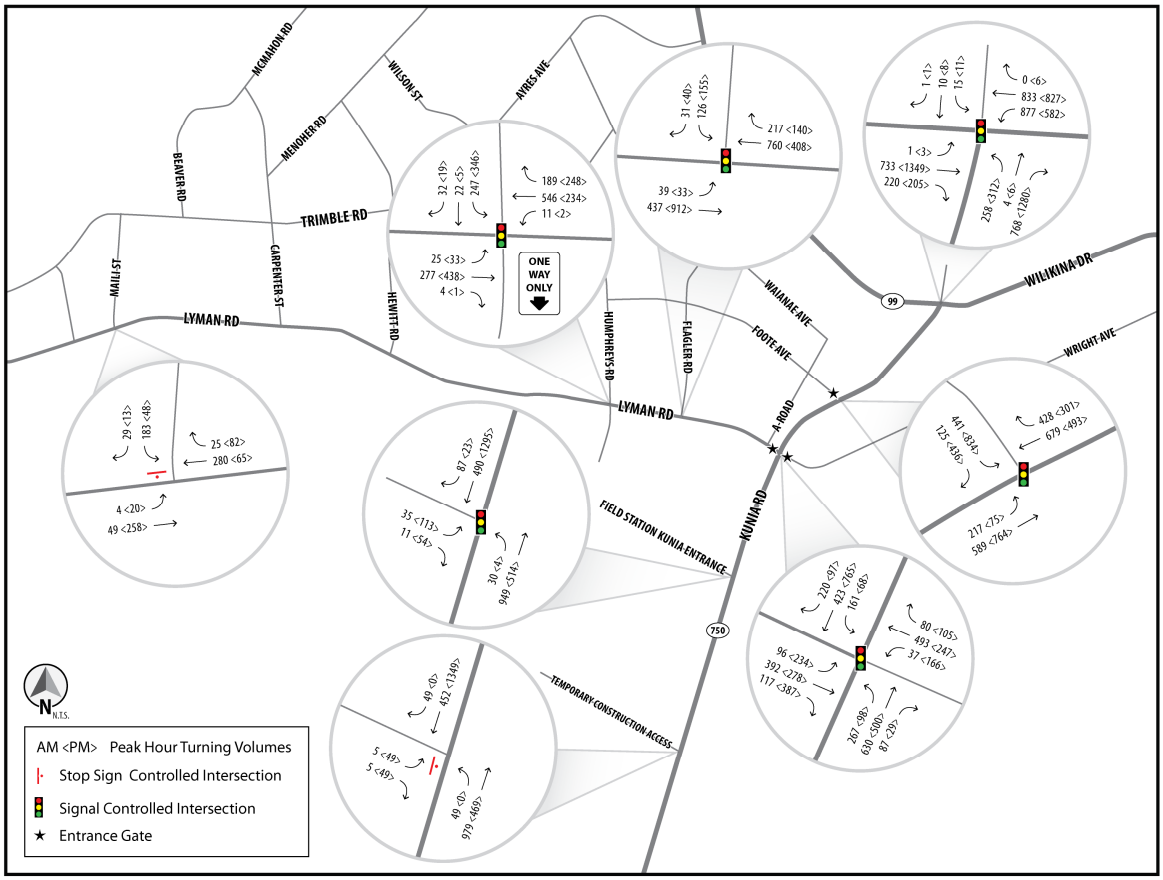


Figure 6. 2017 Peak Hour Traffic Volumes During Construction

2017 construction Synchro models are based on the 2017 No-Build Synchro model. It includes a new intersection on Kunia Road for the temporary construction access road. This intersection will be stop sign controlled with free traffic on Kunia Road.

Trafficware's *Synchro 8* was used to conduct the traffic operations analysis for the 2017 No-Build AM and PM peak hour scenario. ***Table 3*** lists the results of the existing AM and PM peak hour traffic operations.

Table 3. 2017 Construction Peak Hour LOS and Average Delay (sec/veh) Summary

Evaluated Intersection	*Intersection Control*	*2017 AM Peak*	*2017 PM Peak*
		LOS (Avg. Delay)	*LOS (Avg. Delay)*
Kunia Road & Wilikina Dr. (SR 99)	**Signalized**	**E** (64.6 sec/veh)	**E** (56.7 sec/veh)
Kunia Road & Foote Avenue	**Signalized**	**D** (36.6 sec/veh)	**D** (43.3 sec/veh)
Kunia Road & Lyman Road	**Signalized**	**E** (60.7 sec/veh)	**D** (51.8 sec/veh)
Kunia Road & Field Station Kunia Entrance	**Signalized**	**A** (7.7 sec/veh)	**D** (35.0 sec/veh)
Kunia Road & Construction Access Rd	**Stop Sign**	**E** (36.5 sec/veh)	**F** (234.5 sec/veh

Note: sec/veh = seconds per vehicle.

Appendix C provides detailed LOS output reports from Synchro.

The construction traffic will add to the existing traffic congestion within the study area. Although the LOS for the Wilikina Drive and Kunia Road intersection increased from LOS D to LOS E during the PM peak hours, the average delays only increased 2.1 seconds per vehicle. The increase of average control delays for all intersections is less than 4 seconds per vehicle, compared with the 2017 No-Build scenario. The queues and delays are slightly longer on Kunia Road, but the overall traffic impacts generated from construction vehicles are minor.

The vehicle leaving the temporary construction access road intersection will experience delays due to the high volumes on Kunia Road. The traffic on Kunia Road will be minimal. To avoid delays, it is recommended that construction vehicles leaving the site be limited to off-peak hours when possible.

6. 2017 BUILT TRAFFIC OPERATIONS

The Build scenario assumes the project has been constructed and is fully operational. It will include the traffic generated from the GTA facilities and the additional traffic signal at the Flagler Road and Lyman Road intersection. The 2017 Build scenario traffic comprises four elements: (1) existing traffic, (2) background traffic growth, (3) GTA traffic, and (4) facility operational traffic.

All operational traffic will go through the Lyman Gate intersection. It will only affect general traffic during AM peak hours and there will be minimal operational traffic during PM peak hours. ***Figure 7*** shows the 2017 Build traffic AM peak hour volumes**.**

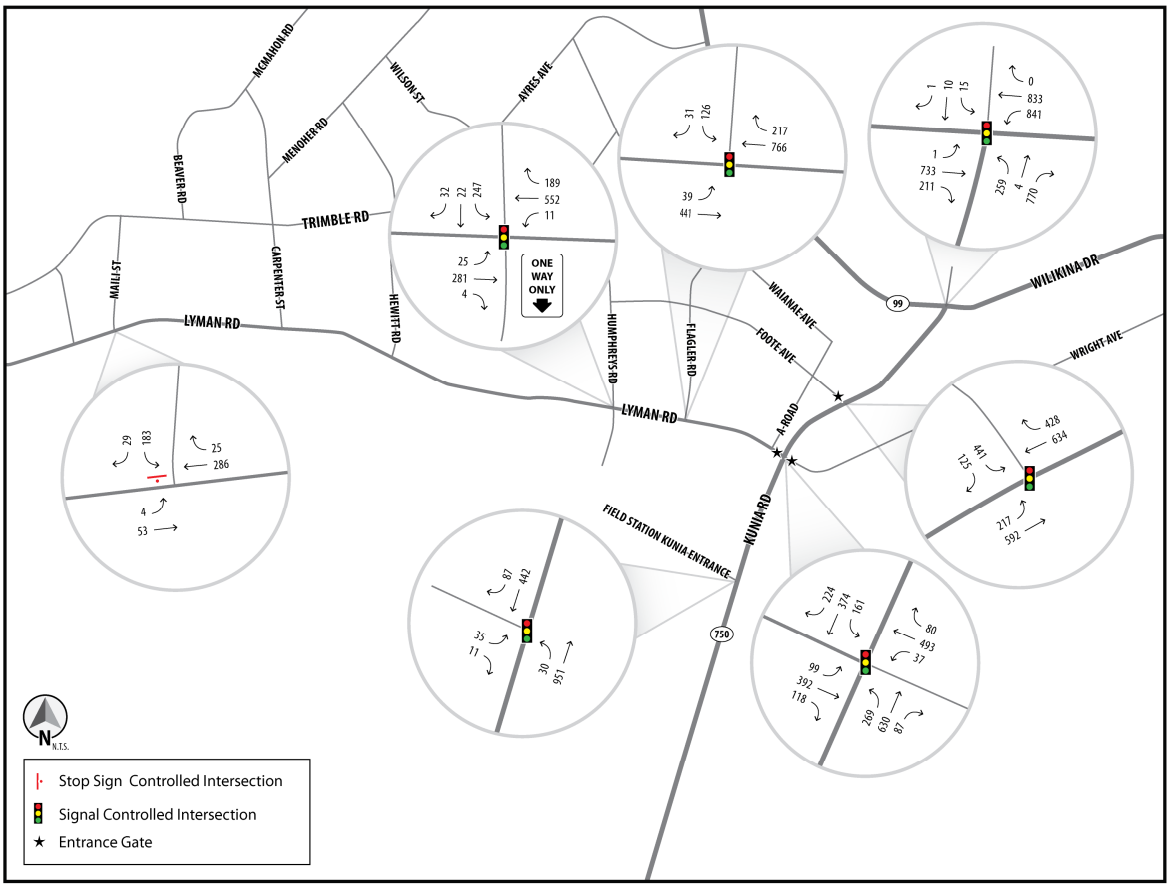


Figure 7. 2017 Build AM Peak Hour Traffic Volumes

2017 Build Synchro models are based on the 2017 No-Build Synchro model. The temporary construction access road is removed from the network.

Trafficware's *Synchro 8* was used to conduct the traffic operations analysis for the 2017 Build AM peak hour scenario. The 2017 Build PM peak hour operation is the same as the 2017 No-Build operation. ***Table 4*** lists the results of the 2017 Build AM peak hour traffic operational analysis. The PM peak hour result is copied from the 2017 No-Build scenario.

Table 4. 2017 Build Peak Hour LOS and Average Delay (sec/veh) Summary

Evaluated Intersection	*Intersection Control*	*2017 AM Peak*	*2017 PM Peak*
		LOS (Avg. Delay)	*LOS (Avg. Delay)*
Kunia Road & Wilikina Dr. (SR 99)	**Signalized**	**E** (61.4 sec/veh)	**D** (54.6 sec/veh)
Kunia Road & Foote Avenue	**Signalized**	**D** (36.2 sec/veh)	**D** (41.8 sec/veh)
Kunia Road & Lyman Road	**Signalized**	**E** (60.6 sec/veh)	**D** (51.9 sec/veh)
Kunia Road & Field Station Kunia Entrance	**Signalized**	**A** (7.6 sec/veh)	**D** (35.8 sec/veh)
Lyman Road & Flagler Road	**Signalized**	**C** (24.8 sec/veh)	**B** (13.1 sec/veh)
Lyman Road & Humphreys Road	**Signalized**	**C** (20.5 sec/veh)	**B** (14.7 sec/veh)
Lyman Road & Maili Street	**Stop Sign**	**C** (15.8 sec/veh)	**B** (14.4 sec/veh)

Note: sec/veh = seconds per vehicle.

Appendix C provides detailed LOS output reports from Synchro.

The facility operational traffic volume is small and only has minimal traffic impact during the AM peak hours. The average traffic delays increase less than 1 second per vehicle during the AM peak hour when compared with the No-Build scenario, and there are no noticeable impacts to queue lengths. All study intersections on the post operate in LOS C during the AM peak hours. No traffic impact is anticipated during the PM peak hours.

7. CONCLUSION

The traffic study analyzed traffic operations of eight intersections on Kunia Road and Lyman Road near SB. Today, the traffic on Kunia Road experiences delays and long queues at intersections during peak hours. By 2017 the traffic in the network will increase from the background growth and the completion of the GTA Phase 1 project. Traffic conditions will be worse on Kunia Road and Lyman Road as traffic demand increases.

The addition of traffic signal and intersection movements on the Flagler Road and Lyman Road intersection are necessary and will improve the operations dramatically compared with the current stop sign-controlled intersections.

The construction and operation of the SGSP project will generate more traffic volumes on the roadway network. These project-generated traffic volumes are small, and will not significantly affect traffic. Compared with the future No-Build scenario, the increase on average vehicle delays from construction traffic is less than 4 seconds per vehicle, and less than 1 second per vehicle for operational traffic during the AM peak hours. There is no traffic impact from operational traffic during the PM peak hour. Overall, the impact from the facility operation traffic is negligible.

The temporary construction access road will have long delays for the construction traffic. It is recommended that limiting the construction traffic to off-peak periods of time to reduce delays be considered if feasible. However, the construction traffic impacts to the general traffic are small because of the low volumes of construction traffic compared to general traffic during the peak hours.

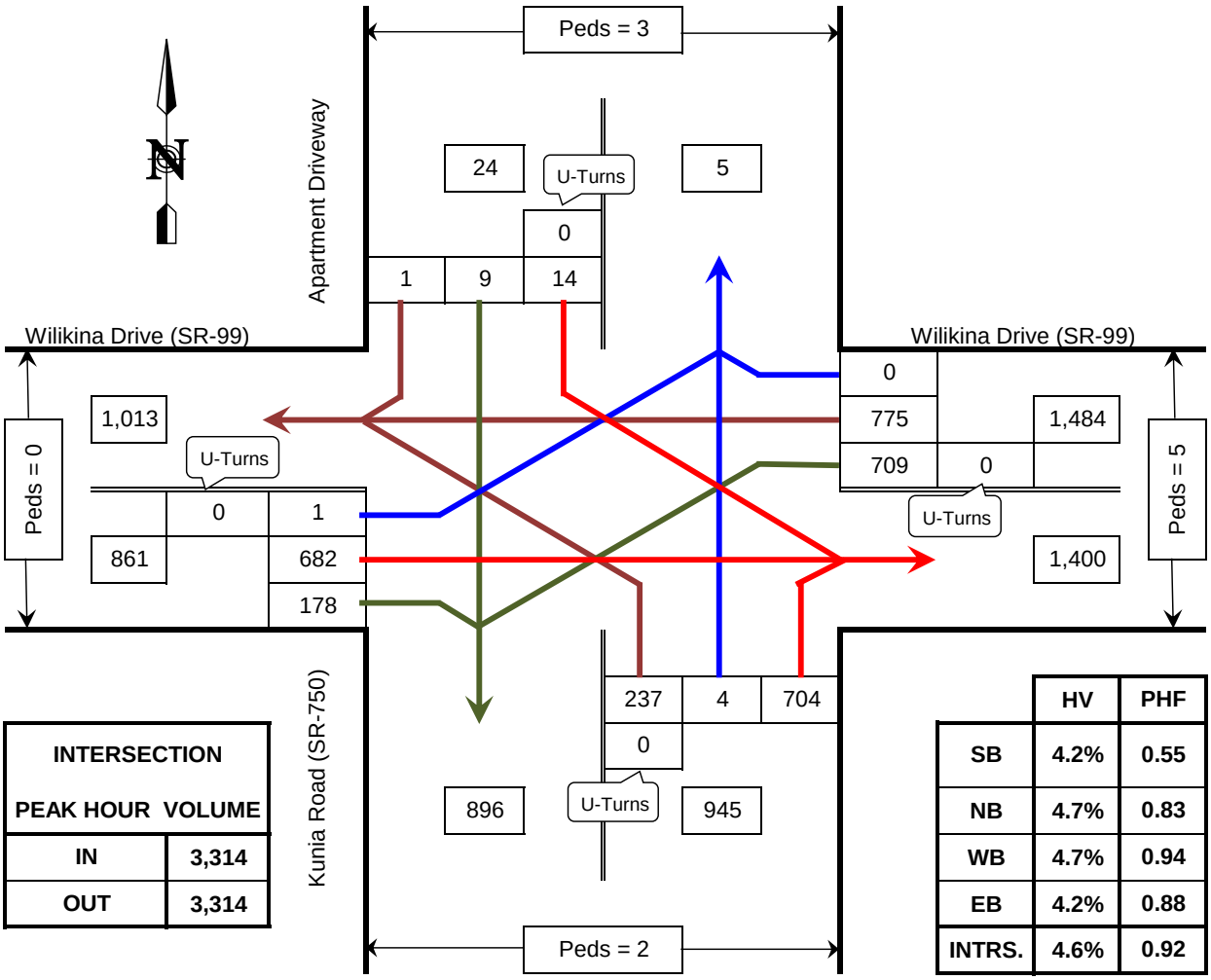
Traffic Study
Appendix A.

Traffic Count Data

TRAFFIC DATA GATHERING

TURNING MOVEMENTS DIAGRAM

7:30 AM - 9:30 AM PEAK HOUR: 7:30 AM TO 8:30 AM



INTERSECTION PEAK HOUR VOLUME	
IN	3,314
OUT	3,314

	HV	PHF
SB	4.2%	0.55
NB	4.7%	0.83
WB	4.7%	0.94
EB	4.2%	0.88
INTRS.	4.6%	0.92

PHF = Peak Hour Factor
HV = Heavy Vehicles

Kunia Road (SR-750) @ Wilikina Drive (SR-99)

Schofield Barracks, HI

COUNTED BY: CN

REDUCED BY: CN

REDUCTION DATE: Fri. 2/28/14

DATE OF COUNT: Thu. 2/27/14

TIME OF COUNT: 7:30 AM - 9:30 AM

WEATHER: Sunny

TRAFFIC DATA GATHERING

INTERSECTION TURNING MOVEMENTS REDUCTION SHEET

LOCATION: Kunia Road (SR-750) @ Wilikina Drive (SR-99)
Schofield Barracks, HI

DATE OF COUNT: Thu. 2/27/14
TIME OF COUNT: 7:30 AM - 9:30 AM

COUNTED BY: CN
WEATHER: Sunny

TIME INTERVAL ENDING AT	FROM NORTH ON Apartment Driveway						FROM SOUTH ON Kunia Road (SR-750)						FROM EAST ON Wilikina Drive (SR-99)						FROM WEST ON Wilikina Drive (SR-99)						INTERVAL TOTALS
	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	
05:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
06:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
06:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
06:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
06:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
07:45 AM	1	1	0	6	5	0	2	10	0	65	2	216	5	21	0	165	196	0	0	6	0	0	189	57	**901**
08:00 AM	0	0	0	4	2	1	0	12	0	53	0	176	0	17	0	180	214	0	0	10	0	1	155	51	**837**
08:15 AM	1	0	0	2	1	0	0	13	0	62	1	190	0	17	0	182	175	0	0	8	0	0	161	36	**810**
08:30 AM	1	0	0	2	1	0	0	9	0	57	1	122	0	15	0	182	190	0	0	12	0	0	177	34	**766**
08:45 AM	0	0	0	0	2	0	0	7	0	30	0	98	0	15	0	148	178	0	0	2	0	0	163	27	**646**
09:00 AM	5	0	0	5	1	0	1	10	0	50	0	109	0	14	0	151	216	0	0	8	0	0	128	38	**698**
09:15 AM	0	0	0	2	1	0	0	5	0	38	0	102	0	18	0	200	206	0	0	10	0	0	152	27	**728**
09:30 AM	0	1	0	3	0	0	2	5	0	39	0	109	2	15	0	141	161	0	0	10	0	0	124	43	**620**
PEAK HOUR TOTALS	**3**	**1**	**0**	**14**	**9**	**1**	**2**	**44**	**0**	**237**	**4**	**704**	**5**	**70**	**0**	**709**	**775**	**0**	**0**	**36**	**0**	**1**	**682**	**178**	**INTERSECTION**
ALL MOVEMENTS	**24**						**945**						**1484**						**861**						**3314**
% HV	**4.2%**						**4.7%**						**4.7%**						**4.2%**						**4.6%**
PEAK HOUR FACTOR	**0.55**						**0.83**						**0.94**						**0.88**						**0.92**

PHF = Peak Hour Factor

7:30 AM - 9:30 AM PEAK HOUR: 7:30 AM TO 8:30 AM

REDUCED BY: CN

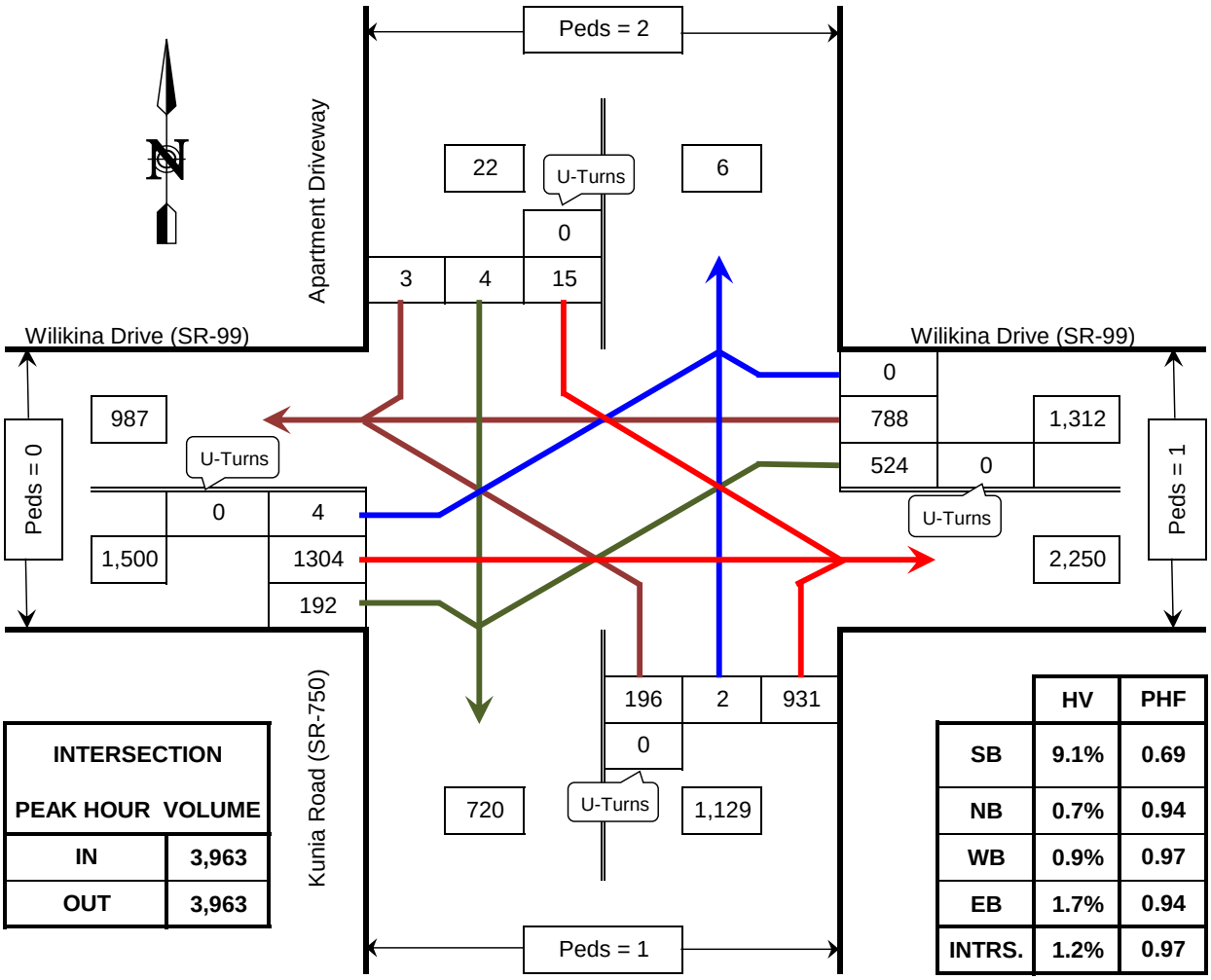
DATE OF REDUCTION: 2/28/2014

	FROM NORTH ON Apartment Driveway						FROM SOUTH ON Kunia Road (SR-750)						FROM EAST ON Wilikina Drive (SR-99)						FROM WEST ON Wilikina Drive (SR-99)						INTERVAL TOTALS
TIME INTERVAL	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	
5:30 AM - 6:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
5:45 AM - 6:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
6:00 AM - 7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
6:15 AM - 7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
6:30 AM - 7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
6:45 AM - 7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
7:00 AM - 8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
7:15 AM - 8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
7:30 AM - 8:30 AM	3	1	0	14	9	1	2	44	0	237	4	704	5	70	0	709	775	0	0	36	0	1	682	178	**3314**
7:45 AM - 8:45 AM	2	0	0	8	6	1	0	41	0	202	2	586	0	64	0	692	757	0	0	32	0	1	656	148	**3059**
8:00 AM - 9:00 AM	7	0	0	9	5	0	1	39	0	199	2	519	0	61	0	663	759	0	0	30	0	0	629	135	**2920**
8:15 AM - 9:15 AM	6	0	0	9	5	0	1	31	0	175	1	431	0	62	0	681	790	0	0	32	0	0	620	126	**2838**
8:30 AM - 9:30 AM	5	1	0	10	4	0	3	27	0	157	0	418	2	62	0	640	761	0	0	30	0	0	567	135	**2692**

TRAFFIC DATA GATHERING

TURNING MOVEMENTS DIAGRAM

3:30 PM - 5:30 PM PEAK HOUR: 4:15 PM TO 5:15 PM



INTERSECTION PEAK HOUR VOLUME	
IN	3,963
OUT	3,963

	HV	PHF
SB	9.1%	0.69
NB	0.7%	0.94
WB	0.9%	0.97
EB	1.7%	0.94
INTRS.	1.2%	0.97

PHF = Peak Hour Factor
HV = Heavy Vehicles

Kunia Road (SR-750) @ Wilikina Drive (SR-99)

Schofield Barracks, HI

COUNTED BY: CN

REDUCED BY: CN

REDUCTION DATE: Fri. 2/28/14

DATE OF COUNT: Thu. 2/27/14

TIME OF COUNT: 3:30 PM - 5:30 PM

WEATHER: Sunny

TRAFFIC DATA GATHERING

INTERSECTION TURNING MOVEMENTS REDUCTION SHEET

LOCATION: Kunia Road (SR-750) @ Wilikina Drive (SR-99)
Schofield Barracks, HI

DATE OF COUNT: Thu. 2/27/14
TIME OF COUNT: 3:30 PM - 5:30 PM

COUNTED BY: CN
WEATHER: Sunny

TIME INTERVAL ENDING AT	FROM NORTH ON Apartment Driveway						FROM SOUTH ON Kunia Road (SR-750)						FROM EAST ON Wilikina Drive (SR-99)						FROM WEST ON Wilikina Drive (SR-99)						INTERVAL TOTALS
	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	
01:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
02:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
02:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
02:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
02:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
03:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
03:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
03:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
03:45 PM	3	0	0	2	1	0	1	9	0	53	0	241	1	5	0	121	187	6	0	7	0	0	278	28	**917**
04:00 PM	1	0	0	3	3	0	0	2	0	51	3	240	0	9	0	113	200	0	0	10	0	0	305	43	**961**
04:15 PM	0	0	0	2	2	0	2	2	0	65	1	221	2	4	0	91	174	0	0	8	0	2	320	48	**926**
04:30 PM	2	1	0	3	0	1	0	3	0	57	1	230	0	5	0	128	208	0	0	2	0	1	352	41	**1022**
04:45 PM	0	1	0	5	2	1	0	1	0	36	1	222	0	2	0	118	196	0	0	9	0	1	343	55	**980**
05:00 PM	0	0	0	3	1	1	1	2	0	49	0	251	1	2	0	152	186	0	0	9	0	2	291	55	**991**
05:15 PM	0	0	0	4	1	0	0	2	0	54	0	228	0	3	0	126	198	0	0	6	0	0	318	41	**970**
05:30 PM	3	0	0	1	0	0	1	1	0	89	1	243	0	2	0	138	174	0	0	9	0	1	303	44	**994**
PEAK HOUR TOTALS	**2**	**2**	**0**	**15**	**4**	**3**	**1**	**8**	**0**	**196**	**2**	**931**	**1**	**12**	**0**	**524**	**788**	**0**	**0**	**26**	**0**	**4**	**1304**	**192**	**INTERSECTION**
ALL MOVEMENTS	**22**						**1129**						**1312**						**1500**						**3963**
% HV	**9.1%**						**0.7%**						**0.9%**						**1.7%**						**1.2%**
PEAK HOUR FACTOR	**0.69**						**0.94**						**0.97**						**0.94**						**0.97**

PHF = Peak Hour Factor

3:30 PM - 5:30 PM PEAK HOUR: **4:15 PM TO 5:15 PM**

REDUCED BY: CN

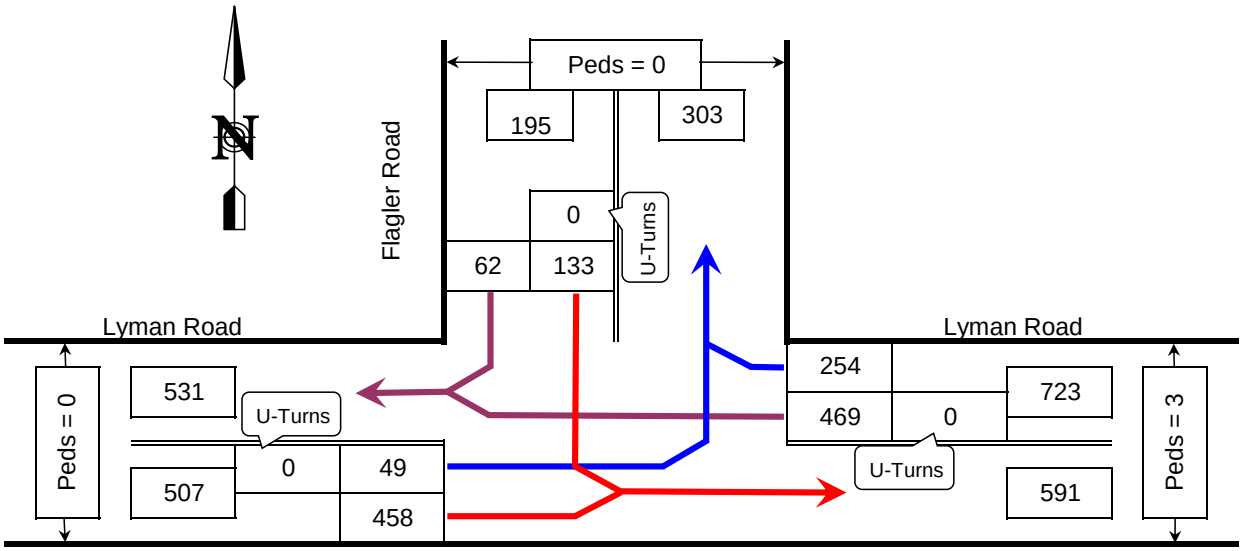
DATE OF REDUCTION: 2/28/2014

	FROM NORTH ON Apartment Driveway						FROM SOUTH ON Kunia Road (SR-750)						FROM EAST ON Wilikina Drive (SR-99)						FROM WEST ON Wilikina Drive (SR-99)						INTERVAL TOTALS
TIME INTERVAL	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	
1:30 PM - 2:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
1:45 PM - 2:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2:00 PM - 3:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2:15 PM - 3:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2:30 PM - 3:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2:45 PM - 3:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
3:00 PM - 4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
3:15 PM - 4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
3:30 PM - 4:30 PM	6	1	0	10	6	1	3	16	0	226	5	932	3	23	0	453	769	6	0	27	0	3	1255	160	**3826**
3:45 PM - 4:45 PM	3	2	0	13	7	2	2	8	0	209	6	913	2	20	0	450	778	0	0	29	0	4	1320	187	**3889**
4:00 PM - 5:00 PM	2	2	0	13	5	3	3	8	0	207	3	924	3	13	0	489	764	0	0	28	0	6	1306	199	**3919**
4:15 PM - 5:15 PM	2	2	0	15	4	3	1	8	0	196	2	931	1	12	0	524	788	0	0	26	0	4	1304	192	**3963**
4:30 PM - 5:30 PM	3	1	0	13	4	2	2	6	0	228	2	944	1	9	0	534	754	0	0	33	0	4	1255	195	**3935**

TRAFFIC DATA GATHERING

TURNING MOVEMENTS DIAGRAM

7:30 AM - 9:30 AM PEAK HOUR: 8:30 AM TO 9:30 AM



INTERSECTION PEAK HOUR VOLUME	
IN	1,425
OUT	1,425

	HV	PHF
SB	1.5%	0.86
WB	6.6%	0.89
EB	11.6%	0.84
INTRS.	7.7%	0.89

HV = Heavy Vehicles
PHF = Peak Hour Factor

Lyman Road @ Flagler Road

Schofield Barracks, HI

COUNTED BY: SN

DATE OF COUNT: Thu. 2/27/14

REDUCED BY: CN

TIME OF COUNT: 7:30 AM - 9:30 AM

REDUCTION DATE: Fri. 2/28/14

WEATHER: Sunny

TRAFFIC DATA GATHERING

INTERSECTION TURNING MOVEMENTS REDUCTION SHEET

LOCATION: Lyman Road @ Flagler Road
Schofield Barracks, HI

DATE OF COUNT: Thu. 2/27/14
TIME OF COUNT: 7:30 AM - 9:30 AM

COUNTED BY: SN
WEATHER: Sunny

TIME INTERVAL ENDING AT	FROM NORTH ON Flagler Road						FROM SOUTH ON						FROM EAST ON Lyman Road						FROM WEST ON Lyman Road						INTERVAL TOTALS
	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	
05:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
06:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
06:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
06:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
06:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
07:45 AM	0	0	0	26	0	4	0	0	0	0	0	0	0	10	0	0	130	16	0	9	0	14	129	0	**319**
08:00 AM	0	1	0	21	0	13	0	0	0	0	0	0	2	6	0	0	113	54	0	6	0	6	75	0	**282**
08:15 AM	0	2	0	23	0	7	0	0	0	0	0	0	0	7	0	0	151	90	0	5	0	3	77	0	**351**
08:30 AM	0	1	0	47	0	5	0	0	0	0	0	0	0	10	0	0	118	42	0	6	0	13	98	0	**323**
08:45 AM	0	2	0	35	0	9	0	0	0	0	0	0	2	12	0	0	119	48	0	8	0	9	97	0	**317**
09:00 AM	0	1	0	30	0	15	0	0	0	0	0	0	0	15	0	0	110	61	0	5	0	9	91	0	**316**
09:15 AM	0	0	0	29	0	20	0	0	0	0	0	0	1	9	0	0	115	87	0	14	0	17	133	0	**401**
09:30 AM	0	0	0	39	0	18	0	0	0	0	0	0	0	12	0	0	125	58	0	32	0	14	137	0	**391**
PEAK HOUR TOTALS	**0**	**3**	**0**	**133**	**0**	**62**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**48**	**0**	**0**	**469**	**254**	**0**	**59**	**0**	**49**	**458**	**0**	**INTERSECTION**
ALL MOVEMENTS	**195**						**0**						**723**						**507**						**1425**
% HV	**1.5%**						**#N/A**						**6.6%**						**11.6%**						**7.7%**
PEAK HOUR FACTOR	**0.86**						**#N/A**						**0.89**						**0.84**						**0.89**

PHF = Peak Hour Factor

7:30 AM - 9:30 AM PEAK HOUR: 8:30 AM TO 9:30 AM

REDUCED BY: CN

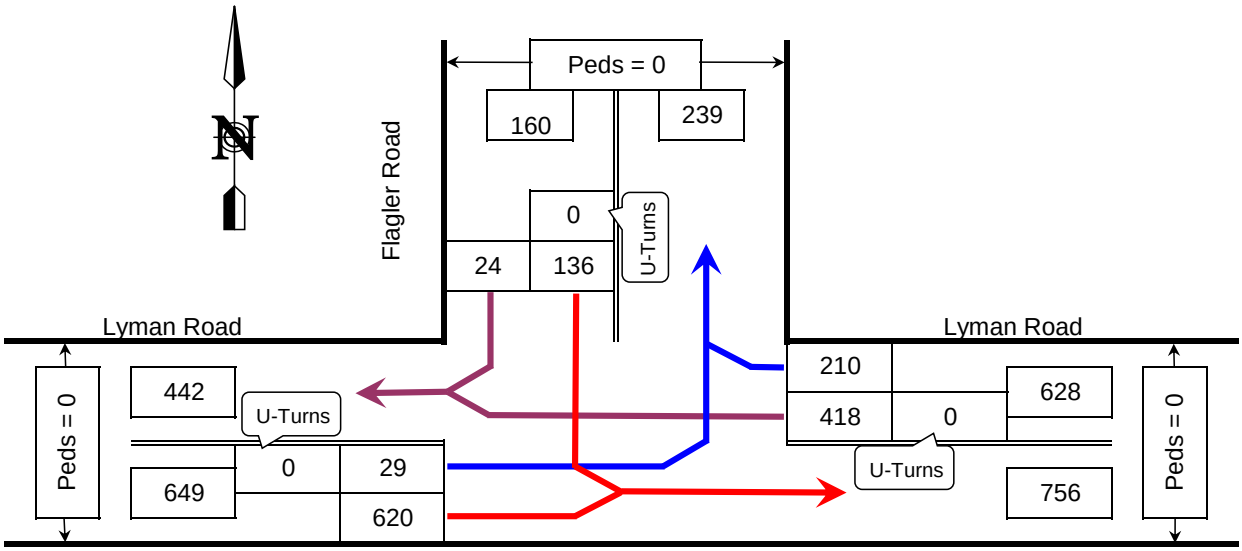
DATE OF REDUCTION: 2/28/2014

	FROM NORTH ON Flagler Road						FROM SOUTH ON						FROM EAST ON Lyman Road						FROM WEST ON Lyman Road						INTERVAL TOTALS
TIME INTERVAL	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	
5:30 AM - 6:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
5:45 AM - 6:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
6:00 AM - 7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
6:15 AM - 7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
6:30 AM - 7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
6:45 AM - 7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
7:00 AM - 8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
7:15 AM - 8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
7:30 AM - 8:30 AM	0	4	0	117	0	29	0	0	0	0	0	0	2	33	0	0	512	202	0	26	0	36	379	0	**1275**
7:45 AM - 8:45 AM	0	6	0	126	0	34	0	0	0	0	0	0	4	35	0	0	501	234	0	25	0	31	347	0	**1273**
8:00 AM - 9:00 AM	0	6	0	135	0	36	0	0	0	0	0	0	2	44	0	0	498	241	0	24	0	34	363	0	**1307**
8:15 AM - 9:15 AM	0	4	0	141	0	49	0	0	0	0	0	0	3	46	0	0	462	238	0	33	0	48	419	0	**1357**
8:30 AM - 9:30 AM	0	3	0	133	0	62	0	0	0	0	0	0	3	48	0	0	469	254	0	59	0	49	458	0	**1425**

TRAFFIC DATA GATHERING

TURNING MOVEMENTS DIAGRAM

3:30 PM - 5:30 PM PEAK HOUR: 4:30 PM TO 5:30 PM



INTERSECTION PEAK HOUR VOLUME	
IN	1,437
OUT	1,437

	HV	PHF
SB	1.9%	0.87
WB	0.6%	0.90
EB	1.4%	0.92
INTRS.	1.1%	0.92

HV = Heavy Vehicles
PHF = Peak Hour Factor

Lyman Road @ Flagler Road

Schofield Barracks, HI

COUNTED BY: SN

DATE OF COUNT: Thu. 2/27/14

REDUCED BY: CN

TIME OF COUNT: 3:30 PM - 5:30 PM

REDUCTION DATE: Fri. 2/28/14

WEATHER: Sunny

TRAFFIC DATA GATHERING

INTERSECTION TURNING MOVEMENTS REDUCTION SHEET

LOCATION: Lyman Road @ Flagler Road
Schofield Barracks, HI

DATE OF COUNT: Thu. 2/27/14
TIME OF COUNT: 3:30 PM - 5:30 PM

COUNTED BY: SN
WEATHER: Sunny

TIME INTERVAL ENDING AT	FROM NORTH ON Flagler Road						FROM SOUTH ON						FROM EAST ON Lyman Road						FROM WEST ON Lyman Road						INTERVAL TOTALS
	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	
01:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
02:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
02:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
02:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
02:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
03:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
03:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
03:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
03:45 PM	0	0	0	39	0	13	0	0	0	0	0	0	0	3	0	0	88	38	0	5	0	10	162	0	**350**
04:00 PM	0	0	0	37	0	5	0	0	0	0	0	0	0	1	0	0	78	22	1	2	0	7	185	0	**334**
04:15 PM	0	0	0	38	0	13	0	0	0	0	0	0	0	5	0	0	97	30	0	3	0	8	142	0	**328**
04:30 PM	0	1	0	30	0	6	0	0	0	0	0	0	0	5	0	0	89	40	0	3	0	6	164	0	**335**
04:45 PM	0	1	0	27	0	6	0	0	0	0	0	0	0	2	0	0	105	51	0	2	0	10	167	0	**366**
05:00 PM	0	1	0	39	0	7	0	0	0	0	0	0	0	1	0	0	87	37	0	3	0	5	141	0	**316**
05:15 PM	0	0	0	37	0	3	0	0	0	0	0	0	0	1	0	0	111	62	0	2	0	5	172	0	**390**
05:30 PM	0	1	0	33	0	8	0	0	0	0	0	0	0	0	0	0	115	60	0	2	0	9	140	0	**365**
PEAK HOUR TOTALS	**0**	**3**	**0**	**136**	**0**	**24**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**418**	**210**	**0**	**9**	**0**	**29**	**620**	**0**	**INTERSECTION**
ALL MOVEMENTS	**160**						**0**						**628**						**649**						**1437**
% HV	**1.9%**						**#N/A**						**0.6%**						**1.4%**						**1.1%**
PEAK HOUR FACTOR	**0.87**						**#N/A**						**0.90**						**0.92**						**0.92**

PHF = Peak Hour Factor

3:30 PM - 5:30 PM PEAK HOUR: 4:30 PM TO 5:30 PM

REDUCED BY: CN

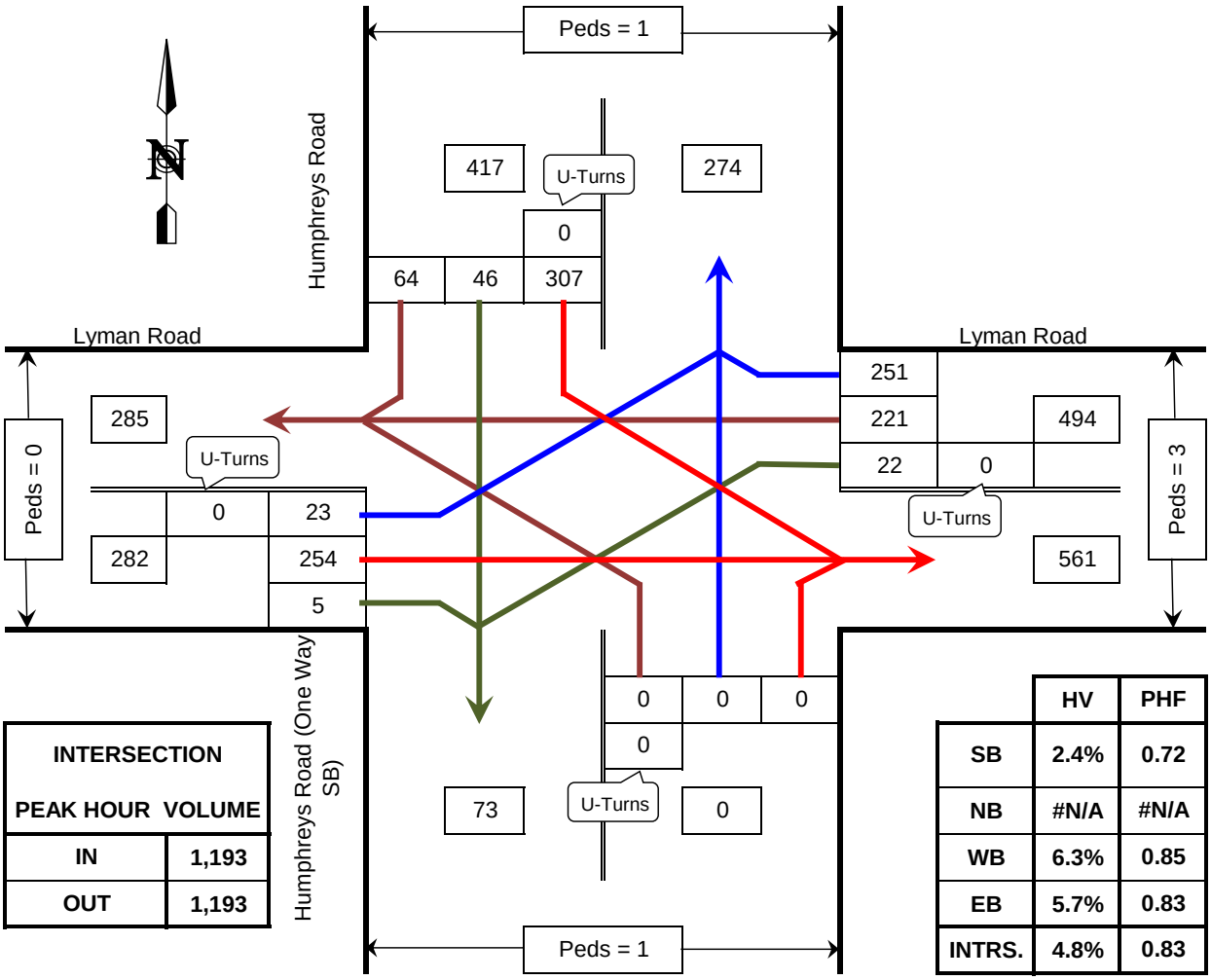
DATE OF REDUCTION: 2/28/2014

	FROM NORTH ON Flagler Road						FROM SOUTH ON						FROM EAST ON Lyman Road						FROM WEST ON Lyman Road						INTERVAL TOTALS
TIME INTERVAL	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	
1:30 PM - 2:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
1:45 PM - 2:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2:00 PM - 3:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2:15 PM - 3:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2:30 PM - 3:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2:45 PM - 3:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
3:00 PM - 4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
3:15 PM - 4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
3:30 PM - 4:30 PM	0	1	0	144	0	37	0	0	0	0	0	0	0	14	0	0	352	130	1	13	0	31	653	0	**1347**
3:45 PM - 4:45 PM	0	2	0	132	0	30	0	0	0	0	0	0	0	13	0	0	369	143	1	10	0	31	658	0	**1363**
4:00 PM - 5:00 PM	0	3	0	134	0	32	0	0	0	0	0	0	0	13	0	0	378	158	0	11	0	29	614	0	**1345**
4:15 PM - 5:15 PM	0	3	0	133	0	22	0	0	0	0	0	0	0	9	0	0	392	190	0	10	0	26	644	0	**1407**
4:30 PM - 5:30 PM	0	3	0	136	0	24	0	0	0	0	0	0	0	4	0	0	418	210	0	9	0	29	620	0	**1437**

TRAFFIC DATA GATHERING

TURNING MOVEMENTS DIAGRAM

7:30 AM - 9:30 AM PEAK HOUR: 8:30 AM TO 9:30 AM



INTERSECTION PEAK HOUR VOLUME	
IN	1,193
OUT	1,193

	HV	PHF
SB	2.4%	0.72
NB	#N/A	#N/A
WB	6.3%	0.85
EB	5.7%	0.83
INTRS.	4.8%	0.83

PHF = Peak Hour Factor
HV = Heavy Vehicles

Lyman Road @ Humphreys Road

Schofield Barracks, HI

COUNTED BY: SN

DATE OF COUNT: Wed. 2/26/14

REDUCED BY: CN

TIME OF COUNT: 7:30 AM - 9:30 AM

REDUCTION DATE: Fri. 2/28/14

WEATHER: Sunny

TRAFFIC DATA GATHERING

INTERSECTION TURNING MOVEMENTS REDUCTION SHEET

LOCATION: Lyman Road @ Humphreys Road
Schofield Barracks, HI

DATE OF COUNT: Wed. 2/26/14
TIME OF COUNT: 7:30 AM - 9:30 AM

COUNTED BY: SN
WEATHER: Sunny

TIME INTERVAL ENDING AT	FROM NORTH ON Humphreys Road						FROM SOUTH ON Humphreys Road (One Way SB)						FROM EAST ON Lyman Road						FROM WEST ON Lyman Road						INTERVAL TOTALS
	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	
05:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
06:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
06:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
06:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
06:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
07:45 AM	0	3	0	66	3	5	24	0	0	0	0	0	16	8	0	0	82	51	9	5	0	6	72	1	**286**
08:00 AM	0	5	0	58	7	7	1	0	0	0	0	0	16	5	0	2	93	32	7	2	0	0	40	1	**240**
08:15 AM	1	2	0	58	7	15	2	0	0	0	0	0	0	7	0	6	84	47	1	2	0	8	63	1	**289**
08:30 AM	0	1	0	48	3	3	1	0	0	0	0	0	0	5	0	2	54	46	1	6	0	9	55	1	**221**
08:45 AM	1	5	0	57	1	13	1	0	0	0	0	0	0	7	0	2	53	50	0	2	0	3	38	0	**217**
09:00 AM	0	1	0	65	9	14	0	0	0	0	0	0	0	13	0	1	70	75	0	3	0	6	78	1	**319**
09:15 AM	0	2	0	78	24	12	0	0	0	0	0	0	2	2	0	12	48	50	0	8	0	6	66	2	**298**
09:30 AM	0	2	0	107	12	25	0	0	0	0	0	0	1	9	0	7	50	76	0	3	0	8	72	2	**359**
PEAK HOUR TOTALS	**1**	**10**	**0**	**307**	**46**	**64**	**1**	**0**	**0**	**0**	**0**	**0**	**3**	**31**	**0**	**22**	**221**	**251**	**0**	**16**	**0**	**23**	**254**	**5**	**INTERSECTION**
ALL MOVEMENTS	**417**						**0**						**494**						**282**						**1193**
% HV	**2.4%**						**#N/A**						**6.3%**						**5.7%**						**4.8%**
PEAK HOUR FACTOR	**0.72**						**#N/A**						**0.85**						**0.83**						**0.83**

PHF = Peak Hour Factor

7:30 AM - 9:30 AM PEAK HOUR: **8:30 AM TO 9:30 AM**

REDUCED BY: CN

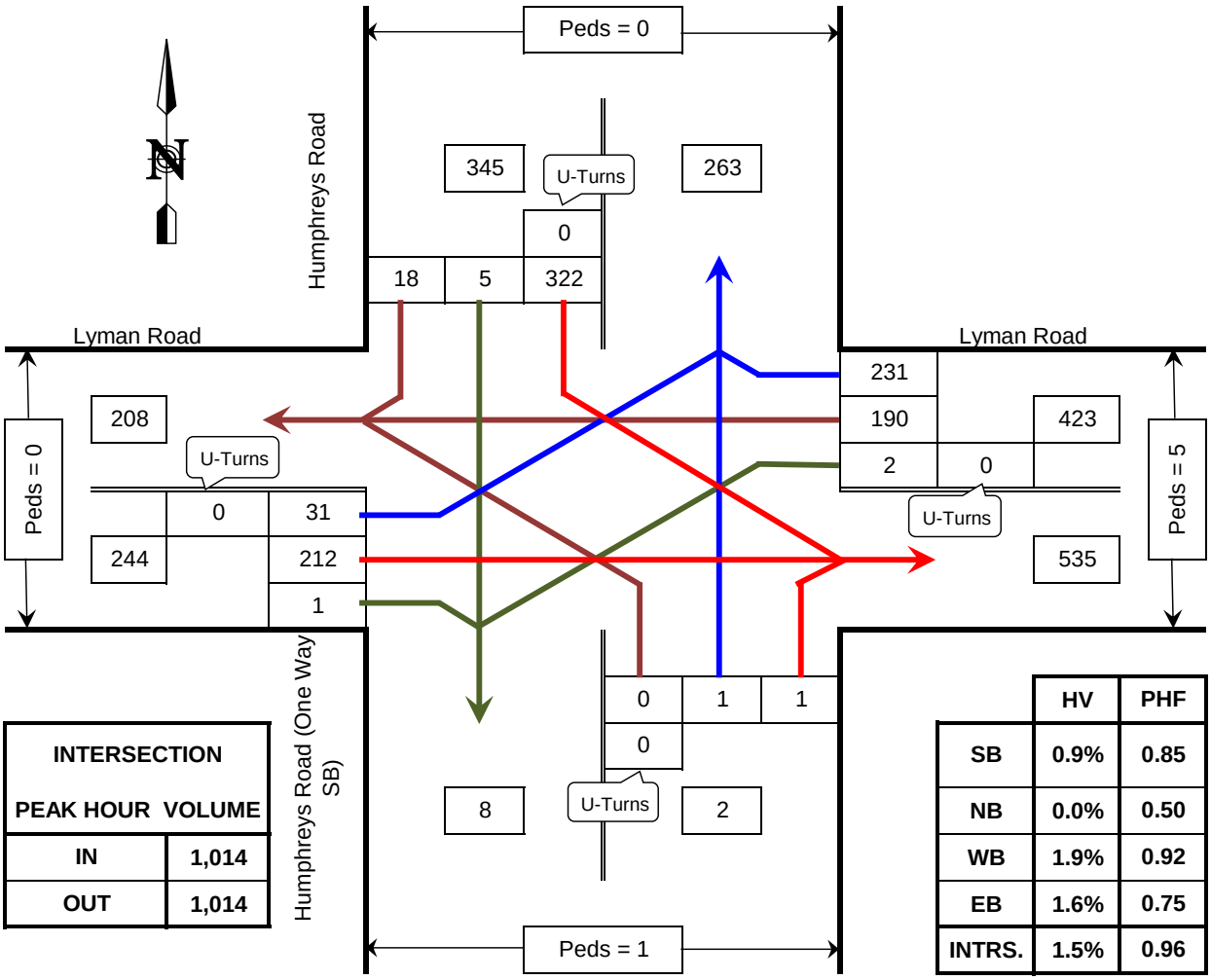
DATE OF REDUCTION: 2/28/2014

	FROM NORTH ON Humphreys Road						FROM SOUTH ON Humphreys Road (One Way SB)						FROM EAST ON Lyman Road						FROM WEST ON Lyman Road						INTERVAL TOTALS
TIME INTERVAL	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	
5:30 AM - 6:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
5:45 AM - 6:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
6:00 AM - 7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
6:15 AM - 7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
6:30 AM - 7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
6:45 AM - 7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
7:00 AM - 8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
7:15 AM - 8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
7:30 AM - 8:30 AM	1	11	0	230	20	30	28	0	0	0	0	0	32	25	0	10	313	176	18	15	0	23	230	4	**1036**
7:45 AM - 8:45 AM	2	13	0	221	18	38	5	0	0	0	0	0	16	24	0	12	284	175	9	12	0	20	196	3	**967**
8:00 AM - 9:00 AM	2	9	0	228	20	45	4	0	0	0	0	0	0	32	0	11	261	218	2	13	0	26	234	3	**1046**
8:15 AM - 9:15 AM	1	9	0	248	37	42	2	0	0	0	0	0	2	27	0	17	225	221	1	19	0	24	237	4	**1055**
8:30 AM - 9:30 AM	1	10	0	307	46	64	1	0	0	0	0	0	3	31	0	22	221	251	0	16	0	23	254	5	**1193**

TRAFFIC DATA GATHERING

TURNING MOVEMENTS DIAGRAM

3:30 PM - 5:30 PM PEAK HOUR: 3:30 PM TO 4:30 PM



INTERSECTION PEAK HOUR VOLUME	
IN	1,014
OUT	1,014

	HV	PHF
SB	0.9%	0.85
NB	0.0%	0.50
WB	1.9%	0.92
EB	1.6%	0.75
INTRS.	1.5%	0.96

PHF = Peak Hour Factor
HV = Heavy Vehicles

Lyman Road @ Humphreys Road

Schofield Barracks, HI

COUNTED BY: SN

DATE OF COUNT: Wed. 2/26/14

REDUCED BY: CN

TIME OF COUNT: 3:30 PM - 5:30 PM

REDUCTION DATE: Fri. 2/28/14

WEATHER: Rainy

TRAFFIC DATA GATHERING

INTERSECTION TURNING MOVEMENTS REDUCTION SHEET

LOCATION: Lyman Road @ Humphreys Road
Schofield Barracks, HI

DATE OF COUNT: Wed. 2/26/14
TIME OF COUNT: 3:30 PM - 5:30 PM

COUNTED BY: SN
WEATHER: Rainy

TIME INTERVAL ENDING AT	FROM NORTH ON Humphreys Road						FROM SOUTH ON Humphreys Road (One Way SB)						FROM EAST ON Lyman Road						FROM WEST ON Lyman Road						INTERVAL TOTALS
	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	
01:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
02:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
02:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
02:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
02:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
03:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
03:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
03:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
03:45 PM	0	0	0	57	1	2	0	0	0	0	1	0	1	2	0	0	59	55	0	2	0	6	50	1	**232**
04:00 PM	0	0	0	83	2	7	0	0	0	0	0	0	2	3	0	1	35	55	0	1	0	15	66	0	**264**
04:15 PM	0	1	0	83	2	7	1	0	0	0	0	1	0	3	0	1	42	60	0	1	0	5	61	0	**262**
04:30 PM	0	2	0	99	0	2	0	0	0	0	0	0	2	0	0	0	54	61	0	0	0	5	35	0	**256**
04:45 PM	0	0	0	65	1	7	1	0	0	0	0	0	0	3	0	0	27	43	0	1	0	1	54	1	**199**
05:00 PM	0	0	0	58	0	1	1	0	0	0	0	0	0	3	0	0	31	43	0	1	0	5	46	0	**184**
05:15 PM	0	1	0	72	1	3	1	0	0	0	0	0	0	1	0	0	40	54	0	2	0	3	29	0	**202**
05:30 PM	0	0	0	78	1	1	0	0	0	0	1	0	0	1	0	0	61	52	0	0	0	1	29	0	**224**
PEAK HOUR TOTALS	**0**	**3**	**0**	**322**	**5**	**18**	**1**	**0**	**0**	**0**	**1**	**1**	**5**	**8**	**0**	**2**	**190**	**231**	**0**	**4**	**0**	**31**	**212**	**1**	**INTERSECTION**
ALL MOVEMENTS	**345**						**2**						**423**						**244**						**1014**
% HV	**0.9%**						**0.0%**						**1.9%**						**1.6%**						**1.5%**
PEAK HOUR FACTOR	**0.85**						**0.50**						**0.92**						**0.75**						**0.96**

PHF = Peak Hour Factor

3:30 PM - 5:30 PM PEAK HOUR: 3:30 PM TO 4:30 PM

REDUCED BY: CN

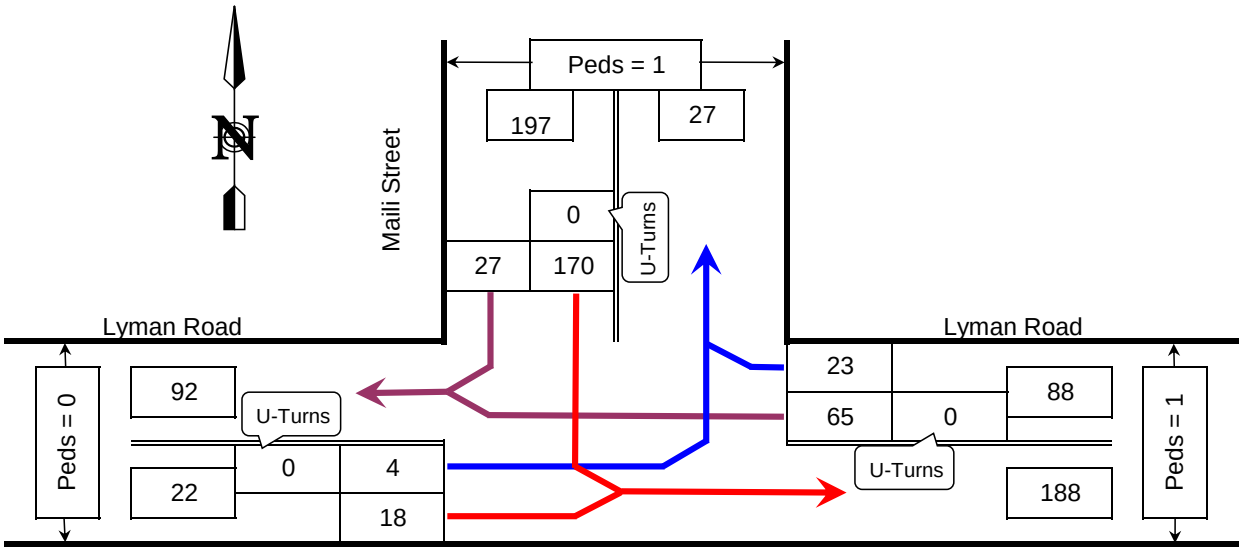
DATE OF REDUCTION: 2/28/2014

	FROM NORTH ON Humphreys Road						FROM SOUTH ON Humphreys Road (One Way SB)						FROM EAST ON Lyman Road						FROM WEST ON Lyman Road						INTERVAL TOTALS
TIME INTERVAL	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	
1:30 PM - 2:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
1:45 PM - 2:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2:00 PM - 3:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2:15 PM - 3:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2:30 PM - 3:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2:45 PM - 3:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
3:00 PM - 4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
3:15 PM - 4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
3:30 PM - 4:30 PM	0	3	0	322	5	18	1	0	0	0	1	1	5	8	0	2	190	231	0	4	0	31	212	1	**1014**
3:45 PM - 4:45 PM	0	3	0	330	5	23	2	0	0	0	0	1	4	9	0	2	158	219	0	3	0	26	216	1	**981**
4:00 PM - 5:00 PM	0	3	0	305	3	17	3	0	0	0	0	1	2	9	0	1	154	207	0	3	0	16	196	1	**901**
4:15 PM - 5:15 PM	0	3	0	294	2	13	3	0	0	0	0	0	2	7	0	0	152	201	0	4	0	14	164	1	**841**
4:30 PM - 5:30 PM	0	1	0	273	3	12	3	0	0	0	1	0	0	8	0	0	159	192	0	4	0	10	158	1	**809**

TRAFFIC DATA GATHERING

TURNING MOVEMENTS DIAGRAM

7:30 AM - 9:30 AM PEAK HOUR: 8:30 AM TO 9:30 AM



INTERSECTION PEAK HOUR VOLUME	
IN	307
OUT	307

	HV	PHF
SB	0.5%	0.78
WB	10.2%	0.88
EB	22.7%	0.79
INTRS.	4.9%	0.85

HV = Heavy Vehicles
PHF = Peak Hour Factor

Lyman Road @ Maili Street

Schofield Barracks, HI

COUNTED BY: SN

DATE OF COUNT: Tue. 2/25/14

REDUCED BY: CN

TIME OF COUNT: 7:30 AM - 9:30 AM

REDUCTION DATE: Fri. 2/28/14

WEATHER: Overcast

TRAFFIC DATA GATHERING

INTERSECTION TURNING MOVEMENTS REDUCTION SHEET

LOCATION: Lyman Road @ Maili Street
Schofield Barracks, HI

DATE OF COUNT: Tue. 2/25/14
TIME OF COUNT: 7:30 AM - 9:30 AM

COUNTED BY: SN
WEATHER: Overcast

TIME INTERVAL ENDING AT	FROM NORTH ON Maili Street						FROM SOUTH ON						FROM EAST ON Lyman Road						FROM WEST ON Lyman Road						INTERVAL TOTALS
	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	
05:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
06:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
06:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
06:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
06:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
07:45 AM	0	0	0	12	0	0	0	0	0	0	0	0	2	0	0	0	6	6	0	0	0	0	2	0	**26**
08:00 AM	0	0	0	8	0	1	0	0	0	0	0	0	0	0	0	0	15	13	0	1	0	0	3	0	**40**
08:15 AM	0	0	0	10	0	1	0	0	0	0	0	0	0	0	0	0	6	13	0	1	0	1	5	0	**36**
08:30 AM	0	0	0	8	0	4	0	0	0	0	0	0	1	0	0	0	8	9	0	1	0	1	2	0	**32**
08:45 AM	0	1	0	23	0	7	0	0	0	0	0	0	1	5	0	0	14	5	0	0	0	1	4	0	**54**
09:00 AM	1	0	0	39	0	10	0	0	0	0	0	0	0	0	0	0	15	8	0	3	0	1	3	0	**76**
09:15 AM	0	0	0	52	0	3	0	0	0	0	0	0	0	3	0	0	19	6	0	0	0	1	6	0	**87**
09:30 AM	0	0	0	56	0	7	0	0	0	0	0	0	0	1	0	0	17	4	0	2	0	1	5	0	**90**
PEAK HOUR TOTALS	**1**	**1**	**0**	**170**	**0**	**27**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**9**	**0**	**0**	**65**	**23**	**0**	**5**	**0**	**4**	**18**	**0**	**INTERSECTION**
ALL MOVEMENTS	**197**						**0**						**88**						**22**						**307**
% HV	**0.5%**						**#N/A**						**10.2%**						**22.7%**						**4.9%**
PEAK HOUR FACTOR	**0.78**						**#N/A**						**0.88**						**0.79**						**0.85**

PHF = Peak Hour Factor

7:30 AM - 9:30 AM PEAK HOUR: 8:30 AM TO 9:30 AM

REDUCED BY: CN

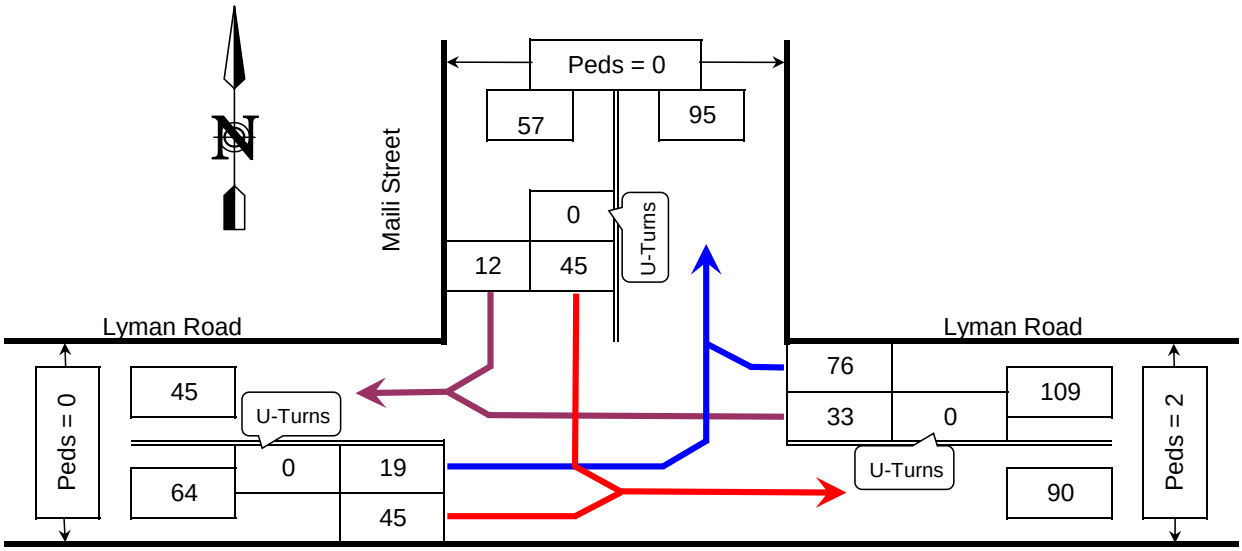
DATE OF REDUCTION: 2/28/2014

	FROM NORTH ON Maili Street						FROM SOUTH ON						FROM EAST ON Lyman Road						FROM WEST ON Lyman Road						INTERVAL TOTALS
TIME INTERVAL	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	
5:30 AM - 6:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
5:45 AM - 6:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
6:00 AM - 7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
6:15 AM - 7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
6:30 AM - 7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
6:45 AM - 7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
7:00 AM - 8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
7:15 AM - 8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
7:30 AM - 8:30 AM	0	0	0	38	0	6	0	0	0	0	0	0	3	0	0	0	35	41	0	3	0	2	12	0	**134**
7:45 AM - 8:45 AM	0	1	0	49	0	13	0	0	0	0	0	0	2	5	0	0	43	40	0	3	0	3	14	0	**162**
8:00 AM - 9:00 AM	1	1	0	80	0	22	0	0	0	0	0	0	2	5	0	0	43	35	0	5	0	4	14	0	**198**
8:15 AM - 9:15 AM	1	1	0	122	0	24	0	0	0	0	0	0	2	8	0	0	56	28	0	4	0	4	15	0	**249**
8:30 AM - 9:30 AM	1	1	0	170	0	27	0	0	0	0	0	0	1	9	0	0	65	23	0	5	0	4	18	0	**307**

TRAFFIC DATA GATHERING

TURNING MOVEMENTS DIAGRAM

3:30 PM - 5:30 PM PEAK HOUR: 3:30 PM TO 4:30 PM



INTERSECTION PEAK HOUR VOLUME	
IN	230
OUT	230

	HV	PHF
SB	7.0%	0.79
WB	1.8%	0.76
EB	7.8%	0.57
INTRS.	4.8%	0.94

HV = Heavy Vehicles
PHF = Peak Hour Factor

Lyman Road @ Maili Street

Schofield Barracks, HI

COUNTED BY: SN

REDUCED BY: CN

REDUCTION DATE: Fri. 2/28/14

DATE OF COUNT: Tue. 2/25/14

TIME OF COUNT: 3:30 PM - 5:30 PM

WEATHER: Overcast

TRAFFIC DATA GATHERING

INTERSECTION TURNING MOVEMENTS REDUCTION SHEET

LOCATION: Lyman Road @ Maili Street
Schofield Barracks, HI

DATE OF COUNT: Tue. 2/25/14
TIME OF COUNT: 3:30 PM - 5:30 PM

COUNTED BY: SN
WEATHER: Overcast

TIME INTERVAL ENDING AT	FROM NORTH ON Maili Street						FROM SOUTH ON						FROM EAST ON Lyman Road						FROM WEST ON Lyman Road						INTERVAL TOTALS
	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	
01:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
02:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
02:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
02:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
02:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
03:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
03:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
03:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
03:45 PM	0	0	0	15	0	2	0	0	0	0	0	0	0	1	0	0	5	18	0	1	0	6	9	0	**55**
04:00 PM	0	1	0	8	0	3	0	0	0	0	0	0	0	0	0	0	4	24	0	0	0	8	6	0	**53**
04:15 PM	0	3	0	7	0	4	0	0	0	0	0	0	0	0	0	0	9	13	0	3	0	4	24	0	**61**
04:30 PM	0	0	0	15	0	3	0	0	0	0	0	0	2	1	0	0	15	21	0	1	0	1	6	0	**61**
04:45 PM	0	0	0	5	0	3	0	0	0	0	0	0	0	1	0	0	9	14	2	0	0	3	20	0	**54**
05:00 PM	1	0	0	8	0	2	0	0	0	0	0	0	0	0	0	0	8	8	0	0	0	5	19	0	**50**
05:15 PM	1	0	0	9	0	1	0	0	0	0	0	0	0	0	0	0	2	17	0	1	0	2	19	0	**50**
05:30 PM	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	5	10	0	1	0	2	10	0	**30**
PEAK HOUR TOTALS	**0**	**4**	**0**	**45**	**0**	**12**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**2**	**0**	**0**	**33**	**76**	**0**	**5**	**0**	**19**	**45**	**0**	**INTERSECTION**
ALL MOVEMENTS	**57**						**0**						**109**						**64**						**230**
% HV	**7.0%**						**#N/A**						**1.8%**						**7.8%**						**4.8%**
PEAK HOUR FACTOR	**0.79**						**#N/A**						**0.76**						**0.57**						**0.94**

PHF = Peak Hour Factor

3:30 PM - 5:30 PM PEAK HOUR: 3:30 PM TO 4:30 PM

REDUCED BY: CN

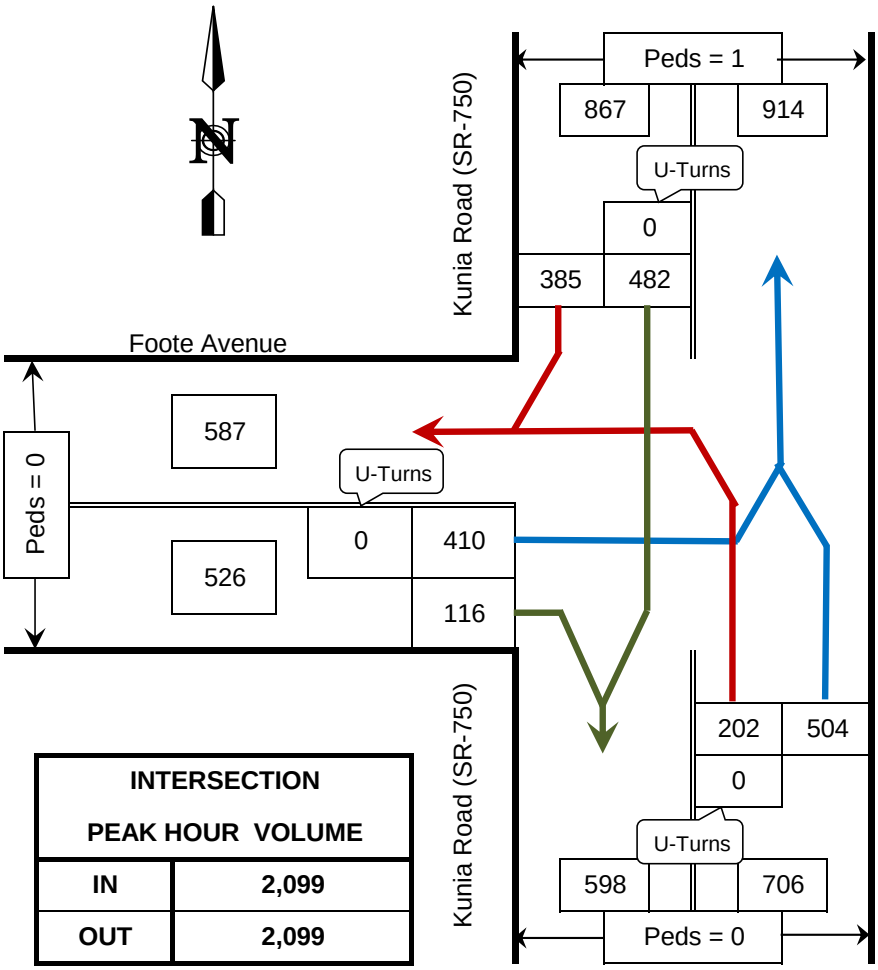
DATE OF REDUCTION: 2/28/2014

	FROM NORTH ON Maili Street						FROM SOUTH ON						FROM EAST ON Lyman Road						FROM WEST ON Lyman Road						INTERVAL TOTALS
TIME INTERVAL	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	
1:30 PM - 2:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
1:45 PM - 2:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2:00 PM - 3:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2:15 PM - 3:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2:30 PM - 3:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2:45 PM - 3:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
3:00 PM - 4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
3:15 PM - 4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
3:30 PM - 4:30 PM	0	4	0	45	0	12	0	0	0	0	0	0	2	2	0	0	33	76	0	5	0	19	45	0	**230**
3:45 PM - 4:45 PM	0	4	0	35	0	13	0	0	0	0	0	0	2	2	0	0	37	72	2	4	0	16	56	0	**229**
4:00 PM - 5:00 PM	1	3	0	35	0	12	0	0	0	0	0	0	2	2	0	0	41	56	2	4	0	13	69	0	**226**
4:15 PM - 5:15 PM	2	0	0	37	0	9	0	0	0	0	0	0	2	2	0	0	34	60	2	2	0	11	64	0	**215**
4:30 PM - 5:30 PM	2	0	0	25	0	6	0	0	0	0	0	0	0	1	0	0	24	49	2	2	0	12	68	0	**184**

TRAFFIC DATA GATHERING

TURNING MOVEMENTS DIAGRAM

7:30 AM - 9:30 AM PEAK HOUR: 7:30 AM TO 8:30 AM



INTERSECTION PEAK HOUR VOLUME	
IN	2,099
OUT	2,099

	HV	PHF
SB	5.0%	0.87
NB	3.4%	0.92
EB	2.5%	0.84
INTRS.	3.8%	0.88

HV = Heavy Vehicles
PHF = Peak Hour Factor

Kunia Road (SR-750) @ Foote Avenue

Schofield Barracks, HI

COUNTED BY: CN

REDUCED BY: CN

REDUCTION DATE: Fri. 2/28/14

DATE OF COUNT: Wed. 2/26/14

TIME OF COUNT: 7:30 AM - 9:30 AM

WEATHER: Sunny

TRAFFIC DATA GATHERING

INTERSECTION TURNING MOVEMENTS REDUCTION SHEET

LOCATION: Kunia Road (SR-750) @ Foote Avenue
Schofield Barracks, HI

DATE OF COUNT: Wed. 2/26/14
TIME OF COUNT: 7:30 AM - 9:30 AM

COUNTED BY: CN
WEATHER: Sunny

TIME INTERVAL ENDING AT	FROM NORTH ON Kunia Road (SR-750)						FROM SOUTH ON Kunia Road (SR-750)						FROM EAST ON						FROM WEST ON Foote Avenue						INTERVAL TOTALS
	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	
05:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
06:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
06:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
06:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
06:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
07:45 AM	0	9	0	0	129	74	0	6	0	41	146	0	0	0	0	0	0	0	0	6	0	119	0	37	**546**
08:00 AM	0	11	0	0	128	90	0	6	0	47	115	0	0	0	0	0	0	0	0	1	0	97	0	24	**501**
08:15 AM	1	13	0	0	121	128	0	7	0	53	139	0	0	0	0	0	0	0	0	4	0	124	0	29	**594**
08:30 AM	0	10	0	0	104	93	0	5	0	61	104	0	0	0	0	0	0	0	0	2	0	70	0	26	**458**
08:45 AM	1	16	0	0	110	90	0	12	0	67	109	0	0	0	0	0	0	0	0	2	0	43	0	17	**436**
09:00 AM	0	13	0	0	111	129	0	8	0	43	93	0	0	0	0	0	0	0	0	1	0	75	0	30	**481**
09:15 AM	0	5	0	0	99	114	0	5	0	71	82	0	0	0	0	0	0	0	0	2	0	70	0	30	**466**
09:30 AM	1	8	0	0	95	96	0	2	0	56	69	0	0	0	0	0	0	0	0	5	0	76	0	23	**415**
PEAK HOUR TOTALS	**1**	**43**	**0**	**0**	**482**	**385**	**0**	**24**	**0**	**202**	**504**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**13**	**0**	**410**	**0**	**116**	**INTERSECTION**
ALL MOVEMENTS	**867**						**706**						**0**						**526**						**2099**
% HV	**5.0%**						**3.4%**						**#N/A**						**2.5%**						**3.8%**
PEAK HOUR FACTOR	**0.87**						**0.92**						**#N/A**						**0.84**						**0.88**

PHF = Peak Hour Factor

7:30 AM - 9:30 AM PEAK HOUR: 7:30 AM TO 8:30 AM

REDUCED BY: CN

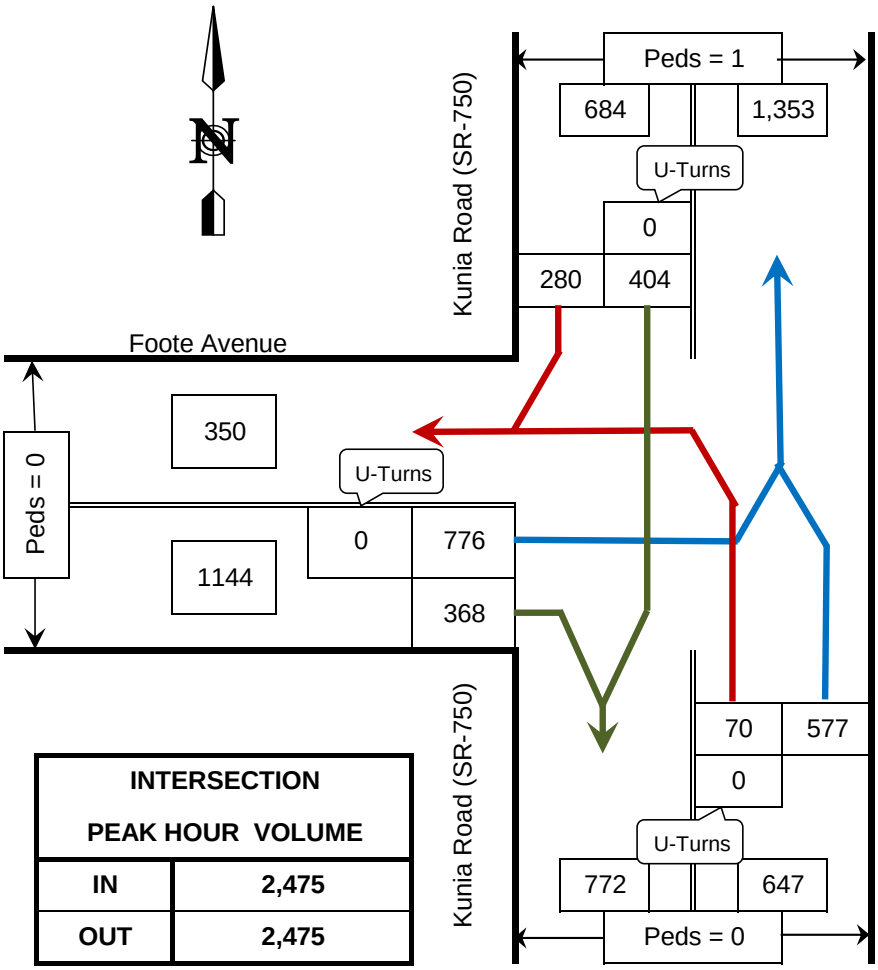
DATE OF REDUCTION: 2/28/2014

	FROM NORTH ON Kunia Road (SR-750)						FROM SOUTH ON Kunia Road (SR-750)						FROM EAST ON						FROM WEST ON Foote Avenue						INTERVAL TOTALS
TIME INTERVAL	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	
5:30 AM - 6:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
5:45 AM - 6:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
6:00 AM - 7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
6:15 AM - 7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
6:30 AM - 7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
6:45 AM - 7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
7:00 AM - 8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
7:15 AM - 8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
7:30 AM - 8:30 AM	1	43	0	0	482	385	0	24	0	202	504	0	0	0	0	0	0	0	0	13	0	410	0	116	**2099**
7:45 AM - 8:45 AM	2	50	0	0	463	401	0	30	0	228	467	0	0	0	0	0	0	0	0	9	0	334	0	96	**1989**
8:00 AM - 9:00 AM	2	52	0	0	446	440	0	32	0	224	445	0	0	0	0	0	0	0	0	9	0	312	0	102	**1969**
8:15 AM - 9:15 AM	1	44	0	0	424	426	0	30	0	242	388	0	0	0	0	0	0	0	0	7	0	258	0	103	**1841**
8:30 AM - 9:30 AM	2	42	0	0	415	429	0	27	0	237	353	0	0	0	0	0	0	0	0	10	0	264	0	100	**1798**

TRAFFIC DATA GATHERING

TURNING MOVEMENTS DIAGRAM

3:30 PM - 5:30 PM PEAK HOUR: 3:30 PM TO 4:30 PM



INTERSECTION PEAK HOUR VOLUME	
IN	2,475
OUT	2,475

	HV	PHF
SB	2.2%	0.87
NB	0.8%	0.83
EB	0.5%	0.81
INTRS.	1.1%	0.93

HV = Heavy Vehicles
PHF = Peak Hour Factor

Kunia Road (SR-750) @ Foote Avenue

Schofield Barracks, HI

COUNTED BY: CN

REDUCED BY: CN

REDUCTION DATE: Fri. 2/28/14

DATE OF COUNT: Wed. 2/26/14

TIME OF COUNT: 3:30 PM - 5:30 PM

WEATHER: Rainy

TRAFFIC DATA GATHERING

INTERSECTION TURNING MOVEMENTS REDUCTION SHEET

LOCATION: Kunia Road (SR-750) @ Foote Avenue
Schofield Barracks, HI

DATE OF COUNT: Wed. 2/26/14
TIME OF COUNT: 3:30 PM - 5:30 PM

COUNTED BY: CN
WEATHER: Rainy

TIME INTERVAL ENDING AT	FROM NORTH ON Kunia Road (SR-750)						FROM SOUTH ON Kunia Road (SR-750)						FROM EAST ON						FROM WEST ON Foote Avenue						INTERVAL TOTALS
	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	
01:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
02:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
02:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
02:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
02:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
03:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
03:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
03:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
03:45 PM	1	0	0	0	82	71	0	2	0	15	116	0	0	0	0	0	0	0	0	0	0	220	0	134	**638**
04:00 PM	0	5	0	0	105	75	0	0	0	23	173	0	0	0	0	0	0	0	0	3	0	198	0	89	**663**
04:15 PM	0	7	0	0	105	50	0	1	0	11	154	0	0	0	0	0	0	0	0	0	0	185	0	93	**598**
04:30 PM	0	3	0	0	112	84	0	2	0	21	134	0	0	0	0	0	0	0	0	3	0	173	0	52	**576**
04:45 PM	0	1	0	0	89	76	0	2	0	26	130	0	0	0	0	0	0	0	0	1	0	141	0	53	**515**
05:00 PM	0	2	0	0	84	69	0	2	0	24	83	0	0	0	0	0	0	0	0	2	0	152	0	47	**459**
05:15 PM	0	4	0	0	109	88	0	2	0	17	129	0	0	0	0	0	0	0	0	1	0	179	0	62	**584**
05:30 PM	0	3	0	0	86	56	0	1	0	19	115	0	0	0	0	0	0	0	0	2	0	166	0	44	**486**
PEAK HOUR TOTALS	**1**	**15**	**0**	**0**	**404**	**280**	**0**	**5**	**0**	**70**	**577**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**6**	**0**	**776**	**0**	**368**	**INTERSECTION**
ALL MOVEMENTS	**684**						**647**						**0**						**1144**						**2475**
% HV	**2.2%**						**0.8%**						**#N/A**						**0.5%**						**1.1%**
PEAK HOUR FACTOR	**0.87**						**0.83**						**#N/A**						**0.81**						**0.93**

PHF = Peak Hour Factor

3:30 PM - 5:30 PM PEAK HOUR: 3:30 PM TO 4:30 PM

REDUCED BY: CN

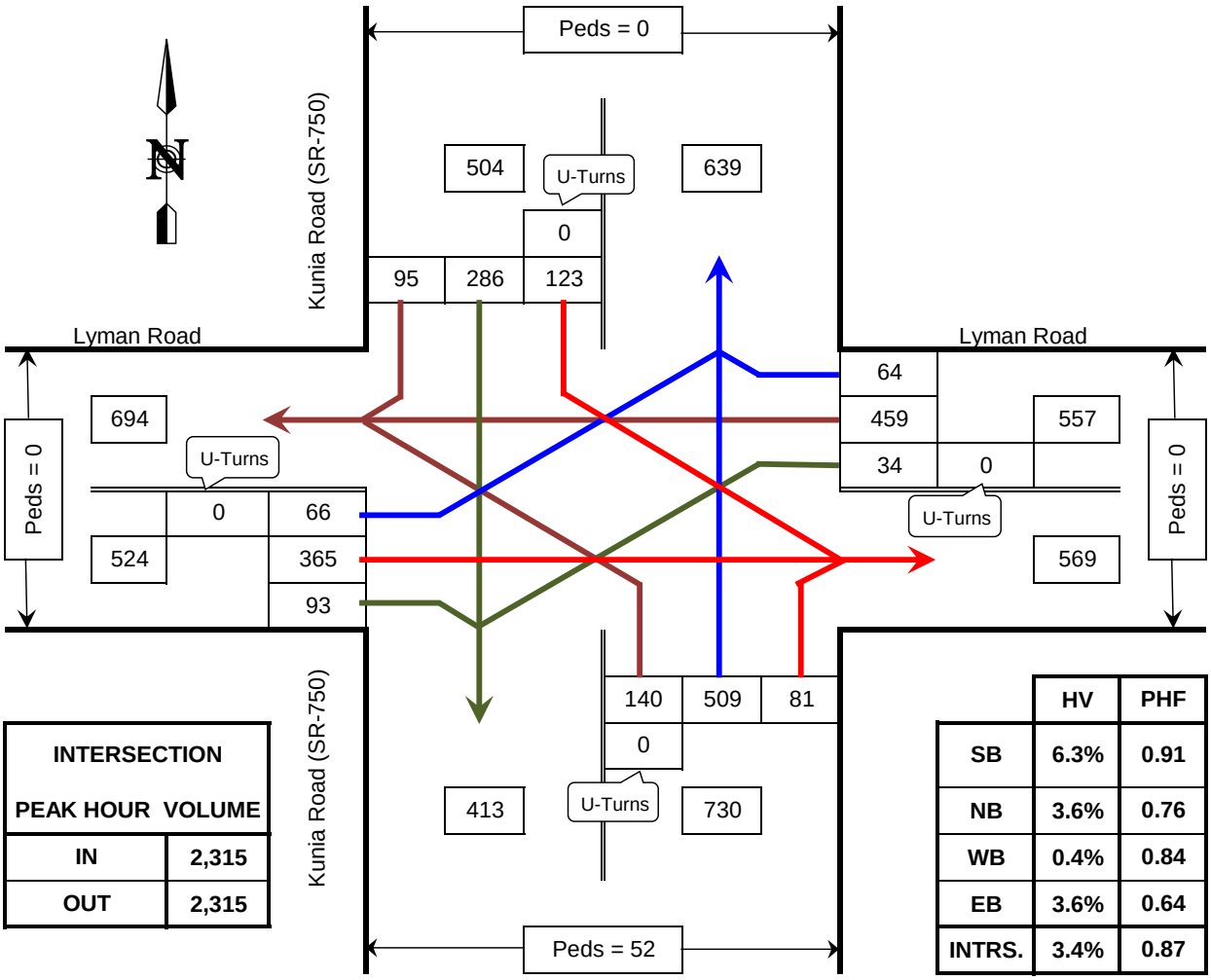
DATE OF REDUCTION: 2/28/2014

	FROM NORTH ON Kunia Road (SR-750)						FROM SOUTH ON Kunia Road (SR-750)						FROM EAST ON						FROM WEST ON Foote Avenue						INTERVAL TOTALS
TIME INTERVAL	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	
1:30 PM - 2:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
1:45 PM - 2:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2:00 PM - 3:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2:15 PM - 3:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2:30 PM - 3:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2:45 PM - 3:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
3:00 PM - 4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
3:15 PM - 4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
3:30 PM - 4:30 PM	1	15	0	0	404	280	0	5	0	70	577	0	0	0	0	0	0	0	0	6	0	776	0	368	**2475**
3:45 PM - 4:45 PM	0	16	0	0	411	285	0	5	0	81	591	0	0	0	0	0	0	0	0	7	0	697	0	287	**2352**
4:00 PM - 5:00 PM	0	13	0	0	390	279	0	7	0	82	501	0	0	0	0	0	0	0	0	6	0	651	0	245	**2148**
4:15 PM - 5:15 PM	0	10	0	0	394	317	0	8	0	88	476	0	0	0	0	0	0	0	0	7	0	645	0	214	**2134**
4:30 PM - 5:30 PM	0	10	0	0	368	289	0	7	0	86	457	0	0	0	0	0	0	0	0	6	0	638	0	206	**2044**

TRAFFIC DATA GATHERING

TURNING MOVEMENTS DIAGRAM

7:30 AM - 9:30 AM PEAK HOUR: 7:30 AM TO 8:30 AM



INTERSECTION PEAK HOUR VOLUME	
IN	2,315
OUT	2,315

	HV	PHF
SB	6.3%	0.91
NB	3.6%	0.76
WB	0.4%	0.84
EB	3.6%	0.64
INTRS.	3.4%	0.87

PHF = Peak Hour Factor
HV = Heavy Vehicles

Kunia Road (SR-750) @ Lyman Road

Schofield Barracks, HI

COUNTED BY: CN

REDUCED BY: CN

REDUCTION DATE: Fri. 2/28/14

DATE OF COUNT: Tue. 2/25/14

TIME OF COUNT: 7:30 AM - 9:30 AM

WEATHER: Overcast

TRAFFIC DATA GATHERING

INTERSECTION TURNING MOVEMENTS REDUCTION SHEET

LOCATION: Kunia Road (SR-750) @ Lyman Road
Schofield Barracks, HI

DATE OF COUNT: Tue. 2/25/14
TIME OF COUNT: 7:30 AM - 9:30 AM

COUNTED BY: CN
WEATHER: Overcast

TIME INTERVAL ENDING AT	FROM NORTH ON Kunia Road (SR-750)						FROM SOUTH ON Kunia Road (SR-750)						FROM EAST ON Lyman Road						FROM WEST ON Lyman Road						INTERVAL TOTALS
	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	
05:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
06:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
06:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
06:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
06:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
07:45 AM	0	8	0	41	59	29	42	3	0	30	140	20	0	0	0	7	121	12	0	1	0	11	168	26	**664**
08:00 AM	0	9	0	30	68	20	9	7	0	38	168	33	0	0	0	7	141	10	0	6	0	20	100	33	**668**
08:15 AM	0	8	0	29	93	16	1	10	0	40	126	18	0	1	0	14	127	24	0	6	0	18	46	23	**574**
08:30 AM	0	7	0	23	66	30	0	6	0	32	75	10	0	1	0	6	70	18	0	6	0	17	51	11	**409**
08:45 AM	0	11	0	23	65	35	0	5	0	44	123	22	0	2	0	6	99	15	0	3	0	6	45	7	**490**
09:00 AM	0	10	0	23	48	44	0	7	0	31	105	18	0	6	0	6	143	14	0	2	0	8	66	15	**521**
09:15 AM	0	8	0	22	74	47	1	5	0	36	113	18	0	2	0	2	110	16	0	4	0	19	101	17	**575**
09:30 AM	0	16	0	28	60	29	0	8	0	42	103	20	0	4	0	3	89	18	0	7	0	13	83	9	**497**
PEAK HOUR TOTALS	**0**	**32**	**0**	**123**	**286**	**95**	**52**	**26**	**0**	**140**	**509**	**81**	**0**	**2**	**0**	**34**	**459**	**64**	**0**	**19**	**0**	**66**	**365**	**93**	**INTERSECTION**
ALL MOVEMENTS	**504**						**730**						**557**						**524**						**2315**
% HV	**6.3%**						**3.6%**						**0.4%**						**3.6%**						**3.4%**
PEAK HOUR FACTOR	**0.91**						**0.76**						**0.84**						**0.64**						**0.87**

PHF = Peak Hour Factor

7:30 AM - 9:30 AM PEAK HOUR: 7:30 AM TO 8:30 AM

REDUCED BY: CN

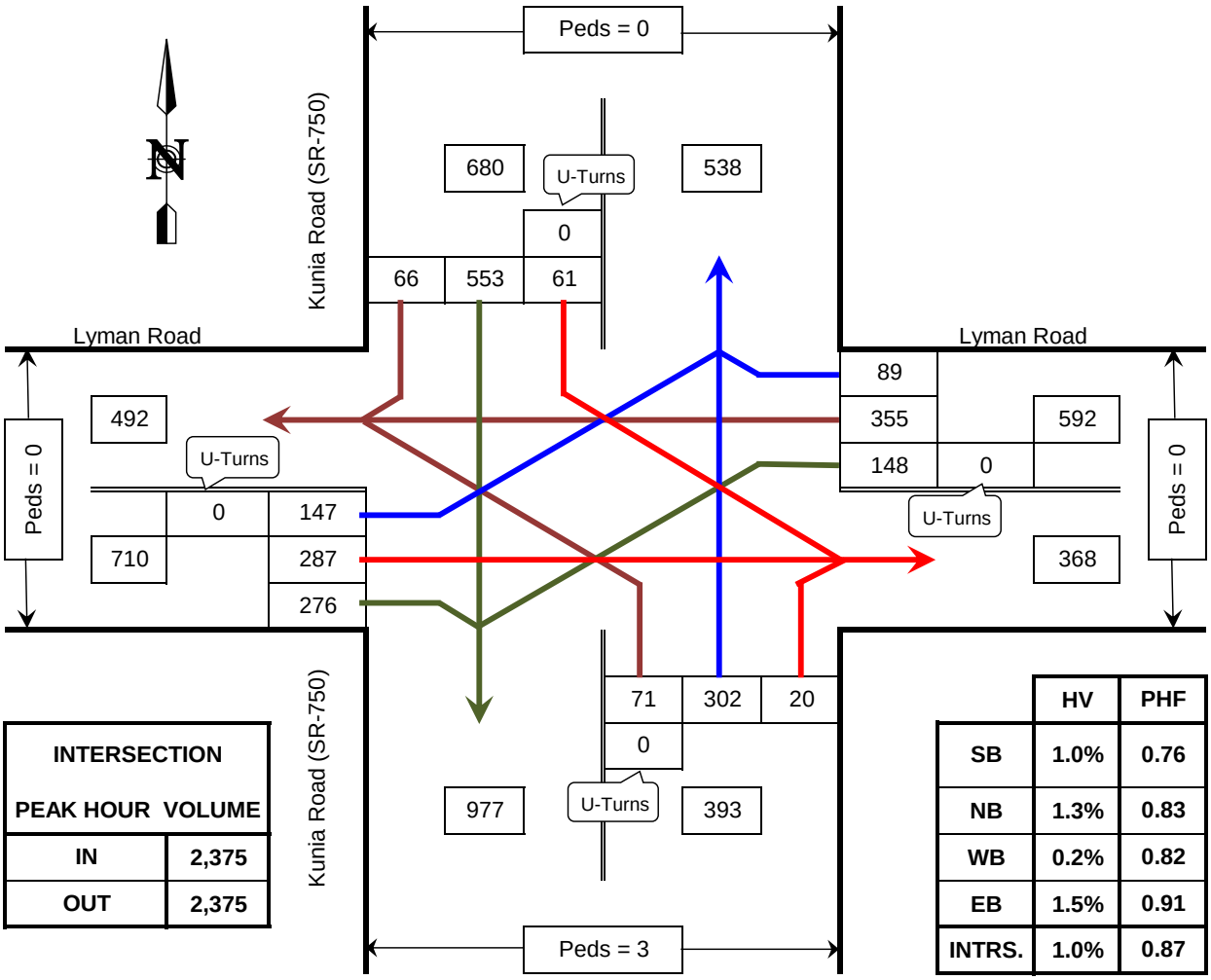
DATE OF REDUCTION: 2/28/2014

	FROM NORTH ON Kunia Road (SR-750)						FROM SOUTH ON Kunia Road (SR-750)						FROM EAST ON Lyman Road						FROM WEST ON Lyman Road						INTERVAL TOTALS
TIME INTERVAL	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	
5:30 AM - 6:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
5:45 AM - 6:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
6:00 AM - 7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
6:15 AM - 7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
6:30 AM - 7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
6:45 AM - 7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
7:00 AM - 8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
7:15 AM - 8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
7:30 AM - 8:30 AM	0	32	0	123	286	95	52	26	0	140	509	81	0	2	0	34	459	64	0	19	0	66	365	93	**2315**
7:45 AM - 8:45 AM	0	35	0	105	292	101	10	28	0	154	492	83	0	4	0	33	437	67	0	21	0	61	242	74	**2141**
8:00 AM - 9:00 AM	0	36	0	98	272	125	1	28	0	147	429	68	0	10	0	32	439	71	0	17	0	49	208	56	**1994**
8:15 AM - 9:15 AM	0	36	0	91	253	156	1	23	0	143	416	68	0	11	0	20	422	63	0	15	0	50	263	50	**1995**
8:30 AM - 9:30 AM	0	45	0	96	247	155	1	25	0	153	444	78	0	14	0	17	441	63	0	16	0	46	295	48	**2083**

TRAFFIC DATA GATHERING

TURNING MOVEMENTS DIAGRAM

3:30 PM - 5:30 PM PEAK HOUR: 4:30 PM TO 5:30 PM



INTERSECTION PEAK HOUR VOLUME	
IN	2,375
OUT	2,375

	HV	PHF
SB	1.0%	0.76
NB	1.3%	0.83
WB	0.2%	0.82
EB	1.5%	0.91
INTRS.	1.0%	0.87

PHF = Peak Hour Factor
HV = Heavy Vehicles

Kunia Road (SR-750) @ Lyman Road

Schofield Barracks, HI

COUNTED BY:	CN	DATE OF COUNT:	Tue. 2/25/14
REDUCED BY:	CN	TIME OF COUNT:	3:30 PM - 5:30 PM
REDUCTION DATE:	Fri. 2/28/14	WEATHER:	Overcast

TRAFFIC DATA GATHERING

INTERSECTION TURNING MOVEMENTS REDUCTION SHEET

LOCATION: Kunia Road (SR-750) @ Lyman Road
Schofield Barracks, HI

DATE OF COUNT: Tue. 2/25/14
TIME OF COUNT: 3:30 PM - 5:30 PM

COUNTED BY: CN
WEATHER: Overcast

TIME INTERVAL ENDING AT	FROM NORTH ON Kunia Road (SR-750)						FROM SOUTH ON Kunia Road (SR-750)						FROM EAST ON Lyman Road						FROM WEST ON Lyman Road						INTERVAL TOTALS
	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	
01:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
02:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
02:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
02:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
02:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
03:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
03:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
03:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
03:45 PM	0	5	0	27	129	23	0	3	0	20	107	11	0	2	0	30	50	18	0	6	0	41	55	30	**541**
04:00 PM	0	3	0	12	147	17	0	2	0	16	134	8	0	1	0	23	47	19	0	2	0	27	63	41	**554**
04:15 PM	0	5	0	13	117	19	1	0	0	18	79	5	0	6	0	36	60	28	0	1	0	28	72	49	**524**
04:30 PM	0	2	0	11	119	18	0	0	0	21	82	3	0	2	0	22	73	29	0	2	0	27	69	61	**535**
04:45 PM	0	1	0	10	130	13	2	1	0	22	73	3	0	1	0	43	62	15	0	5	0	21	69	58	**519**
05:00 PM	0	5	0	14	127	16	0	2	0	9	73	7	0	0	0	32	67	14	0	6	0	48	69	78	**554**
05:15 PM	0	0	0	16	114	15	1	0	0	20	95	3	0	0	0	30	117	31	0	0	0	31	72	78	**622**
05:30 PM	0	1	0	21	182	22	0	2	0	20	61	7	0	0	0	43	109	29	0	0	0	47	77	62	**680**
PEAK HOUR TOTALS	**0**	**7**	**0**	**61**	**553**	**66**	**3**	**5**	**0**	**71**	**302**	**20**	**0**	**1**	**0**	**148**	**355**	**89**	**0**	**11**	**0**	**147**	**287**	**276**	**INTERSECTION**
ALL MOVEMENTS	**680**						**393**						**592**						**710**						**2375**
% HV	**1.0%**						**1.3%**						**0.2%**						**1.5%**						**1.0%**
PEAK HOUR FACTOR	**0.76**						**0.83**						**0.82**						**0.91**						**0.87**

PHF = Peak Hour Factor

3:30 PM - 5:30 PM PEAK HOUR: **4:30 PM TO 5:30 PM**

REDUCED BY: CN

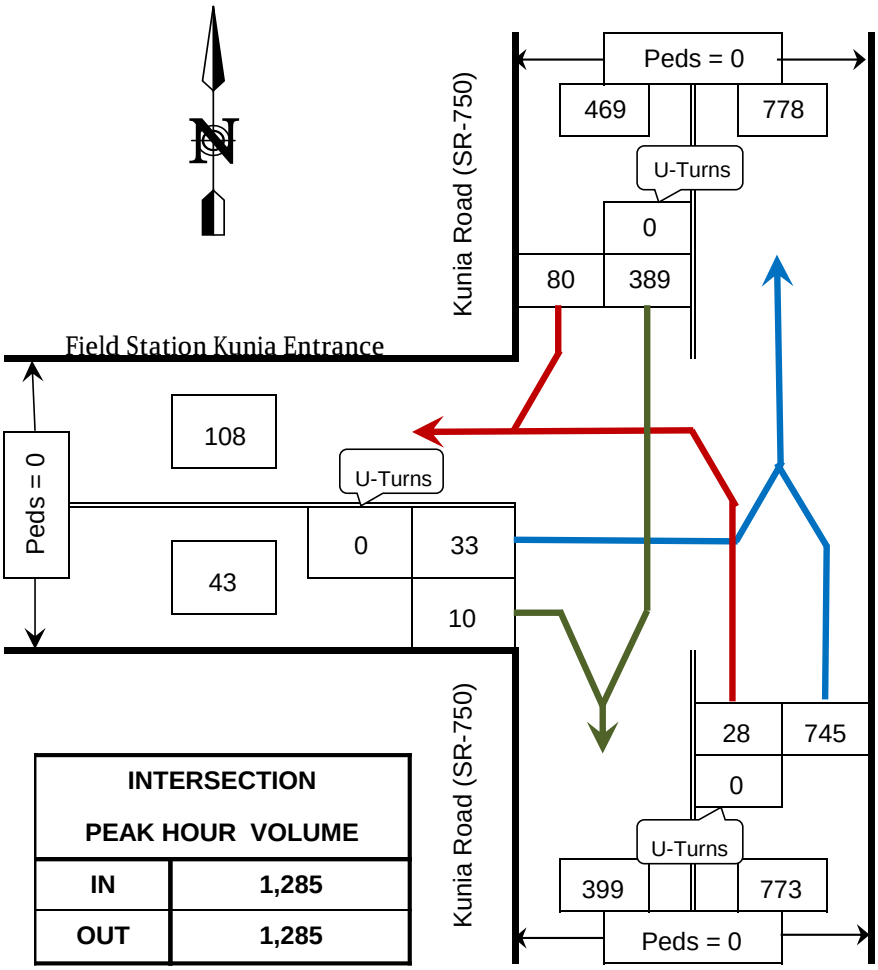
DATE OF REDUCTION: 2/28/2014

	FROM NORTH ON Kunia Road (SR-750)						FROM SOUTH ON Kunia Road (SR-750)						FROM EAST ON Lyman Road						FROM WEST ON Lyman Road						INTERVAL TOTALS
TIME INTERVAL	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	
1:30 PM - 2:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
1:45 PM - 2:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2:00 PM - 3:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2:15 PM - 3:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2:30 PM - 3:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
2:45 PM - 3:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
3:00 PM - 4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
3:15 PM - 4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
3:30 PM - 4:30 PM	0	15	0	63	512	77	1	5	0	75	402	27	0	11	0	111	230	94	0	11	0	123	259	181	**2154**
3:45 PM - 4:45 PM	0	11	0	46	513	67	3	3	0	77	368	19	0	10	0	124	242	91	0	10	0	103	273	209	**2132**
4:00 PM - 5:00 PM	0	13	0	48	493	66	3	3	0	70	307	18	0	9	0	133	262	86	0	14	0	124	279	246	**2132**
4:15 PM - 5:15 PM	0	8	0	51	490	62	3	3	0	72	323	16	0	3	0	127	319	89	0	13	0	127	279	275	**2230**
4:30 PM - 5:30 PM	0	7	0	61	553	66	3	5	0	71	302	20	0	1	0	148	355	89	0	11	0	147	287	276	**2375**

TRAFFIC DATA GATHERING

TURNING MOVEMENTS DIAGRAM

7:30 AM - 9:30 AM PEAK HOUR: 7:30 AM TO 8:30 AM



INTERSECTION PEAK HOUR VOLUME	
IN	1,285
OUT	1,285

	HV	PHF
SB	4.7%	0.92
NB	4.3%	0.89
EB	14.0%	0.51
INTRS.	4.7%	0.95

HV = Heavy Vehicles
PHF = Peak Hour Factor

Kunia Road (SR-750) @ d Entrance

Schofield Barracks, HI

COUNTED BY: VT

DATE OF COUNT: Wed. 2/26/14

REDUCED BY: CN

TIME OF COUNT: 7:30 AM - 9:30 AM

REDUCTION DATE: Fri. 2/28/14

WEATHER: Overcast

TRAFFIC DATA GATHERING

INTERSECTION TURNING MOVEMENTS REDUCTION SHEET

LOCATION: Kunia Road (SR-750) @ Entrance
Schofield Barracks, HI

DATE OF COUNT: Wed. 2/26/14
TIME OF COUNT: 7:30 AM - 9:30 AM

COUNTED BY: VT
WEATHER: Overcast

TIME INTERVAL ENDING AT	FROM NORTH ON Kunia Road (SR-750)						FROM SOUTH ON Kunia Road (SR-750)						FROM EAST ON						FROM WEST ON Entrance						INTERVAL TOTALS
	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	
05:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
06:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
06:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
06:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
06:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
07:45 AM	0	5	0	0	92	25	0	4	0	5	211	0	0	0	0	0	0	0	0	1	0	5	0	1	**339**
08:00 AM	0	8	0	0	105	23	0	5	0	13	165	0	0	0	0	0	0	0	0	1	0	6	0	1	**313**
08:15 AM	0	5	0	0	100	20	0	10	0	4	171	0	0	0	0	0	0	0	0	1	0	7	0	2	**304**
08:30 AM	0	4	0	0	92	12	0	14	0	6	198	0	0	0	0	0	0	0	0	3	0	15	0	6	**329**
08:45 AM	0	7	0	0	76	12	0	18	0	7	195	0	0	0	0	0	0	0	0	0	0	15	0	2	**307**
09:00 AM	0	9	0	0	71	9	0	10	0	2	150	0	0	0	0	0	0	0	0	0	0	11	0	0	**243**
09:15 AM	0	5	0	0	49	16	0	13	0	6	164	0	0	0	0	0	0	0	0	0	0	11	0	3	**249**
09:30 AM	0	6	0	0	59	18	0	7	0	5	117	0	0	0	0	0	0	0	0	0	0	13	0	1	**213**
PEAK HOUR TOTALS	**0**	**22**	**0**	**0**	**389**	**80**	**0**	**33**	**0**	**28**	**745**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**6**	**0**	**33**	**0**	**10**	**INTERSECTION**
ALL MOVEMENTS	**469**						**773**						**0**						**43**						**1285**
% HV	**4.7%**						**4.3%**						**#N/A**						**14.0%**						**4.7%**
PEAK HOUR FACTOR	**0.92**						**0.89**						**#N/A**						**0.51**						**0.95**

PHF = Peak Hour Factor

7:30 AM - 9:30 AM PEAK HOUR: 7:30 AM TO 8:30 AM

REDUCED BY: CN

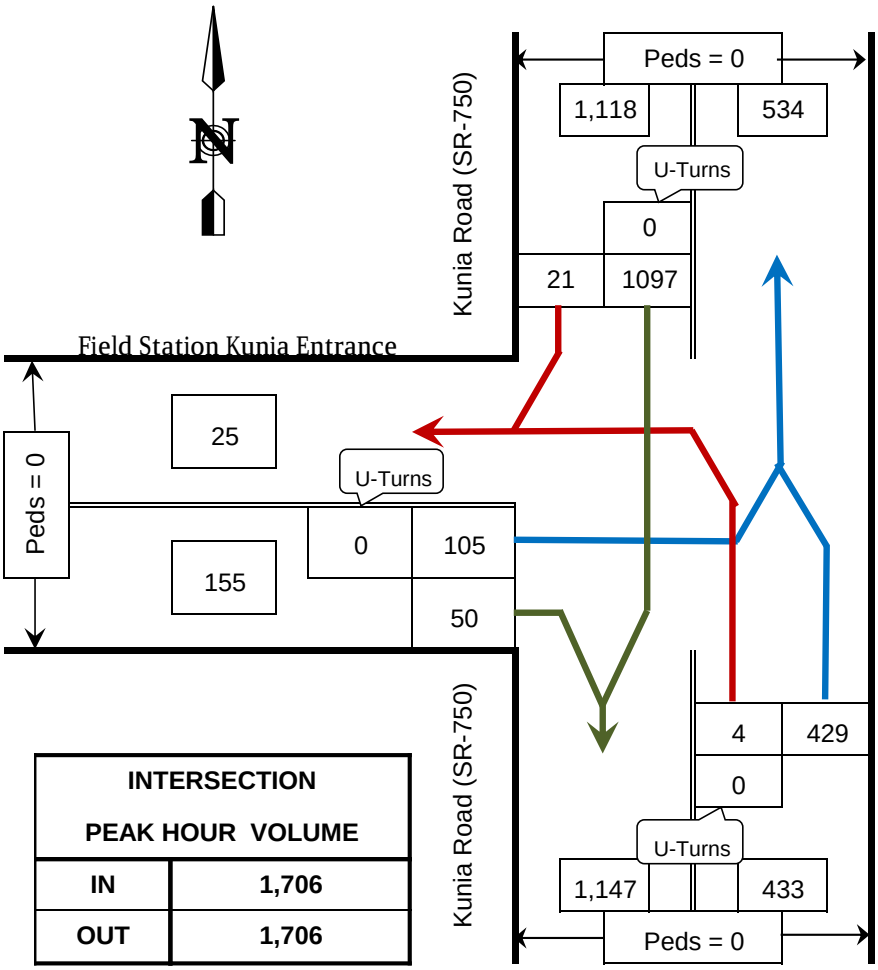
DATE OF REDUCTION: 2/28/2014

	FROM NORTH ON Kunia Road (SR-750)						FROM SOUTH ON Kunia Road (SR-750)						FROM EAST ON						FROM WEST ON Entrance						INTERVAL TOTALS
TIME INTERVAL	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	
5:30 AM - 6:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
5:45 AM - 6:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
6:00 AM - 7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
6:15 AM - 7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
6:30 AM - 7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
6:45 AM - 7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
7:00 AM - 8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
7:15 AM - 8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
7:30 AM - 8:30 AM	0	22	0	0	389	80	0	33	0	28	745	0	0	0	0	0	0	0	0	6	0	33	0	10	**1285**
7:45 AM - 8:45 AM	0	24	0	0	373	67	0	47	0	30	729	0	0	0	0	0	0	0	0	5	0	43	0	11	**1253**
8:00 AM - 9:00 AM	0	25	0	0	339	53	0	52	0	19	714	0	0	0	0	0	0	0	0	4	0	48	0	10	**1183**
8:15 AM - 9:15 AM	0	25	0	0	288	49	0	55	0	21	707	0	0	0	0	0	0	0	0	3	0	52	0	11	**1128**
8:30 AM - 9:30 AM	0	27	0	0	255	55	0	48	0	20	626	0	0	0	0	0	0	0	0	0	0	50	0	6	**1012**

TRAFFIC DATA GATHERING

TURNING MOVEMENTS DIAGRAM

3:30 PM - 5:30 PM PEAK HOUR: 3:30 PM TO 4:30 PM



INTERSECTION PEAK HOUR VOLUME	
IN	1,706
OUT	1,706

	HV	PHF
SB	1.3%	0.87
NB	2.5%	0.87
EB	0.6%	0.97
INTRS.	1.6%	0.90

HV = Heavy Vehicles
PHF = Peak Hour Factor

Kunia Road (SR-750) @ d Entrance

Schofield Barracks, HI

COUNTED BY: VT

DATE OF COUNT: Wed. 2/26/14

REDUCED BY: CN

TIME OF COUNT: 3:30 PM - 5:30 PM

REDUCTION DATE: Fri. 2/28/14

WEATHER: Overcast

TRAFFIC DATA GATHERING

INTERSECTION TURNING MOVEMENTS REDUCTION SHEET

LOCATION: Kunia Road (SR-750) @ Entrance
Schofield Barracks, HI

DATE OF COUNT: Wed. 2/26/14
TIME OF COUNT: 3:30 PM - 5:30 PM

COUNTED BY: VT
WEATHER: Overcast

TIME INTERVAL ENDING AT	FROM NORTH ON Kunia Road (SR-750)						FROM SOUTH ON Kunia Road (SR-750)						FROM EAST ON						FROM WEST ON Entrance						INTERVAL TOTALS
	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	
01:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:45 PM	0	4	0	0	260	6	0	3	0	2	90	0	0	0	0	0	0	0	0	0	0	28	0	12	398
04:00 PM	0	3	0	0	264	6	0	4	0	2	122	0	0	0	0	0	0	0	0	1	0	21	0	18	433
04:15 PM	0	4	0	0	314	6	0	1	0	0	117	0	0	0	0	0	0	0	0	0	0	25	0	13	475
04:30 PM	0	4	0	0	259	3	0	3	0	0	100	0	0	0	0	0	0	0	0	0	0	31	0	7	400
04:45 PM	0	5	0	0	271	2	0	1	0	1	90	0	0	0	0	0	0	0	0	0	0	18	0	8	390
05:00 PM	0	3	0	0	221	4	0	3	0	2	92	0	0	0	0	0	0	0	0	0	0	13	0	9	341
05:15 PM	0	2	0	0	160	3	0	4	0	1	74	0	0	0	0	0	0	0	0	0	0	18	0	4	260
05:30 PM	0	2	0	0	211	1	0	1	0	1	85	0	0	0	0	0	0	0	0	0	0	15	0	3	316
PEAK HOUR TOTALS	0	15	0	0	1097	21	0	11	0	4	429	0	0	0	0	0	0	0	0	1	0	105	0	50	INTERSECTION
ALL MOVEMENTS	1118						433						0						155						1706
% HV	1.3%						2.5%						#N/A						0.6%						1.6%
PEAK HOUR FACTOR	0.87						0.87						#N/A						0.97						0.90

PHF = Peak Hour Factor

3:30 PM - 5:30 PM PEAK HOUR: 3:30 PM TO 4:30 PM

REDUCED BY: CN

DATE OF REDUCTION: 2/28/2014

	FROM NORTH ON Kunia Road (SR-750)						FROM SOUTH ON Kunia Road (SR-750)						FROM EAST ON						FROM WEST ON Entrance						INTERVAL TOTALS
TIME INTERVAL	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	Peds	HV	UTurn	Left	Thru	Right	
1:30 PM - 2:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:45 PM - 2:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:00 PM - 3:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:15 PM - 3:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:30 PM - 3:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:45 PM - 3:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:00 PM - 4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:15 PM - 4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:30 PM - 4:30 PM	0	15	0	0	1097	21	0	11	0	4	429	0	0	0	0	0	0	0	0	1	0	105	0	50	1706
3:45 PM - 4:45 PM	0	16	0	0	1108	17	0	9	0	3	429	0	0	0	0	0	0	0	0	1	0	95	0	46	1698
4:00 PM - 5:00 PM	0	16	0	0	1065	15	0	8	0	3	399	0	0	0	0	0	0	0	0	0	0	87	0	37	1606
4:15 PM - 5:15 PM	0	14	0	0	911	12	0	11	0	4	356	0	0	0	0	0	0	0	0	0	0	80	0	28	1391
4:30 PM - 5:30 PM	0	12	0	0	863	10	0	9	0	5	341	0	0	0	0	0	0	0	0	0	0	64	0	24	1307

Traffic Study
Appendix B.

Level of Service (LOS) Definitions

Level of Service (LOS) Definitions

The following sections describe the Level of Service (LOS) definitions for unsignalized and signalized intersection capacity.

The objective of applied traffic analysis is to provide a method of quantifying the degree of expected traffic congestion and compare this to the overall traffic-related performance of the roadway[1].

The capacity of any transportation facility reflects its ability to accommodate a moving stream of people or vehicles. It is a measure of the supply side of transportation facilities. LOS uses qualitative measures that characterize operational conditions within a traffic stream and perception of these conditions by motorists and passengers. The descriptions of individual LOS characterize these conditions in terms of factors such as speed and travel time, freedom to maneuver, traffic interruptions, and driver comfort and convenience[2].

Six LOS are defined for each type of transportation facility for which analysis procedures are available. They are given letter designations, ranging from "A" to "F," with "A" representing the best operating conditions and "F" representing the worst. Each LOS represents a range of operating conditions that are defined by quantitative factors known as measures of effectiveness.

The volume of traffic that can be served under stop-and-go conditions of LOS F is generally accepted as being lower than that possible at LOS E. Typically a facility that operates a LOS E is at the maximum service flow rate. For most design or planning purposes, however, obtaining service flow rates of C are usually the desired norm because they ensure a more acceptable quality of service to all users of the transportation facility.

Unsignalized Intersection Capacity

The LOS for an unsignalized intersection is determined by the amount of delay experienced at the intersection. Delay is measured as the average time from when a vehicle stops at the end of the queue until the vehicle departs from the stop line. The LOS is determined from the length of the average delay experienced at the intersection during the peak commute hour. LOS A indicates short delays associated with very small queues, while LOS F indicates very long delays associated with longer queues.

Unsignalized intersections were evaluated according to the methodologies presented in Chapter 17 of the 2000 update of the *Highway Capacity Manual* (HCM)[3]. For the purposes of this report, the worst movement at each unsignalized intersection was used to compare LOS and delay to other intersections. The following table summarizes the LOS criteria for unsignalized intersections.

[1] *Principals of Highway Engineering and Traffic Analysis*, Mannering and Kilareksi (1997).
[2] *Traffic Engineering Handbook*, Institute of Transportation Engineers (1999).
[3] *Highway Capacity Manual: Special Report 209*, Transportation Research Board (2000 Update).

Unsignalized Intersection LOS Criteria

Average Control Delay (sec/veh)	*Intersection Level of Service*
≤ 10	A
> 10 and ≤ 15	B
>15 and ≤ 25	C
>25 and ≤ 35	D
>35 and ≤ 50	E
> 50	F

Note: sec/veh = seconds per vehicle.

It should be mentioned that equal LOS values at several locations do not necessarily indicate equal overall performance of intersections. One location might experience a higher degree of delay for a considerable period of the day while at another the peak period is of short duration.

In addition, a poor LOS is more tolerable to drivers at a low-volume intersection than at a high-volume intersection. Capacity analysis for any stop sign-controlled approach is based on the assumption that the major street traffic is not affected by the minor street movements, and left turns from the major streets to the minor streets are influenced only by opposing major street traffic flow. The calculated LOS for stop sign-controlled intersections is only for movements on the minor street and left turn movements on the major street.

Signalized Intersection Capacity

LOS for signalized intersections is defined in terms of delay, and is a measure of driver discomfort, frustration, fuel consumption, and lost travel time. The delay a driver experiences is due to a number of factors related to intersection traffic control phasing and timing, roadway geometrics, traffic volumes, and incidents (traffic accidents) or events.

Signalized intersections were evaluated according to the methodologies presented in Chapter 16 of the 2000 update of the HCM[4]. The table below summarizes the intersection LOS criteria for signalized intersections.

Signalized Intersection LOS Criteria

Control Delay per Vehicle (sec/veh)	*Intersection Level of Service*
≤ 10	A
>10 and ≤ 20	B
>20 and ≤ 35	C
>35 and ≤ 55	D
>55 and ≤ 80	E
> 80	F

Note: sec/veh = seconds per vehicle.

[4] *Highway Capacity Manual: Special Report 209*, Transportation Research Board (2000 Update).

Traffic Study
Appendix C.

Synchro Level of Service Analysis Reports

HCM Signalized Intersection Capacity Analysis
1: Kunia Rd & Foote Ave

3/24/2014

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	410	116	202	535	498	398
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1752	1568	1752	3505	3438	1538
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1752	1568	1752	3505	3438	1538
Peak-hour factor, PHF	0.84	0.84	0.92	0.92	0.87	0.87
Adj. Flow (vph)	488	138	220	582	572	457
RTOR Reduction (vph)	0	0	0	0	0	297
Lane Group Flow (vph)	488	138	220	582	572	160
Confl. Peds. (#/hr)	1					
Heavy Vehicles (%)	3%	3%	3%	3%	5%	5%
Turn Type	NA	custom	Prot	NA	NA	Perm
Protected Phases	4	4	1	6	2	
Permitted Phases		6				2
Actuated Green, G (s)	55.6	109.0	19.9	53.4	28.5	28.5
Effective Green, g (s)	55.6	109.0	19.9	53.4	28.5	28.5
Actuated g/C Ratio	0.47	0.92	0.17	0.45	0.24	0.24
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	819	1568	293	1573	823	368
v/s Ratio Prot	c0.28	0.04	c0.13	0.17	c0.17	
v/s Ratio Perm		0.05				0.10
v/c Ratio	0.60	0.09	0.75	0.37	0.70	0.44
Uniform Delay, d1	23.4	0.5	47.2	21.7	41.3	38.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.2	0.0	10.3	0.1	2.6	0.8
Delay (s)	26.6	0.5	57.5	21.8	43.8	39.3
Level of Service	C	A	E	C	D	D
Approach Delay (s)	20.8			31.6	41.8	
Approach LOS	C			C	D	

Intersection Summary			
HCM Average Control Delay	33.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	119.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	60.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Queues
1: Kunia Rd & Foote Ave

3/24/2014

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	488	138	220	582	572	457
v/c Ratio	0.60	0.09	0.75	0.37	0.70	0.69
Control Delay	29.8	0.1	64.4	21.8	46.5	13.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.8	0.1	64.4	21.8	46.5	13.0
Queue Length 50th (ft)	270	0	161	150	211	41
Queue Length 95th (ft)	444	0	272	191	281	139
Internal Link Dist (ft)	1099			1376	2153	
Turn Bay Length (ft)			150			150
Base Capacity (vph)	818	1568	416	2232	1226	799
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.60	0.09	0.53	0.26	0.47	0.57

Intersection Summary

HCM Signalized Intersection Capacity Analysis
30: Kunia Rd/Driveway & SR 99

3/24/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	682	178	709	775	6	237	4	704	14	9	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	2.0	3.0	3.0			3.0	3.0		3.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			1.00	1.00		1.00	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00			1.00	0.99		1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.97	
Satd. Flow (prot)	1736	3471	1533	1719	3433			1725	1517		1764	
Flt Permitted	0.34	1.00	1.00	0.95	1.00			0.70	1.00		0.59	
Satd. Flow (perm)	620	3471	1533	1719	3433			1264	1517		1069	
Peak-hour factor, PHF	0.88	0.88	0.88	0.94	0.94	0.94	0.83	0.83	0.83	0.55	0.55	0.55
Adj. Flow (vph)	1	775	202	754	824	6	286	5	848	25	16	2
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	1	0
Lane Group Flow (vph)	1	775	202	754	830	0	0	291	848	0	42	0
Confl. Peds. (#/hr)			2			3			5	5		
Heavy Vehicles (%)	4%	4%	4%	5%	5%	5%	5%	5%	5%	4%	4%	4%
Turn Type	Perm	NA	Free	Prot	NA		Perm	NA	Free	Perm	NA	
Protected Phases		6		5	2			8			4	
Permitted Phases	6		Free				8		Free	4		
Actuated Green, G (s)	47.6	47.6	200.1	89.9	142.5			47.6	200.1		47.6	
Effective Green, g (s)	49.6	49.6	200.1	91.9	144.5			49.6	200.1		49.6	
Actuated g/C Ratio	0.25	0.25	1.00	0.46	0.72			0.25	1.00		0.25	
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	154	860	1533	789	2479			313	1517		265	
v/s Ratio Prot		c0.22		c0.44	0.24							
v/s Ratio Perm	0.00		0.13					c0.23	0.56		0.04	
v/c Ratio	0.01	0.90	0.13	0.96	0.33			0.93	0.56		0.16	
Uniform Delay, d1	56.7	72.9	0.0	52.1	10.2			73.5	0.0		58.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2	0.0	12.5	0.2	21.7	0.1			32.6	1.5		0.3	
Delay (s)	56.7	85.4	0.2	73.8	10.3			106.2	1.5		59.2	
Level of Service	E	F	A	E	B			F	A		E	
Approach Delay (s)		67.8			40.5			28.2			59.2	
Approach LOS		E			D			C			E	

Intersection Summary			
HCM Average Control Delay	44.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	200.1	Sum of lost time (s)	9.0
Intersection Capacity Utilization	88.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Queues
30: Kunia Rd/Driveway & SR 99

3/24/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	1	775	202	754	830	291	848	43
v/c Ratio	0.01	0.90	0.13	0.96	0.33	0.93	0.56	0.16
Control Delay	60.0	88.1	0.2	74.9	10.7	109.0	1.5	62.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	60.0	88.1	0.2	74.9	10.7	109.0	1.5	62.4
Queue Length 50th (ft)	1	554	0	998	207	399	0	46
Queue Length 95th (ft)	7	624	0	#1288	239	#520	0	52
Internal Link Dist (ft)		1998			2306	2153		237
Turn Bay Length (ft)	150		200	150				
Base Capacity (vph)	162	911	1533	842	2636	332	1517	282
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.85	0.13	0.90	0.31	0.88	0.56	0.15

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	36	379	512	202	117	29
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.84	0.84	0.89	0.89	0.86	0.86
Hourly flow rate (vph)	43	451	575	227	136	34
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						3
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		1279				
pX, platoon unblocked						
vC, conflicting volume	802				1226	689
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	802				1226	689
tC, single (s)	4.2				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.3				3.5	3.3
p0 queue free %	94				27	92
cM capacity (veh/h)	779				186	446

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	494	802	170
Volume Left	43	0	136
Volume Right	0	227	34
cSH	779	1700	233
Volume to Capacity	0.06	0.47	0.73
Queue Length 95th (ft)	4	0	124
Control Delay (s)	1.5	0.0	53.8
Lane LOS	A		F
Approach Delay (s)	1.5	0.0	53.8
Approach LOS			F

Intersection Summary			
Average Delay	6.7		
Intersection Capacity Utilization	63.0%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
44: Kunia Rd & Lyman Rd

7/17/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	76	365	93	34	459	74	140	587	81	150	348	116
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	4.0	3.0	3.0	4.0	3.0	3.0	4.0	3.0	3.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.87	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1736	1827	1356	1787	1881	1599	1736	3471	1553	1703	3406	1524
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1736	1827	1356	1787	1881	1599	1736	3471	1553	1703	3406	1524
Peak-hour factor, PHF	0.64	0.64	0.64	0.84	0.84	0.84	0.76	0.76	0.76	0.91	0.91	0.91
Adj. Flow (vph)	119	570	145	40	546	88	184	772	107	165	382	127
RTOR Reduction (vph)	0	0	15	0	0	12	0	0	41	0	0	67
Lane Group Flow (vph)	119	570	130	40	546	76	184	772	66	165	382	60
Confl. Peds. (#/hr)			52									
Heavy Vehicles (%)	4%	4%	4%	1%	1%	1%	4%	4%	4%	6%	6%	6%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases			4			8			6			2
Actuated Green, G (s)	16.7	65.4	65.4	6.9	55.6	55.6	23.1	43.8	43.8	21.6	42.3	42.3
Effective Green, g (s)	18.7	67.4	66.4	8.9	57.6	56.6	25.1	45.8	44.8	23.6	44.3	43.3
Actuated g/C Ratio	0.12	0.43	0.42	0.06	0.37	0.36	0.16	0.29	0.28	0.15	0.28	0.27
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	206	781	571	101	687	574	276	1008	441	255	957	418
v/s Ratio Prot	c0.07	0.31		0.02	c0.29		c0.11	c0.22		0.10	0.11	
v/s Ratio Perm			0.10			0.05			0.04			0.04
v/c Ratio	0.58	0.73	0.23	0.40	0.79	0.13	0.67	0.77	0.15	0.65	0.40	0.14
Uniform Delay, d1	65.8	37.6	29.2	71.8	44.8	34.0	62.4	51.1	42.2	63.1	45.9	43.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.9	3.4	0.2	2.5	6.3	0.1	6.0	3.5	0.2	5.6	0.3	0.2
Delay (s)	69.7	41.0	29.4	74.4	51.1	34.1	68.3	54.6	42.4	68.7	46.2	43.3
Level of Service	E	D	C	E	D	C	E	D	D	E	D	D
Approach Delay (s)		43.1			50.3			55.7			51.2	
Approach LOS		D			D			E			D	

Intersection Summary			
HCM Average Control Delay	50.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	157.7	Sum of lost time (s)	9.0
Intersection Capacity Utilization	66.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Queues
44: Kunia Rd & Lyman Rd

7/17/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	119	570	145	40	546	88	184	772	107	165	382	127
v/c Ratio	0.57	0.73	0.26	0.33	0.81	0.15	0.66	0.76	0.22	0.64	0.40	0.26
Control Delay	84.5	46.4	28.3	89.9	58.5	30.9	79.8	58.9	25.7	81.0	49.9	18.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	84.5	46.4	28.3	89.9	58.5	30.9	79.8	58.9	25.7	81.0	49.9	18.0
Queue Length 50th (ft)	118	503	81	40	510	48	181	384	38	163	169	26
Queue Length 95th (ft)	167	491	104	97	744	102	282	480	82	313	282	100
Internal Link Dist (ft)		1752			1465			949			1376	
Turn Bay Length (ft)	150		60	240		80	250		200	250		130
Base Capacity (vph)	283	1140	811	145	1021	866	400	1460	676	370	1386	666
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.42	0.50	0.18	0.28	0.53	0.10	0.46	0.53	0.16	0.45	0.28	0.19

Intersection Summary

HCM Signalized Intersection Capacity Analysis
16: Humphreys Rd & Lyman Rd

3/24/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	23	230	4	10	313	176	0	0	0	230	20	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0						5.0	5.0
Lane Util. Factor		1.00			1.00						1.00	1.00
Frt		1.00			0.95						1.00	0.85
Flt Protected		1.00			1.00						0.96	1.00
Satd. Flow (prot)		1781			1705						1781	1583
Flt Permitted		0.93			0.99						0.96	1.00
Satd. Flow (perm)		1660			1693						1781	1583
Peak-hour factor, PHF	0.83	0.83	0.83	0.85	0.85	0.85	0.92	0.92	0.92	0.72	0.72	0.72
Adj. Flow (vph)	28	277	5	12	368	207	0	0	0	319	28	42
RTOR Reduction (vph)	0	1	0	0	30	0	0	0	0	0	0	28
Lane Group Flow (vph)	0	309	0	0	557	0	0	0	0	0	347	14
Heavy Vehicles (%)	6%	6%	6%	6%	6%	6%	2%	2%	2%	2%	2%	2%
Turn Type	Perm	NA		Perm	NA					Split	NA	Perm
Protected Phases		4			8					2	2	
Permitted Phases	4			8								2
Actuated Green, G (s)		21.5			21.5						15.4	15.4
Effective Green, g (s)		21.5			21.5						15.4	15.4
Actuated g/C Ratio		0.46			0.46						0.33	0.33
Clearance Time (s)		5.0			5.0						5.0	5.0
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		761			776						585	520
v/s Ratio Prot											c0.19	
v/s Ratio Perm		0.19			c0.33							0.01
v/c Ratio		0.41			0.72						0.59	0.03
Uniform Delay, d1		8.5			10.2						13.1	10.7
Progression Factor		1.00			1.00						1.00	1.00
Incremental Delay, d2		0.4			3.2						1.6	0.0
Delay (s)		8.8			13.4						14.8	10.7
Level of Service		A			B						B	B
Approach Delay (s)		8.8			13.4			0.0			14.3	
Approach LOS		A			B			A			B	

Intersection Summary			
HCM Average Control Delay	12.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	46.9	Sum of lost time (s)	10.0
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	WBT	SBT	SBR
Lane Group Flow (vph)	310	587	347	42
v/c Ratio	0.42	0.74	0.61	0.08
Control Delay	11.2	16.8	20.1	5.9
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	11.2	16.8	20.1	5.9
Queue Length 50th (ft)	48	100	74	0
Queue Length 95th (ft)	116	242	143	12
Internal Link Dist (ft)	2460	1199	1412	
Turn Bay Length (ft)				200
Base Capacity (vph)	1266	1304	1020	925
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.24	0.45	0.34	0.05

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
3: Lyman Rd & Maili Rd

3/24/2014

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	4	18	65	23	170	27
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.79	0.79	0.88	0.88	0.78	0.78
Hourly flow rate (vph)	5	23	74	26	218	35
Pedestrians			1		1	
Lane Width (ft)			12.0		12.0	
Walking Speed (ft/s)			4.0		4.0	
Percent Blockage			0		0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	101				122	88
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	101				122	88
tC, single (s)	4.3				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.4				3.5	3.3
p0 queue free %	100				75	96
cM capacity (veh/h)	1369				871	972

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	28	100	253
Volume Left	5	0	218
Volume Right	0	26	35
cSH	1369	1700	884
Volume to Capacity	0.00	0.06	0.29
Queue Length 95th (ft)	0	0	30
Control Delay (s)	1.4	0.0	10.7
Lane LOS	A		B
Approach Delay (s)	1.4	0.0	10.7
Approach LOS			B

Intersection Summary			
Average Delay	7.2		
Intersection Capacity Utilization	22.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	33	10	28	775	394	81
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	4.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.98	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1583	1417	1736	1827	1768	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1583	1417	1736	1827	1768	
Peak-hour factor, PHF	0.51	0.51	0.89	0.89	0.92	0.92
Adj. Flow (vph)	65	20	31	871	428	88
RTOR Reduction (vph)	0	17	0	0	6	0
Lane Group Flow (vph)	65	3	31	871	510	0
Heavy Vehicles (%)	14%	14%	4%	4%	5%	5%
Turn Type	NA	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	6.5	6.5	2.8	40.2	32.4	
Effective Green, g (s)	8.5	7.5	4.8	42.2	34.4	
Actuated g/C Ratio	0.15	0.13	0.08	0.74	0.61	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	237	187	147	1360	1073	
v/s Ratio Prot	c0.04		0.02	c0.48	0.29	
v/s Ratio Perm		0.00				
v/c Ratio	0.27	0.01	0.21	0.64	0.48	
Uniform Delay, d1	21.4	21.4	24.2	3.5	6.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.6	0.0	0.7	1.0	0.3	
Delay (s)	22.0	21.4	24.9	4.6	6.5	
Level of Service	C	C	C	A	A	
Approach Delay (s)	21.9			5.3	6.5	
Approach LOS	C			A	A	

Intersection Summary			
HCM Average Control Delay	6.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	56.7	Sum of lost time (s)	6.0
Intersection Capacity Utilization	51.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Queues
41: Kunia Rd & Field Station Kunia Entrance

7/17/2014

Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	65	20	31	871	516
v/c Ratio	0.20	0.07	0.10	0.62	0.43
Control Delay	22.1	11.1	22.8	7.2	9.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	22.1	11.1	22.8	7.2	9.2
Queue Length 50th (ft)	19	0	9	115	48
Queue Length 95th (ft)	29	6	32	263	225
Internal Link Dist (ft)	642			1901	1624
Turn Bay Length (ft)	140		300		
Base Capacity (vph)	936	818	566	1814	1491
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.07	0.02	0.05	0.48	0.35

Intersection Summary

HCM Signalized Intersection Capacity Analysis
1: Kunia Rd & Foote Ave

3/28/2014

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	776	406	70	577	446	280
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1787	1599	1787	3574	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1787	1599	1787	3574	3539	1583
Peak-hour factor, PHF	0.81	0.81	0.83	0.83	0.87	0.87
Adj. Flow (vph)	958	501	84	695	513	322
RTOR Reduction (vph)	0	0	0	0	0	237
Lane Group Flow (vph)	958	501	84	695	513	85
Confl. Peds. (#/hr)	1					
Heavy Vehicles (%)	1%	1%	1%	1%	2%	2%
Turn Type	NA	custom	Prot	NA	NA	Perm
Protected Phases	4	4	1	6	2	
Permitted Phases		6				2
Actuated Green, G (s)	70.4	111.3	11.1	40.9	24.8	24.8
Effective Green, g (s)	70.4	111.3	11.1	40.9	24.8	24.8
Actuated g/C Ratio	0.58	0.92	0.09	0.34	0.20	0.20
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1037	1599	164	1205	724	324
v/s Ratio Prot	c0.54	0.18	0.05	c0.19	c0.14	
v/s Ratio Perm		0.13				0.05
v/c Ratio	0.92	0.31	0.51	0.58	0.71	0.26
Uniform Delay, d1	23.0	0.6	52.5	33.1	44.9	40.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	14.7	0.1	2.7	0.7	3.2	0.4
Delay (s)	37.7	0.7	55.2	33.8	48.1	41.0
Level of Service	D	A	E	C	D	D
Approach Delay (s)	25.0			36.1	45.3	
Approach LOS	C			D	D	

Intersection Summary			
HCM Average Control Delay	33.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	121.3	Sum of lost time (s)	15.0
Intersection Capacity Utilization	72.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Queues
1: Kunia Rd & Foote Ave

3/28/2014

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	958	501	84	695	513	322
v/c Ratio	0.92	0.31	0.52	0.58	0.71	0.57
Control Delay	40.2	0.5	65.3	34.7	50.7	10.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.2	0.5	65.3	34.7	50.7	10.5
Queue Length 50th (ft)	636	0	63	233	197	15
Queue Length 95th (ft)	#960	0	114	262	257	85
Internal Link Dist (ft)	1138			1376	2153	
Turn Bay Length (ft)			150			150
Base Capacity (vph)	1036	1599	237	1777	1143	713
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.92	0.31	0.35	0.39	0.45	0.45

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
30: Kunia Rd/Driveway & SR 99

3/28/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	3	1255	188	531	769	6	263	6	1084	10	7	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	2.0	3.0	3.0			3.0	3.0		3.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			1.00	1.00		1.00	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00			1.00	0.99		1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.97	
Satd. Flow (prot)	1770	3539	1564	1787	3570			1793	1579		1686	
Flt Permitted	0.35	1.00	1.00	0.95	1.00			0.73	1.00		0.68	
Satd. Flow (perm)	651	3539	1564	1787	3570			1366	1579		1187	
Peak-hour factor, PHF	0.94	0.94	0.94	0.97	0.97	0.97	0.94	0.94	0.94	0.69	0.69	0.69
Adj. Flow (vph)	3	1335	200	547	793	6	280	6	1153	14	10	1
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	1	0
Lane Group Flow (vph)	3	1335	200	547	799	0	0	286	1153	0	24	0
Confl. Peds. (#/hr)			1						1			
Heavy Vehicles (%)	2%	2%	2%	1%	1%	1%	1%	1%	1%	9%	9%	9%
Turn Type	Perm	NA	Free	Prot	NA		Perm	NA	Free	Perm	NA	
Protected Phases		6		5	2			8			4	
Permitted Phases	6		Free				8		Free	4		
Actuated Green, G (s)	79.8	79.8	201.2	62.2	147.0			44.2	201.2		44.2	
Effective Green, g (s)	81.8	81.8	201.2	64.2	149.0			46.2	201.2		46.2	
Actuated g/C Ratio	0.41	0.41	1.00	0.32	0.74			0.23	1.00		0.23	
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	265	1439	1564	570	2644			314	1579		273	
v/s Ratio Prot		c0.38		c0.31	0.22							
v/s Ratio Perm	0.00		0.13					c0.21	0.73		0.02	
v/c Ratio	0.01	0.93	0.13	0.96	0.30			0.91	0.73		0.09	
Uniform Delay, d1	35.6	56.9	0.0	67.2	8.7			75.5	0.0		60.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2	0.0	10.6	0.2	27.5	0.1			29.1	3.0		0.1	
Delay (s)	35.6	67.5	0.2	94.7	8.8			104.6	3.0		61.1	
Level of Service	D	E	A	F	A			F	A		E	
Approach Delay (s)		58.6			43.7			23.2			61.1	
Approach LOS		E			D			C			E	

Intersection Summary			
HCM Average Control Delay	42.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	201.2	Sum of lost time (s)	9.0
Intersection Capacity Utilization	95.7%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Queues
30: Kunia Rd/Driveway & SR 99

3/28/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	3	1335	200	547	799	286	1153	25
v/c Ratio	0.01	0.93	0.13	0.96	0.30	0.91	0.73	0.09
Control Delay	37.3	69.1	0.2	95.4	9.2	108.1	3.0	62.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.3	69.1	0.2	95.4	9.2	108.1	3.0	62.3
Queue Length 50th (ft)	3	924	0	756	184	389	0	26
Queue Length 95th (ft)	12	1030	0	#1014	213	#577	0	45
Internal Link Dist (ft)		1998			2306	2153		237
Turn Bay Length (ft)	150		200	150				
Base Capacity (vph)	281	1523	1564	591	2771	335	1579	292
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.88	0.13	0.93	0.29	0.85	0.73	0.09

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	31	653	352	130	144	37
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.90	0.90	0.87	0.87
Hourly flow rate (vph)	34	710	391	144	166	43
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						3
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		1279				
pX, platoon unblocked						
vC, conflicting volume	536				1241	463
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	536				1241	463
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				11	93
cM capacity (veh/h)	1037				187	599

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	743	536	208
Volume Left	34	0	166
Volume Right	0	144	43
cSH	1037	1700	228
Volume to Capacity	0.03	0.32	0.91
Queue Length 95th (ft)	3	0	192
Control Delay (s)	0.8	0.0	83.9
Lane LOS	A		F
Approach Delay (s)	0.8	0.0	83.9
Approach LOS			F

Intersection Summary			
Average Delay	12.2		
Intersection Capacity Utilization	74.2%	ICU Level of Service	D
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
44: Kunia Rd & Lyman Rd

3/28/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	129	259	252	154	230	98	75	420	27	63	712	77
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	4.0	3.0	3.0	4.0	3.0	3.0	4.0	3.0	3.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1556	1787	1881	1599	1787	3574	1599	1787	3574	1599
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1556	1787	1881	1599	1787	3574	1599	1787	3574	1599
Peak-hour factor, PHF	0.91	0.91	0.91	0.82	0.82	0.82	0.83	0.83	0.83	0.76	0.76	0.76
Adj. Flow (vph)	142	285	277	188	280	120	90	506	33	83	937	101
RTOR Reduction (vph)	0	0	70	0	0	36	0	0	18	0	0	20
Lane Group Flow (vph)	142	285	207	188	280	84	90	506	15	83	937	81
Confl. Peds. (#/hr)			3									
Heavy Vehicles (%)	2%	2%	2%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases			4			8			6			2
Actuated Green, G (s)	17.0	28.0	28.0	20.4	31.4	31.4	12.8	42.0	42.0	12.2	41.4	41.4
Effective Green, g (s)	19.0	30.0	29.0	22.4	33.4	32.4	14.8	44.0	43.0	14.2	43.4	42.4
Actuated g/C Ratio	0.15	0.24	0.24	0.18	0.27	0.26	0.12	0.36	0.35	0.12	0.35	0.35
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	274	456	368	326	512	423	216	1283	561	207	1265	553
v/s Ratio Prot	0.08	c0.15		c0.11	0.15		c0.05	0.14		0.05	c0.26	
v/s Ratio Perm			0.13			0.05			0.01			0.05
v/c Ratio	0.52	0.62	0.56	0.58	0.55	0.20	0.42	0.39	0.03	0.40	0.74	0.15
Uniform Delay, d1	47.6	41.3	41.2	45.8	38.1	35.0	49.9	29.3	26.1	50.3	34.7	27.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.7	2.7	2.0	2.5	1.2	0.2	1.3	0.2	0.0	1.3	2.4	0.1
Delay (s)	49.3	44.0	43.2	48.2	39.3	35.2	51.2	29.6	26.1	51.5	37.0	27.7
Level of Service	D	D	D	D	D	D	D	C	C	D	D	C
Approach Delay (s)		44.7			41.3			32.5			37.3	
Approach LOS		D			D			C			D	

Intersection Summary			
HCM Average Control Delay	38.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	122.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	59.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Queues
44: Kunia Rd & Lyman Rd

3/28/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	142	285	277	188	280	120	90	506	33	83	937	101
v/c Ratio	0.52	0.63	0.64	0.58	0.55	0.26	0.42	0.40	0.06	0.40	0.75	0.18
Control Delay	60.4	51.5	37.6	58.1	45.7	26.1	63.4	32.3	12.9	64.0	40.8	23.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	60.4	51.5	37.6	58.1	45.7	26.1	63.4	32.3	12.9	64.0	40.8	23.3
Queue Length 50th (ft)	105	202	132	137	190	43	67	157	3	62	341	38
Queue Length 95th (ft)	221	380	288	246	318	101	141	239	25	121	428	77
Internal Link Dist (ft)		1752			1815			882			1376	
Turn Bay Length (ft)	150		60	240		80	250		200	250		130
Base Capacity (vph)	499	1305	1101	473	1285	1095	305	2015	901	290	1985	888
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.28	0.22	0.25	0.40	0.22	0.11	0.30	0.25	0.04	0.29	0.47	0.11

Intersection Summary

HCM Signalized Intersection Capacity Analysis
16: Humphreys Rd & Lyman Rd

3/28/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	31	212	1	2	190	231	0	0	0	322	5	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0						5.0	5.0
Lane Util. Factor		1.00			1.00						1.00	1.00
Frpb, ped/bikes		1.00			1.00						1.00	1.00
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		1.00			0.93						1.00	0.85
Flt Protected		0.99			1.00						0.95	1.00
Satd. Flow (prot)		1850			1725						1793	1599
Flt Permitted		0.92			1.00						0.95	1.00
Satd. Flow (perm)		1709			1723						1793	1599
Peak-hour factor, PHF	0.75	0.75	0.75	0.92	0.92	0.92	0.92	0.92	0.92	0.85	0.85	0.85
Adj. Flow (vph)	41	283	1	2	207	251	0	0	0	379	6	21
RTOR Reduction (vph)	0	0	0	0	69	0	0	0	0	0	0	13
Lane Group Flow (vph)	0	325	0	0	391	0	0	0	0	0	385	8
Confl. Peds. (#/hr)										5		
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	1%	1%	1%
Turn Type	Perm	NA		Perm	NA					Split	NA	Perm
Protected Phases		4			8					2	2	
Permitted Phases	4			8								2
Actuated Green, G (s)		15.2			15.2						14.9	14.9
Effective Green, g (s)		15.2			15.2						14.9	14.9
Actuated g/C Ratio		0.38			0.38						0.37	0.37
Clearance Time (s)		5.0			5.0						5.0	5.0
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		648			653						666	594
v/s Ratio Prot											c0.21	
v/s Ratio Perm		0.19			c0.23							0.00
v/c Ratio		0.50			0.60						0.58	0.01
Uniform Delay, d1		9.5			10.0						10.1	8.0
Progression Factor		1.00			1.00						1.00	1.00
Incremental Delay, d2		0.6			1.5						1.2	0.0
Delay (s)		10.2			11.5						11.3	8.0
Level of Service		B			B						B	A
Approach Delay (s)		10.2			11.5			0.0			11.1	
Approach LOS		B			B			A			B	

Intersection Summary			
HCM Average Control Delay	11.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	40.1	Sum of lost time (s)	10.0
Intersection Capacity Utilization	60.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	SBT	SBR
Lane Group Flow (vph)	325	460	385	21
v/c Ratio	0.51	0.65	0.59	0.04
Control Delay	13.8	13.4	15.8	5.5
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	13.8	13.4	15.8	5.5
Queue Length 50th (ft)	49	53	60	0
Queue Length 95th (ft)	111	172	167	10
Internal Link Dist (ft)	2460	1199	1378	
Turn Bay Length (ft)				200
Base Capacity (vph)	1355	1387	1353	1211
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.24	0.33	0.28	0.02

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
3: Lyman Rd & Maili Rd

3/28/2014

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	19	45	33	76	45	12
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.57	0.57	0.76	0.76	0.79	0.79
Hourly flow rate (vph)	33	79	43	100	57	15
Pedestrians			2			
Lane Width (ft)			12.0			
Walking Speed (ft/s)			4.0			
Percent Blockage			0			
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	143				241	93
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	143				241	93
tC, single (s)	4.2				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.3				3.6	3.4
p0 queue free %	98				92	98
cM capacity (veh/h)	1403				718	950

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	112	143	72
Volume Left	33	0	57
Volume Right	0	100	15
cSH	1403	1700	757
Volume to Capacity	0.02	0.08	0.10
Queue Length 95th (ft)	2	0	8
Control Delay (s)	2.4	0.0	10.3
Lane LOS	A		B
Approach Delay (s)	2.4	0.0	10.3
Approach LOS			B

Intersection Summary			
Average Delay	3.1		
Intersection Capacity Utilization	20.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	105	50	4	417	1097	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	4.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1787	1599	1752	1845	1876	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1787	1599	1752	1845	1876	
Peak-hour factor, PHF	0.97	0.97	0.87	0.87	0.87	0.87
Adj. Flow (vph)	108	52	5	479	1261	24
RTOR Reduction (vph)	0	46	0	0	1	0
Lane Group Flow (vph)	108	6	5	479	1284	0
Heavy Vehicles (%)	1%	1%	3%	3%	1%	1%
Turn Type	NA	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	8.7	8.7	1.2	66.9	60.7	
Effective Green, g (s)	10.7	9.7	3.2	68.9	62.7	
Actuated g/C Ratio	0.12	0.11	0.04	0.80	0.73	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	223	181	65	1485	1374	
v/s Ratio Prot	c0.06		0.00	c0.26	c0.68	
v/s Ratio Perm		0.00				
v/c Ratio	0.48	0.03	0.08	0.32	0.93	
Uniform Delay, d1	34.9	33.8	39.8	2.2	9.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.7	0.1	0.5	0.1	11.9	
Delay (s)	36.5	33.8	40.3	2.3	21.6	
Level of Service	D	C	D	A	C	
Approach Delay (s)	35.7			2.7	21.6	
Approach LOS	D			A	C	

Intersection Summary			
HCM Average Control Delay	18.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	85.6	Sum of lost time (s)	9.0
Intersection Capacity Utilization	71.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Queues
41: Kunia Rd & Field Station Kunia Entrance

7/17/2014

Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	108	52	5	479	1285
v/c Ratio	0.40	0.19	0.03	0.32	0.87
Control Delay	35.5	11.2	34.8	3.5	18.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	35.5	11.2	34.8	3.5	18.5
Queue Length 50th (ft)	48	0	2	54	340
Queue Length 95th (ft)	102	31	13	106	#1036
Internal Link Dist (ft)	642			1901	1685
Turn Bay Length (ft)	140		300		
Base Capacity (vph)	514	477	263	1652	1477
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.21	0.11	0.02	0.29	0.87

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
1: Kunia Rd & Foote Ave

3/24/2014

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	441	125	217	589	630	428
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1752	1568	1752	3505	3438	1538
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1752	1568	1752	3505	3438	1538
Peak-hour factor, PHF	0.84	0.84	0.92	0.92	0.87	0.87
Adj. Flow (vph)	525	149	236	640	724	492
RTOR Reduction (vph)	0	0	0	0	0	242
Lane Group Flow (vph)	525	149	236	640	724	250
Confl. Peds. (#/hr)	1					
Heavy Vehicles (%)	3%	3%	3%	3%	5%	5%
Turn Type	NA	custom	Prot	NA	NA	Perm
Protected Phases	4	4	1	6	2	
Permitted Phases		6				2
Actuated Green, G (s)	55.5	117.5	21.5	62.0	35.5	35.5
Effective Green, g (s)	55.5	117.5	21.5	62.0	35.5	35.5
Actuated g/C Ratio	0.44	0.92	0.17	0.49	0.28	0.28
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	763	1568	295	1704	957	428
v/s Ratio Prot	c0.30	0.04	c0.13	0.18	c0.21	
v/s Ratio Perm		0.05				0.16
v/c Ratio	0.69	0.10	0.80	0.38	0.76	0.58
Uniform Delay, d1	29.0	0.4	50.9	20.6	42.0	39.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.0	0.0	14.3	0.1	3.5	2.0
Delay (s)	34.0	0.5	65.3	20.7	45.5	41.7
Level of Service	C	A	E	C	D	D
Approach Delay (s)	26.6			32.7	44.0	
Approach LOS	C			C	D	

Intersection Summary			
HCM Average Control Delay	36.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	127.5	Sum of lost time (s)	15.0
Intersection Capacity Utilization	66.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Queues
1: Kunia Rd & Foote Ave

3/24/2014

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	525	149	236	640	724	492
v/c Ratio	0.69	0.10	0.80	0.38	0.76	0.74
Control Delay	37.2	0.1	71.8	20.8	48.1	20.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.2	0.1	71.8	20.8	48.1	20.1
Queue Length 50th (ft)	358	0	191	168	290	119
Queue Length 95th (ft)	502	0	300	211	361	238
Internal Link Dist (ft)	1099			1376	2153	
Turn Bay Length (ft)			150			150
Base Capacity (vph)	762	1568	374	2080	1170	744
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.69	0.10	0.63	0.31	0.62	0.66

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	441	125	217	592	634	428
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1752	1568	1752	3505	3438	1538
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1752	1568	1752	3505	3438	1538
Peak-hour factor, PHF	0.84	0.84	0.92	0.92	0.87	0.87
Adj. Flow (vph)	525	149	236	643	729	492
RTOR Reduction (vph)	0	0	0	0	0	240
Lane Group Flow (vph)	525	149	236	643	729	252
Confl. Peds. (#/hr)	1					
Heavy Vehicles (%)	3%	3%	3%	3%	5%	5%
Turn Type	NA	custom	Prot	NA	NA	Perm
Protected Phases	4	4	1	6	2	
Permitted Phases		6				2
Actuated Green, G (s)	55.5	117.9	21.6	62.4	35.8	35.8
Effective Green, g (s)	55.5	117.9	21.6	62.4	35.8	35.8
Actuated g/C Ratio	0.43	0.92	0.17	0.49	0.28	0.28
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	760	1568	296	1710	962	430
v/s Ratio Prot	c0.30	0.04	c0.13	0.18	c0.21	
v/s Ratio Perm		0.05				0.16
v/c Ratio	0.69	0.10	0.80	0.38	0.76	0.59
Uniform Delay, d1	29.3	0.4	51.0	20.5	42.1	39.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.1	0.0	13.8	0.1	3.5	2.0
Delay (s)	34.4	0.5	64.9	20.7	45.5	41.7
Level of Service	C	A	E	C	D	D
Approach Delay (s)	26.9			32.5	44.0	
Approach LOS	C			C	D	

Intersection Summary			
HCM Average Control Delay	36.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	127.9	Sum of lost time (s)	15.0
Intersection Capacity Utilization	66.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Queues
1: Kunia Rd & Foote Ave

3/25/2014

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	525	149	236	643	729	492
v/c Ratio	0.69	0.10	0.80	0.38	0.76	0.73
Control Delay	37.5	0.1	72.0	20.7	48.0	20.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.5	0.1	72.0	20.7	48.0	20.2
Queue Length 50th (ft)	359	0	192	170	293	120
Queue Length 95th (ft)	502	0	300	212	363	240
Internal Link Dist (ft)	1099			1376	2153	
Turn Bay Length (ft)			150			150
Base Capacity (vph)	759	1568	373	2072	1165	741
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.69	0.10	0.63	0.31	0.63	0.66

Intersection Summary

HCM Signalized Intersection Capacity Analysis
30: Kunia Rd/Driveway & SR 99

3/25/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	733	211	841	833	0	259	4	770	15	10	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	2.0	3.0	3.0			3.0	3.0		3.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			1.00	1.00		1.00	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00			1.00	0.99		1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.97	
Satd. Flow (prot)	1736	3471	1533	1719	3438			1725	1517		1766	
Flt Permitted	0.32	1.00	1.00	0.95	1.00			0.69	1.00		0.48	
Satd. Flow (perm)	586	3471	1533	1719	3438			1250	1517		871	
Peak-hour factor, PHF	0.88	0.88	0.88	0.94	0.94	0.94	0.83	0.83	0.83	0.55	0.55	0.55
Adj. Flow (vph)	1	833	240	895	886	0	312	5	928	27	18	2
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	1	0
Lane Group Flow (vph)	1	833	240	895	886	0	0	317	928	0	46	0
Confl. Peds. (#/hr)			2			3			5	5		
Heavy Vehicles (%)	4%	4%	4%	5%	5%	5%	5%	5%	5%	4%	4%	4%
Turn Type	Perm	NA	Free	Prot	NA		Perm	NA	Free	Perm	NA	
Protected Phases		6		5	2			8			4	
Permitted Phases	6		Free				8		Free	4		
Actuated Green, G (s)	47.0	47.0	210.0	101.0	153.0			47.0	210.0		47.0	
Effective Green, g (s)	49.0	49.0	210.0	103.0	155.0			49.0	210.0		49.0	
Actuated g/C Ratio	0.23	0.23	1.00	0.49	0.74			0.23	1.00		0.23	
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	137	810	1533	843	2538			292	1517		203	
v/s Ratio Prot		c0.24		c0.52	0.26							
v/s Ratio Perm	0.00		0.16					c0.25	0.61		0.05	
v/c Ratio	0.01	1.03	0.16	1.06	0.35			1.09	0.61		0.23	
Uniform Delay, d1	61.8	80.5	0.0	53.5	9.7			80.5	0.0		65.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2	0.0	39.1	0.2	48.7	0.1			77.4	1.8		0.6	
Delay (s)	61.8	119.6	0.2	102.2	9.8			157.9	1.8		65.8	
Level of Service	E	F	A	F	A			F	A		E	
Approach Delay (s)		92.9			56.2			41.6			65.8	
Approach LOS		F			E			D			E	

Intersection Summary			
HCM Average Control Delay	61.4	HCM Level of Service	E
HCM Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	210.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	98.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Queues
30: Kunia Rd/Driveway & SR 99

3/25/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	1	833	240	895	886	317	928	47
v/c Ratio	0.01	1.03	0.16	1.06	0.35	1.09	0.61	0.23
Control Delay	62.0	115.2	0.2	98.6	10.1	148.2	1.8	67.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.0	115.2	0.2	98.6	10.1	148.2	1.8	67.5
Queue Length 50th (ft)	1	~644	0	~1355	213	~490	0	52
Queue Length 95th (ft)	8	#754	0	#1624	245	#624	0	58
Internal Link Dist (ft)		1998			2306	2153		237
Turn Bay Length (ft)	150		200	150				
Base Capacity (vph)	137	810	1533	843	2538	292	1517	204
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	1.03	0.16	1.06	0.35	1.09	0.61	0.23

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
30: Kunia Rd/Driveway & SR 99

3/24/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	733	210	838	833	0	258	4	768	15	10	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	2.0	3.0	3.0			3.0	3.0		3.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			1.00	1.00		1.00	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00			1.00	0.99		1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.97	
Satd. Flow (prot)	1736	3471	1533	1719	3438			1725	1517		1766	
Flt Permitted	0.32	1.00	1.00	0.95	1.00			0.69	1.00		0.48	
Satd. Flow (perm)	586	3471	1533	1719	3438			1250	1517		874	
Peak-hour factor, PHF	0.88	0.88	0.88	0.94	0.94	0.94	0.83	0.83	0.83	0.55	0.55	0.55
Adj. Flow (vph)	1	833	239	891	886	0	311	5	925	27	18	2
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	1	0
Lane Group Flow (vph)	1	833	239	891	886	0	0	316	925	0	46	0
Confl. Peds. (#/hr)			2			3			5	5		
Heavy Vehicles (%)	4%	4%	4%	5%	5%	5%	5%	5%	5%	4%	4%	4%
Turn Type	Perm	NA	Free	Prot	NA		Perm	NA	Free	Perm	NA	
Protected Phases		6		5	2			8			4	
Permitted Phases	6		Free				8		Free	4		
Actuated Green, G (s)	47.0	47.0	210.0	101.0	153.0			47.0	210.0		47.0	
Effective Green, g (s)	49.0	49.0	210.0	103.0	155.0			49.0	210.0		49.0	
Actuated g/C Ratio	0.23	0.23	1.00	0.49	0.74			0.23	1.00		0.23	
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	137	810	1533	843	2538			292	1517		204	
v/s Ratio Prot		c0.24		c0.52	0.26							
v/s Ratio Perm	0.00		0.16					c0.25	0.61		0.05	
v/c Ratio	0.01	1.03	0.16	1.06	0.35			1.08	0.61		0.23	
Uniform Delay, d1	61.8	80.5	0.0	53.5	9.7			80.5	0.0		65.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2	0.0	39.1	0.2	47.2	0.1			76.3	1.8		0.6	
Delay (s)	61.8	119.6	0.2	100.7	9.8			156.8	1.8		65.7	
Level of Service	E	F	A	F	A			F	A		E	
Approach Delay (s)		92.9			55.3			41.3			65.7	
Approach LOS		F			E			D			E	

Intersection Summary			
HCM Average Control Delay	61.0	HCM Level of Service	E
HCM Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	210.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	97.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Queues
30: Kunia Rd/Driveway & SR 99

3/24/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	1	833	239	891	886	316	925	47
v/c Ratio	0.01	1.03	0.16	1.06	0.35	1.08	0.61	0.23
Control Delay	62.0	115.2	0.2	97.2	10.1	147.4	1.8	67.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.0	115.2	0.2	97.2	10.1	147.4	1.8	67.5
Queue Length 50th (ft)	1	~644	0	~1343	213	~487	0	52
Queue Length 95th (ft)	8	#754	0	#1612	245	#622	0	58
Internal Link Dist (ft)		1998			2306	2153		237
Turn Bay Length (ft)	150		200	150				
Base Capacity (vph)	137	810	1533	843	2538	292	1517	204
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	1.03	0.16	1.06	0.35	1.08	0.61	0.23

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	39	437	760	217	126	31
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1612	1696	1722		1770	1583
Flt Permitted	0.08	1.00	1.00		0.95	1.00
Satd. Flow (perm)	138	1696	1722		1770	1583
Peak-hour factor, PHF	0.84	0.84	0.89	0.89	0.86	0.86
Adj. Flow (vph)	46	520	854	244	147	36
RTOR Reduction (vph)	0	0	7	0	0	28
Lane Group Flow (vph)	46	520	1091	0	147	8
Heavy Vehicles (%)	12%	12%	7%	7%	2%	2%
Turn Type	pm+pt	NA	NA		NA	Perm
Protected Phases	7	4	8		2	
Permitted Phases	4					2
Actuated Green, G (s)	86.2	86.2	74.6		14.2	14.2
Effective Green, g (s)	86.2	86.2	74.6		14.2	14.2
Actuated g/C Ratio	0.78	0.78	0.68		0.13	0.13
Clearance Time (s)	5.0	5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	196	1324	1164		228	204
v/s Ratio Prot	0.01	c0.31	c0.63		c0.08	
v/s Ratio Perm	0.17					0.01
v/c Ratio	0.23	0.39	0.94		0.64	0.04
Uniform Delay, d1	18.5	3.8	15.8		45.7	42.1
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.6	0.2	13.8		6.1	0.1
Delay (s)	19.1	4.0	29.6		51.8	42.2
Level of Service	B	A	C		D	D
Approach Delay (s)		5.2	29.6		49.9	
Approach LOS		A	C		D	

Intersection Summary			
HCM Average Control Delay	24.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	110.4	Sum of lost time (s)	15.0
Intersection Capacity Utilization	68.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Queues
9: Lyman Rd & Flagler Rd

7/17/2014

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	46	520	1098	147	36
v/c Ratio	0.22	0.39	0.93	0.64	0.15
Control Delay	5.7	5.3	32.2	59.0	17.8
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	5.7	5.3	32.2	59.0	17.8
Queue Length 50th (ft)	6	96	646	101	3
Queue Length 95th (ft)	16	162	#1128	163	30
Internal Link Dist (ft)		1199	1752	1564	
Turn Bay Length (ft)	100				65
Base Capacity (vph)	243	1392	1182	343	332
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.19	0.37	0.93	0.43	0.11

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
44: Kunia Rd & Lyman Rd

3/24/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	96	392	117	37	493	80	267	630	87	161	374	220
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	4.0	3.0	3.0	4.0	3.0	3.0	4.0	3.0	3.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.86	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1736	1827	1337	1787	1881	1599	1736	3471	1553	1703	3406	1524
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1736	1827	1337	1787	1881	1599	1736	3471	1553	1703	3406	1524
Peak-hour factor, PHF	0.64	0.64	0.64	0.84	0.84	0.84	0.76	0.76	0.76	0.91	0.91	0.91
Adj. Flow (vph)	150	612	183	44	587	95	351	829	114	177	411	242
RTOR Reduction (vph)	0	0	17	0	0	12	0	0	41	0	0	118
Lane Group Flow (vph)	150	612	166	44	587	83	351	829	73	177	411	124
Confl. Peds. (#/hr)			52									
Heavy Vehicles (%)	4%	4%	4%	1%	1%	1%	4%	4%	4%	6%	6%	6%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases			4			8			6			2
Actuated Green, G (s)	19.8	75.2	75.2	7.1	62.5	62.5	41.1	48.9	48.9	23.0	30.8	30.8
Effective Green, g (s)	21.8	77.2	76.2	9.1	64.5	63.5	43.1	50.9	49.9	25.0	32.8	31.8
Actuated g/C Ratio	0.13	0.44	0.44	0.05	0.37	0.36	0.25	0.29	0.29	0.14	0.19	0.18
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	217	810	585	93	696	583	430	1014	445	244	641	278
v/s Ratio Prot	c0.09	0.33		0.02	c0.31		c0.20	c0.24		0.10	0.12	
v/s Ratio Perm			0.12			0.05			0.05			0.08
v/c Ratio	0.69	0.76	0.28	0.47	0.84	0.14	0.82	0.82	0.16	0.73	0.64	0.45
Uniform Delay, d1	73.0	40.6	31.5	80.2	50.2	37.1	61.8	57.3	46.5	71.3	65.3	63.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	9.1	4.0	0.3	3.8	9.2	0.1	11.4	5.2	0.2	10.2	2.2	1.1
Delay (s)	82.1	44.6	31.7	84.0	59.4	37.2	73.2	62.5	46.7	81.5	67.5	64.5
Level of Service	F	D	C	F	E	D	E	E	D	F	E	E
Approach Delay (s)		48.1			58.0			64.0			69.6	
Approach LOS		D			E			E			E	

Intersection Summary			
HCM Average Control Delay	60.1	HCM Level of Service	E
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	174.2	Sum of lost time (s)	9.0
Intersection Capacity Utilization	70.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Queues
44: Kunia Rd & Lyman Rd

3/24/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	150	612	183	44	587	95	351	829	114	177	411	242
v/c Ratio	0.68	0.75	0.31	0.39	0.86	0.16	0.81	0.81	0.23	0.72	0.64	0.61
Control Delay	95.1	49.8	30.1	99.3	66.6	33.3	80.0	66.3	28.3	93.0	73.6	36.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	95.1	49.8	30.1	99.3	66.6	33.3	80.0	66.3	28.3	93.0	73.6	36.3
Queue Length 50th (ft)	175	631	121	52	655	62	402	491	51	206	242	108
Queue Length 95th (ft)	201	525	128	104	820	109	477	521	90	339	352	241
Internal Link Dist (ft)		1752			1465			949			1376	
Turn Bay Length (ft)	150		60	240		80	250		200	250		130
Base Capacity (vph)	273	1039	743	130	910	774	578	1302	609	309	765	446
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.55	0.59	0.25	0.34	0.65	0.12	0.61	0.64	0.19	0.57	0.54	0.54

Intersection Summary

HCM Signalized Intersection Capacity Analysis
16: Humphreys Rd & Lyman Rd

3/25/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	277	4	11	546	189	0	0	0	247	22	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0						5.0	5.0
Lane Util. Factor		1.00			1.00						1.00	1.00
Frt		1.00			0.97						1.00	0.85
Flt Protected		1.00			1.00						0.96	1.00
Satd. Flow (prot)		1782			1730						1781	1583
Flt Permitted		0.91			0.99						0.96	1.00
Satd. Flow (perm)		1625			1720						1781	1583
Peak-hour factor, PHF	0.83	0.83	0.83	0.85	0.85	0.85	0.92	0.92	0.92	0.72	0.72	0.72
Adj. Flow (vph)	30	334	5	13	642	222	0	0	0	343	31	44
RTOR Reduction (vph)	0	1	0	0	17	0	0	0	0	0	0	32
Lane Group Flow (vph)	0	368	0	0	860	0	0	0	0	0	374	12
Heavy Vehicles (%)	6%	6%	6%	6%	6%	6%	2%	2%	2%	2%	2%	2%
Turn Type	Perm	NA		Perm	NA					Split	NA	Perm
Protected Phases		4			8					2	2	
Permitted Phases	4			8								2
Actuated Green, G (s)		34.5			34.5						17.4	17.4
Effective Green, g (s)		34.5			34.5						17.4	17.4
Actuated g/C Ratio		0.56			0.56						0.28	0.28
Clearance Time (s)		5.0			5.0						5.0	5.0
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		906			959						501	445
v/s Ratio Prot											c0.21	
v/s Ratio Perm		0.23			c0.50							0.01
v/c Ratio		0.41			0.90						0.75	0.03
Uniform Delay, d1		7.8			12.1						20.2	16.1
Progression Factor		1.00			1.00						1.00	1.00
Incremental Delay, d2		0.3			10.9						6.0	0.0
Delay (s)		8.1			23.0						26.2	16.1
Level of Service		A			C						C	B
Approach Delay (s)		8.1			23.0			0.0			25.2	
Approach LOS		A			C			A			C	

Intersection Summary			
HCM Average Control Delay	20.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	61.9	Sum of lost time (s)	10.0
Intersection Capacity Utilization	66.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	WBT	SBT	SBR
Lane Group Flow (vph)	369	877	374	44
v/c Ratio	0.41	0.90	0.75	0.09
Control Delay	10.0	27.3	32.4	6.9
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	10.0	27.3	32.4	6.9
Queue Length 50th (ft)	77	275	141	0
Queue Length 95th (ft)	123	#502	171	14
Internal Link Dist (ft)	2460	1199	1412	
Turn Bay Length (ft)				200
Base Capacity (vph)	1053	1129	622	581
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.35	0.78	0.60	0.08

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Unsignalized Intersection Capacity Analysis
3: Lyman Rd & Maili Rd

3/25/2014

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	4	49	280	25	183	29
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.79	0.79	0.88	0.88	0.78	0.78
Hourly flow rate (vph)	5	62	318	28	235	37
Pedestrians			1		1	
Lane Width (ft)			12.0		12.0	
Walking Speed (ft/s)			4.0		4.0	
Percent Blockage			0		0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	348				407	333
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	348				407	333
tC, single (s)	4.3				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.4				3.5	3.3
p0 queue free %	100				61	95
cM capacity (veh/h)	1103				599	710

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	67	347	272
Volume Left	5	0	235
Volume Right	0	28	37
cSH	1103	1700	612
Volume to Capacity	0.00	0.20	0.44
Queue Length 95th (ft)	0	0	57
Control Delay (s)	0.7	0.0	15.5
Lane LOS	A		C
Approach Delay (s)	0.7	0.0	15.5
Approach LOS			C

Intersection Summary			
Average Delay	6.2		
Intersection Capacity Utilization	34.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	35	11	30	949	441	87
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	4.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.98	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1583	1417	1736	1827	1769	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1583	1417	1736	1827	1769	
Peak-hour factor, PHF	0.51	0.51	0.89	0.89	0.92	0.92
Adj. Flow (vph)	69	22	34	1066	479	95
RTOR Reduction (vph)	0	19	0	0	5	0
Lane Group Flow (vph)	69	3	34	1066	569	0
Heavy Vehicles (%)	14%	14%	4%	4%	5%	5%
Turn Type	NA	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	7.0	7.0	2.8	52.6	44.8	
Effective Green, g (s)	9.0	8.0	4.8	54.6	46.8	
Actuated g/C Ratio	0.13	0.11	0.07	0.78	0.67	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	205	163	120	1433	1190	
v/s Ratio Prot	c0.04		0.02	c0.58	0.32	
v/s Ratio Perm		0.00				
v/c Ratio	0.34	0.02	0.28	0.74	0.48	
Uniform Delay, d1	27.6	27.3	30.8	3.9	5.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.0	0.0	1.3	2.1	0.3	
Delay (s)	28.6	27.3	32.1	6.0	5.8	
Level of Service	C	C	C	A	A	
Approach Delay (s)	28.3			6.8	5.8	
Approach LOS	C			A	A	

Intersection Summary			
HCM Average Control Delay	7.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	69.6	Sum of lost time (s)	6.0
Intersection Capacity Utilization	60.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Queues
41: Kunia Rd & Field Station Kunia Entrance

7/17/2014

Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	69	22	34	1066	574
v/c Ratio	0.25	0.09	0.13	0.73	0.44
Control Delay	31.3	14.7	32.1	8.7	7.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	31.3	14.7	32.1	8.7	7.9
Queue Length 50th (ft)	26	0	13	189	60
Queue Length 95th (ft)	41	7	46	410	252
Internal Link Dist (ft)	642			1901	1624
Turn Bay Length (ft)	140		300		
Base Capacity (vph)	620	544	355	1744	1460
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.11	0.04	0.10	0.61	0.39

Intersection Summary

HCM Signalized Intersection Capacity Analysis
1: Kunia Rd & Foote Ave

3/25/2014

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	441	125	217	589	679	428
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1752	1568	1752	3505	3438	1538
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1752	1568	1752	3505	3438	1538
Peak-hour factor, PHF	0.84	0.84	0.92	0.92	0.87	0.87
Adj. Flow (vph)	525	149	236	640	780	492
RTOR Reduction (vph)	0	0	0	0	0	223
Lane Group Flow (vph)	525	149	236	640	780	269
Confl. Peds. (#/hr)	1					
Heavy Vehicles (%)	3%	3%	3%	3%	5%	5%
Turn Type	NA	custom	Prot	NA	NA	Perm
Protected Phases	4	4	1	6	2	
Permitted Phases		6				2
Actuated Green, G (s)	54.5	118.5	21.6	64.0	37.4	37.4
Effective Green, g (s)	54.5	118.5	21.6	64.0	37.4	37.4
Actuated g/C Ratio	0.42	0.92	0.17	0.50	0.29	0.29
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	743	1568	294	1746	1001	448
v/s Ratio Prot	c0.30	0.04	c0.13	0.18	c0.23	
v/s Ratio Perm		0.05				0.18
v/c Ratio	0.71	0.10	0.80	0.37	0.78	0.60
Uniform Delay, d1	30.4	0.4	51.4	19.8	41.8	39.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.6	0.0	14.6	0.1	3.9	2.3
Delay (s)	36.0	0.5	66.0	19.9	45.7	41.4
Level of Service	D	A	E	B	D	D
Approach Delay (s)	28.2			32.3	44.0	
Approach LOS	C			C	D	

Intersection Summary			
HCM Average Control Delay	36.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	128.5	Sum of lost time (s)	15.0
Intersection Capacity Utilization	67.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Queues
1: Kunia Rd & Foote Ave

3/25/2014

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	525	149	236	640	780	492
v/c Ratio	0.71	0.10	0.80	0.37	0.78	0.74
Control Delay	39.2	0.1	72.4	20.0	48.2	21.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.2	0.1	72.4	20.0	48.2	21.5
Queue Length 50th (ft)	371	0	194	165	316	137
Queue Length 95th (ft)	509	0	300	207	390	258
Internal Link Dist (ft)	1099			1376	2153	
Turn Bay Length (ft)			150			150
Base Capacity (vph)	742	1568	371	2090	1187	736
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.71	0.10	0.64	0.31	0.66	0.67

Intersection Summary

HCM Signalized Intersection Capacity Analysis
30: Kunia Rd/Driveway & SR 99

3/25/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1	733	220	877	833	0	258	4	768	15	10	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	2.0	3.0	3.0			3.0	3.0		3.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			1.00	1.00		1.00	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00			1.00	0.99		1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.97	
Satd. Flow (prot)	1736	3471	1533	1719	3438			1725	1517		1766	
Flt Permitted	0.32	1.00	1.00	0.95	1.00			0.69	1.00		0.45	
Satd. Flow (perm)	586	3471	1533	1719	3438			1248	1517		826	
Peak-hour factor, PHF	0.88	0.88	0.88	0.94	0.94	0.94	0.83	0.83	0.83	0.55	0.55	0.55
Adj. Flow (vph)	1	833	250	933	886	0	311	5	925	27	18	2
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	1	0
Lane Group Flow (vph)	1	833	250	933	886	0	0	316	925	0	46	0
Confl. Peds. (#/hr)			2			3			5	5		
Heavy Vehicles (%)	4%	4%	4%	5%	5%	5%	5%	5%	5%	4%	4%	4%
Turn Type	Perm	NA	Free	Prot	NA		Perm	NA	Free	Perm	NA	
Protected Phases		6		5	2			8			4	
Permitted Phases	6		Free				8		Free	4		
Actuated Green, G (s)	47.0	47.0	210.0	103.0	155.0			45.0	210.0		45.0	
Effective Green, g (s)	49.0	49.0	210.0	105.0	157.0			47.0	210.0		47.0	
Actuated g/C Ratio	0.23	0.23	1.00	0.50	0.75			0.22	1.00		0.22	
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	137	810	1533	860	2570			279	1517		185	
v/s Ratio Prot		c0.24		c0.54	0.26							
v/s Ratio Perm	0.00		0.16					c0.25	0.61		0.06	
v/c Ratio	0.01	1.03	0.16	1.08	0.34			1.13	0.61		0.25	
Uniform Delay, d1	61.8	80.5	0.0	52.5	9.0			81.5	0.0		67.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2	0.0	39.1	0.2	56.3	0.1			94.5	1.8		0.7	
Delay (s)	61.8	119.6	0.2	108.8	9.1			176.0	1.8		67.7	
Level of Service	E	F	A	F	A			F	A		E	
Approach Delay (s)		92.0			60.3			46.2			67.7	
Approach LOS		F			E			D			E	

Intersection Summary			
HCM Average Control Delay	64.4	HCM Level of Service	E
HCM Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	210.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	100.0%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Queues
30: Kunia Rd/Driveway & SR 99

3/25/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	1	833	250	933	886	316	925	47
v/c Ratio	0.01	1.03	0.16	1.08	0.34	1.13	0.61	0.25
Control Delay	62.0	115.2	0.2	104.7	9.4	161.7	1.8	70.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.0	115.2	0.2	104.7	9.4	161.7	1.8	70.0
Queue Length 50th (ft)	1	~644	0	~1440	205	~504	0	53
Queue Length 95th (ft)	8	#754	0	#1709	235	#639	0	59
Internal Link Dist (ft)		1998			2306	2153		237
Turn Bay Length (ft)	150		200	150				
Base Capacity (vph)	137	810	1533	860	2570	280	1517	185
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	1.03	0.16	1.08	0.34	1.13	0.61	0.25

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
44: Kunia Rd & Lyman Rd

3/25/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	96	392	117	37	493	80	267	630	87	161	423	220
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	4.0	3.0	3.0	4.0	3.0	3.0	4.0	3.0	3.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.86	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1736	1827	1337	1787	1881	1599	1736	3471	1553	1703	3406	1524
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1736	1827	1337	1787	1881	1599	1736	3471	1553	1703	3406	1524
Peak-hour factor, PHF	0.64	0.64	0.64	0.84	0.84	0.84	0.76	0.76	0.76	0.91	0.91	0.91
Adj. Flow (vph)	150	612	183	44	587	95	351	829	114	177	465	242
RTOR Reduction (vph)	0	0	17	0	0	12	0	0	41	0	0	104
Lane Group Flow (vph)	150	612	166	44	587	83	351	829	73	177	465	138
Confl. Peds. (#/hr)			52									
Heavy Vehicles (%)	4%	4%	4%	1%	1%	1%	4%	4%	4%	6%	6%	6%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases			4			8			6			2
Actuated Green, G (s)	19.8	75.2	75.2	7.1	62.5	62.5	41.0	49.0	49.0	23.0	31.0	31.0
Effective Green, g (s)	21.8	77.2	76.2	9.1	64.5	63.5	43.0	51.0	50.0	25.0	33.0	32.0
Actuated g/C Ratio	0.13	0.44	0.44	0.05	0.37	0.36	0.25	0.29	0.29	0.14	0.19	0.18
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	217	809	585	93	696	583	428	1016	445	244	645	280
v/s Ratio Prot	c0.09	0.33		0.02	c0.31		c0.20	c0.24		0.10	0.14	
v/s Ratio Perm			0.12			0.05			0.05			0.09
v/c Ratio	0.69	0.76	0.28	0.47	0.84	0.14	0.82	0.82	0.16	0.73	0.72	0.49
Uniform Delay, d1	73.0	40.7	31.5	80.3	50.3	37.1	62.0	57.3	46.5	71.4	66.3	63.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	9.1	4.1	0.3	3.8	9.2	0.1	11.9	5.1	0.2	10.2	4.0	1.4
Delay (s)	82.2	44.7	31.8	84.0	59.4	37.3	73.9	62.4	46.7	81.6	70.3	65.3
Level of Service	F	D	C	F	E	D	E	E	D	F	E	E
Approach Delay (s)		48.2			58.0			64.2			71.2	
Approach LOS		D			E			E			E	

Intersection Summary			
HCM Average Control Delay	60.7	HCM Level of Service	E
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	174.3	Sum of lost time (s)	9.0
Intersection Capacity Utilization	71.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Queues
44: Kunia Rd & Lyman Rd

3/25/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	150	612	183	44	587	95	351	829	114	177	465	242
v/c Ratio	0.69	0.75	0.31	0.39	0.86	0.16	0.81	0.81	0.23	0.72	0.72	0.63
Control Delay	95.2	49.9	30.2	99.4	66.7	33.3	80.4	66.2	28.3	93.2	76.4	41.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	95.2	49.9	30.2	99.4	66.7	33.3	80.4	66.2	28.3	93.2	76.4	41.5
Queue Length 50th (ft)	175	631	121	52	655	62	402	491	51	206	278	129
Queue Length 95th (ft)	201	525	128	104	820	109	480	521	90	339	398	265
Internal Link Dist (ft)		1752			1465			949			1376	
Turn Bay Length (ft)	150		60	240		80	250		200	250		130
Base Capacity (vph)	273	1038	743	130	910	774	567	1302	609	309	783	440
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.55	0.59	0.25	0.34	0.65	0.12	0.62	0.64	0.19	0.57	0.59	0.55

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	35	11	30	949	490	87
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	4.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.98	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1583	1417	1736	1827	1773	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1583	1417	1736	1827	1773	
Peak-hour factor, PHF	0.51	0.51	0.89	0.89	0.92	0.92
Adj. Flow (vph)	69	22	34	1066	533	95
RTOR Reduction (vph)	0	19	0	0	5	0
Lane Group Flow (vph)	69	3	34	1066	623	0
Heavy Vehicles (%)	14%	14%	4%	4%	5%	5%
Turn Type	NA	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	7.0	7.0	2.8	52.6	44.8	
Effective Green, g (s)	9.0	8.0	4.8	54.6	46.8	
Actuated g/C Ratio	0.13	0.11	0.07	0.78	0.67	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	205	163	120	1433	1192	
v/s Ratio Prot	c0.04		0.02	c0.58	0.35	
v/s Ratio Perm		0.00				
v/c Ratio	0.34	0.02	0.28	0.74	0.52	
Uniform Delay, d1	27.6	27.3	30.8	3.9	5.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.0	0.0	1.3	2.1	0.4	
Delay (s)	28.6	27.3	32.1	6.0	6.2	
Level of Service	C	C	C	A	A	
Approach Delay (s)	28.3			6.8	6.2	
Approach LOS	C			A	A	

Intersection Summary			
HCM Average Control Delay	7.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	69.6	Sum of lost time (s)	6.0
Intersection Capacity Utilization	60.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	69	22	34	1066	628
v/c Ratio	0.25	0.09	0.13	0.73	0.48
Control Delay	31.3	14.7	32.1	8.7	8.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	31.3	14.7	32.1	8.7	8.5
Queue Length 50th (ft)	26	0	13	189	69
Queue Length 95th (ft)	41	7	46	410	289
Internal Link Dist (ft)	642			1901	1624
Turn Bay Length (ft)	140		300		
Base Capacity (vph)	620	544	355	1744	1462
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.11	0.04	0.10	0.61	0.43

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
5: Kunia Rd & Temp Access

3/24/2014

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	5	5	49	979	452	49
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	0.77	0.77	0.91	0.91
Hourly flow rate (vph)	5	5	64	1271	497	54
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1922	524	551			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1922	524	551			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	93	99	94			
cM capacity (veh/h)	70	557	1019			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	10	1335	551
Volume Left	5	64	0
Volume Right	5	0	54
cSH	124	1019	1700
Volume to Capacity	0.08	0.06	0.32
Queue Length 95th (ft)	6	5	0
Control Delay (s)	36.5	2.5	0.0
Lane LOS	E	A	
Approach Delay (s)	36.5	2.5	0.0
Approach LOS	E		

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	103.3%	ICU Level of Service	G
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	39	441	766	217	126	31
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1612	1696	1723		1770	1583
Flt Permitted	0.08	1.00	1.00		0.95	1.00
Satd. Flow (perm)	132	1696	1723		1770	1583
Peak-hour factor, PHF	0.84	0.84	0.89	0.89	0.86	0.86
Adj. Flow (vph)	46	525	861	244	147	36
RTOR Reduction (vph)	0	0	7	0	0	28
Lane Group Flow (vph)	46	525	1098	0	147	8
Heavy Vehicles (%)	12%	12%	7%	7%	2%	2%
Turn Type	pm+pt	NA	NA		NA	Perm
Protected Phases	7	4	8		2	
Permitted Phases	4					2
Actuated Green, G (s)	86.2	86.2	74.6		14.2	14.2
Effective Green, g (s)	86.2	86.2	74.6		14.2	14.2
Actuated g/C Ratio	0.78	0.78	0.68		0.13	0.13
Clearance Time (s)	5.0	5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	192	1324	1164		228	204
v/s Ratio Prot	0.01	c0.31	c0.64		c0.08	
v/s Ratio Perm	0.17					0.01
v/c Ratio	0.24	0.40	0.94		0.64	0.04
Uniform Delay, d1	19.0	3.8	16.0		45.7	42.1
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.6	0.2	14.7		6.1	0.1
Delay (s)	19.7	4.0	30.7		51.8	42.2
Level of Service	B	A	C		D	D
Approach Delay (s)		5.3	30.7		49.9	
Approach LOS		A	C		D	

Intersection Summary			
HCM Average Control Delay	24.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	110.4	Sum of lost time (s)	15.0
Intersection Capacity Utilization	68.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	46	525	1105	147	36
v/c Ratio	0.22	0.40	0.93	0.64	0.15
Control Delay	5.8	5.3	33.1	59.0	17.8
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	5.8	5.3	33.1	59.0	17.8
Queue Length 50th (ft)	6	97	658	101	3
Queue Length 95th (ft)	16	164	#1140	163	30
Internal Link Dist (ft)		1199	1752	1564	
Turn Bay Length (ft)	100				65
Base Capacity (vph)	239	1392	1182	343	332
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.19	0.38	0.93	0.43	0.11

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
44: Kunia Rd & Lyman Rd

3/28/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	99	392	118	37	493	80	269	630	87	161	374	224
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	4.0	3.0	3.0	4.0	3.0	3.0	4.0	3.0	3.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.86	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1736	1827	1336	1787	1881	1599	1736	3471	1553	1703	3406	1524
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1736	1827	1336	1787	1881	1599	1736	3471	1553	1703	3406	1524
Peak-hour factor, PHF	0.64	0.64	0.64	0.84	0.84	0.84	0.76	0.76	0.76	0.91	0.91	0.91
Adj. Flow (vph)	155	612	184	44	587	95	354	829	114	177	411	246
RTOR Reduction (vph)	0	0	17	0	0	12	0	0	41	0	0	120
Lane Group Flow (vph)	155	612	167	44	587	83	354	829	73	177	411	126
Confl. Peds. (#/hr)			52									
Heavy Vehicles (%)	4%	4%	4%	1%	1%	1%	4%	4%	4%	6%	6%	6%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases			4			8			6			2
Actuated Green, G (s)	20.2	75.8	75.8	7.1	62.7	62.7	41.4	49.1	49.1	23.0	30.7	30.7
Effective Green, g (s)	22.2	77.8	76.8	9.1	64.7	63.7	43.4	51.1	50.1	25.0	32.7	31.7
Actuated g/C Ratio	0.13	0.44	0.44	0.05	0.37	0.36	0.25	0.29	0.29	0.14	0.19	0.18
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	220	812	586	93	695	582	431	1014	445	243	636	276
v/s Ratio Prot	c0.09	0.33		0.02	c0.31		c0.20	c0.24		0.10	0.12	
v/s Ratio Perm			0.12			0.05			0.05			0.08
v/c Ratio	0.70	0.75	0.28	0.47	0.84	0.14	0.82	0.82	0.16	0.73	0.65	0.46
Uniform Delay, d1	73.3	40.6	31.5	80.6	50.5	37.3	62.1	57.6	46.8	71.8	65.8	64.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	9.8	4.0	0.3	3.8	9.2	0.1	11.9	5.2	0.2	10.4	2.3	1.2
Delay (s)	83.1	44.6	31.7	84.4	59.8	37.4	74.0	62.8	47.0	82.2	68.1	65.2
Level of Service	F	D	C	F	E	D	E	E	D	F	E	E
Approach Delay (s)		48.4			58.4			64.5			70.2	
Approach LOS		D			E			E			E	

Intersection Summary			
HCM Average Control Delay	60.5	HCM Level of Service	E
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	175.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	71.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Queues
44: Kunia Rd & Lyman Rd

3/28/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	155	612	184	44	587	95	354	829	114	177	411	246
v/c Ratio	0.70	0.75	0.31	0.39	0.86	0.16	0.82	0.81	0.23	0.72	0.64	0.62
Control Delay	95.4	49.6	30.1	99.7	67.0	33.4	80.6	66.6	28.4	93.6	74.2	36.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	95.4	49.6	30.1	99.7	67.0	33.4	80.6	66.6	28.4	93.6	74.2	36.8
Queue Length 50th (ft)	182	633	122	52	661	62	409	496	52	207	244	112
Queue Length 95th (ft)	209	525	129	104	820	109	480	521	90	339	352	246
Internal Link Dist (ft)		1752			1465			949			1376	
Turn Bay Length (ft)	150		60	240		80	250		200	250		130
Base Capacity (vph)	272	1033	739	129	905	770	575	1295	606	307	760	445
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.57	0.59	0.25	0.34	0.65	0.12	0.62	0.64	0.19	0.58	0.54	0.55

Intersection Summary

HCM Signalized Intersection Capacity Analysis
16: Humphreys Rd & Lyman Rd

3/21/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	281	4	11	552	189	0	0	0	247	22	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0						5.0	5.0
Lane Util. Factor		1.00			1.00						1.00	1.00
Frt		1.00			0.97						1.00	0.85
Flt Protected		1.00			1.00						0.96	1.00
Satd. Flow (prot)		1782			1730						1781	1583
Flt Permitted		0.91			0.99						0.96	1.00
Satd. Flow (perm)		1626			1721						1781	1583
Peak-hour factor, PHF	0.83	0.83	0.83	0.85	0.85	0.85	0.92	0.92	0.92	0.72	0.72	0.72
Adj. Flow (vph)	30	339	5	13	649	222	0	0	0	343	31	44
RTOR Reduction (vph)	0	1	0	0	17	0	0	0	0	0	0	32
Lane Group Flow (vph)	0	373	0	0	867	0	0	0	0	0	374	12
Heavy Vehicles (%)	6%	6%	6%	6%	6%	6%	2%	2%	2%	2%	2%	2%
Turn Type	Perm	NA		Perm	NA					Split	NA	Perm
Protected Phases		4			8					2	2	
Permitted Phases	4			8								2
Actuated Green, G (s)		34.9			34.9						17.4	17.4
Effective Green, g (s)		34.9			34.9						17.4	17.4
Actuated g/C Ratio		0.56			0.56						0.28	0.28
Clearance Time (s)		5.0			5.0						5.0	5.0
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		911			964						497	442
v/s Ratio Prot											c0.21	
v/s Ratio Perm		0.23			c0.50							0.01
v/c Ratio		0.41			0.90						0.75	0.03
Uniform Delay, d1		7.8			12.1						20.5	16.3
Progression Factor		1.00			1.00						1.00	1.00
Incremental Delay, d2		0.3			11.0						6.4	0.0
Delay (s)		8.1			23.2						26.8	16.3
Level of Service		A			C						C	B
Approach Delay (s)		8.1			23.2			0.0			25.7	
Approach LOS		A			C			A			C	

Intersection Summary			
HCM Average Control Delay	20.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	62.3	Sum of lost time (s)	10.0
Intersection Capacity Utilization	66.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
3: Lyman Rd & Maili Rd

3/28/2014

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	4	53	286	25	183	29
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.79	0.79	0.88	0.88	0.78	0.78
Hourly flow rate (vph)	5	67	325	28	235	37
Pedestrians			1		1	
Lane Width (ft)			12.0		12.0	
Walking Speed (ft/s)			4.0		4.0	
Percent Blockage			0		0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	354				418	340
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	354				418	340
tC, single (s)	4.3				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.4				3.5	3.3
p0 queue free %	100				60	95
cM capacity (veh/h)	1096				589	704

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	72	353	272
Volume Left	5	0	235
Volume Right	0	28	37
cSH	1096	1700	603
Volume to Capacity	0.00	0.21	0.45
Queue Length 95th (ft)	0	0	58
Control Delay (s)	0.6	0.0	15.8
Lane LOS	A		C
Approach Delay (s)	0.6	0.0	15.8
Approach LOS			C

Intersection Summary			
Average Delay	6.2		
Intersection Capacity Utilization	35.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	35	11	30	951	442	87
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	4.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.98	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1583	1417	1736	1827	1769	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1583	1417	1736	1827	1769	
Peak-hour factor, PHF	0.51	0.51	0.89	0.89	0.92	0.92
Adj. Flow (vph)	69	22	34	1069	480	95
RTOR Reduction (vph)	0	19	0	0	5	0
Lane Group Flow (vph)	69	3	34	1069	570	0
Heavy Vehicles (%)	14%	14%	4%	4%	5%	5%
Turn Type	NA	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	7.0	7.0	2.8	52.9	45.1	
Effective Green, g (s)	9.0	8.0	4.8	54.9	47.1	
Actuated g/C Ratio	0.13	0.11	0.07	0.79	0.67	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	204	162	119	1435	1192	
v/s Ratio Prot	c0.04		0.02	c0.59	0.32	
v/s Ratio Perm		0.00				
v/c Ratio	0.34	0.02	0.29	0.74	0.48	
Uniform Delay, d1	27.7	27.5	30.9	3.9	5.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.0	0.0	1.3	2.1	0.3	
Delay (s)	28.7	27.5	32.2	6.0	5.8	
Level of Service	C	C	C	A	A	
Approach Delay (s)	28.4			6.8	5.8	
Approach LOS	C			A	A	

Intersection Summary			
HCM Average Control Delay	7.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	69.9	Sum of lost time (s)	6.0
Intersection Capacity Utilization	60.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Queues
41: Kunia Rd & Field Station Kunia Entrance

7/17/2014

Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	69	22	34	1069	575
v/c Ratio	0.25	0.09	0.13	0.73	0.44
Control Delay	31.4	14.6	32.2	8.7	7.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	31.4	14.6	32.2	8.7	7.9
Queue Length 50th (ft)	26	0	13	191	60
Queue Length 95th (ft)	41	7	46	411	253
Internal Link Dist (ft)	642			1901	1624
Turn Bay Length (ft)	140		300		
Base Capacity (vph)	617	542	353	1741	1455
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.11	0.04	0.10	0.61	0.40

Intersection Summary

HCM Signalized Intersection Capacity Analysis
1: Kunia Rd & Foote Ave

3/24/2014

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	834	436	75	715	493	301
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1787	1599	1787	3574	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1787	1599	1787	3574	3539	1583
Peak-hour factor, PHF	0.81	0.81	0.83	0.83	0.87	0.87
Adj. Flow (vph)	1030	538	90	861	567	346
RTOR Reduction (vph)	0	0	0	0	0	210
Lane Group Flow (vph)	1030	538	90	861	567	136
Confl. Peds. (#/hr)	1					
Heavy Vehicles (%)	1%	1%	1%	1%	2%	2%
Turn Type	NA	custom	Prot	NA	NA	Perm
Protected Phases	4	4	1	6	2	
Permitted Phases		6				2
Actuated Green, G (s)	89.0	128.8	9.6	39.8	25.2	25.2
Effective Green, g (s)	89.0	128.8	9.6	39.8	25.2	25.2
Actuated g/C Ratio	0.64	0.93	0.07	0.29	0.18	0.18
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1146	1599	124	1025	643	287
v/s Ratio Prot	c0.58	0.22	0.05	c0.24	0.16	
v/s Ratio Perm		0.12				0.09
v/c Ratio	0.90	0.34	0.73	0.84	0.88	0.47
Uniform Delay, d1	21.1	0.5	63.3	46.5	55.3	50.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	11.2	0.1	18.9	6.2	13.5	1.2
Delay (s)	32.3	0.6	82.2	52.7	68.8	52.1
Level of Service	C	A	F	D	E	D
Approach Delay (s)	21.4			55.5	62.5	
Approach LOS	C			E	E	

Intersection Summary			
HCM Average Control Delay	41.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	138.8	Sum of lost time (s)	10.0
Intersection Capacity Utilization	76.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Queues
1: Kunia Rd & Foote Ave

3/24/2014

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	1030	538	90	861	567	346
v/c Ratio	0.90	0.34	0.73	0.84	0.88	0.69
Control Delay	33.6	0.6	94.8	55.1	71.5	22.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.6	0.6	94.8	55.1	71.5	22.3
Queue Length 50th (ft)	760	0	82	385	266	72
Queue Length 95th (ft)	799	0	#144	420	#328	171
Internal Link Dist (ft)	1138			1376	2153	
Turn Bay Length (ft)			150			150
Base Capacity (vph)	1146	1599	129	1056	663	505
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.90	0.34	0.70	0.82	0.86	0.69

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
30: Kunia Rd/Driveway & SR 99

3/24/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	3	1349	205	582	827	6	302	6	1241	11	8	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	2.0	3.0	3.0			3.0	3.0		3.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			1.00	1.00		1.00	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00			1.00	0.99		1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.97	
Satd. Flow (prot)	1770	3539	1564	1787	3571			1793	1579		1688	
Flt Permitted	0.33	1.00	1.00	0.95	1.00			0.72	1.00		0.56	
Satd. Flow (perm)	614	3539	1564	1787	3571			1348	1579		980	
Peak-hour factor, PHF	0.94	0.94	0.94	0.97	0.97	0.97	0.94	0.94	0.94	0.69	0.69	0.69
Adj. Flow (vph)	3	1435	218	600	853	6	321	6	1320	16	12	1
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	1	0
Lane Group Flow (vph)	3	1435	218	600	859	0	0	327	1320	0	28	0
Confl. Peds. (#/hr)			1						1			
Heavy Vehicles (%)	2%	2%	2%	1%	1%	1%	1%	1%	1%	9%	9%	9%
Turn Type	Perm	NA	Free	Prot	NA		Perm	NA	Free	Perm	NA	
Protected Phases		6		5	2			8			4	
Permitted Phases	6		Free				8		Free	4		
Actuated Green, G (s)	83.0	83.0	210.0	66.0	154.0			46.0	210.0		46.0	
Effective Green, g (s)	85.0	85.0	210.0	68.0	156.0			48.0	210.0		48.0	
Actuated g/C Ratio	0.40	0.40	1.00	0.32	0.74			0.23	1.00		0.23	
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	249	1432	1564	579	2653			308	1579		224	
v/s Ratio Prot		c0.41		c0.34	0.24							
v/s Ratio Perm	0.00		0.14					c0.24	0.84		0.03	
v/c Ratio	0.01	1.00	0.14	1.04	0.32			1.06	0.84		0.13	
Uniform Delay, d1	37.4	62.5	0.0	71.0	9.1			81.0	0.0		64.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2	0.0	24.3	0.2	47.1	0.1			68.5	5.4		0.3	
Delay (s)	37.4	86.8	0.2	118.1	9.2			149.5	5.4		64.6	
Level of Service	D	F	A	F	A			F	A		E	
Approach Delay (s)		75.3			54.0			34.0			64.6	
Approach LOS		E			D			C			E	

Intersection Summary			
HCM Average Control Delay	54.6	HCM Level of Service	D
HCM Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	210.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	103.2%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Queues
30: Kunia Rd/Driveway & SR 99

3/24/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	3	1435	218	600	859	327	1320	29
v/c Ratio	0.01	1.00	0.14	1.04	0.32	1.06	0.84	0.13
Control Delay	37.7	85.2	0.2	113.5	9.5	141.5	5.4	64.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.7	85.2	0.2	113.5	9.5	141.5	5.4	64.7
Queue Length 50th (ft)	3	~1053	0	~889	197	~495	0	31
Queue Length 95th (ft)	12	#1216	0	#1147	227	#718	0	51
Internal Link Dist (ft)		1998			2306	2153		237
Turn Bay Length (ft)	150		200	150				
Base Capacity (vph)	249	1432	1564	579	2653	308	1579	225
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	1.00	0.14	1.04	0.32	1.06	0.84	0.13

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	33	912	408	140	155	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1787	1881	1816		1770	1583
Flt Permitted	0.26	1.00	1.00		0.95	1.00
Satd. Flow (perm)	491	1881	1816		1770	1583
Peak-hour factor, PHF	0.92	0.92	0.90	0.90	0.87	0.87
Adj. Flow (vph)	36	991	453	156	178	46
RTOR Reduction (vph)	0	0	13	0	0	37
Lane Group Flow (vph)	36	991	596	0	178	9
Heavy Vehicles (%)	1%	1%	1%	1%	2%	2%
Turn Type	pm+pt	NA	NA		NA	Perm
Protected Phases	7	4	8		2	
Permitted Phases	4					2
Actuated Green, G (s)	38.9	38.9	31.6		11.2	11.2
Effective Green, g (s)	38.9	38.9	31.6		11.2	11.2
Actuated g/C Ratio	0.65	0.65	0.53		0.19	0.19
Clearance Time (s)	5.0	5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	367	1217	955		330	295
v/s Ratio Prot	0.00	c0.53	0.33		c0.10	
v/s Ratio Perm	0.06					0.01
v/c Ratio	0.10	0.81	0.62		0.54	0.03
Uniform Delay, d1	5.7	7.9	10.1		22.1	20.0
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.1	4.3	1.3		1.7	0.0
Delay (s)	5.8	12.2	11.3		23.8	20.0
Level of Service	A	B	B		C	C
Approach Delay (s)		12.0	11.3		23.0	
Approach LOS		B	B		C	

Intersection Summary			
HCM Average Control Delay	13.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	60.1	Sum of lost time (s)	10.0
Intersection Capacity Utilization	64.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Queues
9: Lyman Rd & Flagler Road

3/21/2014

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	36	991	609	178	46
v/c Ratio	0.08	0.84	0.60	0.51	0.13
Control Delay	5.1	18.1	14.4	27.2	8.0
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	5.1	18.1	14.4	27.2	8.0
Queue Length 50th (ft)	4	222	91	59	0
Queue Length 95th (ft)	14	#571	#361	107	21
Internal Link Dist (ft)		1199	1752	1508	
Turn Bay Length (ft)	100				50
Base Capacity (vph)	539	1311	1016	664	623
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.07	0.76	0.60	0.27	0.07

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
44: Kunia Rd & Lyman Rd

3/24/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	234	278	387	166	247	105	98	452	29	68	765	97
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	4.0	3.0	3.0	4.0	3.0	3.0	4.0	3.0	3.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1554	1787	1881	1599	1787	3574	1599	1787	3574	1599
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1554	1787	1881	1599	1787	3574	1599	1787	3574	1599
Peak-hour factor, PHF	0.91	0.91	0.91	0.82	0.82	0.82	0.83	0.83	0.83	0.76	0.76	0.76
Adj. Flow (vph)	257	305	425	202	301	128	118	545	35	89	1007	128
RTOR Reduction (vph)	0	0	85	0	0	32	0	0	18	0	0	25
Lane Group Flow (vph)	257	305	340	202	301	96	118	545	17	89	1007	103
Confl. Peds. (#/hr)			3									
Heavy Vehicles (%)	2%	2%	2%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases			4			8			6			2
Actuated Green, G (s)	29.9	42.6	42.6	24.5	37.2	37.2	16.3	56.5	56.5	13.2	53.4	53.4
Effective Green, g (s)	31.9	44.6	43.6	26.5	39.2	38.2	18.3	58.5	57.5	15.2	55.4	54.4
Actuated g/C Ratio	0.20	0.28	0.28	0.17	0.25	0.24	0.12	0.37	0.37	0.10	0.35	0.35
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	360	530	432	302	470	390	209	1333	586	173	1263	555
v/s Ratio Prot	c0.15	0.16		0.11	0.16		c0.07	0.15		0.05	c0.28	
v/s Ratio Perm			c0.22			0.06			0.01			0.06
v/c Ratio	0.71	0.58	0.79	0.67	0.64	0.25	0.56	0.41	0.03	0.51	0.80	0.18
Uniform Delay, d1	58.2	48.0	52.3	61.0	52.5	47.7	65.5	36.4	31.8	67.3	45.6	35.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.6	1.5	9.1	5.5	3.0	0.3	3.5	0.2	0.0	2.6	3.6	0.2
Delay (s)	64.8	49.5	61.4	66.6	55.5	48.1	69.0	36.6	31.8	69.9	49.2	35.9
Level of Service	E	D	E	E	E	D	E	D	C	E	D	D
Approach Delay (s)		58.6			57.5			41.8			49.3	
Approach LOS		E			E			D			D	

Intersection Summary			
HCM Average Control Delay	51.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	156.8	Sum of lost time (s)	9.0
Intersection Capacity Utilization	65.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Queues
44: Kunia Rd & Lyman Rd

3/24/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	257	305	425	202	301	128	118	545	35	89	1007	128
v/c Ratio	0.72	0.58	0.83	0.67	0.64	0.31	0.56	0.41	0.06	0.51	0.80	0.22
Control Delay	75.5	55.7	54.7	79.0	62.8	37.5	85.2	40.1	15.3	88.6	54.6	29.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	75.5	55.7	54.7	79.0	62.8	37.5	85.2	40.1	15.3	88.6	54.6	29.9
Queue Length 50th (ft)	252	273	313	199	282	72	118	221	4	89	496	64
Queue Length 95th (ft)	449	457	551	331	424	141	219	323	30	160	605	118
Internal Link Dist (ft)		1752			1815			882			1376	
Turn Bay Length (ft)	150		60	240		80	250		200	250		130
Base Capacity (vph)	529	848	760	437	754	655	279	1869	839	218	1747	791
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.49	0.36	0.56	0.46	0.40	0.20	0.42	0.29	0.04	0.41	0.58	0.16

Intersection Summary

HCM Signalized Intersection Capacity Analysis
16: Humphreys Rd & Lyman Rd

3/24/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	33	438	1	2	234	248	0	0	0	346	5	19
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0						5.0	5.0
Lane Util. Factor		1.00			1.00						1.00	1.00
Frpb, ped/bikes		1.00			1.00						1.00	1.00
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		1.00			0.93						1.00	0.85
Flt Protected		1.00			1.00						0.95	1.00
Satd. Flow (prot)		1856			1733						1793	1599
Flt Permitted		0.94			1.00						0.95	1.00
Satd. Flow (perm)		1752			1731						1793	1599
Peak-hour factor, PHF	0.75	0.75	0.75	0.92	0.92	0.92	0.92	0.92	0.92	0.85	0.85	0.85
Adj. Flow (vph)	44	584	1	2	254	270	0	0	0	407	6	22
RTOR Reduction (vph)	0	0	0	0	57	0	0	0	0	0	0	15
Lane Group Flow (vph)	0	629	0	0	469	0	0	0	0	0	413	7
Confl. Peds. (#/hr)										5		
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	1%	1%	1%
Turn Type	Perm	NA		Perm	NA					Split	NA	Perm
Protected Phases		4			8					2	2	
Permitted Phases	4			8								2
Actuated Green, G (s)		24.4			24.4						17.6	17.6
Effective Green, g (s)		24.4			24.4						17.6	17.6
Actuated g/C Ratio		0.47			0.47						0.34	0.34
Clearance Time (s)		5.0			5.0						5.0	5.0
Vehicle Extension (s)		3.0			3.0						3.0	3.0
Lane Grp Cap (vph)		822			812						607	541
v/s Ratio Prot											c0.23	
v/s Ratio Perm		c0.36			0.27							0.00
v/c Ratio		0.77			0.58						0.68	0.01
Uniform Delay, d1		11.4			10.0						14.8	11.4
Progression Factor		1.00			1.00						1.00	1.00
Incremental Delay, d2		4.3			1.0						3.1	0.0
Delay (s)		15.7			11.0						17.9	11.4
Level of Service		B			B						B	B
Approach Delay (s)		15.7			11.0			0.0			17.6	
Approach LOS		B			B			A			B	

Intersection Summary			
HCM Average Control Delay	14.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	52.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	75.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	SBT	SBR
Lane Group Flow (vph)	629	526	413	22
v/c Ratio	0.78	0.61	0.69	0.04
Control Delay	20.2	12.2	23.5	7.2
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	20.2	12.2	23.5	7.2
Queue Length 50th (ft)	146	83	106	0
Queue Length 95th (ft)	232	202	218	12
Internal Link Dist (ft)	2460	1199	1378	
Turn Bay Length (ft)				200
Base Capacity (vph)	1232	1249	922	833
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.51	0.42	0.45	0.03

Intersection Summary

HCM Unsignalized Intersection Capacity Analysis
3: Lyman Rd & Maili Rd

3/25/2014

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	20	258	65	82	48	13
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.57	0.57	0.76	0.76	0.79	0.79
Hourly flow rate (vph)	35	453	86	108	61	16
Pedestrians			2			
Lane Width (ft)			12.0			
Walking Speed (ft/s)			4.0			
Percent Blockage			0			
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	193				664	139
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	193				664	139
tC, single (s)	4.2				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.3				3.6	3.4
p0 queue free %	97				85	98
cM capacity (veh/h)	1345				406	895

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	488	193	77
Volume Left	35	0	61
Volume Right	0	108	16
cSH	1345	1700	460
Volume to Capacity	0.03	0.11	0.17
Queue Length 95th (ft)	2	0	15
Control Delay (s)	0.8	0.0	14.4
Lane LOS	A		B
Approach Delay (s)	0.8	0.0	14.4
Approach LOS			B

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	36.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	113	54	4	465	1295	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	4.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1787	1599	1752	1845	1877	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1787	1599	1752	1845	1877	
Peak-hour factor, PHF	0.97	0.97	0.87	0.87	0.87	0.87
Adj. Flow (vph)	116	56	5	534	1489	26
RTOR Reduction (vph)	0	50	0	0	0	0
Lane Group Flow (vph)	116	6	5	534	1515	0
Heavy Vehicles (%)	1%	1%	3%	3%	1%	1%
Turn Type	NA	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	13.2	13.2	1.3	103.6	97.3	
Effective Green, g (s)	15.2	14.2	3.3	105.6	99.3	
Actuated g/C Ratio	0.12	0.11	0.03	0.83	0.78	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	214	179	46	1537	1470	
v/s Ratio Prot	c0.06		0.00	c0.29	c0.81	
v/s Ratio Perm		0.00				
v/c Ratio	0.54	0.04	0.11	0.35	1.03	
Uniform Delay, d1	52.5	50.2	60.3	2.5	13.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.8	0.1	1.0	0.1	31.6	
Delay (s)	55.3	50.3	61.4	2.6	45.4	
Level of Service	E	D	E	A	D	
Approach Delay (s)	53.7			3.2	45.4	
Approach LOS	D			A	D	

Intersection Summary			
HCM Average Control Delay	35.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	126.8	Sum of lost time (s)	9.0
Intersection Capacity Utilization	82.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Queues
41: Kunia Rd & Field Station Kunia Entrance

7/17/2014

Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	116	56	5	534	1515
v/c Ratio	0.52	0.24	0.04	0.35	1.00
Control Delay	59.0	15.1	57.0	3.6	36.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	59.0	15.1	57.0	3.6	36.2
Queue Length 50th (ft)	85	0	4	78	822
Queue Length 95th (ft)	156	41	18	143	#1718
Internal Link Dist (ft)	642			1901	1685
Turn Bay Length (ft)	140		300		
Base Capacity (vph)	336	333	172	1672	1519
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.35	0.17	0.03	0.32	1.00

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
1: Kunia Rd & Foote Ave

3/25/2014

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	834	436	75	764	493	301
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1787	1599	1787	3574	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1787	1599	1787	3574	3539	1583
Peak-hour factor, PHF	0.81	0.81	0.83	0.83	0.87	0.87
Adj. Flow (vph)	1030	538	90	920	567	346
RTOR Reduction (vph)	0	0	0	0	0	210
Lane Group Flow (vph)	1030	538	90	920	567	136
Confl. Peds. (#/hr)	1					
Heavy Vehicles (%)	1%	1%	1%	1%	2%	2%
Turn Type	NA	custom	Prot	NA	NA	Perm
Protected Phases	4	4	1	6	2	
Permitted Phases		6				2
Actuated Green, G (s)	89.0	128.8	9.6	39.8	25.2	25.2
Effective Green, g (s)	89.0	128.8	9.6	39.8	25.2	25.2
Actuated g/C Ratio	0.64	0.93	0.07	0.29	0.18	0.18
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	1146	1599	124	1025	643	287
v/s Ratio Prot	c0.58	0.22	0.05	c0.26	0.16	
v/s Ratio Perm		0.12				0.09
v/c Ratio	0.90	0.34	0.73	0.90	0.88	0.47
Uniform Delay, d1	21.1	0.5	63.3	47.5	55.3	50.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	11.2	0.1	18.9	10.4	13.5	1.2
Delay (s)	32.3	0.6	82.2	57.9	68.8	52.1
Level of Service	C	A	F	E	E	D
Approach Delay (s)	21.4			60.1	62.5	
Approach LOS	C			E	E	

Intersection Summary			
HCM Average Control Delay	43.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	138.8	Sum of lost time (s)	10.0
Intersection Capacity Utilization	76.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Queues
1: Kunia Rd & Foote Ave

3/25/2014

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	1030	538	90	920	567	346
v/c Ratio	0.90	0.34	0.73	0.90	0.88	0.69
Control Delay	33.6	0.6	94.8	59.8	71.5	22.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.6	0.6	94.8	59.8	71.5	22.3
Queue Length 50th (ft)	760	0	82	421	266	72
Queue Length 95th (ft)	799	0	#144	455	#328	171
Internal Link Dist (ft)	1138			1376	2153	
Turn Bay Length (ft)			150			150
Base Capacity (vph)	1146	1599	129	1056	663	505
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.90	0.34	0.70	0.87	0.86	0.69

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
30: Kunia Rd/Driveway & SR 99

3/25/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	3	1349	205	582	827	6	312	6	1280	11	8	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	2.0	3.0	3.0			3.0	3.0		3.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			1.00	1.00		1.00	
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00			1.00	0.99		1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.97	
Satd. Flow (prot)	1770	3539	1564	1787	3571			1793	1579		1688	
Flt Permitted	0.33	1.00	1.00	0.95	1.00			0.72	1.00		0.57	
Satd. Flow (perm)	614	3539	1564	1787	3571			1348	1579		991	
Peak-hour factor, PHF	0.94	0.94	0.94	0.97	0.97	0.97	0.94	0.94	0.94	0.69	0.69	0.69
Adj. Flow (vph)	3	1435	218	600	853	6	332	6	1362	16	12	1
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	1	0
Lane Group Flow (vph)	3	1435	218	600	859	0	0	338	1362	0	28	0
Confl. Peds. (#/hr)			1						1			
Heavy Vehicles (%)	2%	2%	2%	1%	1%	1%	1%	1%	1%	9%	9%	9%
Turn Type	Perm	NA	Free	Prot	NA		Perm	NA	Free	Perm	NA	
Protected Phases		6		5	2			8			4	
Permitted Phases	6		Free				8		Free	4		
Actuated Green, G (s)	81.0	81.0	210.0	66.0	152.0			48.0	210.0		48.0	
Effective Green, g (s)	83.0	83.0	210.0	68.0	154.0			50.0	210.0		50.0	
Actuated g/C Ratio	0.40	0.40	1.00	0.32	0.73			0.24	1.00		0.24	
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	243	1399	1564	579	2619			321	1579		236	
v/s Ratio Prot		c0.41		c0.34	0.24							
v/s Ratio Perm	0.00		0.14					c0.25	0.86		0.03	
v/c Ratio	0.01	1.03	0.14	1.04	0.33			1.05	0.86		0.12	
Uniform Delay, d1	38.6	63.5	0.0	71.0	9.8			80.0	0.0		62.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2	0.0	30.8	0.2	47.1	0.1			64.8	6.5		0.2	
Delay (s)	38.6	94.3	0.2	118.1	9.9			144.8	6.5		63.0	
Level of Service	D	F	A	F	A			F	A		E	
Approach Delay (s)		81.8			54.4			34.0			63.0	
Approach LOS		F			D			C			E	

Intersection Summary			
HCM Average Control Delay	56.7	HCM Level of Service	E
HCM Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	210.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	103.8%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
44: Kunia Rd & Lyman Rd

3/25/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	234	278	387	166	247	105	98	500	29	68	765	97
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0	4.0	3.0	3.0	4.0	3.0	3.0	4.0	3.0	3.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1554	1787	1881	1599	1787	3574	1599	1787	3574	1599
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1554	1787	1881	1599	1787	3574	1599	1787	3574	1599
Peak-hour factor, PHF	0.91	0.91	0.91	0.82	0.82	0.82	0.83	0.83	0.83	0.76	0.76	0.76
Adj. Flow (vph)	257	305	425	202	301	128	118	602	35	89	1007	128
RTOR Reduction (vph)	0	0	85	0	0	32	0	0	17	0	0	25
Lane Group Flow (vph)	257	305	340	202	301	96	118	602	18	89	1007	103
Confl. Peds. (#/hr)			3									
Heavy Vehicles (%)	2%	2%	2%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases			4			8			6			2
Actuated Green, G (s)	29.9	42.6	42.6	24.5	37.2	37.2	16.3	56.5	56.5	13.2	53.4	53.4
Effective Green, g (s)	31.9	44.6	43.6	26.5	39.2	38.2	18.3	58.5	57.5	15.2	55.4	54.4
Actuated g/C Ratio	0.20	0.28	0.28	0.17	0.25	0.24	0.12	0.37	0.37	0.10	0.35	0.35
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	360	530	432	302	470	390	209	1333	586	173	1263	555
v/s Ratio Prot	c0.15	0.16		0.11	0.16		c0.07	0.17		0.05	c0.28	
v/s Ratio Perm			c0.22			0.06			0.01			0.06
v/c Ratio	0.71	0.58	0.79	0.67	0.64	0.25	0.56	0.45	0.03	0.51	0.80	0.18
Uniform Delay, d1	58.2	48.0	52.3	61.0	52.5	47.7	65.5	37.1	31.8	67.3	45.6	35.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.6	1.5	9.1	5.5	3.0	0.3	3.5	0.2	0.0	2.6	3.6	0.2
Delay (s)	64.8	49.5	61.4	66.6	55.5	48.1	69.0	37.3	31.8	69.9	49.2	35.9
Level of Service	E	D	E	E	E	D	E	D	C	E	D	D
Approach Delay (s)		58.6			57.5			42.0			49.3	
Approach LOS		E			E			D			D	

Intersection Summary			
HCM Average Control Delay	51.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	156.8	Sum of lost time (s)	9.0
Intersection Capacity Utilization	65.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Queues
44: Kunia Rd & Lyman Rd

3/25/2014

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	257	305	425	202	301	128	118	602	35	89	1007	128
v/c Ratio	0.72	0.58	0.83	0.67	0.64	0.31	0.56	0.46	0.06	0.51	0.80	0.22
Control Delay	75.5	55.7	54.7	79.0	62.8	37.5	85.2	41.0	16.7	88.6	54.6	29.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	75.5	55.7	54.7	79.0	62.8	37.5	85.2	41.0	16.7	88.6	54.6	29.9
Queue Length 50th (ft)	252	273	313	199	282	72	118	248	5	89	496	64
Queue Length 95th (ft)	449	457	551	331	424	141	219	360	32	160	605	118
Internal Link Dist (ft)		1752			1815			882			1376	
Turn Bay Length (ft)	150		60	240		80	250		200	250		130
Base Capacity (vph)	529	848	760	437	754	655	279	1869	838	218	1747	791
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.49	0.36	0.56	0.46	0.40	0.20	0.42	0.32	0.04	0.41	0.58	0.16

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	113	54	4	514	1295	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	4.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1787	1599	1752	1845	1877	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1787	1599	1752	1845	1877	
Peak-hour factor, PHF	0.97	0.97	0.87	0.87	0.87	0.87
Adj. Flow (vph)	116	56	5	591	1489	26
RTOR Reduction (vph)	0	50	0	0	0	0
Lane Group Flow (vph)	116	6	5	591	1515	0
Heavy Vehicles (%)	1%	1%	3%	3%	1%	1%
Turn Type	NA	Perm	Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	13.2	13.2	1.3	103.6	97.3	
Effective Green, g (s)	15.2	14.2	3.3	105.6	99.3	
Actuated g/C Ratio	0.12	0.11	0.03	0.83	0.78	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	214	179	46	1537	1470	
v/s Ratio Prot	c0.06		0.00	c0.32	c0.81	
v/s Ratio Perm		0.00				
v/c Ratio	0.54	0.04	0.11	0.38	1.03	
Uniform Delay, d1	52.5	50.2	60.3	2.6	13.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.8	0.1	1.0	0.2	31.6	
Delay (s)	55.3	50.3	61.4	2.8	45.4	
Level of Service	E	D	E	A	D	
Approach Delay (s)	53.7			3.3	45.4	
Approach LOS	D			A	D	

Intersection Summary			
HCM Average Control Delay	35.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	126.8	Sum of lost time (s)	9.0
Intersection Capacity Utilization	82.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Queues
41: Kunia Rd & Field Station Kunia Entrance

7/17/2014

Lane Group	EBL	EBR	NBL	NBT	SBT
Lane Group Flow (vph)	116	56	5	591	1515
v/c Ratio	0.52	0.24	0.04	0.39	1.00
Control Delay	59.0	15.1	57.0	3.8	36.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	59.0	15.1	57.0	3.8	36.2
Queue Length 50th (ft)	85	0	4	90	822
Queue Length 95th (ft)	156	41	18	163	#1718
Internal Link Dist (ft)	642			1901	1685
Turn Bay Length (ft)	140		300		
Base Capacity (vph)	336	333	172	1672	1519
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.35	0.17	0.03	0.35	1.00

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Unsignalized Intersection Capacity Analysis
5: Kunia Rd & Temp Access

3/21/2014

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	49	49	0	469	1349	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	0.77	0.77	0.91	0.91
Hourly flow rate (vph)	49	49	0	609	1482	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2092	1482	1482			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2092	1482	1482			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	16	68	100			
cM capacity (veh/h)	58	155	454			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	98	609	1482
Volume Left	49	0	0
Volume Right	49	0	0
cSH	85	454	1700
Volume to Capacity	1.15	0.00	0.87
Queue Length 95th (ft)	173	0	0
Control Delay (s)	234.5	0.0	0.0
Lane LOS	F		
Approach Delay (s)	234.5	0.0	0.0
Approach LOS	F		

Intersection Summary			
Average Delay	10.5		
Intersection Capacity Utilization	91.9%	ICU Level of Service	F
Analysis Period (min)	15		

Appendix D

Agency Coordination under the Coastal Zone Management Act

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DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
DIRECTORATE OF PUBLIC WORKS
947 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5013

REPLY TO
ATTENTION OF:

Directorate of Public Works

OCT 2 2 2014

Mr. Leo Asuncion, Planning Program Manager
Coastal Zone Management Program
Office of Planning
P.O. Box 2359
Honolulu, Hawaii, 96804

Dear Mr. Asuncion:

The US Army Garrison, Hawaii (USAG-HI) proposes to lease 8.13 acres of land and grant a 2.5-acre interconnection easement on Schofield Barracks and Wheeler Army Airfield on Oahu to Hawaiian Electric Company (Hawaiian Electric) to construct, operate, and maintain a 50-megawatt (MW) capacity renewable energy power plant, including associated power poles, high-tension power lines, and related equipment and facilities. The proposed action is referred to as the Schofield Generating Station Project (SGSP). The State of Hawaii Department of Land and Natural Resources would grant a 1.28-acre easement and a 0.7-acre conservation district authorization to Hawaiian Electric to allow for the construction of a 46-kilovolt (kV) electrical power transmission line between the SGSP site and the existing Wahiawa Substation. The Army is currently preparing an Environmental Impact Statement (EIS) that analyzes the potential impacts of the proposed action in accordance with the National Environmental Policy Act of 1969 (NEPA). The Draft EIS is expected to be published in early 2015.

The primary site for the SGSP is on Army-owned property on Schofield Barracks' South Range. The transmission line interconnection easement would be partially on Army-owned property on Schofield Barracks and Wheeler Army Airfield and partially on properties owned or leased by the State of Hawaii. The Wahiawa Substation is on land owned by Hawaiian Electric.

The purposes for leasing the property and constructing the SGSP are to provide improved energy security to the USAG-HI at Schofield Barracks, Wheeler Army Airfield, and Field Station Kunia, and to provide new secure, firm, dispatchable, flexible, and renewable energy generation to the grid on Oahu, Hawaii. The electricity produced by the SGSP would normally supply power to all Hawaiian Electric customers through the island-wide electrical grid. During outages that meet the criteria specified in the Operating Agreement, SGSP output would first be provided to Army facilities at Schofield Barracks, Wheeler Army Airfield, and Field Station Kunia up to their peak demand of 32 MW to meet their missions and would additionally support the grid up to its full capacity. If there were a full island outage, the plant could also be used to blackstart other plants.

The USAG-HI has concluded that the SGSP will be consistent with all enforceable policies of the Hawaii Coastal Zone Management Program. Applicable best management practices and permit requirements will be strictly adhered to during construction and operation of the SGSP. Additionally, no direct, indirect or cumulative effects resulting from the construction and operation of the SGSP are anticipated to impact the state's coastal zone. For further information, please see the enclosed Project Impacts Summary and location map.

A copy this letter will be funished to Hawaiian Electric. If you have any questions, the point of contact is the NEPA Program Manager, Lisa Graham, by telephone at (808) 656.3075 or by email at lisa.m.graham52.civ@mail.mil.

Sincerely,

Steven Raymond
Director of Public Works

Enclosures

Project Impacts Summary
Schofield Generating Station Project
Schofield Barracks, Hawaii

Recreational Resources:
The proposed project would have a temporary minor impact on a recreational area. The new electrical transmission line would be next to Lake Wilson along Kamehameha Highway (Route 80), and the easternmost portion of the proposed transmission line would pass into the Wahiawa Freshwater State Park. However, where it crosses Lake Wilson, the new line would be placed on replacement poles that will carry both the new line and an existing 46-kilovolt electrical line and would terminate at the Wahiawa Substation between Neal Avenue and Walker Avenue. Other than the temporary disturbance for installation of the transmission line, no recreational resources would be impacted by the proposed project.

Historic Resources:
The project site is not within an historic or cultural district. Some transmission poles and portions of the electrical transmission line would be visible from the Schofield Barracks and Wheeler Army Airfield historic districts. The Army is consulting with SHPD regarding these visual effects, and SHPD will be provided with a copy of the draft Environmental Impact Statement for review. If, during construction, any previously unidentified archaeological or historic site was identified, construction activities would be halted in the vicinity and SHPD would be immediately notified. The project site is not listed on or nominated to the Hawaii or National Register of Historic Places. The project site land has been surveyed by an archaeologist, and there was no evidence of traditional Hawaiian or early historic cultural deposition. The project site is not within or near a Hawaiian fishpond or historic settlement area.

Scenic and Open Space Resources:
The project site does not abut a scenic landmark. Various elements of the power generating station would exceed one story in height. The engine hall would be 33 feet tall, engine-generator exhaust systems would each have a 75-foot-tall exhaust gas silencer stack, the switchyard will include a 75 foot tall microwave tower, two 40-foot-high aboveground fuel storage tanks would be installed to store biodiesel and diesel, and forty-seven steel poles would be installed for the overhead transmission line. The poles would be 60 to 80 feet tall. However, the generating station would be installed entirely on an undeveloped parcel of land and the station would be surrounded by undeveloped land on Army and state property. The transmission line poles would be installed on undeveloped property adjacent to an existing electrical transmission line.

Coastal Ecosystems:
The proposed action would not impact coastal ecosystems. Uncontaminated stormwater from the generating station would be discharged to the permitted plant stormwater drainage system. Earthwork would be required for construction of the generating station. A portion of the site would be paved to provide access to project facilities. Sanitary wastewater from the site would discharge to the Army wastewater system. Process wastewater would be passed into an oil/water separator the accumulated sludge would be managed and disposed of appropriately. Waikele Stream is about 100 to 150 feet north of the proposed site for the generating station, and three transmission line poles would be installed near Lake Wilson on the South Fork of Kaukonahua Stream, but the project would have no impacts on these waters.

The project would not have any detrimental impact on wildlife as it will incorporate measures that should avoid any risk of harm. The Hawaiian hoary bat is the only protected species with likelihood to occur in the project area, and though consultation with US Fish and Wildlife Service, the SGSP will incorporate measures that should avoid any risk of harm to the Hawaiian hoary bat. The proposed action would not involve dredge or fill activities, it is not within the Shoreline Setback Area, and is not in and does not abut a Natural Area Reserve, a Marine Life Conservation District, or an estuary.

Economic Uses:
The project would not impact coastal dependent development. The proposed project is to construct, operate, and maintain a 50-megawatt (MW) capacity renewable energy power plant that would be powered by a biofuel blend. The purposes of the generating station will be to provide improved energy security to the U.S. Army Garrison-Hawaii at Schofield Barracks, Wheeler Army Airfield, and Field Station Kunia, and to provide new secure, firm, dispatchable, flexible, and renewable energy generation to the grid on Oahu, Hawaii.

The primary project site is Army-owned land that was previously in agricultural production, but that has been fallow in recent years. The proposed project does not involve a harbor or port, is not within a designated tourist destination area, and does not relate to commercial fishing, seafood production, or seabed mining.

Coastal Hazards:
The project would not increase the risk of life or property to coastal hazards. The project site is not on and does not abut a sandy beach, is not within a potential tsunami inundation area, a potential flood inundation area, or a potential subsidence hazard area, and is not near any shoreline areas.

Managing Development:
The project will require numerous permits and approvals, and the Army and Hawaiian Electric are either in the process of obtaining them or will do so at the appropriate time during the project's development process. The project will conform with State and County land use designations for the site. The public has been notified of the proposed activity (see below, Public Participation), and a draft Environmental Impact Statement for the proposed project is being prepared.

Public Participation:
A public notice announcing the time and location of two public scoping meetings that were held to solicit public input and comments on the scope of the environmental impact statement (EIS) was published in the *Honolulu Star Advertiser* on January 17, 2014. In addition, the EIS public notice (EISPN) was published in the January 8, 2014 issue of *The Environmental Notice*, published by the State of Hawaii Department of Health, Office of Environmental Quality Control. Persons who were known to have a potential interest in the proposed action were notified and invited to participate in the environmental impact analysis process. The public mailing list contained the names of 145 parties. A notice of availability (NOA) of the EIS for the proposed project will be published in the *Federal Register*, the *Honolulu Star Advertiser*, and *The Environmental Notice*. The Army will hold public meetings to following publication of the NOA to provide opportunities for presenting oral and written comments on the Draft EIS.

Beach Protection: The proposed project would not impact any beach areas. The entire project would occur in inland areas and will not involve the construction of private or public beach erosion-protection structures.
Marine Resources: The proposed project would not impact any marine or coastal resources.

LEGEND

- DoD/Federal Land
- State Route
- SGSP Site
- Interconnection Easement

Source: Schofield Barracks GIS 2014, ESRI 2011.

Project Location

Appendix E
Water Characterization Study

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FINAL
Water Characterization Study
Schofield Generating Station Project
USAG-HI Schofield, Oahu, HI

Submitted by:

Tetra Tech
9444 Balboa Ave., Suite 215
San Diego, CA 92123

November 19, 2013

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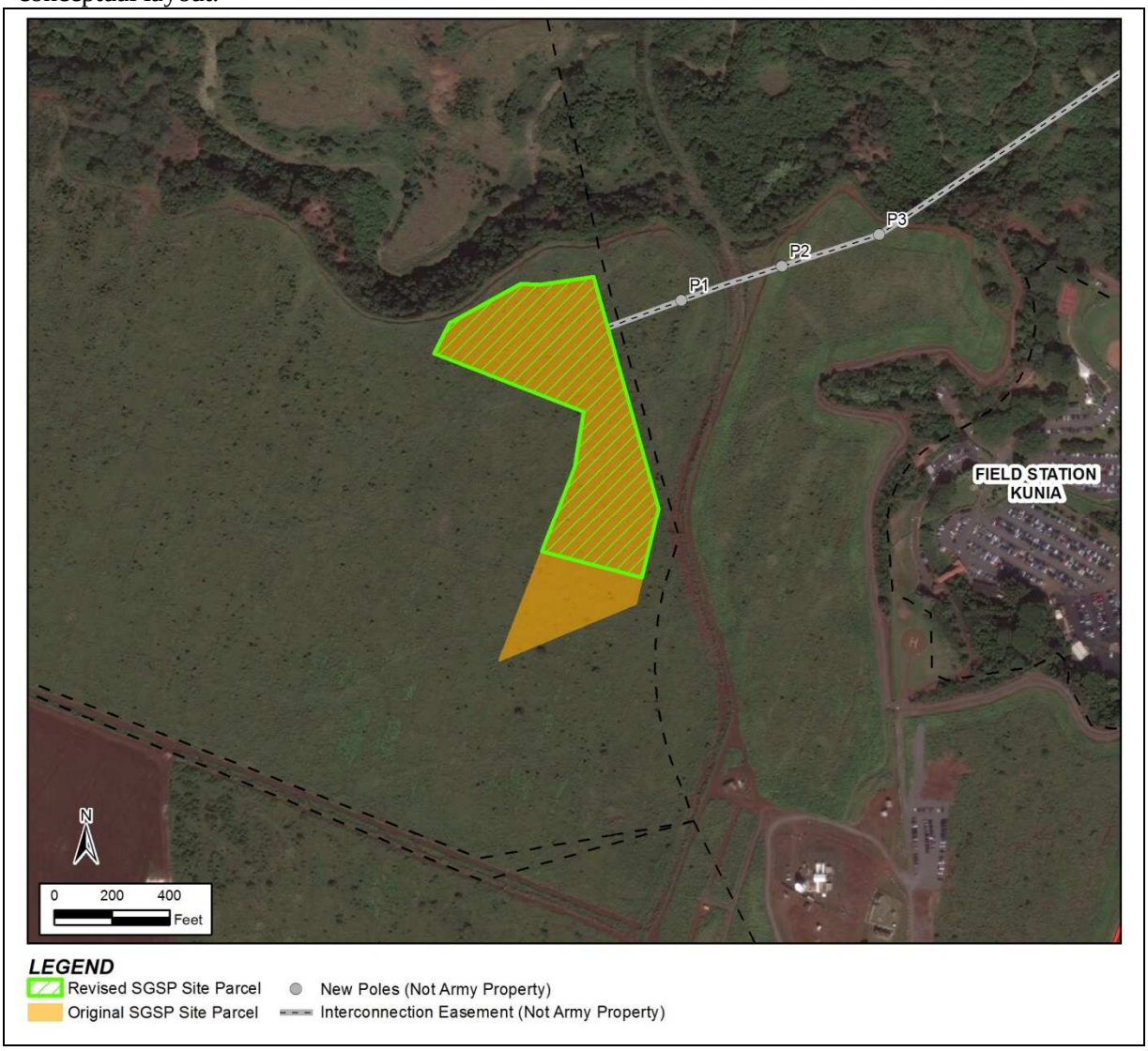
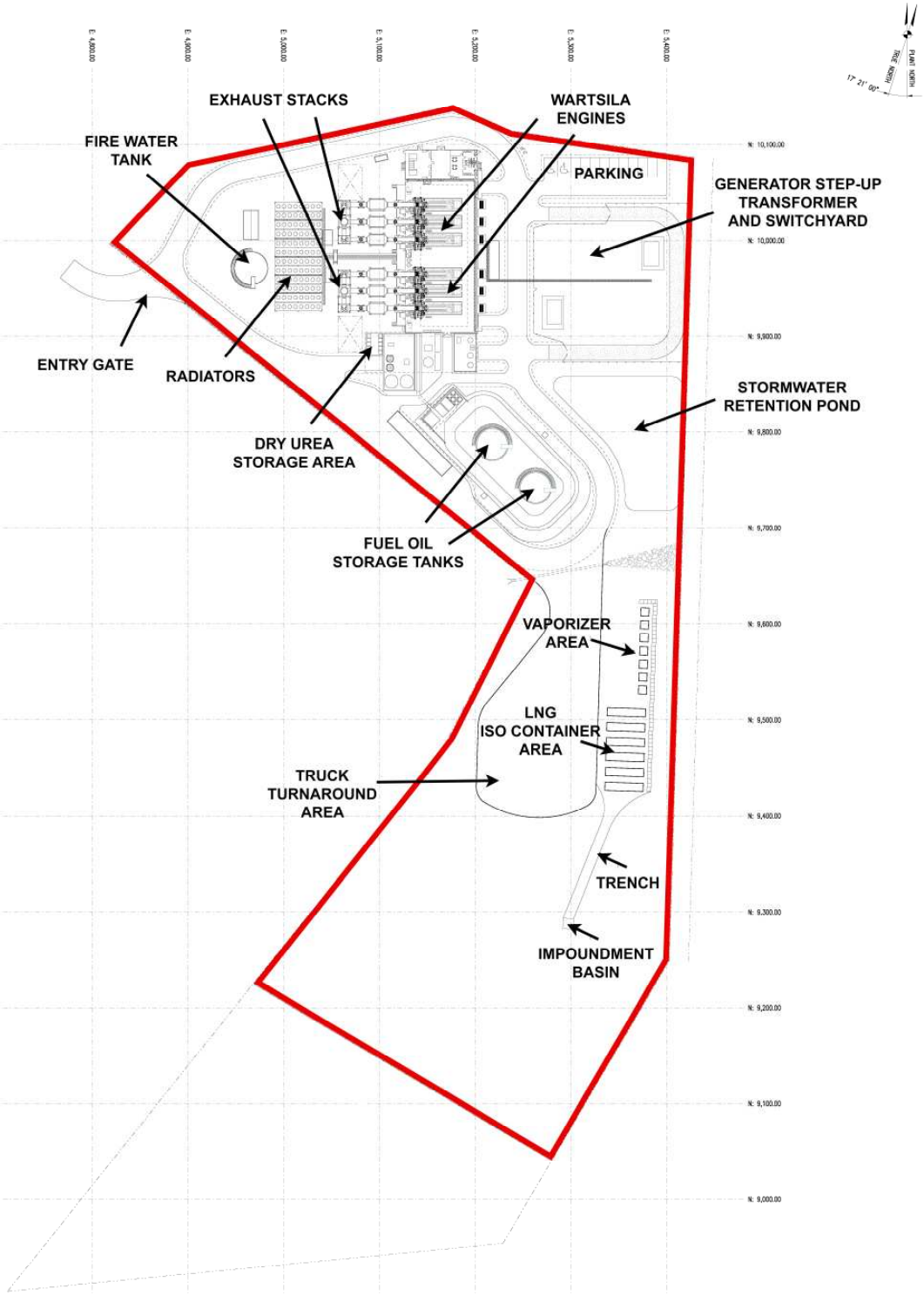
Errata

Prepared on August 18, 2014

After completing the Water Characterization Study, the Army and Hawaiian Electric reduced the size of the parcel on which the generating station will be located and revised the conceptual site layout to accommodate infrastructure associated with use of containerized liquefied natural gas if and when it becomes an available fuel source for the project. The Schofield Generating Station parcel was reduced from 10.3 acres to 8.13 acres. The first map below shows the reduced parcel indicated by hatch marks and the second map shows the revised site conceptual plan. Please note that the figures and discussions within the Water Characterization Study are based on the larger 10.3 parcel and initial conceptual design, and therefore do not match the parcel size and site design discussed in the EIS. However, the reduction in parcel size and revised site layout does not affect the recommendations made in the Water Characterization Study regarding storm water management. In fact, recommendations in the Water Characterization Study were taken into account during the redesign of the site conceptual layout.




EXHAUST STACKS
WARTSILA ENGINES
FIRE WATER TANK
PARKING
GENERATOR STEP-UP TRANSFORMER AND SWITCHYARD
ENTRY GATE
RADIATORS
STORMWATER RETENTION POND
DRY UREA STORAGE AREA
FUEL OIL STORAGE TANKS
VAPORIZER AREA
LNG ISO CONTAINER AREA
TRUCK TURNAROUND AREA
TRENCH
IMPOUNDMENT BASIN

EXECUTIVE SUMMARY

The National Environmental Policy Act (NEPA) requires federal agencies to account for environmental impacts and identify mitigation options by submitting environmental impact statements (EIS) for federal projects. In 2007, Congress passed the Energy Independence and Security Act (EISA), and Section 438 of that legislation establishes strict stormwater runoff requirements for federal development and redevelopment projects. Additional Army policies enacted in 2010 encourage the use of low impact development (LID) to manage stormwater on federal property. The 2010 Army policies also require a potable water use reduction of 30 percent and suggest rainwater harvesting as an option. Further, local regulations require developments to comply with flood control criteria specified in the City and County of Honolulu Rules Relating to Storm Drainage Standards (2000).

The purpose of this study is to:

1) identify cost effective solutions (mitigation measures) to meet compliance with federal and local regulations for the U.S. Army Garrison Hawaii and Hawaii Electric Company's proposed Schofield Generating Station (SGS) near Schofield Barracks on the Hawaiian island of O'ahu, and
2) document these mitigation measures in support of the NEPA EIS for the SGS project.

This characterization study analyzes two options to mitigate post-development runoff for EISA compliance; Option 1 requires retaining the 95th percentile rainfall event on-site (by means of infiltration, evapotranspiration, or reuse), and Option 2 requires maintenance or restoration of predevelopment hydrology on the basis of site-specific conditions through the use of continuous simulation modeling techniques, published data, studies, or other established tools. Modeling results identified Option 1 as the cost-effective compliance solution. When compared to Option 2, Option 1 identified a 34 percent smaller facility that would be required to retain the runoff generated by the 1.8 inch, 95th percentile event.

Once EISA Option 1 was identified as the more cost-effective compliance solution, two alternatives were proposed to select a design that is compliant with EISA Option 1, provides cost-effective stormwater management, and supports the Army's goal for a sustainable future. Alternative 1 proposed the conceptual plan's detention basin as an infiltration basin best management practice (BMP). Alternative 2 included LID implementation of distributed bioretention and cistern BMPs throughout the site. Based on optimization modeling results, Alternative 1 was projected to cost 18% less than Alternative 2, and was selected as the optimal design.

In addition to the EISA requirements, Honolulu City and County Storm Drain Standards state that additional storage would be needed to retain and infiltrate the 10-year design storm excess runoff from post-development conditions. To accommodate this, the proposed Option 1 BMP volume would need to be expanded by 0.071 ac-ft.

Army LID policy requires that rainwater harvesting be considered for new federal site designs. A continuous simulation model was used to guide selection of an optimum cistern size based on a projected daily municipal water use of 500 gallons. A 30-year return on investment (ROI) analysis was also performed to determine the cost-effectiveness of a rainwater harvesting system. Results predicted that rainwater harvesting could offset 71% of long-term potable water demand at SGS by implementing an 8,000-gallon cistern with a backup water supply. The 30-year ROI analysis predicted an 11-year payback period for the recommended system.

Final recommendations for stormwater management at the proposed SGS include meeting EISA compliance and flood control requirements using an infiltration basin BMP. Rainwater harvesting implementation will help reduce potable water use and promote a sustainable future for the Army. These designs are recommended as a cost-effective and sustainable solution to mitigate for potential environmental impacts due to the development of SGS at U.S. Army Garrison-Hawaii, Schofield.

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1 INTRODUCTION

1.1 PURPOSE

The United States Army (Army) Schofield Barracks is located on the island of O'ahu, Hawaii, in Honolulu County. The Army must increase their renewable energy sources to adhere to Federal energy statutes and mandates and ensure 100% energy security to the Schofield Barracks, Wheeler Army Airfield, and Kunia Station. To meet these requirements, the Army is proposing to lease of 10.3 acres of undeveloped land and a related 2.5-acre interconnection easement on Schofield Barracks to Hawaiian Electric, for Hawaiian Electric's construction, ownership, operation, and maintenance of a 50 MW capacity biofuel-capable power generation plant and 46-kilovolt subtransmission line required to connect the Schofield Generating Station to the Hawaiian Electric grid. If implemented, the SGSP would be a source of renewable power that would provide energy security for the installations if loss of service occurs.

The SGSP would benefit Hawaiian Electric and the residents of O'ahu. It would add 50 MW of utility-owned, dispatchable capacity to the O'ahu grid; provide a quick-starting, high-ramp rate facility to help maintain grid stability and compensate for increasing network penetration by variable sources of power generation, such as wind and solar; provide a power generation facility at a higher elevation and away from coastlines, which contributes to grid reliability and continuity of operation if a natural disaster occurs; provide a physically secure power generation facility on a military installation, contributing to grid continuity of operation in cases of a man-made threat; and make progress towards the State Renewable Portfolio Standards.

The project is proposed to be constructed on an undeveloped site (formerly agricultural land), which, if left unmitigated, could have adverse impacts on the environment.

The United States National Environmental Policy Act (NEPA) introduced national environmental considerations and implementations for the federal government. NEPA Title I declared federal agencies to "use all practicable means to create and maintain conditions under which man and nature can exist in productive harmony" (NEPA citation). NEPA requires federal agencies to prepare environmental impact statements (EIS) to analyze potentially significant environmental effects and alternatives for proposed federal projects and decisions. This report addresses stormwater management for the SGSP EIS; in particular, the pre- and post-development hydrology was characterized and environmental solutions were identified to comply with relevant regulations.

The purpose of this study is to:

1) identify cost effective solutions (mitigation measures) to meet compliance with federal and local regulations for the proposed project and
2) document these mitigation measures in support of the NEPA EIS for the proposed project.

1.2 REGULATORY BACKGROUND

The following section outlines the pertinent federal and local regulations and policies governing stormwater management at the proposed project site.

1.2.1 EISA REGULATIONS

Congress enacted the Energy Independence and Security Act (EISA) in December 2007; Section 438 of that legislation establishes strict stormwater runoff requirements for federal development and redevelopment projects. The legislation reads as follows:

> The sponsor of any development or redevelopment project involving a Federal facility with a footprint that exceeds 5,000 square feet shall use site planning, design, construction, and maintenance strategies for the property to maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the temperature, rate, volume, and duration of flow. (EISA 2007)

Section 438 is intended to address the inadequacies of common approaches to managing stormwater and promote practices that maintain or restore predevelopment site hydrology. Although Congress did not prescribe specific strategies to comply with Section 438, it can be inferred that one of the goals of the act is to promote the use of sustainable stormwater management approaches, designs, and practices that better protect receiving water quality and better address volume control (USEPA 2009). LID is the preferred approach that can be used to meet the criteria of Section 438. To assist federal agencies with compliance, EPA developed Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act. EPA's technical guidance document describes two options for demonstrating compliance with EISA Section 438 requirements, each of which is intended to achieve the outcome of maintaining or restoring predevelopment hydrology. Option 1 is to retain the 95th percentile rainfall event on-site, and Option 2 is to determine predevelopment hydrology on the basis of site-specific conditions through the use of continuous simulation modeling techniques, published data, studies, or other established tools to determine the volume of water to be managed and retained on-site. (USEPA 2009)

1.2.2 ARMY LID POLICIES

In a 2010 memorandum, the Army instated requirements for managing stormwater with LID. This memorandum was distributed as a follow-up to Section 438 of EISA, Department of Defense (DoD) Stormwater Requirements for EISA, and a June 2010 sustainable design and development policy memorandum update. The Army addresses the need to take a more sustainable, innovative approach, like LID, to manage the stormwater runoff from Army-owned land, regardless of size and type of construction projects. The LID guidelines were instated in 2011 for all "sustainment, restoration, and modernization (SRM) funded projects", and all Army construction projects are expected to comply by 2013. The proposed LID requirements also follow LID criteria stated in the LID Unified Facilities Code (UFC) 3-210-10N and EPA Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of EISA.

In addition to the LID Policy, the Army released a policy update in a memorandum on October 27, 2010, regarding sustainable design and development of any facility construction activities in the U.S. at active Army installations, Army Reserve Centers, Army National Guard Facilities, and Armed Force Reserve Centers, regardless of the funding source. In particular, Section 5f pertains to stormwater management and compliance with EISA Section 438, and it reiterates the installation of LID and minimizing site disturbance. Furthermore, Section 5g and 5h respectively state that any facility construction project is

required to reduce its indoor potable water use by 30 percent and outdoor water use by 50% relative to projected baseline rates. Strategies used to reduce the potable water should follow American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 189.1 Sec 6 guidelines. The policy lists xeriscaping, rainwater retention, and water reuse and recycling as strategies to reduce potable water use. (Army 2010b)

1.2.3 CITY & COUNTY OF HONOLULU REGULATIONS

In addition to federal regulations regarding stormwater management, local flood control standards from Honolulu County also apply to the proposed SGS site. In particular, the Hawaiian Electric request for proposal (RFP) stated that surface drainage systems within SGS boundaries should be sized to convey the 10-year, 24-hour runoff to prevent roadway flooding and 50-year, 24-hour storm event to prevent equipment and building flooding (HECO 2013). The City and County of Honolulu further require development projects that disturb less than 100 acres to maintain predevelopment runoff volume and flow rates from the 10-yr design storm if the site ultimately discharges to a water body other than open coastal waters.

1.2.4 SUMMARY OF RELEVANT STORMWATER CRITERIA

The following summarizes pertinent regulations and policies for stormwater management:

- EISA Section 438 requires maintaining or restoring predevelopment hydrology for developments or redevelopments greater than 5,000 square feet (EISA 2007)

- EPA's Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act provides two options to reach EISA compliance by treating stormwater runoff quantity from:

    - Option 1) 95th percentile storm event or

    - Option 2) pre-development hydrology (EPA 2009). Any construction project on Federal land operated by the Army that requires stormwater management must incorporate LID practices (Army 2010a)

- LID techniques such as rainwater harvesting are encouraged for water reuse for irrigation and/or toilets (Army 2010a)

- A cost-benefit analysis must accompany all rainwater harvesting projects to demonstrate a favorable return on investment (ROI) over a 30-year period (Army 2010a)

- Traditional stormwater practices such as retention and detention ponds are discouraged by the Army (Army 2010a)

- Indoor potable water use should be reduced by 30 percent from baseline conditions in any Army facility (Army 2010b).

- Outdoor potable water use should be reduced by a minimum of 50 percent through strategies such as rainwater retention and water reuse at Army facilities (Army 2010b).

- Meet local flood control standards requiring that runoff volume from the 10-year design storm be limited to predevelopment values (City and County of Honolulu 2000). Furthermore, the 10-year, 24-hour storm discharge should be managed without flooding roadways and the 50-year, 24-hour discharge without flooding equipment and buildings at SGS (HECO 2013).

1.3 PROJECT DESCRIPTION

The proposed Schofield Generating Station is located on the Army's South Range Acquisition Area, which is adjacent to Schofield Barracks Main Post, near Wahiawa, Hawaii, as shown in Figure 1-1. The Army's Energy Initiatives Task Force (EITF), which was established to ensure Army energy security and sustainability, recommended the Schofield Barracks site as an ideal location for cost-effective, secure renewable energy management. The proposed 10.3 acre site is located on federally-owned land that would be leased to Hawaiian Electric for construction, ownership, operation and maintenance of a biodiesel-fired power plant. Six Wartsila multi-fuel capable engines are projected to provide a combined power of about 50 megawatts (MW), which will be transferred into the local grid by a new 46 kilowatt (kW) transmission line. The liquid biofuel will be stored on site in two aboveground fuel storage tanks, which will provide storage for 1.6 million gallons of fuel. In addition to the engines, the site will also contain selective catalytic reduction and oxidation catalyst systems. Stormwater runoff from the diesel tanks and lubricating oil equipment areas at SGS will be routed into water collection sumps. These sumps will routinely be checked for contamination from the equipment and will occasionally be pumped through an on-site oil water separator system. Primary potential contaminants include fuel and oil from the biodiesel engines and their accompanying equipment. Non-contaminated water will be subjected to stormwater management through LID solutions. Trucks will transport toxic stormwater for off-site treatment at an appropriate wastewater disposal facility. (HECO 2103)

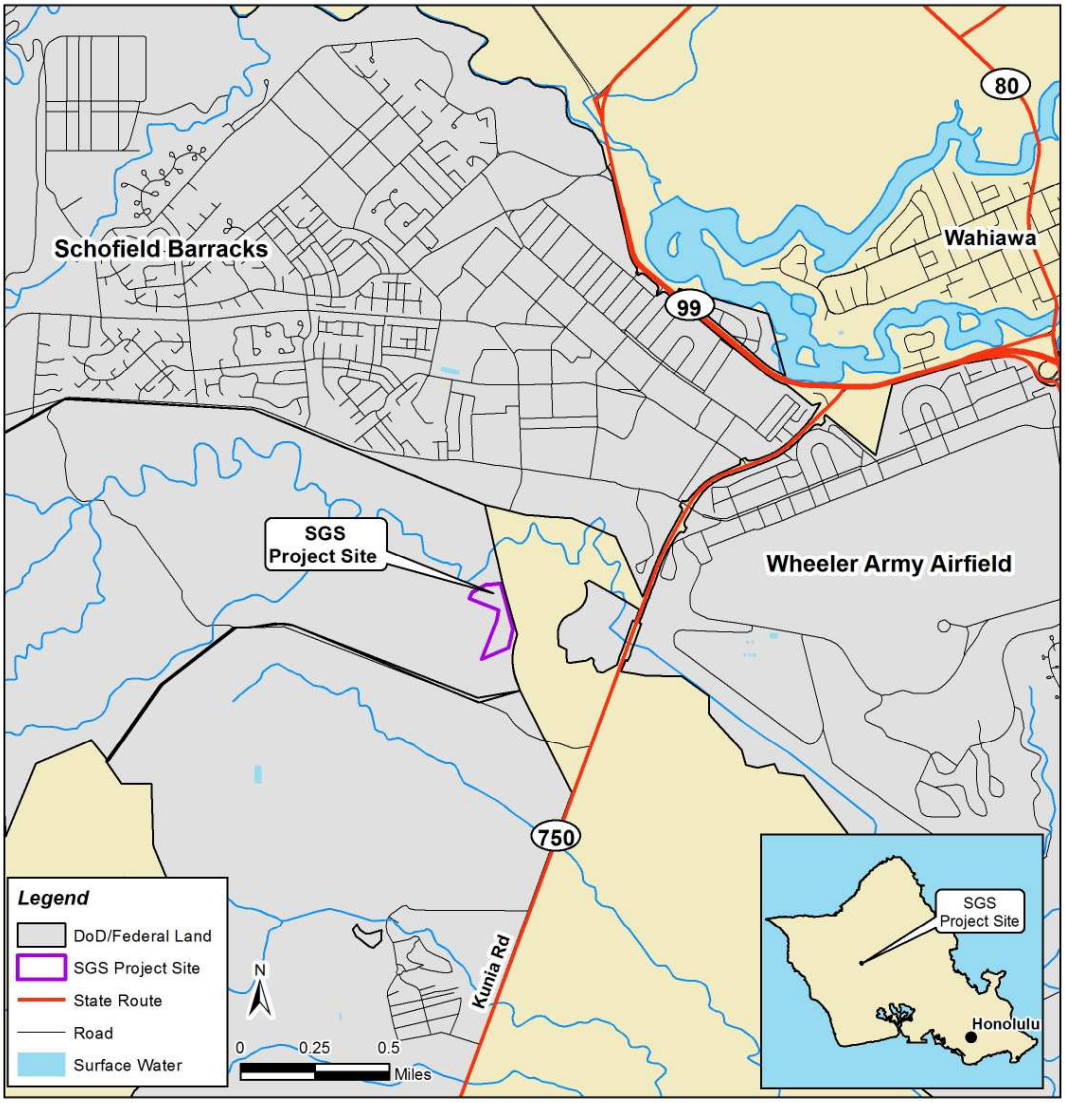


Figure 1-1: Location of proposed Schofield Generating Station

Based on UFC and the Army LID Policy, the Army encourages rainwater harvesting as a sustainable, land-efficient stormwater management option. The proposed SGSP RFP Appendix B Section 2.9 details water use for the site. Potable water will be used for the engine hall, control building, water treatment facility, sinks, men's and women's lavatories, showers, water fountains and emergency eyewash and shower stations. The potable water will be sourced from an existing U.S. Army Base potable water system (HECO 2013). The Initial Scope of Work Planning Package (ISOWPP) estimated that 500 gallons per day of City of Honolulu water would be necessary for service and potable needs for the site (USACE 2012). Per the Army policy updates from 2010, water harvesting will be studied for this site to determine if captured stormwater can be recycled for some of the proposed water uses in a cost-effective manner. In particular, this would help achieve the requirement of a 30 percent potable water reduction for indoor use and 50 percent reduction for outdoor use. This report will further discuss the volume of stormwater that could be captured and reused based on the site's climate and proposed impervious surfaces. Other LID options will also be analyzed to determine the optimal design for SGS.

1.4 RELEVANT LID PRINCIPLES

LID offers numerous benefits and advantages over the conventional approach to stormwater management. In short, LID is a more environmentally sound technology. LID protects environmental assets, protects water quality, and builds community livability by addressing runoff close to the source through intelligent site design to reduce volume and decentralize flows. This is usually best accomplished by creating a series of smaller retention or detention areas that allow localized filtration instead of carrying runoff to a remote collection area to be treated. The natural processes employed by LID practices allow pollutants to be filtered or biologically or chemically degraded before stormwater reaches local water bodies. Relevant LID practices to this study include bioretention BMPs and cistern BMPs for water reuse (Table 1-1).

Table 1-1: Summary of Stormwater Management Practices

Stormwater Management Practice	**Conventional Detention Pond**	**Bioretention and Infiltration Facilities**	**Rain Water Harvesting Cisterns**
Description	Basins designed to capture and slowly release runoff for flood control, channel protection, and water quality.	Basins designed to capture and infiltrate runoff. Engineered soils are often specified to improve infiltration and water quality.	Tanks designed to capture and store stormwater runoff. Water can be slowly drained or reused to offset potable water use.
Pollutant Removal Efficiency			
Sediment	Medium	High	N/A[1]
Metals	Low	High	
Hydrocarbons	Low	High	
Nutrients(TN & TP)	Low	Medium	
Bacteria	Medium	High	
Thermal Load	Medium	High	
Land Use Required	High	High	Low
Peak Runoff Attenuation	Yes	Yes	Yes
Runoff Volume Reduction	No	Yes	Yes
Costs	$-$$	$$-$$$	$-$$
Operation & Maintenance	Medium	Medium-High	Medium-High
LID concept	No	Yes	Yes
Help achieve Army goals for 30% indoor & 50% outdoor potable water reductions?	No	No	Yes

[1] Rainwater harvesting pollutant removal is difficult to quantify since the influent pollutant concentrations from roofs (typical drainage area) are typically low, so the pollutant concentrations entering cisterns are often irreducible.

2 APPROACH & ANALYSIS

The following section presents relevant hydrologic and hydraulic methodologies to address the regulatory requirements summarized in Section 1. Results in this section will be synthesized into compliance recommendations in Section 3.

2.1 EISA COMPLIANCE

This section describes methodology to characterize site hydrology and identify the most cost-effective option for EISA compliance. The EPA's Storm Water Management Model (SWMM), version 5.0, was used to characterize existing and proposed hydrologic conditions and the EPA's System for Urban Stormwater Treatment and Analysis Integration (SUSTAIN), version 1.2, model was used to simulate and optimize stormwater management practice performance. A detailed summary of model inputs and assumptions is provided in Appendix A.

2.1.1 BASELINE CONDITIONS

To evaluate runoff conditions and simulate prospective BMP performance for current and future conditions, several key data sets were processed and formatted for input into the model. The data sets required for this study were identified as land use (current and future), topography, soils, groundwater, and precipitation (Table 2-1).

Table 2-1: Model Input Data

Topography	
Proposed Site Area	10.3 acre
Proposed Site Impervious Area[1]	1.4 acre
Site Elevation Range AMSL[2]	860-886 feet
Average Site Slope	3.2%
Soils[3]	
Current Land Use	Cultivated
Existing Soil	HSG B
Minimum Infiltration Rate	0.2 inch/hour
Maximum Infiltration Rate	2.0 inch/hour
Average Saturated Hydraulic Conductivity	1 inch/hour
Climate Data[4]	
Precipitation Station	Wahiawa Dam 863
Temperature Station	Schofield East

[1] Based on conceptual plans; [2] Above Mean Seal Level (AMSL); [3] Obtained from the National Resources Conservation Services (NRCS) Soil Survey Geographic (SSURGO) database; [4] collected from National Climatic Data Center (NCDC) Climate Data Online

Soil borings conducted onsite confirmed SSURGO classification of site soils as clayey silts (HECO 2013). To ensure conservative analyses, the saturated hydraulic conductivity of site soils was assumed

equal to the minimum infiltration rate for HSG B soils (0.2 inch/hour), as recommended in SWMM User's Manual produced by EPA (Huber and Dickinson 1988). Both of the climate stations' data were combined due to their close proximity to each other and the proposed SGS site to create 11 years (2001-2011) of continuous temperature and precipitation data for modeling purposes. Pan evaporation rates were estimated for the site by averaging the evaporation rates measured at the three closest monitoring stations in Ekern and Change (1985). Pan evaporation was converted to reference evapotranspiration using the formula recommended in Snyder et al. (2005).These data were input to SWMM to generate runoff timeseries data for the baseline (predevelopment) conditions. Hydrology was simulated for an 11-year period from 2001 through 2011 and also for the 10-year, 24-hour average recurrence interval storm event and the 95th percentile storm event.

2.1.2 EISA OPTIONS

<u>EISA Option 1</u>
Option 1 for meeting EISA regulations requires that runoff from the 95th percentile storm be fully contained. Using the local precipitation data, the 95th percentile storm was calculated by sorting the available data from largest to smallest recorded precipitation over a 24-hour period then eliminating values less than or equal to 0.1 inch according to technical guidelines described in EPA's technical guidance document. A statistical analysis was performed on the organized data to find the 95th percentile storm.

To generate a conservative runoff estimate for comparison with Option 2, the impervious surface was assumed to have no depression storage in the Option 1 analysis. The effective BMP volume needed for treating a certain amount of increased imperviousness in a subwatershed was calculated as the area of the increased imperviousness in the conceptual site layout multiplied by the 95th percentile storm depth. For purpose of comparison, all runoff was assumed to be captured by an arbitrary BMP with a uniform surface storage depth of 4 feet (consistent with following Option 2 analyses). The total BMP volume required under Option 1 was compared to results from the following Option 2 analysis.

<u>EISA Option 2</u>
The SUSTAIN model in Option 2 provides a continuous simulation alternative to the 95th percentile storm approach under Option 1. During the continuous simulation, long-term rainfall characteristics, evapotranspiration from BMPs, and detention effects from BMPs are all considered. Runoff from subwatersheds is computed using hydrologic response unit (HRU) timeseries that were generated for each HRU using SWMM.

BMP Representation in SUSTAIN
Infiltration BMPs are effective measures to restore post-development runoff conditions to the predevelopment level. The SUSTAIN model can help quantify the hydrologic benefits from BMP implementation. As subwatershed runoff is routed through an infiltration BMP, porous spaces in BMPs provide total volume and peak flow reduction control. The degree of hydrologic benefit varies as the size of the BMPs change. As BMPs are implemented for continuous simulation, percolation of infiltrated water to the natural soil from the bottom of BMPs must be accounted for. In addition to infiltration BMPs, SUSTAIN simulates rainwater harvesting by using cisterns to capture runoff and control release through orifices. Cisterns can be sized to provide total volume and peak flow reduction control, and specific water volumes can be allocated for reuse for toilet flushing or irrigation, for example. For the purpose of comparing Option 1 to Option 2, runoff generated from the new impervious surfaces proposed

in the conceptual site layout was routed to an arbitrary infiltration BMP consistent with characteristics applied to Option 1 analysis.

Compliance Option Selection

The 95th percentile rainfall depth was calculated to be 1.8 inches (Figure 2-1), which equates to a required BMP storage volume of 0.21 acre-feet to capture and infiltrate all associated runoff from the new impervious surfaces proposed in the conceptual site layout (HECO 2013). Option 2 for meeting EISA regulations requires that future runoff conditions match the pre-development hydrology during long term simulation, and the resulting volume that would need to be captured by BMPs such that the site experiences no net increase in runoff is 0.31 acre-feet (Table 2-2). In order to meet EISA compliance in a cost-effective manner, Option 1 is the optimal criteria because it allows a 34% smaller BMP footprint than Option 2. The required treatment volume for the 95th percentile event is greater than local Honolulu water quality volume requirements (0.146 acre-feet from the 1-inch event, as calculated using the simple method), so the recommended EISA compliance strategy is assumed to satisfy local water quality requirements (City and County of Honolulu 2000).

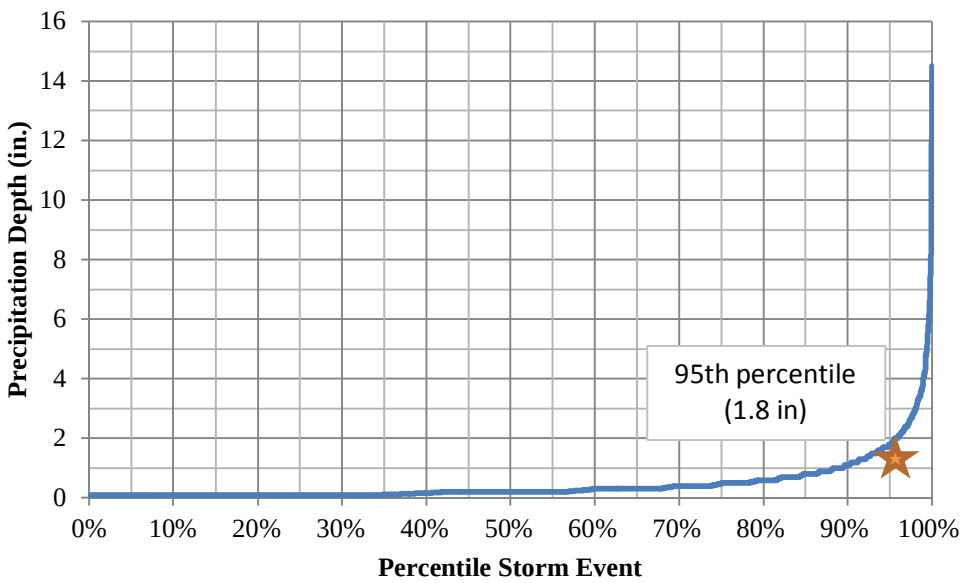


Figure 2-1. Percentile distribution of storm events at proposed SGS (excluding daily rainfall depths < 0.1 inch)

Table 2-2: EISA options comparison for compliance selection

	Option 1 (Retain Onsite 95th Percentile Volume)	Option 2 (Match Predevelopment Hydrology)
Required Storage Volume for Compliance (Arbitrary BMP[1])	0.21 acre-feet	0.31 acre-feet
Normalized BMP Footprint for Compliance (Arbitrary BMP[1])	0.037 acre / acre impervious	0.056 acre / acre impervious

[1]Assumes infiltration into native soils from arbitrary infiltration basin with uniform surface storage depth of 4 feet

2.1.3 EISA COMPLIANCE ALTERNATIVES

The following design options are proposed alternative solutions for stormwater management at the proposed SGS site. Based on modeling results, the two alternative designs were compared to select a best design that is compliant with EISA Option 1, cost-effective for stormwater management, and promotes the Army's goal for a sustainable future.

Alternative 1 – Centralized Infiltration Basin

Original proposed site plans from Hawaiian Electric include a detention pond as the sole design for stormwater management on the proposed SGS site. While this design would capture volume from the proposed impervious surface and reduce stormwater peak discharge, it would provide little *volume* reduction and water quality improvement; therefore, it would not meet EISA requirements. To achieve compliance with EISA Option 1 and provide enhanced water quality treatment, aesthetics, and sustainability, the proposed detention pond was adapted to function as an infiltration basin in Alternative 1. The facility would capture water on the surface and rely on infiltration into native soils. Surface soils would be tilled to a depth of 12 to 24 inches and amended with at least 2 inches of organic or mineral topsoil amendments per USEPA (2011) to enhance the physical structure and the chemical and biological properties critical to infiltration. To determine the most cost effective configuration, SUSTAIN's optimization algorithm was configured to adjust the ponding depth and surface area of the infiltration facility until the minimum cost design (compliant with Option 1) was identified.

Alternative 2 – Distributed LID BMPs

The Alternative 2 design consists of a combination of LID practices (namely bioretention and rainwater harvesting cisterns) distributed throughout the site. SUSTAIN was used to optimize BMP size with the goal of balancing costs and effectiveness for stormwater management. Modeled under this alternative would be multiple BMPs that could be grouped or spread throughout the site to capture runoff and treat it efficiently.

Comparison of Alternatives

Figure 2-2 illustrates the results of modeling Alternative 1 and Alternative 2. Alternative 1 was predicted to cost approximately 18% less than Alternative 2 based on planning-level construction cost functions.

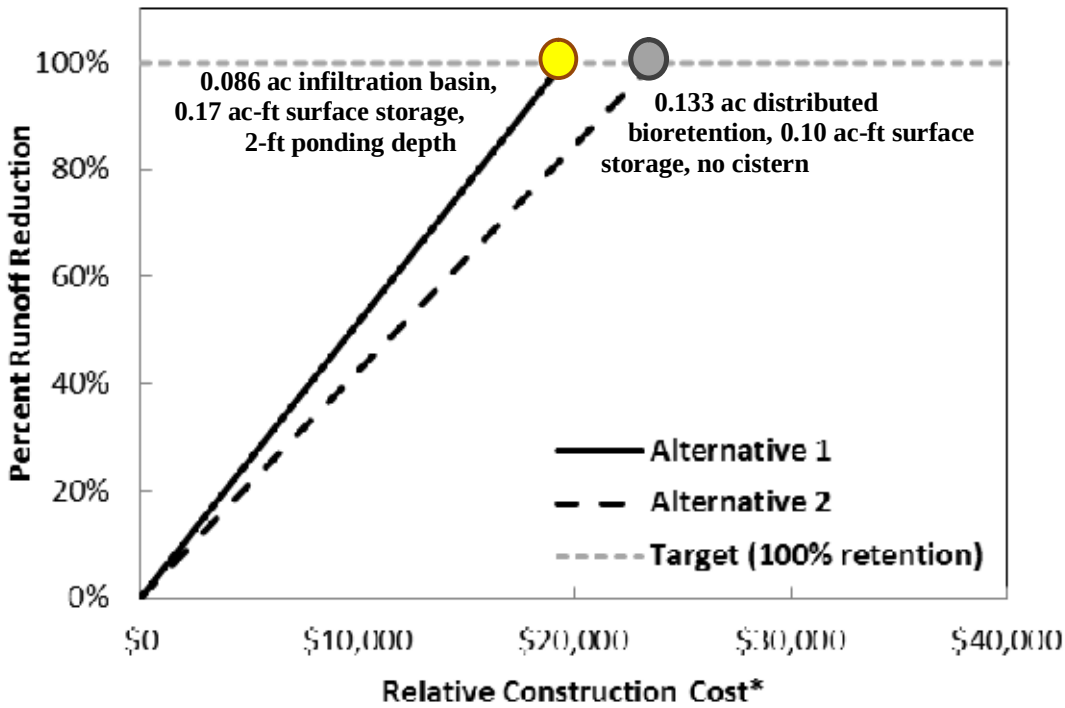


Figure 2-2. Cost effectiveness comparison between Alternative 1 and Alternative 2. *Modeled construction cost functions are relative and should not be used for engineering cost estimation.

2.2 CITY AND COUNTY OF HONOLULU STORM DRAINAGE STANDARDS COMPLIANCE

Additional retention volume will be required to comply with local flood control standards. Per City and County of Honolulu Rules Relating to Storm Drainage Standards (2000), the proposed BMP must be sized to maintain predevelopment runoff volume and discharge from the 10-year design storm event. For discharge-based analyses, the design storm duration should be equivalent to the time of concentration (the duration required for runoff to reach the drainage area outlet from the most hydraulically remote point). The time of concentration for the site was 5 minutes, as calculated using the methods in City and County of Honolulu Rules Relating to Storm Drainage Standards (2000) and the corresponding adjusted 10-year rainfall intensity was 7.6 inch/hour. Runoff coefficients were selected from Table 1 in City and County of Honolulu Rules Relating to Storm Drainage Standards (2000) and the rational method was used to predict the design storm peak discharge from predevelopment and developed conditions. Results are summarized in Table and a detailed summary of model inputs and assumptions is provided in Appendix A.

In addition to discharge, the volume of runoff from the design storm must also be maintained at or below predevelopment conditions to satisfy local regulations. For volume-based analyses, a design storm duration of 1-hour was selected because it is featured prominently throughout the City and County of Honolulu Rules Relating to Storm Drainage Standards (2000). To fully retain and infiltrate the excess

runoff volume from the 10-year design storm associated with post-development conditions, 0.241 acre-feet of surface storage would be required, as summarized in Table 2-3.

Table 2-3. Results of Rational method analyses relating to local flood control requirements

Flow Based Analysis	
Predevelopment 10-year, 5-minute Runoff Discharge	15.7 cfs
Post-development 10-year, 5-minute Runoff Discharge	23.5 cfs
Excess Runoff Discharge	7.8 cfs
Volume-Based Analysis	
Predevelopment 10-year, 1-hour Runoff Volume	0.472 acre-feet
Post-development 10-year, 1-hour Runoff Volume	0.713 acre-feet
Excess Runoff Volume	0.241 acre-feet

2.3 ARMY LID POLICY COMPLIANCE

As previously discussed, Army LID policy updates require the consideration of rainwater harvesting and reuse in all new designs. Furthermore, a 30% reduction in indoor water use and 50% reduction in outdoor water use are mandated under these directives. In order to meet these policies, rainwater harvesting was analyzed as an alternative solution to the proposed water line. According to the Hawaiian Electric RFP, the project is expected to use approximately 500 gallons of service and potable water uses. Currently, the water is to be piped in from a future 2-inch water line in conjunction with the proposed wastewater lift station.

The North Carolina State University Rainwater Harvester Model (NCSU 2008) was used to simulate various long-term continuous water reuse scenarios. Eleven years of rainfall data from 2001 to 2011 were used to drive the model and it was assumed that rooftop runoff would be collected from the approximately 15,000 square foot metal roof of the engine hall specified in the conceptual site layout (HECO 2013). An effectiveness curve was generated comparing cistern size to potable (municipal) water use reduction. The cost-effective cistern volume to comply with Army directives was selected from this curve.

A 30-year ROI analysis was performed assuming an annual linear increase in unit water prices. Future water prices were projected based on published historic rates and fees for nonresidential purposes provided at Honolulu Board of Water Supply (2013). Captured water could be used for toilet/water closet use, irrigation, equipment washing, and possibly emergency firefighting water supply. Filtration and disinfection systems can be used treat harvested water for potable use, but the majority of demand tends to be non-potable.

3 RECOMMENDATIONS

The following design options are proposed solutions for compliance with EISA (2007), City and County of Honolulu Storm Drainage Standards (2000), and Army LID Policy (2010a) at the proposed SGS site.

3.1 EISA COMPLIANCE RECOMMENDATIONS

Analyses summarized in Section 2.1.3 indicated that Alternative 1 (centralized infiltration basin) would likely offer the most cost-effective solution for compliance with EISA Option 1. Figure 3-1 predicts the required infiltration basin footprint depending on the actual imperviousness in the final site plans (the conceptual site layout used for preceding calculations was considered the baseline condition). Note that the required storage volume is greater than the volume indicated in

Table 2-2 because these analyses used the optimum ponding depth of 2 feet (versus the arbitrary 4-foot ponding depth used for comparison of Option 1 and Option 2). The required infiltration basin footprint for the baseline condition is 0.086 acre 67% smaller than the detention basin shown on the current conceptual site layout; HECO 2013).

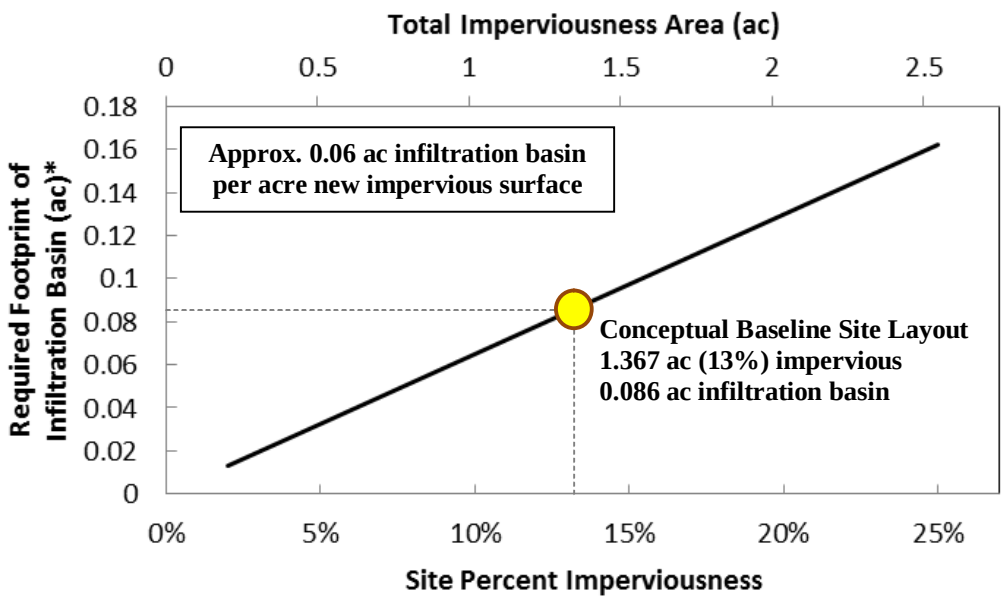


Figure 3-1. Predicted infiltration basin footprint required to retain 95th percentile runoff volume from new impervious surfaces. *Assumes 2-foot surface ponding depth and infiltration into native soils tilled to a depth of 12-24 inches and amended with 2 inches of mineral or organic topsoil amendment.

3.2 CITY AND COUNTY OF HONULULU STORM DRAINAGE STANDARDS COMPLIANCE RECOMMENDATIONS

The retention volume for compliance with local flood control standards (0.24 acre-feet) exceeds the retention volume required for EISA compliance (0.17 acre-feet); therefore, the excess flood control volume (0.071 acre-feet) must be added to the infiltration basin. This additional volume translates to increasing the depth of the proposed basin by 0.83 feet to a total depth of 2.83 feet or increasing the footprint of the basin by 0.036 acre (as illustrated in Figure 3-2 based on the baseline conditions in the current conceptual site layout provided in the Hawaiian Electric RFP dated May 1, 2013). It is recommended that the footprint of the basin be increased in order to maximize the surface area available for infiltration. Flood control retention volume sizing will vary depending upon the final site layout, routing, and preferred infiltration basin design configuration.

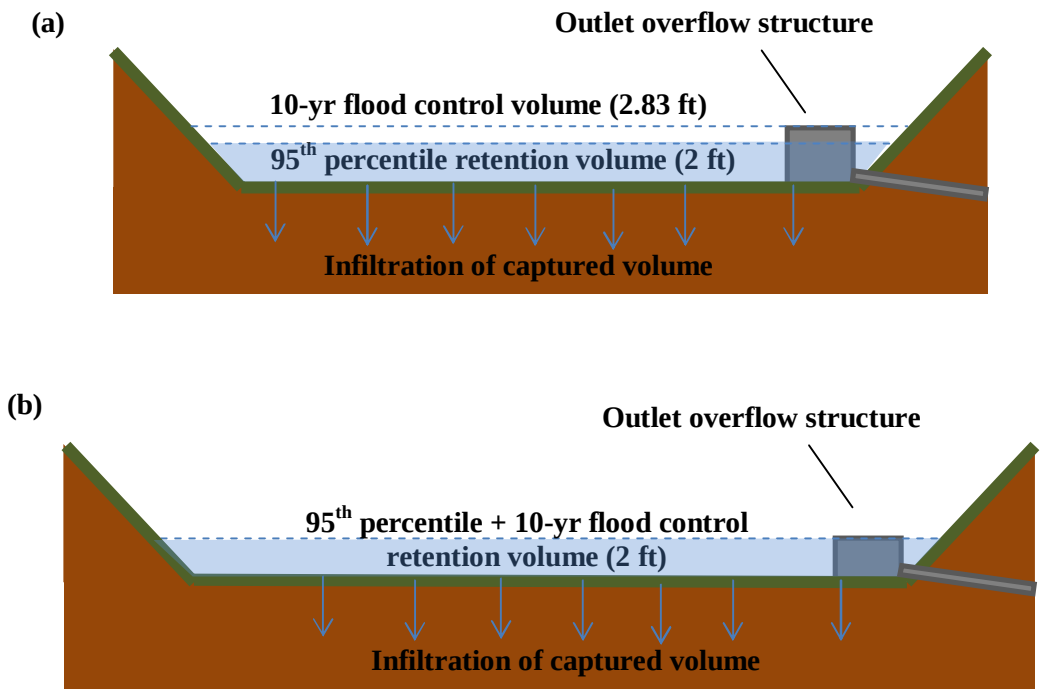


Figure 3-2. Conceptual schematic of possible basin configurations for EISA and flood control compliance, including (a) increased surface ponding depth and (b) increased footprint (recommended). Not to scale.

3.3 ARMY LID POLICY COMPLIANCE RECOMMENDATIONS

Results of rainwater harvesting and reuse optimization modeling are shown in Figure 3-2. The optimum rainwater harvesting solution was predicted to offset 71% of water demand at the facility with no backup (municipal) water (although a backup system is recommended to ensure consistent supply during dry periods).

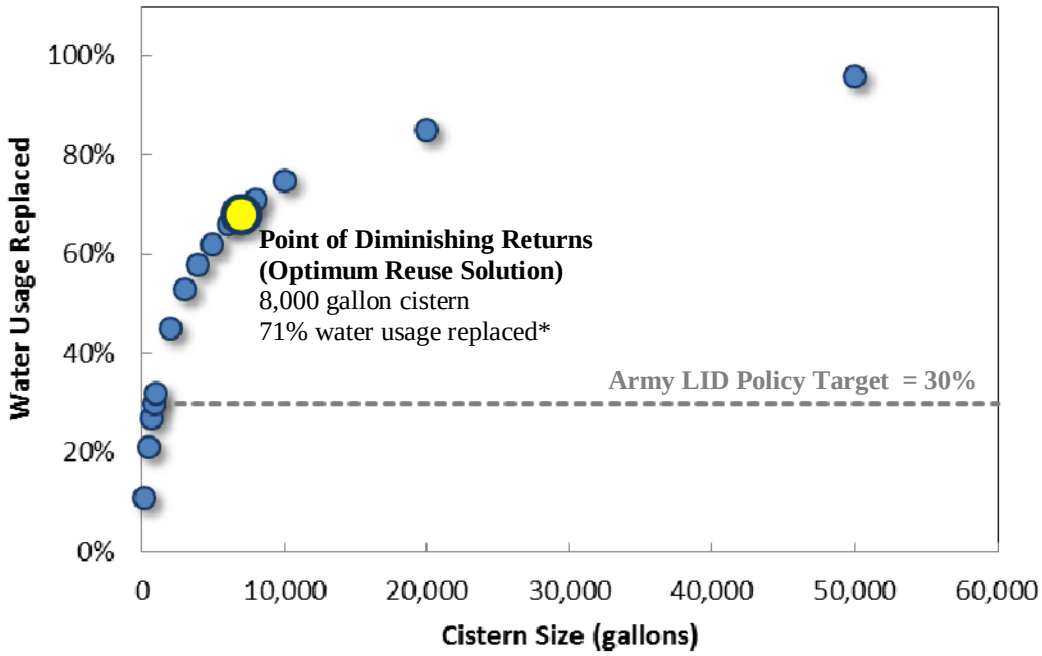


Figure 3-2. Rainwater harvesting and reuse cost effectiveness curve. *Assumes no backup water supply

Because a backup water system will likely be installed to ensure consistent supply, the 8,000-gallon cistern was modeled with a backup water supply, and Figure 3-3 was generated based on extrapolation of Honolulu water cost data (including projected increased costs). The approximate payback period for the optimal cistern size is 11 years.

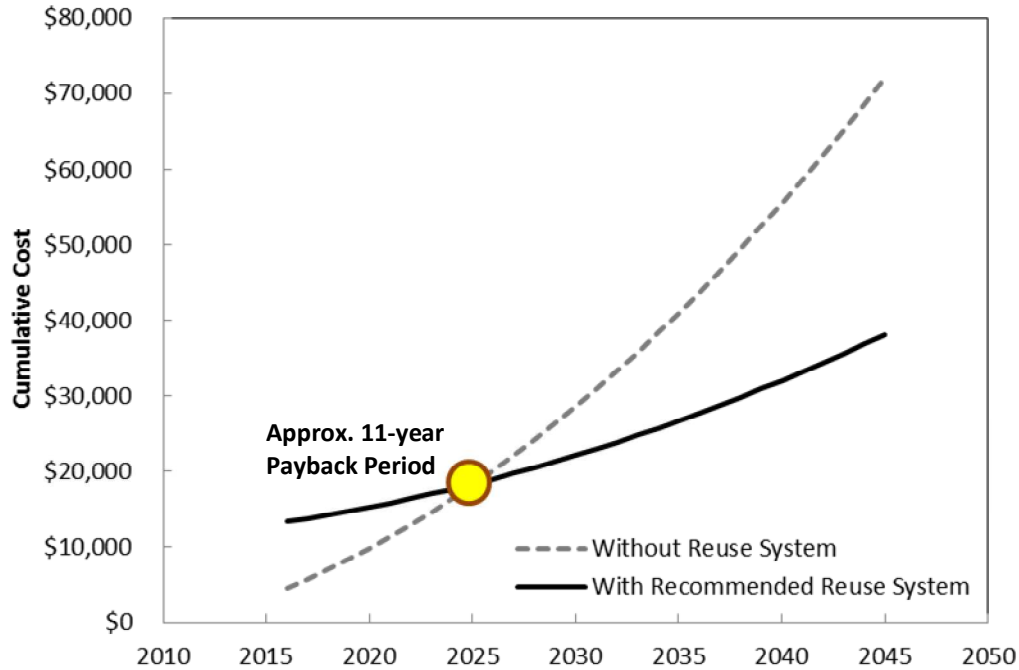


Figure 3-3. 30-year ROI analysis for rainwater harvesting and reuse system.

3.4 SUMMARY OF COMPLIANCE RECOMMENDATIONS

Table 3-1 synthesizes the design configuration that, based on modeling results, would comply with EISA Option 1, meet City and County of Honolulu Storm Drainage Standards for flood control, and follow Army's LID policies on a 30% potable water reduction through to rainwater harvesting. The design configuration of an infiltration basin and cisterns will provide cost-effective stormwater management while promoting the Army's goal of a sustainable future.

Table 3-1. Recommended compliance solution for retaining 95th percentile runoff volume from new impervious surface. New pervious surfaces were assumed to generate no net increase in runoff volume.

	Infiltration Basin[1]			Rainwater Harvesting Cistern
	Min.	Baseline	Max.	
Impervious Drainage Area[2]	0.61 acre (6% of site)	1.4 acre (13% of site)	2.1 acre (21% of site)	0.35 acre rooftop (3.4% of site)
Surface Storage Volume[3]	0.11 acre-feet	0.24 acre-feet	0.36 acre-feet	8,000 gallon
Footprint[3]	0.052 acre	0.12 acre	0.18 acre	varies
Surface Ponding Depth	2 feet			

[1]Assumes amendment of native soils with 2 inches of loamy sand or organic topsoil and ripping or tilling soils to a depth of 12-24 inches.

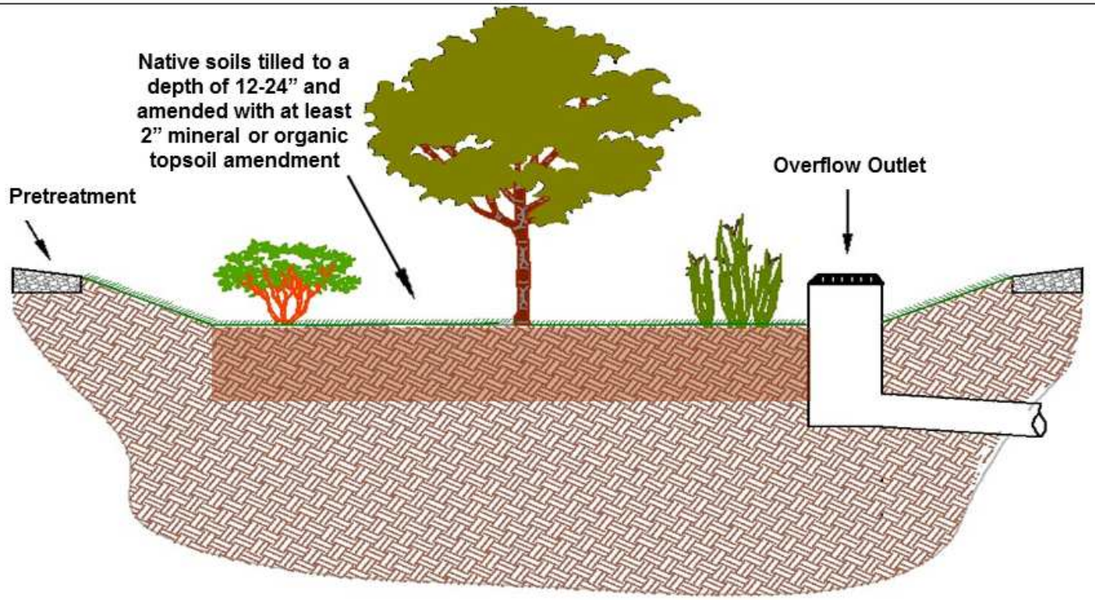
[2]To ensure capture of the 95th percentile runoff volume, the drainage area to the infiltration basin includes rooftop area that directly drains to cistern. In the event that the cistern is full or taken offline for maintenance, the recommended basin dimensions will have sufficient volume to capture the 95th percentile runoff volume from all new impervious surfaces and maintain compliance with EISA criteria.

[3] Surface storage volumes and footprints include additional volume and area for City and County of Honolulu Storm Drainage Standards compliance.

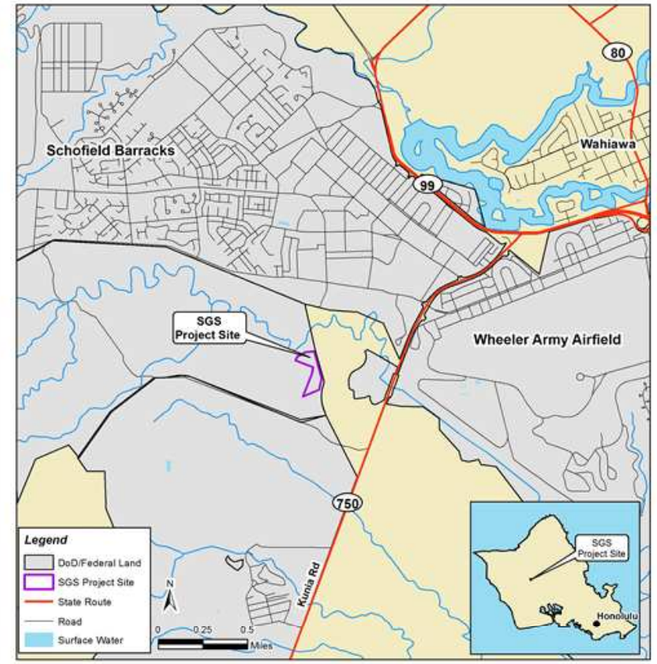
BMP FACT SHEETS

The following fact sheets can be used to guide preliminary and final design of stormwater control and LID features at the SGS site.

BMP Factsheet 1 – Infiltration Basin
EISA COMPLIANCE – ALTERNATIVE 1
SITE: PROPOSED SCHOFIELD GENERATING STATION, U.S. ARMY GARRISON, HAWAII



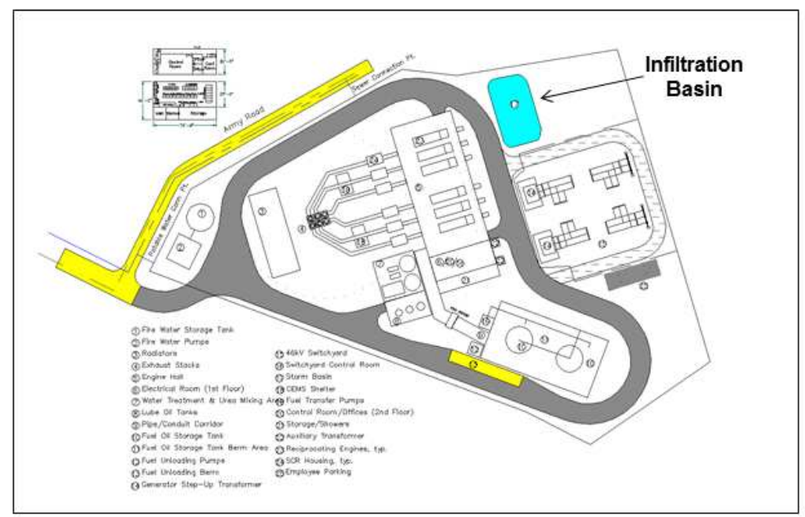
Conceptual Infiltration Basin Side Profile



INFILTRATION BASIN SPECIFICATIONS	
Impervious Drainage Area	1.4 ac (13% of site)
Normalized BMP Footprint for Compliance	0.06 ac / ac impervious
Infiltration Basin Footprint*	0.12 ac
Surface Ponding Depth	2 ft
Surface Storage Volume	0.24 ac-ft
BMP Dimensions	0.12 ac basin with 2 foot ponding depth

Proposed BMP Considerations:
Infiltration basins provide stormwater management by providing large storage area for volume and peak flow control. A pretreatment area allows for stormwater runoff to first be treated through energy dissipation and sediment settling. Pretreatment is typically provided by rocky forebays or vegetated swales and filter strips. Infiltration basins should be routinely maintained and inspected for optimal performance. The basin should include emergency overflow structures for high volume storm and/or frequent events. Surface soils should be amended with at least 2 inches of organic or mineral topsoil amendment, and the soils should be ripped or tilled to a depth of 12 to 24 inches to enhance infiltration and ensure establishment of native plants.

* Infiltration basin footprint includes 0.036 ac for 10-yr storm event excess runoff per City and County of Honolulu Storm Drainage Standards Compliance



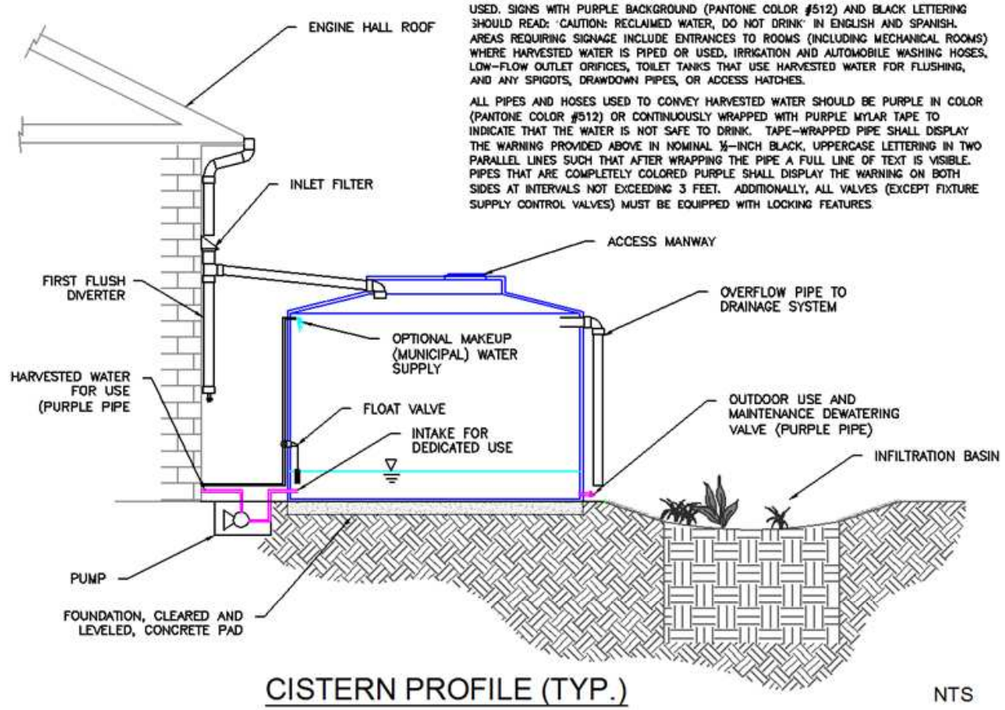
Top Image: Site Location on Oahu Island in Hawaii;
Bottom Image: Proposed Site Plan for Schofield Generating Station

BMP FACTSHEET 2 – RAINWATER HARVESTING
ARMY LID POLICY COMPLIANCE
SITE: PROPOSED SCHOFIELD GENERATING STATION, U.S. ARMY GARRISON, HAWAII

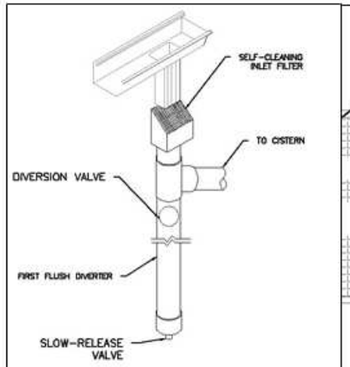
NOTES: CAUTIONARY SIGNAGE, PIPE COLOR, AND LOCKING FEATURES

CLEAR AND OBVIOUS SIGNAGE MUST BE PROVIDED WHEREVER HARVESTED RAINWATER IS USED. SIGNS WITH PURPLE BACKGROUND (PANTONE COLOR #512) AND BLACK LETTERING SHOULD READ: 'CAUTION: RECLAIMED WATER, DO NOT DRINK' IN ENGLISH AND SPANISH. AREAS REQUIRING SIGNAGE INCLUDE ENTRANCES TO ROOMS (INCLUDING MECHANICAL ROOMS) WHERE HARVESTED WATER IS PIPED OR USED, IRRIGATION AND AUTOMOBILE WASHING HOSES, LOW-FLOW OUTLET ORIFICES, TOILET TANKS THAT USE HARVESTED WATER FOR FLUSHING, AND ANY SPIGOTS, DRAWDOWN PIPES, OR ACCESS HATCHES.

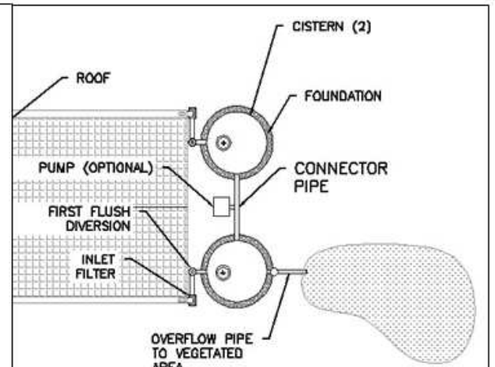
ALL PIPES AND HOSES USED TO CONVEY HARVESTED WATER SHOULD BE PURPLE IN COLOR (PANTONE COLOR #512) OR CONTINUOUSLY WRAPPED WITH PURPLE MYLAR TAPE TO INDICATE THAT THE WATER IS NOT SAFE TO DRINK. TAPE-WRAPPED PIPE SHALL DISPLAY THE WARNING PROVIDED ABOVE IN NOMINAL ½-INCH BLACK, UPPERCASE LETTERING IN TWO PARALLEL LINES SUCH THAT AFTER WRAPPING THE PIPE A FULL LINE OF TEXT IS VISIBLE. PIPES THAT ARE COMPLETELY COLORED PURPLE SHALL DISPLAY THE WARNING ON BOTH SIDES AT INTERVALS NOT EXCEEDING 3 FEET. ADDITIONALLY, ALL VALVES (EXCEPT FIXTURE SUPPLY CONTROL VALVES) MUST BE EQUIPPED WITH LOCKING FEATURES.



CISTERN PROFILE (TYP.) NTS



PRETREATMENT DETAIL (TYP) NTS



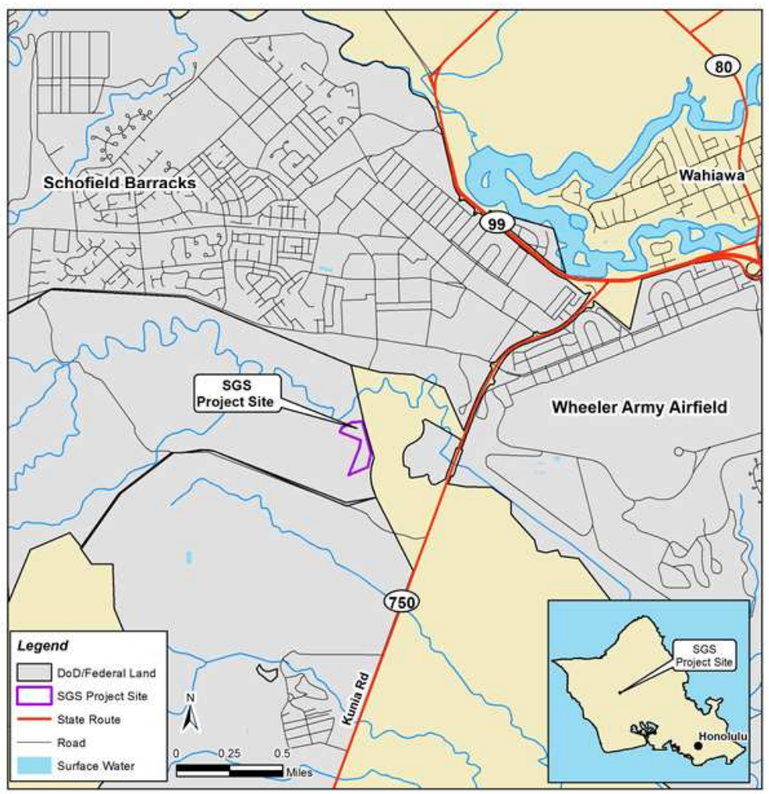
CISTERN PLAN VIEW (TYP) NTS

WATER USE STATISTICS			
Anticipated Potable/ Service Water Demand	500 gal/day	Army Indoor Water Use Reduction Goal	30%
Return on Investment Payback Period	11 years*	Average Annual Water Use Offset by Cistern	71%
Anticipated Water Uses	Lavatory flushing, building and equipment washing, sinks, showers.		

RAINWATER HARVESTING CISTERN SPECIFICATIONS	
Impervious Drainage Area	0.35 ac (3.4% of site) rooftop of engine hall
Cistern Storage Capacity	8,000 gal
BMP Dimensions	Sizing will vary based on final site design plans.

Proposed Retrofit Consideration:
Cisterns should be placed near a roof downspout, but can also be located remotely if a "wet conveyance" configuration is used. The structural capacity of soils should be investigated to determine whether a concrete foundation is needed; generally concrete is required for cisterns exerting greater than 2,000 pounds per square foot. Cisterns are available commercially in numerous sizes, shapes, and materials. The configuration will be determined by available space, intended reuse strategy, and aesthetic preference. An overflow mechanism is important to prevent water from backing up onto rooftops—overflow should be conveyed in a safe direction away from building foundations. Filtration and disinfection systems are commercially available.

*Based on planning-level cost estimate and projected annual increases in Honolulu municipal water unit prices and fees



General site area in relation to Schoefield Barracks; Site location on Oahu Island in Hawaii

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Appendix A. HYDROLOGIC INPUTS & ASSUMPTIONS

This Appendix presents relevant assumptions, inputs, and calculations to support the findings in the preceding report. All hydrologic calculations are based on the data available and should be verified with onsite testing. Assumptions and calculations should be adjusted to reflect the final site layout.

A.1 SWMM LAND SIMULATION ANALYSES

The following inputs were used to generate runoff timeseries data for predevelopment and developed land use conditions. Runoff timeseries files represent runoff generated from a given hydrologic response unit (HRU) over a specified climatic period; these files were ultimately used to drive hydrologic analysis scenarios in SUSTAIN. Tables A1-A5 present the relevant hydrologic inputs and assumptions

Table A2. Input hydrologic parameters for predevelopment HRU runoff timeseries generation

Predevelopment Input Land Parameters – Pineapple Plantation		**Unit**	**Source/Assumption**
Area	1	ac	Time series generated on a per-acre unit basis
Site width	152	ft	Scaled proportionally to actual site length of 430 ft
Slope	3.2	%	Contours in conceptual site plan
Imperviousness	0	%	
Surface Roughness Manning's N	0.13		Range (natural), EPA SWMM Manual
Depressional Storage Depth	0.2	in	Pasture, EPA SWMM Manual
Infiltration Method	Horton		
Horton Max. infiltration	2.0	in/hr	Based on silty HSG B soils from NRCS SSURGO, as verified by site-specific geotechnical analysis from RFP; Wanielista, Kersten, and Eaglin (1997); and Viessman and Lewis (2003)
Horton Min. Infiltration	0.2	in/hr	Based on silty HSG B soils from NRCS SSURGO, as verified by site-specific geotechnical analysis from RFP; Wanielista, Kersten, and Eaglin (1997); and Viessman and Lewis (2003)
Horton Decay Rate Constant	4	/hr	Based on silty HSG B soils from NRCS SSURGO, as verified by site-specific geotechnical analysis from RFP; Wanielista, Kersten, and Eaglin (1997); and Viessman and Lewis (2003)

Table A3. Input hydrologic parameters for generation station engine hall roof HRU runoff timeseries generation

Developed Land Parameters – Engine Hall Roof		Unit	Source/Assumption
Area	1	ac	Time series generated on a per-acre unit basis
Site width	209	ft	Assumed square HRU
Slope	15	%	Scaled from conceptual building layout in RFP
Imperviousness	100	%	
Surface Roughness Manning's N	0.011		Smooth metal roof, EPA SWMM Manual
Depression Storage Depth	0.01	in	EPA SWMM Manual
Infiltration Method	Curve Number		
Runoff Curve Number	98		Impervious

Table A4. Input hydrologic parameters for all other impervious HRU (driveways, parking lots, utility structures) runoff timeseries generation

Developed Land Parameters – Other Impervious		Unit	Source/Assumption
Area	1	ac	Time series generated on a per-acre unit basis
Site width	209	ft	Assumed square HRU
Slope	3.2	%	Assumed average site slope was maintained
Imperviousness	100	%	
Surface Roughness Manning's N	0.011		Smooth metal roofs and smooth asphalt, EPA SWMM Manual
Depressional Storage Depth	0.05	in	EPA SWMM Manual
Infiltration Method	Curve Number		
Runoff Curve Number	98		Impervious

Table A5. Climatology and precipitation inputs

Input	Resolution	Period	Source
Precipitation – Long Term	Hourly	01/01/2001-12/31/2011	NCDC, Wahiawa Dam Weather Station
Precipitation – Design Storm	Hourly	24 hours	Distributed design storm depth over 24-hr period using Type I rainfall distribution
Temperature	Daily minimum/ maximum	01/01/2001-12/31/2011	NCDC, Schofield Barracks Weather Station
Wind Speed	n/a	n/a	Assumed 0, SWMM default

Table A6. Mean daily pan evaporation (in/day) from three closest monthly pan evaporation stations (815.00, 820.20, 851.00; Ekern and Chang 1985)

Jan	Feb	Mar	Apr	May	Jun
0.144	0.163	0.186	0.199	0.226	0.257
Jul	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
0.256	0.255	0.228	0.192	0.153	0.134

A.2 SUSTAIN ANALYSES

SUSTAIN was used to simulate BMP hydrologic performance, compare EISA Option 1 and Option 2, and as a decision support tool for determining the cost-effective BMP configuration. The following site-specific assumptions were incorporated into the modeling framework.

Table A7. Input parameters for SUSTAIN modeling of infiltration BMPs

BMP Parameter	Input		Unit	Source/Assumption
	Infiltration Basin	Bioretention		
Width	75	10	ft	Arbitrary, detention basin width from conceptual site layout
Length	Varied (0-150)	Varied (0-4200)	ft	Decision variable for optimization, range reflects available implementation area at proposed project site
Overflow Outlet Height	Varied (1-4)	0.75	ft	Outlet height was a decision variable for infiltration basin optimization; 9 inches represents recommended average ponding depth for bioretention
Weir Width	36		ft	Arbitrary, assumed flow will not be limited by outlet hydraulics
Soil Media Depth	2		in	Assumed amend top 2-inches with sandy loam topsoil
Soil Media Porosity	0.35		vol/ vol	Based on Brown et al. 2013
Soil Media Field Capacity	0.25		vol/ vol	Based on Brown et al. 2013
Soil Media Wilting Point	0.1		vol/ vol	Based on Brown et al. 2013
Underlying Soil Saturated Hydraulic Conductivity	0.2		in/hr	Minimum in range given by NRCS, as recommended in EPA SWMM Manual
Infiltration Method	Horton			
Horton Max. infiltration	2.0		in/hr	Based on silty HSG B soils from NRCS SSURGO, as verified by site-specific geotechnical analysis from RFP; Wanielista, Kersten, and Eaglin (1997); and Viessman and Lewis (2003)
Horton Min. Infiltration	0.2		in/hr	Based on silty HSG B soils from NRCS SSURGO, as verified by site-specific geotechnical analysis from RFP; Wanielista, Kersten, and Eaglin (1997); and Viessman and Lewis (2003)
Horton Decay Rate Constant	4		/hr	Based on silty HSG B soils from NRCS SSURGO, as verified by site-specific geotechnical analysis from RFP; Wanielista, Kersten, and Eaglin (1997); and Viessman and Lewis (2003)

Table A8. Input parameters for SUSTAIN modeling of cisterns

BMP Parameter – Infiltration Basin		Unit	Source/Assumption
Width	30	ft	Arbitrary
Length	Varied (0-80)	ft	Based on available area along engine hall
Overflow Outlet Height	10	ft	Arbitrary
Weir Width	1	ft	Arbitrary, assumed flow will not be limited by outlet hydraulics
Daily Use	500	gal/day	Based on anticipated potable/service water use specified in RFP

Table A9. Mean daily reference evapotranspiration (in/day) derived from three closest monthly pan evaporation stations (815.00, 820.20, 851.00; Ekern and Chang 1985). Derived using methods in Snyder et al. (2005).

Jan	Feb	Mar	Apr	May	Jun
0.116	0.131	0.149	0.158	0.178	0.200
Jul	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
0.200	0.199	0.180	0.153	0.123	0.108

A.3 LOCAL FLOOD CONTROL & WATER QUALITY VOLUME HYDROLOGIC & HYDRAULIC ANALYSES

The following calculations summarize flood control analyses per recommended methods in City and County of Honolulu Rules Relating to Storm Drainage Standards (2000).

Recurrence interval of 10 years used since the contributing drainage area to the storm water facility is less than 100 acres. Rational method used since the contributing drainage area to the storm water facility is less than 100 acres.

Average 10-year, 1-hour rainfall intensity for site area = 2.75 in/hr (Plate 1)

Runoff coefficient determined by assuming C = 0.95 for impervious areas and C = 0.20 for existing areas.
Pre-development runoff coefficient = 0.20 (Table 1 – Band 4)
Post-development impervious surface = 1.4 acres
Post-development pervious surface = 8.9 acres
Composite post-development runoff coefficient revised = 0.30

Time of concentration (use Plate 5)
Use lower curve (areas with little or no cover)
L = 811 feet
S = 0.032
K = 4,531
Tc = 5 minutes

Design rainfall intensity (use Plate 4)
Average rainfall intensity (from Plate 1) x Correction Factor (from Plate 4)

Design rainfall intensity = 2.75 in/hr x 2.75
Design rainfall intensity = 7.6 in/hr (for 5 minute duration)

Pre-development Q10 = (0.20) x (7.6 in/hr) x (10.3 ac)
Pre-development Q10 = 15.7 cfs

Post-development Q10 = (0.30) x (7.6 in/hr) x (10.3 ac)
Post-development Q10 = 23.5 cfs

If peak flow mitigation is required, then the 10-year peak flow must be mitigated from 23.5 cfs to 15.7 cfs or lower.

*** To determine the required detention volume, the 1-hour rainfall duration was selected for the volumetric calculations since the 1-hour storm is prominently featured in the regulations.

Pre-development 10-year runoff volume = (0.20) * 2.75 in * 10.3 acre
Pre-development 10-year runoff volume = 0.472 acre-feet

Post-development 10-year runoff volume = (0.30) * 2.75 in * 10.3 acre
Post-development 10-year runoff volume = 0.708 acre-feet

*** This analysis approach results in an excess runoff volume of 0.236 acre-feet

This excess runoff volume total is greater than the previously calculated 95th percentile volume of 0.17 acre-feet.

Per the Hawaii regulations, the water quality storage volume is calculated as follows.
WQV = P x C x A x 3630
P = 1 inch
C = 0.05 + 0.009 (% Impervious) = 0.17
A = 10.3 acres
WQV = 6,356 cubic feet
WQV = 0.146 acre-feet

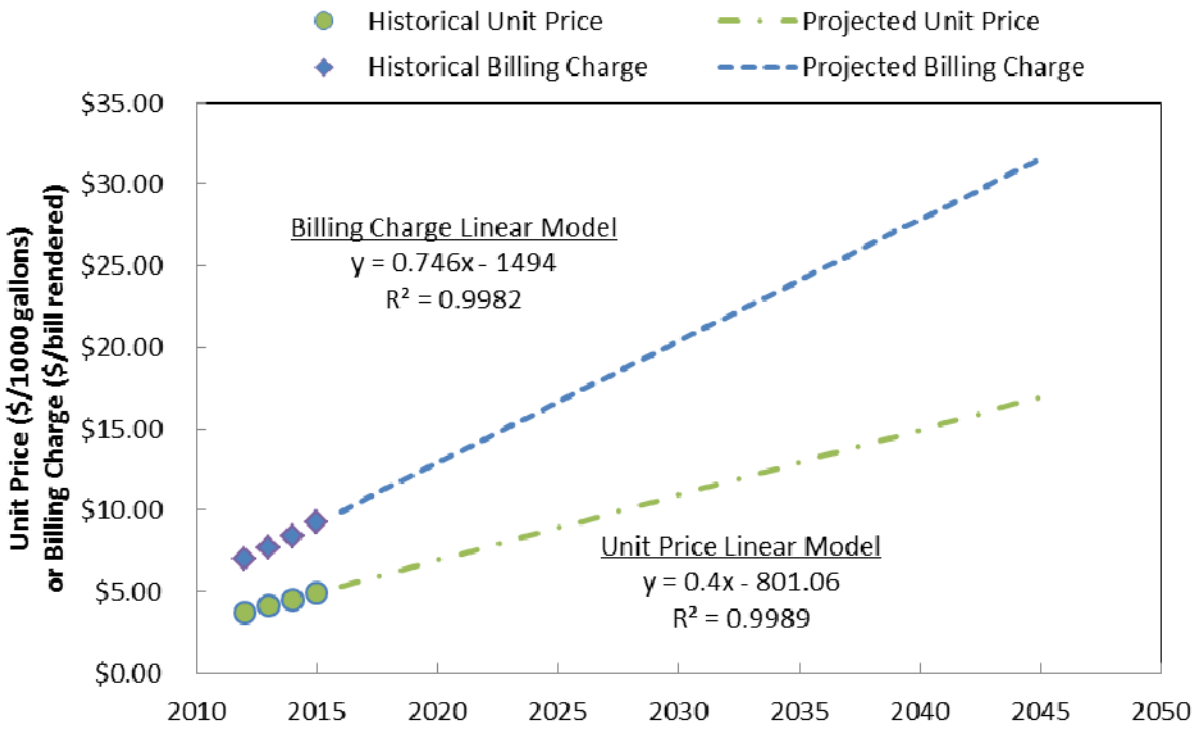
Assumptions

- Site does not drain to sump condition or roadway culvert
- Though downstream conveyance facilities are not known to be significantly under capacity, detention storage has been provided to mitigate the 10-year post-development peak flow to pre-development 10-year peak flow level.
- All offsite drainage to the project site area should be diverted around the proposed storm water BMP facility. Only flow from the project site should drain to the facility.
- It is unlikely that the pre and post-development slope and flow lengths would be exactly the same. These assumptions were made based on a lack of information regarding the proposed developed site. The calculations should eventually be updated based upon the proposed site design.

Drainage area values are the same for pre and post-developed conditions, indicated no diversion of area to or from the project site as a result of development. This assumption should be verified upon review of the proposed site design.

A.4 RAINWATER HARVESTING – FUTURE MUNICIPAL WATER COST PROJECTIONS

The following figure presents the projection of future municipal water costs based on historical data provided by Honolulu Board of Water Supply. These projected costs were used to calculate the return on investment from implementing a rainwater harvesting system.



A.5 REFERENCES

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Snyder, R.L., M. Orang, S. Mayac., and M.E. Grismer. 2005. Simplified Estimation of Reference Evapotranspiration from Pan Evaporation Data in California. Journal of Irrigation and Drainage Engineering. 131(3): 249-253.

Appendix F

Agency Coordination under Section 7 of the Endangered Species Act

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DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
745 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF:

Office of the Garrison Commander

Mr. Paul Henson
Acting Field Supervisor
US Fish and Wildlife Service
300 Ala Moana Blvd., Room 3-122
Honolulu, Hawaii 96850

Dear Mr. Henson:

This letter is to inform you that the Army is proposing to lease 8.13 acres of land at Schofield Barracks and grant a 2.5-acre interconnection easement on Schofield Barracks and Wheeler Army Airfield to the Hawaiian Electric Company to construct, operate, and maintain a 50-megawatt capacity renewable energy power plant and associated 46-kilovolt transmission line. The proposed project is referred to as the Schofield Generating Station Project. The Army requests your concurrence with our determination that this project is not likely to affect listed species or adversely modify designated critical habitat.

The Army is in the process of assessing the affects of the proposed action in accordance with the National Environmental Policy Act and the Hawaii Environmental Policy Act. The draft environmental impact statement for the project is expected to be available for public review in early 2015. A map of the proposed action is enclosed.

The purpose of the proposed action is two-fold: 1) to provide improved energy security to the U.S. Army Garrison-Hawaii at Schofield Barracks, Wheeler Army Airfield, and Field Station Kunia and 2) to provide new secure, firm, dispatchable, flexible, and renewable energy generation to the grid on Oahu, Hawaii.

The Army anticipates that six species listed as endangered under the Endangered Species Act could be affected by implementing the proposed action: Hawaiian hoary bat (*Lasiurus cinereus semotus*), nene (*Branta sandvicensis*), Hawaiian stilt (*Himantopus mexicanus knudseni*), Hawaiian coot (*Fulica americana alai*), Hawaiian common moorhen (*Gallinula chloropus sandvicensis*), and Hawaiian duck (*Anas wyvilliana*).

Hawaiian Electric has incorporated the following measures into their design to avoid effects to these listed species:

- To protect the Hawaiian hoary bat, removal or trimming of woody vegetation and trees taller than 15 feet would be done between September 16 and May 31, the period of time outside the pupping season. If tree trimming or removal were to become necessary between June 1 and September 15, Hawaiian Electric would conduct a survey of the trees marked for tree trimming or removal and those within 200 feet, utilizing monitoring techniques similar to those recently implemented by the Kauai Island Utility Cooperative. The protocol involves the use of thermal imaging equipment to identify potential roosting bats. The trees identified for removal would be monitored in the morning, prior to tree trimming or

removal, to look for warm-blooded animals. If warm-blooded animals are detected, personnel will confirm the species and will be treated as bats if confirmation is not possible. If bats are found, the tree occupied by the bat would be avoided (i.e., not removed or trimmed), if feasible. If avoidance of the tree were not feasible, Hawaiian Electric will consult with the US Fish and Wildlife Service. Personnel will be trained in accordance to a program set up and reviewed by a qualified biologist.

- Hawaiian Electric would install a system that will deter waterfowl from landing or nesting in the stormwater detention basin at the power plant, such as netting over the basin, floating "bird balls," or an equivalent system.

- Outdoor lighting would utlize cut-off lenses or shields to minimize effects on migratory birds.

The Army and Hawaiian Electric Company met with your agency on November 6, 2014, to discuss the effectiveness of these measures to avoid the potential for adverse effects on listed species. At that time, Hawaiian Electric Company was considering using barbed wire as part of the power plant fence. Since then, however, Hawaiian Electric has determined that for this particular project the use of barbed wire is unnecessary due to its location within a secured military installation. The power plant will be enclosed by a chain-link fence.

The Army is confident that these design measures will prevent adverse effects to listed species and their habitat, and has therefore determined that the project is not likely to adversely affect any listed species or modify designated critical habitat. The Army requests your agency's concurrence in this determination.

If you have any questions or would like to meet to further discuss this project, please call Ms. Michelle Mansker, Chief, Natural Resource Section, Directorate of Public Works Environmental Division at (808) 655-9189.

Sincerely,

Richard A. Fromm
Colonel, US Army
Commanding

Enclosure

New Pole on Army Land
New Pole on State Land
Existing 46kV line
Existing 46kV line Dual Circuit
Schofield Generating Station
Substations as labeled
New 46kvExpress Line
Existing 46kV line

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawai`i 96850

JAN 2 9 2015

In Reply Refer To:
2015-I-0113

Colonel Richard A. Fromm
Office of the Garrison Commander
U.S. Army Installation Management Command, Pacific Region
Headquarters, United States Army Garrison, Hawaii
745 Wright Avenue, Wheeler Army Airfield
Schofield Barracks, Hawaii 96857-5000

Subject: Informal Consultation for the Schofield Generating Station Project, O'ahu

Dear Colonel Fromm:

The U.S. Fish and Wildlife Service (Service) received your letter on December 30, 2014, requesting our concurrence with your determination that the proposed Schofield Generating Station at Schofield Barracks, O'ahu, will not adversely affect the following listed species, pursuant to the Endangered Species Act of 1973 [16 U.S.C. 1531 et seq.; 87 Stat. 884], as amended (ESA): the Hawaiian hoary bat or ope'ape'a (*Lasiurus cinereus semotus*), Hawaiian goose or nēnē (*Branta sandvicensis*), Hawaiian stilt or ae'o (*Himantopus mexicanus knudseni*), Hawaiian coot or 'alae ke'oke'o (*Fulica alai*), Hawaiian moorhen or 'alae 'ula (*Gallinula chloropus sandvicensis*), and the Hawaiian duck or koloa maoli (*Anas wyvilliana*). Prior to your letter, on November 6, 2014 the Service met with U.S. Army (Army) and Hawaiian Electric Company, Inc. (HECO) representatives to discuss the proposed Schofield Generating Station (SGS) project and ways to modify the action to reduce or remove adverse effects to listed species or critical habitats. The purpose for the SGS project is to meet the common needs of the Army and HECO for secure, reliable and renewable power generation on the island of O'ahu.

The findings and recommendations in this consultation are based on: (1) meeting conversations and email correspondences, including materials received from November 6, 2014 – January 6, 2015; (2) previous Army consultations; and (3) other biological information available to us. Copies of pertinent materials and documentation are maintained in an administrative record in the Service's Pacific Islands Fish and Wildlife Office in Honolulu, Hawai'i. This response is in accordance with section 7 of the ESA, and other authorities mandating Department of the Interior concern for environmental values.

Project Description

The Army is proposing to lease approximately 8.13 acres of land to HECO to construct, operate and maintain the Schofield Generating Station. The Army would also grant a 2.5-acre interconnection easement to HECO on Schofield Barracks and Wheeler Army Airfield for a

portion of the associated 46-kilovolt transmission line. The new 46-kilovolt transmission line would connect SGS to the island's electrical grid and would be approximately four kilometers, running primarily alongside an existing roadway. The SGS would burn biofuels, diesel, and biofuels/diesel blends. The Service provided technical assistance to HECO regarding potential impacts of fuel emissions, in a letter dated March 12, 2013 (Service File# 2013-TA-0127). Following Service recommendations to HECO, the SGS will include selective catalytic reduction equipment to control and reduce fuel emissions to meet proposed emission standards. On January 6, 2015, the Service was informed via email that the proposed project would also include a 30-foot tall meteorological tower at the facility site, required by the State of Hawaii Department of Health, Clean Air Branch and Federal Environmental Protection Agency, for related emissions monitoring.

Previous SGS project plans included the use of a three-strand barb wire fence securing the 8.13-acre facility. During our November 6, 2014 meeting, the Service recommended eliminating the use of barb wire due to potential entanglement risk to the Hawaiian hoary bat. After our November meeting, HECO determined that for this particular project the use of barb wire is unnecessary due to its location within a secured military installation. The Army confirmed in writing on December 30, 2014 that the SGS project will not include barb wire and the facility will be enclosed by a chain-link fence.

Conservation Measures

The following conservation measures are further designed to avoid or minimize effects to the listed species reviewed in this informal consultation and is considered part of the project description. Any changes to, modification of, or failure to implement these conservation measures may result in a need to reinitiate this consultation. During our November 6, 2014 meeting and confirmed in writing on December 30, 2014, you formally agreed to the following conservation measures:

- To avoid impacts to the Hawaiian hoary bat, removal or trimming of woody vegetation and trees taller than 15 feet will be done between September 16 and May 31, the period of time outside the bat pupping season. If tree trimming or removal were to become necessary between June 1 and September 15, the Army will ensure that HECO has submitted protocols to the Service and the Service has approved such protocols to survey for potential roosting bats using thermal imaging equipment, prior to any tree removal or tree trimming between June 1 and September 15.

- To avoid impacts to the Hawaiian goose, stilt, moorhen, coot, and Hawaiian duck (hereinafter collectively referred to as "Hawaiian Water birds"), the Army will ensure that the SGS facility includes the installation of netting, floating bird deterrent balls, or an equivalent system to prevent Hawaiian Water birds from landing or nesting at the SGS facility storm water detention basin.

- All outdoor lighting at the SGS facility will be fully shielded with full cut-off luminary lights.

- The 30-foot meteorological tower at the facility site will be free-standing (no guy-wires) and no lights will be used or required on the structure.

Conclusion

Based on the implementation of the above avoidance and minimization measures, the Service concurs with your determination that the construction, operation, and maintenance of the Schofield Generating Station may effect, but is not likely to adversely affect the Hawaiian hoary bat, and Hawaiian Water birds. Based on the location of the proposed project, there is no designated critical habitat at or adjacent to the proposed Schofield Generating Station project. Unless the project description changes or new information reveals that the action may affect listed species or designated critical habitat in a manner or to an extent not considered, no further action pursuant to section 7 of the ESA is necessary.

We appreciate your efforts to conserve endangered species. If you have questions regarding this letter, please contact Lasha-Lynn Salbosa, Fish and Wildlife Biologist (phone: 808-792-9400 or email: Lasha-Lynn_Salbosa@fws.gov).

Sincerely,

Aaron Nadig
O'ahu, Kaua'i, Northwestern Hawaiian Islands, and American Samoa Island Team Manager

cc: U.S. Army Garrison Hawaii, Directorate of Public Works, Environmental Division, Natural Resource Section
Hawaiian Electric Company, Inc.

Appendix G

Agency Coordination under Section 106 of the National Historic Preservation Act

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DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
851 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF:

OCT 09 2014

Office of the Garrison Commander

Mr. William Aila
State Historic Preservation Officer
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, Hawai'i 96707

Dear Mr. Aila:

The Office of the Garrison Commander, United States Army Garrison-Hawaii, is writing to open consultation with you pursuant to Section 106 of The National Historic Preservation Act of 1966, as amended (16 USC 470f), on the proposed construction of a new power plant on the south range of Schofield Barracks which is located on the central plateau on the Island of Oahu, Hawaii. The construction of this power plant is a joint venture between the US Army Garrison in Hawaii and the Hawaiian Electric Company. This venture will allow the Army bases in central Oahu to have better energy security as well as providing Oahu with a power plant located more inland in case the more coastal energy plants are compromised. The Tax Map Key designation for Schofield Barracks and Wheeler Army Airfield (WAAF) is 1-07-07-001.

The proposed undertaking involves the US Army's lease of 8.13 acres of land and the related granting of a 2.5 acre interconnection easement, on Schofield Barracks and WAAF to Hawaiian Electric Company (Hawaiian Electric) for the purpose of the construction, operation, and maintenance of a 50-megawatt (MW) capacity renewable energy power plant to include associated power poles, high-tension power lines, and related equipment and facilities by Hawaiian Electric. The lease would be under the authority of Title 10 of the United States Code (USC) §2667. The project also calls for The State of Hawaii Department of Land and Natural Resources granting of a 1.28 acre easement and a 0.7 acre conservation district authorization allowing for the construction of a 46 kV electrical power transmission line between the power plant site and the existing Wahiawa Substation. Hawaiian Electric's construction, ownership, operation, and maintenance of a 50 megawatt capacity, biofuel-capable power generation plant and 46 kV sub-transmission line are required to connect the Schofield Generating Station to the Hawaiian Electric grid. Hawaiian Electric would be the sole owner of the plant and the electrical power transmission facilities. The proposed facilities would be constructed and operated in accordance with all applicable laws, with approval of the Hawaii Public Utilities Commission (PUC).

The Area of Potential Effect (APE) for this undertaking is approximately 882 acres of land which includes the National Register District at Schofield Barracks, the National Historic Landmark District at WAAF as well as the National Register eligible district at WAAF. The enclosed map illustrates the the APE (Enclosure 1).

Wheeler Army Airfield has a National Historic Landmark District that was created in 1986-87 when a thematic series of districts were created in Hawaii associated with World War II history and the attack on Oahu by the Empire of Japan on the December 7th, 1941. The National Register District at Schofield Barracks was created in 1998. The district's significance is based upon its historic architecture, early 20th century military installation planning, its historic landscape, and the events related to the history of the US Army in Hawaii, particularly from the early Territorial Period through World War II. The Period of Significance is defined as 1908-1945. In the absence of an extensive report on the historic districts of Schofield Barracks and Wheeler Army Airfield, a summary of the historic resources is enclosed for your review (Enclosure 2).

The proposed Schofield Generating Station building is still in its early stages of planning. Information regarding its size, height and other details will be forthcoming. Color conceptual renderings of the structure are enclosed for your review (Enclosure 3).

The undertaking will involve in part the placement of 80' electrical poles along Kunia Road and Wilikina Drive that will be directly adjacent to the National Register District at Schofield Barracks and the historic Garden City neighborhoods at Wheeler Army Airfield (NR eligible). The existing power poles on Kunia Road and Wilikina Drive are approximately 45' tall.

The new poles associated with the project will be placed somewhat close to General's Loop that is within the boundaries of the historic district. However, it is anticipated that the visual impacts may be minimal to the homes at General's Loop due to the large trees that are in the area. The new poles will, however, be placed close to the small two bedroom stucco/mission style homes adjacent to Ralston Field, on Dickman and Kona Road, which have been determined eligible for inclusion on the National Register. These homes were constructed by the Federal Works Program/Works Progress Administration in 1932-33 while the same style homes were built at the Canby neighborhood at Schofield Barracks and at WAAF. The new poles (pole numbers 42, 43 and 44) and lines may be visible from the historic neighborhood.

The new poles and wires proposed for the project may cause negative visual impacts to the Garden City Loops (Langley Loop with the placement of poles 14-18 and at Sperry Loop with the placement of poles 23-27). Poles 11-13 and 28-30 may have visual impacts on the 1936 historic neighborhoods that flank the loops at Wheeler Army Airfield. There may be the potential to have visual impacts on the Landmark district at its western end by the new poles and wires.

A 3D rendering of the proposed poles and wires is included to assist in the visualization of the end results of the undertaking (Enclosure 4).

In compliance with 36 CFR 800.4, the Army in its identification efforts, commissioned the *Archaeological Inventory Survey for Schofield Generating Station Project, Waianae Uka, Honouliuli, and Waikele Ahupua'a in Wahiawa and 'Ewa Districts, Oahu Island, Hawaii* (Garcia & Assoc.—June, 2014). A copy of the report is enclosed for your review (Enclosure 5).

The Army is preparing an Environmental Impact Statement (EIS) to satisfy the National Environmental Policy Act requirements for this undertaking. The Army will transmit a copy of the EIS once it becomes available. A public draft of the EIS is expected to be released in the first quarter of 2015.

A copy of the initial Section 106 consultation regarding this project from 2011 is enclosed for your review (Enclosure 6).

The Army looks forward to consulting with you on the proposed undertaking. We ask for your initial comments on the proposed undertaking. If you have any questions regarding architectural/landscape issues, please contact Kenneth Hays, with the Cultural Resources Section of the Directorate of Public Works at 808-656-6790. If you have any questions pertaining to archeological issues, you may contact Richard Davis, with the Cultural Resources Section of the Directorate of Public Works at 808-655-9709.

Sincerely,

Richard A. Fromm
Colonel, US Army
Commanding

Enclosures

Distribution List for the Section 106 Letter –Schofield Barracks Power Station

Mr. William Aila, Jr., Chairman
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Kapolei, Hawai'i 96707

Dr. Kamana'opono M. Crabbe
Ka Pouhana, Chief Executive Officer
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Mr. John Fowler
Advisory Council on Historic Preservation
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Mr. Kalahikiola Keliinoi
'Ohana Keliinoi

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Historic Hawaii Foundation
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Suite 690
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Ms. Marti Townsend
The Outdoor Circle
1314 S King Street, Suite 306
Honolulu, Hawaii 96814

Mr. Glen Makakauali'i Kila, Kahu Kulaiwi, Ko'a Mana
Kupuka'aina O Wai'anae Moku, O'ahu
84-255 Makaha Valley Road
Wai'anae, Hawai'i 96792

Ms. Terrilee Keko'olani
AFSC Hawaii
2426 Oahu Avenue
Honolulu, Hawaii 96822

DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
851 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF:

OCT 09 2014

Office of the Garrison Commander

Mr. John Fowler
Advisory Council on Historic Preservation
Old Post Office Building
1100 Pennsylvania Avenue NW
Suite 809
Washington D.C. 20004

Dear Mr. Fowler:

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The proposed undertaking involves the US Army's lease of 8.13 acres of land and the related granting of a 2.5 acre interconnection easement, on Schofield Barracks and WAAF to Hawaiian Electric Company (Hawaiian Electric) for the purpose of the construction, operation, and maintenance of a 50-megawatt (MW) capacity renewable energy power plant to include associated power poles, high-tension power lines, and related equipment and facilities by Hawaiian Electric. The lease would be under the authority of Title 10 of the United States Code (USC) §2667. The project also calls for The State of Hawaii Department of Land and Natural Resources granting of a 1.28 acre easement and a 0.7 acre conservation district authorization allowing for the construction of a 46 kV electrical power transmission line between the power plant site and the existing Wahiawa Substation. Hawaiian Electric's construction, ownership, operation, and maintenance of a 50 megawatt capacity, biofuel-capable power generation plant and 46 kV sub-transmission line are required to connect the Schofield Generating Station to the Hawaiian Electric grid. Hawaiian Electric would be the sole owner of the plant and the electrical power transmission facilities. The proposed facilities would be constructed and operated in accordance with all applicable laws, with approval of the Hawaii Public Utilities Commission (PUC).

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The new poles associated with the project will be placed somewhat close to General's Loop that is within the boundaries of the historic district. However, it is anticipated that the visual impacts may be minimal to the homes at General's Loop due to the large trees that are in the area. The new poles will, however, be placed close to the small two bedroom stucco/mission style homes adjacent to Ralston Field, on Dickman and Kona Road, which have been determined eligible for inclusion on the National Register. These homes were constructed by the Federal Works Program/Works Progress Administration in 1932-33 while the same style homes were built at the Canby neighborhood at Schofield Barracks and at WAAF. The new poles (pole numbers 42, 43 and 44) and lines may be visible from the historic neighborhood.

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Sincerely,

Richard A. Fromm
Colonel, US Army
Commanding

Enclosures

DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
851 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF:

OCT 09 2014

Office of the Garrison Commander

Ms. Marti Townsend
The Outdoor Circle
1314 S King Street, Suite 306
Honolulu, Hawaii 96814

Dear Ms. Townsend:

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Sincerely,

Richard A. Fromm
Colonel, US Army
Commanding

Enclosures

DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
851 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF:

OCT 09 2014

Office of the Garrison Commander

Ms. Melia Lane-Kamehele
The National Park Service
300 Ala Moana Blvd.
Honolulu, Hawaii 96850

Dear Ms. Lane-Kamehele:

The Office of the Garrison Commander, United States Army Garrison-Hawaii, is writing to open consultation with you pursuant to Section 106 of The National Historic Preservation Act of 1966, as amended (16 USC 470f), on the proposed construction of a new power plant on the south range of Schofield Barracks which is located on the central plateau on the Island of Oahu, Hawaii. The construction of this power plant is a joint venture between the US Army Garrison in Hawaii and the Hawaiian Electric Company. This venture will allow the Army bases in central Oahu to have better energy security as well as providing Oahu with a power plant located more inland in case the more coastal energy plants are compromised. The Tax Map Key designation for Schofield Barracks and Wheeler Army Airfield (WAAF) is 1-07-07-001.

The proposed undertaking involves the US Army's lease of 8.13 acres of land and the related granting of a 2.5 acre interconnection easement, on Schofield Barracks and WAAF to Hawaiian Electric Company (Hawaiian Electric) for the purpose of the construction, operation, and maintenance of a 50-megawatt (MW) capacity renewable energy power plant to include associated power poles, high-tension power lines, and related equipment and facilities by Hawaiian Electric. The lease would be under the authority of Title 10 of the United States Code (USC) §2667. The project also calls for The State of Hawaii Department of Land and Natural Resources granting of a 1.28 acre easement and a 0.7 acre conservation district authorization allowing for the construction of a 46 kV electrical power transmission line between the power plant site and the existing Wahiawa Substation. Hawaiian Electric's construction, ownership, operation, and maintenance of a 50 megawatt capacity, biofuel-capable power generation plant and 46 kV sub-transmission line are required to connect the Schofield Generating Station to the Hawaiian Electric grid. Hawaiian Electric would be the sole owner of the plant and the electrical power transmission facilities. The proposed facilities would be constructed and operated in accordance with all applicable laws, with approval of the Hawaii Public Utilities Commission (PUC).

The Area of Potential Effect (APE) for this undertaking is approximately 882 acres of land which includes the National Register District at Schofield Barracks, the National Historic Landmark District at WAAF as well as the National Register eligible district at WAAF. The enclosed map illustrates the the APE (Enclosure 1).

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The undertaking will involve in part the placement of 80' electrical poles along Kunia Road and Wilikina Drive that will be directly adjacent to the National Register District at Schofield Barracks and the historic Garden City neighborhoods at Wheeler Army Airfield (NR eligible). The existing power poles on Kunia Road and Wilikina Drive are approximately 45' tall.

The new poles associated with the project will be placed somewhat close to General's Loop that is within the boundaries of the historic district. However, it is anticipated that the visual impacts may be minimal to the homes at General's Loop due to the large trees that are in the area. The new poles will, however, be placed close to the small two bedroom stucco/mission style homes adjacent to Ralston Field, on Dickman and Kona Road, which have been determined eligible for inclusion on the National Register. These homes were constructed by the Federal Works Program/Works Progress Administration in 1932-33 while the same style homes were built at the Canby neighborhood at Schofield Barracks and at WAAF. The new poles (pole numbers 42, 43 and 44) and lines may be visible from the historic neighborhood.

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Sincerely,

Richard A. Fromm
Colonel, US Army
Commanding

Enclosures

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US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
851 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO ATTENTION OF:

OCT 09 2014

Office of the Garrison Commander

Mr. Tom Lenchanko
Hawaiian National, Kahuakai Ola Ko Laila Waha Olelo 'Aha Kukaniloko
Ko'a Mana Mea Ola Kanaka Mauli
932 Uakaniko'o Street
Wahiawa, Hawaii 96796

Dear Mr. Lenchanko:

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Sincerely,

Richard A. Fromm
Colonel, US Army
Commanding

Enclosures

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US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
851 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF:

OCT 09 2014

Office of the Garrison Commander

Dr. Kamana'opono M. Crabbe
Ka Pouhana, Chief Executive Officer
Office of Hawaiian Affairs
560 N. Nimitz Highway, Suite 200
Honolulu, Hawaii 96817

Dear Dr. Crabbe:

The Office of the Garrison Commander, United States Army Garrison-Hawaii, is writing to open consultation with you pursuant to Section 106 of The National Historic Preservation Act of 1966, as amended (16 USC 470f), on the proposed construction of a new power plant on the south range of Schofield Barracks which is located on the central plateau on the Island of Oahu, Hawaii. The construction of this power plant is a joint venture between the US Army Garrison in Hawaii and the Hawaiian Electric Company. This venture will allow the Army bases in central Oahu to have better energy security as well as providing Oahu with a power plant located more inland in case the more coastal energy plants are compromised. The Tax Map Key designation for Schofield Barracks and Wheeler Army Airfield (WAAF) is 1-07-07-001.

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Sincerely,

Richard A. Fromm
Colonel, US Army
Commanding

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US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
851 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF:

OCT 09 2014

Office of the Garrison Commander

Ms. Kiersten Faulkner, Executive Director
Historic Hawaii Foundation
680 Iwilei Road
Suite 690
Honolulu, Hawaii 96817

Dear Ms. Faulkner:

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HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
851 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF:

OCT 09 2014

Office of the Garrison Commander

Mr. Alika Poe Silva
Kahu Kulāiwi, Ko'a Mana
Kupuka'āina O Wai'anae Moku, O'ahu
85-140 Maiu'u Road
Wai'anae, Hawai'i 96792

Dear Mr. Silva:

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Sincerely,

Richard A. Fromm
Colonel, US Army
Commanding

Enclosures

DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
851 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO ATTENTION OF:

OCT 09 2014

Office of the Garrison Commander

Mr. JR Keoneakapu Williams
'Ohana Kapu
85-1029 Mahi'aina St
Wai'anae, Hawai'i 96792

Dear Mr. Williams:

The Office of the Garrison Commander, United States Army Garrison-Hawaii, is writing to open consultation with you pursuant to Section 106 of The National Historic Preservation Act of 1966, as amended (16 USC 470f), on the proposed construction of a new power plant on the south range of Schofield Barracks which is located on the central plateau on the Island of Oahu, Hawaii. The construction of this power plant is a joint venture between the US Army Garrison in Hawaii and the Hawaiian Electric Company. This venture will allow the Army bases in central Oahu to have better energy security as well as providing Oahu with a power plant located more inland in case the more coastal energy plants are compromised. The Tax Map Key designation for Schofield Barracks and Wheeler Army Airfield (WAAF) is 1-07-07-001.

The proposed undertaking involves the US Army's lease of 8.13 acres of land and the related granting of a 2.5 acre interconnection easement, on Schofield Barracks and WAAF to Hawaiian Electric Company (Hawaiian Electric) for the purpose of the construction, operation, and maintenance of a 50-megawatt (MW) capacity renewable energy power plant to include associated power poles, high-tension power lines, and related equipment and facilities by Hawaiian Electric. The lease would be under the authority of Title 10 of the United States Code (USC) §2667. The project also calls for The State of Hawaii Department of Land and Natural Resources granting of a 1.28 acre easement and a 0.7 acre conservation district authorization allowing for the construction of a 46 kV electrical power transmission line between the power plant site and the existing Wahiawa Substation. Hawaiian Electric's construction, ownership, operation, and maintenance of a 50 megawatt capacity, biofuel-capable power generation plant and 46 kV sub-transmission line are required to connect the Schofield Generating Station to the Hawaiian Electric grid. Hawaiian Electric would be the sole owner of the plant and the electrical power transmission facilities. The proposed facilities would be constructed and operated in accordance with all applicable laws, with approval of the Hawaii Public Utilities Commission (PUC).

The Area of Potential Effect (APE) for this undertaking is approximately 882 acres of land which includes the National Register District at Schofield Barracks, the National Historic Landmark District at WAAF as well as the National Register eligible district at WAAF. The enclosed map illustrates the the APE (Enclosure 1).

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The new poles associated with the project will be placed somewhat close to General's Loop that is within the boundaries of the historic district. However, it is anticipated that the visual impacts may be minimal to the homes at General's Loop due to the large trees that are in the area. The new poles will, however, be placed close to the small two bedroom stucco/mission style homes adjacent to Ralston Field, on Dickman and Kona Road, which have been determined eligible for inclusion on the National Register. These homes were constructed by the Federal Works Program/Works Progress Administration in 1932-33 while the same style homes were built at the Canby neighborhood at Schofield Barracks and at WAAF. The new poles (pole numbers 42, 43 and 44) and lines may be visible from the historic neighborhood.

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Sincerely,

Richard A. Fromm
Colonel, US Army
Commanding

Enclosures

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US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
851 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF:

OCT 09 2014

Office of the Garrison Commander

Mr. Kimball Kekaimalino Kaopio
'Ohana Naihe
85-1029 Mahi'aina St.
Wai'anae, Hawai'i 96792

Dear Mr. Kaopio:

The Office of the Garrison Commander, United States Army Garrison-Hawaii, is writing to open consultation with you pursuant to Section 106 of The National Historic Preservation Act of 1966, as amended (16 USC 470f), on the proposed construction of a new power plant on the south range of Schofield Barracks which is located on the central plateau on the Island of Oahu, Hawaii. The construction of this power plant is a joint venture between the US Army Garrison in Hawaii and the Hawaiian Electric Company. This venture will allow the Army bases in central Oahu to have better energy security as well as providing Oahu with a power plant located more inland in case the more coastal energy plants are compromised. The Tax Map Key designation for Schofield Barracks and Wheeler Army Airfield (WAAF) is 1-07-07-001.

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The new poles associated with the project will be placed somewhat close to General's Loop that is within the boundaries of the historic district. However, it is anticipated that the visual impacts may be minimal to the homes at General's Loop due to the large trees that are in the area. The new poles will, however, be placed close to the small two bedroom stucco/mission style homes adjacent to Ralston Field, on Dickman and Kona Road, which have been determined eligible for inclusion on the National Register. These homes were constructed by the Federal Works Program/Works Progress Administration in 1932-33 while the same style homes were built at the Canby neighborhood at Schofield Barracks and at WAAF. The new poles (pole numbers 42, 43 and 44) and lines may be visible from the historic neighborhood.

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Sincerely,

Richard A. Fromm
Colonel, US Army
Commanding

Enclosures

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US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
861 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF:

OCT 09 2014

Office of the Garrison Commander

Mr. Norman Mana Kaleilani Caceres
'Ohana Huihui
91-225 Pilipiliula Place
Kapolei, Hawai'i 96707

Dear Mr. Caceres:

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Sincerely,

Richard A. Fromm
Colonel, US Army
Commanding

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US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
851 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF:

OCT 09 2014

Office of the Garrison Commander

Mrs. Leimaile Quitevis
84-695 Farrington Highway
B-212
Waianae, Hawaii 96792

Dear Mrs. Quitevis:

The Office of the Garrison Commander, United States Army Garrison-Hawaii, is writing to open consultation with you pursuant to Section 106 of The National Historic Preservation Act of 1966, as amended (16 USC 470f), on the proposed construction of a new power plant on the south range of Schofield Barracks which is located on the central plateau on the Island of Oahu, Hawaii. The construction of this power plant is a joint venture between the US Army Garrison in Hawaii and the Hawaiian Electric Company. This venture will allow the Army bases in central Oahu to have better energy security as well as providing Oahu with a power plant located more inland in case the more coastal energy plants are compromised. The Tax Map Key designation for Schofield Barracks and Wheeler Army Airfield (WAAF) is 1-07-07-001.

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Sincerely,

Richard A. Fromm
Colonel, US Army
Commanding

Enclosures

DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
851 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF:

OCT 09 2014

Office of the Garrison Commander

Ms. Mahealani Cypher, President
C/O Mr. Shad Kane
O'ahu Council of Hawaiian Civic Clubs
92-1309 Uahanai Street
Kapolei, Hawai'i 96707

Dear Ms. Cypher:

The Office of the Garrison Commander, United States Army Garrison-Hawaii, is writing to open consultation with you pursuant to Section 106 of The National Historic Preservation Act of 1966, as amended (16 USC 470f), on the proposed construction of a new power plant on the south range of Schofield Barracks which is located on the central plateau on the Island of Oahu, Hawaii. The construction of this power plant is a joint venture between the US Army Garrison in Hawaii and the Hawaiian Electric Company. This venture will allow the Army bases in central Oahu to have better energy security as well as providing Oahu with a power plant located more inland in case the more coastal energy plants are compromised. The Tax Map Key designation for Schofield Barracks and Wheeler Army Airfield (WAAF) is 1-07-07-001.

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Sincerely,

Richard A. Fromm
Colonel, US Army
Commanding

Enclosures

DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
851 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF:

OCT 09 2014

Office of the Garrison Commander

Ms. Paulette Ka'anohiokalani Kaleikini
'Ohana Keaweamahi
89-107 Nanaikala Street
Wai'anae, Hawai'i 96792

Dear Ms. Kaleikini:

The Office of the Garrison Commander, United States Army Garrison-Hawaii, is writing to open consultation with you pursuant to Section 106 of The National Historic Preservation Act of 1966, as amended (16 USC 470f), on the proposed construction of a new power plant on the south range of Schofield Barracks which is located on the central plateau on the Island of Oahu, Hawaii. The construction of this power plant is a joint venture between the US Army Garrison in Hawaii and the Hawaiian Electric Company. This venture will allow the Army bases in central Oahu to have better energy security as well as providing Oahu with a power plant located more inland in case the more coastal energy plants are compromised. The Tax Map Key designation for Schofield Barracks and Wheeler Army Airfield (WAAF) is 1-07-07-001.

The proposed undertaking involves the US Army's lease of 8.13 acres of land and the related granting of a 2.5 acre interconnection easement, on Schofield Barracks and WAAF to Hawaiian Electric Company (Hawaiian Electric) for the purpose of the construction, operation, and maintenance of a 50-megawatt (MW) capacity renewable energy power plant to include associated power poles, high-tension power lines, and related equipment and facilities by Hawaiian Electric. The lease would be under the authority of Title 10 of the United States Code (USC) §2667. The project also calls for The State of Hawaii Department of Land and Natural Resources granting of a 1.28 acre easement and a 0.7 acre conservation district authorization allowing for the construction of a 46 kV electrical power transmission line between the power plant site and the existing Wahiawa Substation. Hawaiian Electric's construction, ownership, operation, and maintenance of a 50 megawatt capacity, biofuel-capable power generation plant and 46 kV sub-transmission line are required to connect the Schofield Generating Station to the Hawaiian Electric grid. Hawaiian Electric would be the sole owner of the plant and the electrical power transmission facilities. The proposed facilities would be constructed and operated in accordance with all applicable laws, with approval of the Hawaii Public Utilities Commission (PUC).

The Area of Potential Effect (APE) for this undertaking is approximately 882 acres of land which includes the National Register District at Schofield Barracks, the National Historic Landmark District at WAAF as well as the National Register eligible district at WAAF. The enclosed map illustrates the the APE (Enclosure 1).

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The new poles associated with the project will be placed somewhat close to General's Loop that is within the boundaries of the historic district. However, it is anticipated that the visual impacts may be minimal to the homes at General's Loop due to the large trees that are in the area. The new poles will, however, be placed close to the small two bedroom stucco/mission style homes adjacent to Ralston Field, on Dickman and Kona Road, which have been determined eligible for inclusion on the National Register. These homes were constructed by the Federal Works Program/Works Progress Administration in 1932-33 while the same style homes were built at the Canby neighborhood at Schofield Barracks and at WAAF. The new poles (pole numbers 42, 43 and 44) and lines may be visible from the historic neighborhood.

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Sincerely,

Richard A. Fromm
Colonel, US Army
Commanding

Enclosures

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US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
851 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF:

OCT 09 2014

Office of the Garrison Commander

Mr. Edward Halealoha Ayau, Po'o
Hui Malama I Na Kumpuna O Hawaii Nei
P.O. Box 365
Ho'olehua, Hawaii 96729

Dear Mr. Ayau, Po'o:

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Enclosures

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US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
851 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF:

OCT 09 2014

Office of the Garrison Commander

Mr. Kalahikiola Keliinoi
'Ohana Keliinoi
89-107 Nanaikala Street
Wai'anae Hawai'i 96792

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Colonel, US Army
Commanding

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US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
851 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF:

OCT 09 2014

Office of the Garrison Commander

Ms. Kehaulani Souza
94-115 Puanane Loop
Mililani, Hawaii 96789

Dear Ms. Souza:

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Commanding

Enclosures

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US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
851 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF:

OCT 09 2014

Office of the Garrison Commander

Ms. Keona Mark
'Ohana Mahu
PO Box 2
Hale'iwa, Hawai'i 96712

Dear Ms. Mark:

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Sincerely,

Richard A. Fromm
Colonel, US Army
Commanding

Enclosures

DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
851 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF:

OCT 09 2014

Office of the Garrison Commander

Mr. Kihei Nahale-a
Hui Malama I Na Kupuna O Hawaii Nei
c/o Mr. Edward Halealoha Ayau, Po'o
P.O. Box 365
Ho'olehua, Hawaii

Dear Mr. Nahale-a:

The Office of the Garrison Commander, United States Army Garrison-Hawaii, is writing to open consultation with you pursuant to Section 106 of The National Historic Preservation Act of 1966, as amended (16 USC 470f), on the proposed construction of a new power plant on the south range of Schofield Barracks which is located on the central plateau on the Island of Oahu, Hawaii. The construction of this power plant is a joint venture between the US Army Garrison in Hawaii and the Hawaiian Electric Company. This venture will allow the Army bases in central Oahu to have better energy security as well as providing Oahu with a power plant located more inland in case the more coastal energy plants are compromised. The Tax Map Key designation for Schofield Barracks and Wheeler Army Airfield (WAAF) is 1-07-07-001.

The proposed undertaking involves the US Army's lease of 8.13 acres of land and the related granting of a 2.5 acre interconnection easement, on Schofield Barracks and WAAF to Hawaiian Electric Company (Hawaiian Electric) for the purpose of the construction, operation, and maintenance of a 50-megawatt (MW) capacity renewable energy power plant to include associated power poles, high-tension power lines, and related equipment and facilities by Hawaiian Electric. The lease would be under the authority of Title 10 of the United States Code (USC) §2667. The project also calls for The State of Hawaii Department of Land and Natural Resources granting of a 1.28 acre easement and a 0.7 acre conservation district authorization allowing for the construction of a 46 kV electrical power transmission line between the power plant site and the existing Wahiawa Substation. Hawaiian Electric's construction, ownership, operation, and maintenance of a 50 megawatt capacity, biofuel-capable power generation plant and 46 kV sub-transmission line are required to connect the Schofield Generating Station to the Hawaiian Electric grid. Hawaiian Electric would be the sole owner of the plant and the electrical power transmission facilities. The proposed facilities would be constructed and operated in accordance with all applicable laws, with approval of the Hawaii Public Utilities Commission (PUC).

The Area of Potential Effect (APE) for this undertaking is approximately 882 acres of land which includes the National Register District at Schofield Barracks, the National Historic Landmark District at WAAF as well as the National Register eligible district at WAAF. The enclosed map illustrates the the APE (Enclosure 1).

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The new poles associated with the project will be placed somewhat close to General's Loop that is within the boundaries of the historic district. However, it is anticipated that the visual impacts may be minimal to the homes at General's Loop due to the large trees that are in the area. The new poles will, however, be placed close to the small two bedroom stucco/mission style homes adjacent to Ralston Field, on Dickman and Kona Road, which have been determined eligible for inclusion on the National Register. These homes were constructed by the Federal Works Program/Works Progress Administration in 1932-33 while the same style homes were built at the Canby neighborhood at Schofield Barracks and at WAAF. The new poles (pole numbers 42, 43 and 44) and lines may be visible from the historic neighborhood.

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Sincerely,

Richard A. Fromm
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Commanding

Enclosures

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US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
851 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF:

OCT 09 2014

Office of the Garrison Commander

Ms. Terrilee Keko'olani
AFSC Hawaii
2426 Oahu Avenue
Honolulu, Hawaii 96822

Dear Ms. Keo'olani:

The Office of the Garrison Commander, United States Army Garrison-Hawaii, is writing to open consultation with you pursuant to Section 106 of The National Historic Preservation Act of 1966, as amended (16 USC 470f), on the proposed construction of a new power plant on the south range of Schofield Barracks which is located on the central plateau on the Island of Oahu, Hawaii. The construction of this power plant is a joint venture between the US Army Garrison in Hawaii and the Hawaiian Electric Company. This venture will allow the Army bases in central Oahu to have better energy security as well as providing Oahu with a power plant located more inland in case the more coastal energy plants are compromised. The Tax Map Key designation for Schofield Barracks and Wheeler Army Airfield (WAAF) is 1-07-07-001.

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Enclosures

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US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
851 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF:

OCT 09 2014

Office of the Garrison Commander

Ms. Hinaleimoana Wong-Kalu
Chairperson
Oahu Island Burial Council
Honolulu, Hawaii 96817

Dear Ms. Wong-Kalu:

The Office of the Garrison Commander, United States Army Garrison-Hawaii, is writing to open consultation with you pursuant to Section 106 of The National Historic Preservation Act of 1966, as amended (16 USC 470f), on the proposed construction of a new power plant on the south range of Schofield Barracks which is located on the central plateau on the Island of Oahu, Hawaii. The construction of this power plant is a joint venture between the US Army Garrison in Hawaii and the Hawaiian Electric Company. This venture will allow the Army bases in central Oahu to have better energy security as well as providing Oahu with a power plant located more inland in case the more coastal energy plants are compromised. The Tax Map Key designation for Schofield Barracks and Wheeler Army Airfield (WAAF) is 1-07-07-001.

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Commanding

Enclosures

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US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
851 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF:

OCT 09 2014

Office of the Garrison Commander

Mr. Christophor Oliveira
Ko'a Mana
84-255 Makaha Valley Road
Wai'anae, Hawai'i 96792

Dear Mr. Oliveira:

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Commanding

Enclosures

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US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
851 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF:

OCT 09 2014

Office of the Garrison Commander

Mr. Glen Makakauali'i Kila, Kahu Kulaiwi, Ko'a Mana
Kupuka'aina O Wai'anae Moku, O'ahu
84-255 Makaha Valley Road
Wai'anae, Hawai'i 96792

Dear Mr. Makakauali'i Kila:

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In compliance with 36 CFR 800.4, the Army in its identification efforts, commissioned the *Archaeological Inventory Survey for Schofield Generating Station Project, Waianae Uka, Honouliuli, and Waikele Ahupua'a in Wahiawa and 'Ewa Districts, Oahu Island, Hawaii* (Garcia & Assoc.—June, 2014). A copy of the report is enclosed for your review (Enclosure 5).

The Army is preparing an Environmental Impact Statement (EIS) to satisfy the National Environmental Policy Act requirements for this undertaking. The Army will transmit a copy of the EIS once it becomes available. A public draft of the EIS is expected to be released in the first quarter of 2015.

A copy of the initial Section 106 consultation regarding this project from 2011 is enclosed for your review (Enclosure 6).

The Army looks forward to consulting with you on the proposed undertaking. We ask for your initial comments on the proposed undertaking. If you have any questions regarding architectural/landscape issues, please contact Kenneth Hays, with the Cultural Resources Section of the Directorate of Public Works at 808-656-6790. If you have any questions pertaining to archeological issues, you may contact Richard Davis, with the Cultural Resources Section of the Directorate of Public Works at 808-655-9709.

Sincerely,

Richard A. Fromm
Colonel, US Army
Commanding

Enclosures

DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
947 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF:

Directorate of Public Works

MAR 2 4 2015

SUBJECT: Construction of a Power Plant and Installation of Power Poles at Schofield Barracks and Wheeler Army Airfield; TMK: 1-07-07-001;Waianae Uka Honouliuli and Waikele Ahupua'a in Wahiawa and 'Ewa Districts, Oahu Island.

Dr. Alan Downer, Deputy State Historic Preservation Officer
State Historic Preservation Division
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, HI 96707

Dear Dr. Downer:

The Directorate of Public Works, United States Army Garrison, Hawaii (USAG-HI) is writing to continue consultation with you pursuant to Section 106 of The National Historic Preservation Act of 1966, as amended (54 USC §306108), on the proposed construction of a new power plant on the South Range of Schofield Barracks (SB), located on the central plateau on the Island of Oahu, Hawaii. The construction of this power plant is a joint venture between the USAG-HI and the Hawaiian Electric Company (HECO). The full description of the undertaking and supporting information is contained in our initial consultation letter to you (October 14, 2014, Enclosure 1).

The proposal includes leasing 8.13 acres of US Army land and granting a 2.5-acre interconnection easement on SB and Wheeler Army Airfield (WAAF) to HECO to construct, operate, and maintain a 50-megawatt-capacity, renewable energy power plant. HECO will install power poles, high-tension power lines, and related equipment and facilities. The Area of Potential Effect for this undertaking is approximately 882 acres of land which includes the SB Historic District (listed on July 31, 1998), the WAAF National Historic Landmark District (listed 1987), and the adjacent WAAF Garden City Historic District, considered eligible (2010).

SHPD responded in a letter dated November 18, 2014 (Enclosure 2) with a request for additional details and a meeting between HECO, SHPD, USAG-HI, the Historic Hawaii Foundation, and interested parties to discuss design alternatives on the placement of the 47 steel electrical poles. The Advisory Council on Historic Preservation requested to be informed of the outcome of consultation to make a decision on their participation (Enclosure 3).

Consulting parties agreed at a meeting (December 5, 2014) that the only remaining issues of potential effect were those questions regarding potential intrusive visual effects to the historic districts along the route of the electrical lines to be upgraded. SHPD staff expressed particular concerns about the visual effect of the

poles along Kunia Road and Wilikina Drive (Enclosure 4). These concerns centered on: Poles 11-13 along the Stryker Avenue neighborhood; Poles 14-18 at the WAAF historic Garden City Loops (Langley Loop); Poles 21-22 next to Building E at Wheeler Elementary and Intermediate School (School); and Poles 23-30 next to the Sperry Loop neighborhood. Furthermore, Poles 42-47 are located near to the small, two-bedroom stucco/mission style homes adjacent to Ralston Field at SB.

SHPD staff inquired why Poles 11-28 along Kunia Road and Wilikina Road could not be relocated to other areas or underground. HECO explained that relocating them was precluded by existing infrastructure, technical, and code reasons. HECO provided alternatives that SHPD staff found acceptable to avoid adverse visual effects, such as painting the poles to blend in with the environment, and planting trees compatible with the historic districts to limit and screen their views. The Army recommends using colors and trees that are appropriate for the WAAF neighborhoods. USAG-HI will submit a list of colors for the poles and a tree-location plan for your review.

Although the SHPD staff has not expressed concerns that the power plant will affect any historic properties since it is not in close proximity to the historic districts, we would like to inform you that the originally proposed 75-foot-high power plant exhaust stacks will now be 95 feet high (Enclosure 5). Furthermore, Pole 18 that was originally on the School's property was moved to another location on the opposite side of Kunia Road, and the pole heights were changed from 80 feet to 60 feet. These changes will further diminish visual impacts to the historic neighborhoods. Since the Ralston neighborhood has existing 60-foot-tall poles to be changed with poles of the same height, we do not foresee visual impacts to this neighborhood.

The Army determined that with the incorporated measures to diminish the potential visual prominence of the new poles and electric lines in the vicinity of the historic districts, the proposed project will have *no adverse effect* per 36 CFR 800.5(b). We request your concurrence with this determination. If you have any questions, you may contact Richard Davis, the Cultural Resources Manager of the Directorate of Public Works at 808-655-9709.

Sincerely,

Steven M. Raymond
Director of Public Works

Enclosures

DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
851 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF:

OCT 09 2014

Office of the Garrison Commander

Mr. William Aila
State Historic Preservation Officer
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, Hawai'i 96707

Dear Mr. Aila:

The Office of the Garrison Commander, United States Army Garrison-Hawaii, is writing to open consultation with you pursuant to Section 106 of The National Historic Preservation Act of 1966, as amended (16 USC 470f), on the proposed construction of a new power plant on the south range of Schofield Barracks which is located on the central plateau on the Island of Oahu, Hawaii. The construction of this power plant is a joint venture between the US Army Garrison in Hawaii and the Hawaiian Electric Company. This venture will allow the Army bases in central Oahu to have better energy security as well as providing Oahu with a power plant located more inland in case the more coastal energy plants are compromised. The Tax Map Key designation for Schofield Barracks and Wheeler Army Airfield (WAAF) is 1-07-07-001.

The proposed undertaking involves the US Army's lease of 8.13 acres of land and the related granting of a 2.5 acre interconnection easement, on Schofield Barracks and WAAF to Hawaiian Electric Company (Hawaiian Electric) for the purpose of the construction, operation, and maintenance of a 50-megawatt (MW) capacity renewable energy power plant to include associated power poles, high-tension power lines, and related equipment and facilities by Hawaiian Electric. The lease would be under the authority of Title 10 of the United States Code (USC) §2667. The project also calls for The State of Hawaii Department of Land and Natural Resources granting of a 1.28 acre easement and a 0.7 acre conservation district authorization allowing for the construction of a 46 kV electrical power transmission line between the power plant site and the existing Wahiawa Substation. Hawaiian Electric's construction, ownership, operation, and maintenance of a 50 megawatt capacity, biofuel-capable power generation plant and 46 kV sub-transmission line are required to connect the Schofield Generating Station to the Hawaiian Electric grid. Hawaiian Electric would be the sole owner of the plant and the electrical power transmission facilities. The proposed facilities would be constructed and operated in accordance with all applicable laws, with approval of the Hawaii Public Utilities Commission (PUC).

The Area of Potential Effect (APE) for this undertaking is approximately 882 acres of land which includes the National Register District at Schofield Barracks, the National Historic Landmark District at WAAF as well as the National Register eligible district at WAAF. The enclosed map illustrates the the APE (Enclosure 1).

Wheeler Army Airfield has a National Historic Landmark District that was created in 1986-87 when a thematic series of districts were created in Hawaii associated with World War II history and the attack on Oahu by the Empire of Japan on the December 7th, 1941. The National Register District at Schofield Barracks was created in 1998. The district's significance is based upon its historic architecture, early 20th century military installation planning, its historic landscape, and the events related to the history of the US Army in Hawaii, particularly from the early Territorial Period through World War II. The Period of Significance is defined as 1908-1945. In the absence of an extensive report on the historic districts of Schofield Barracks and Wheeler Army Airfield, a summary of the historic resources is enclosed for your review (Enclosure 2).

The proposed Schofield Generating Station building is still in its early stages of planning. Information regarding its size, height and other details will be forthcoming. Color conceptual renderings of the structure are enclosed for your review (Enclosure 3).

The undertaking will involve in part the placement of 80' electrical poles along Kunia Road and Wilikina Drive that will be directly adjacent to the National Register District at Schofield Barracks and the historic Garden City neighborhoods at Wheeler Army Airfield (NR eligible). The existing power poles on Kunia Road and Wilikina Drive are approximately 45' tall.

The new poles associated with the project will be placed somewhat close to General's Loop that is within the boundaries of the historic district. However, it is anticipated that the visual impacts may be minimal to the homes at General's Loop due to the large trees that are in the area. The new poles will, however, be placed close to the small two bedroom stucco/mission style homes adjacent to Ralston Field, on Dickman and Kona Road, which have been determined eligible for inclusion on the National Register. These homes were constructed by the Federal Works Program/Works Progress Administration in 1932-33 while the same style homes were built at the Canby neighborhood at Schofield Barracks and at WAAF. The new poles (pole numbers 42, 43 and 44) and lines may be visible from the historic neighborhood.

The new poles and wires proposed for the project may cause negative visual impacts to the Garden City Loops (Langley Loop with the placement of poles 14-18 and at Sperry Loop with the placement of poles 23-27). Poles 11-13 and 28-30 may have visual impacts on the 1936 historic neighborhoods that flank the loops at Wheeler Army Airfield. There may be the potential to have visual impacts on the Landmark district at its western end by the new poles and wires.

A 3D rendering of the proposed poles and wires is included to assist in the visualization of the end results of the undertaking (Enclosure 4).

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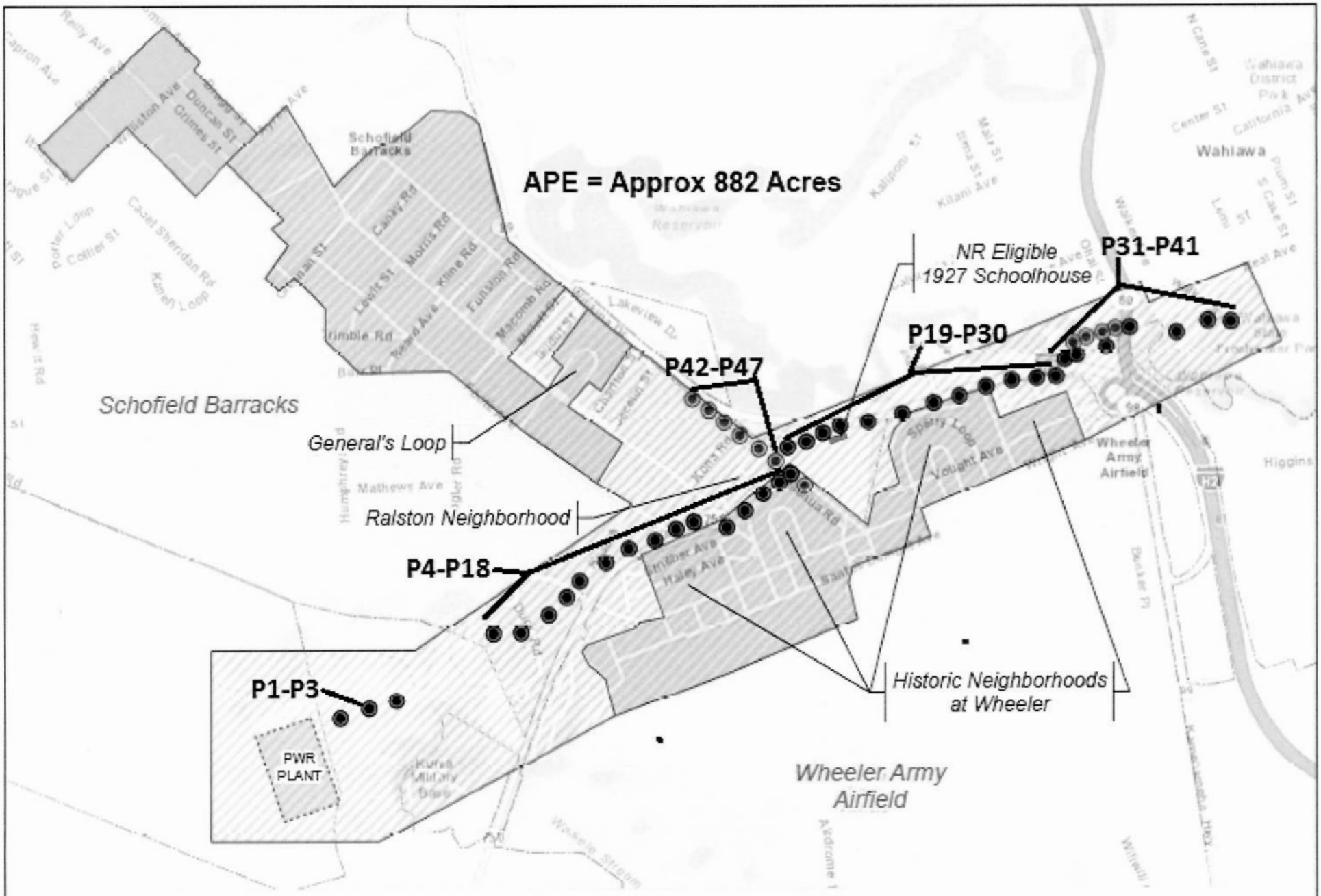


AREA OF POTENTIAL EFFECT FOR
VISUAL IMPACTS TO THE HISTORIC RESOURCES
AT SCHOFIELD BARRACKS AND
WHEELER ARMY AIRFIELD

HECO Poles
- Existing
- Proposed

- Future Power Plant
- Historic District
- Installation Area
- Area of Potential Effect

Feet
0 750 1,500 3,000

U.S. Army Garrison-Hawaii, DPW-Environmental
September 2014
Source: "Streets" Basemap (ESRI et al. 2013)
APE information may be reviewed and updated

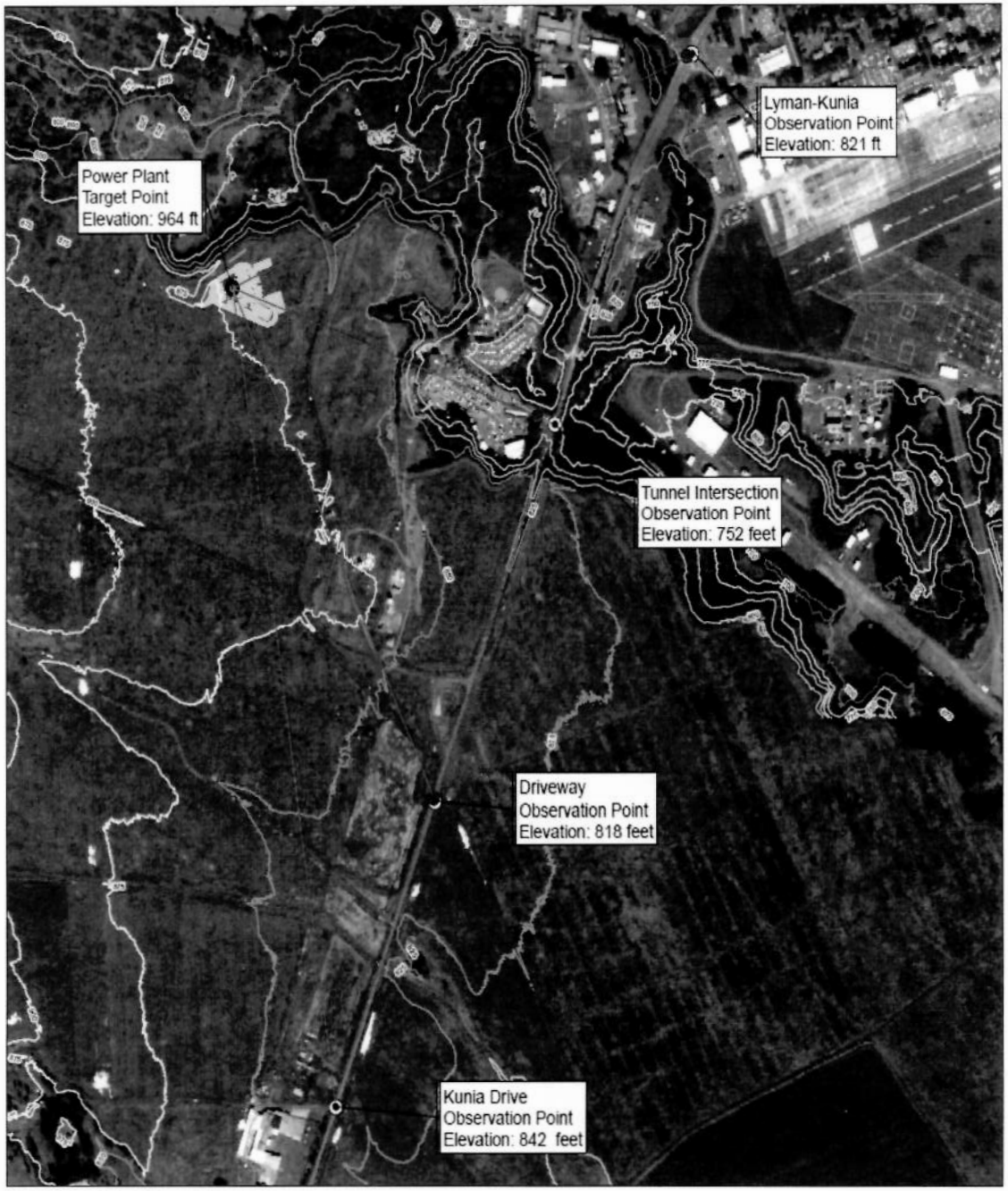
ENCL 1

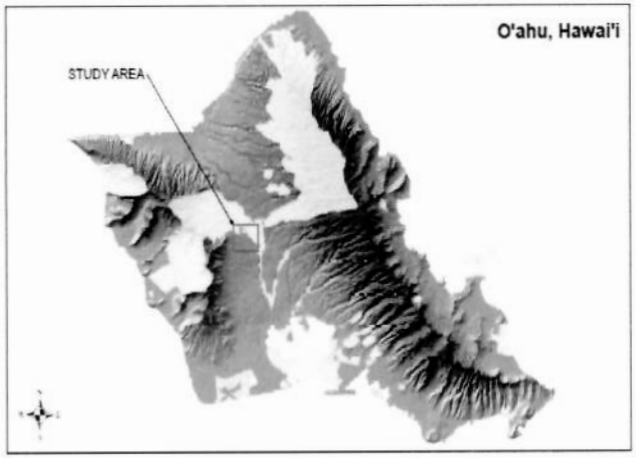
Schofield Generating Station
Preferred Overhead 46kV Route

- New Pole on Army Land
- New Pole on State Land
- Existing 46kV line
- Existing 46kV line Dual Circuit
- Schofield Generating Station
- Substations as labeled
- New 46kvExpress Line
- Existing 46kV line

Project Features

Figure 2-2





Schofield Power Plant

Line of Sight Analysis

LEGEND

- Target Location
- Observer Location
- Obstruction Point
- Not Visible
- Visible
- Power Plant

Contour Lines

- 700 feet
- 750 feet
- 800 feet
- 850 feet
- 900 feet

N

0 500 1,000 2,000 Feet

US Army Corps of Engineers®
Honolulu District

NOAA 2013 LIDAR Oahu Collection Source of elevation data from MSL
Coordinate System: NAD 1983 HARN StatePlane Hawaii 3 FIPS 5103 Feet
Projection: Transverse Mercator
Horizontal Datum: North American 1983 HARN

Schofield Power Plant Methodology

1) Coordinate System

The Line of Sight analysis and the associated data were created using ArcGIS's ArcCatalog and ArcMap software. A new file based geodatabase was created in ArcCatalog. The Coordinate System used is NAD 1983 HARN StatePlane Hawaii 3 FIPS 5103, in feet. Projection is the Transverse Mercator, and the Horizontal Datum is the North American 1983 HARN. No Z-factor was used.

2) Terrain to TIN

A feature dataset was created in the new geodatabase. The study area boundary feature was imported into the feature dataset. The boundary feature was used as a hard clip surface feature to limit the area that contained the LiDAR data. The LiDAR data (LAS files) were converted into multipoints, a collection of points that can be used to store a collection of point-based information, using 3DAnalyst tool in ArcCatalog. Multipoints for bare earth and first returns were converted from the same LAS files. For the bare earth terrain, class code 2 was the only one used in the conversion of multipoints. For the first returns, class codes 1, 4,5,6 were used (See Figure 1). A bare earth and first return terrain were produced using the boundary feature and the multipoints.

ASPRS Standard LiDAR Point Classes

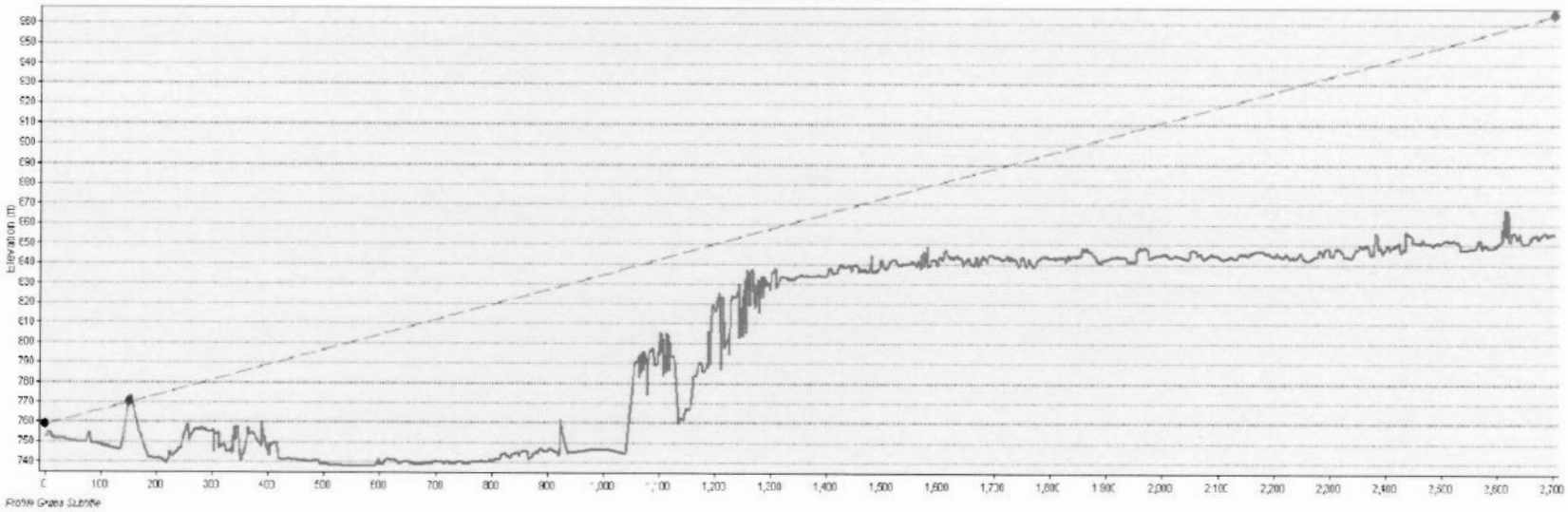
Classification Value	Meaning
0	Created, never classified
1	Unclassified
2	Ground
3	Low Vegetation
4	Medium Vegetation
5	High Vegetation
6	Building
7	Low Points (noise)
8	Model Key-Points (mass points)
9	Water
10	Reserved for ASPRS Definition
11	Reserved for ASPRS Definition
12	Overlap Points
13-31	Reserved fro ASPRS Definition

Figure 1. ASPRS Standard LiDAR Point Class Codes (ESRI Support)

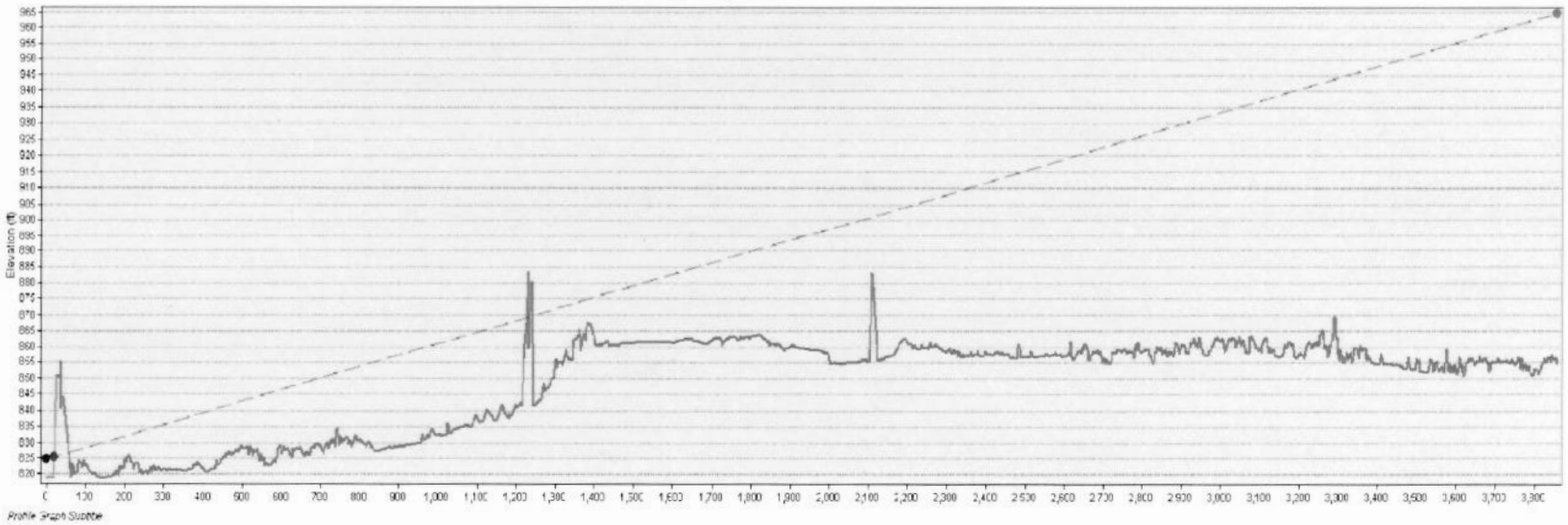
In order to do a Line of Sight analysis, the first return terrain was converted into a triangulated irregular network (TIN) using the 3DAnalyst tool. The TIN was created by triangulating the terrain's surface using nodes.

Lyman-Kunia Observation Point Profile

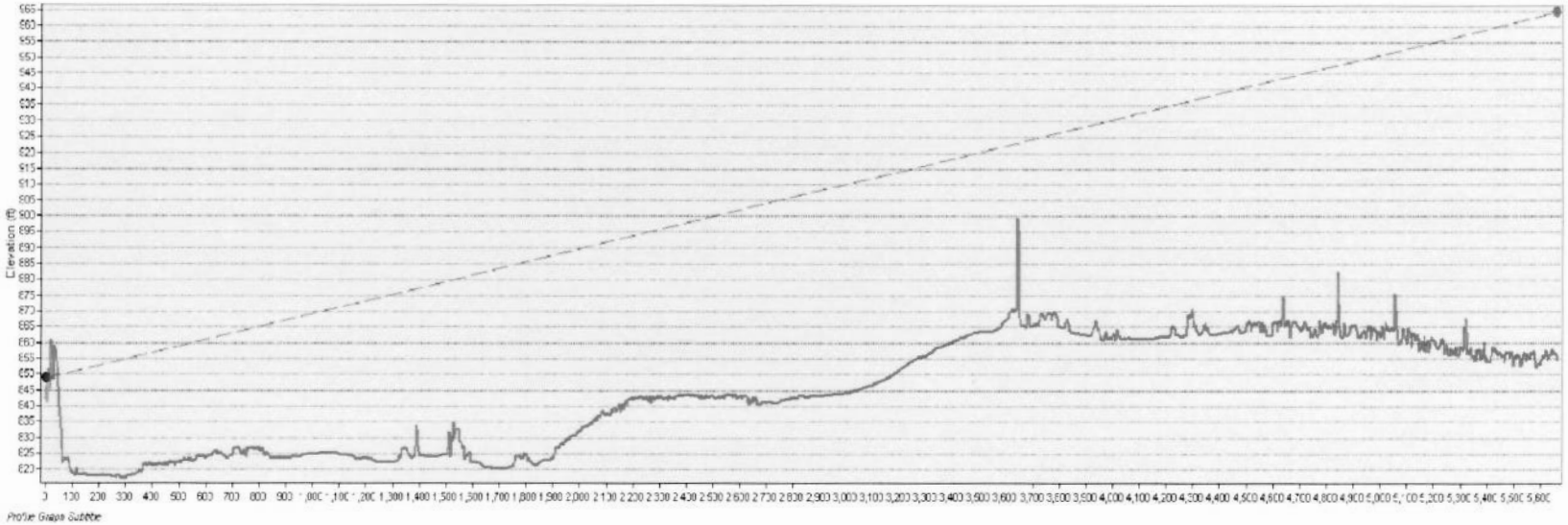
Tunnel Intersection Observation Point Profile



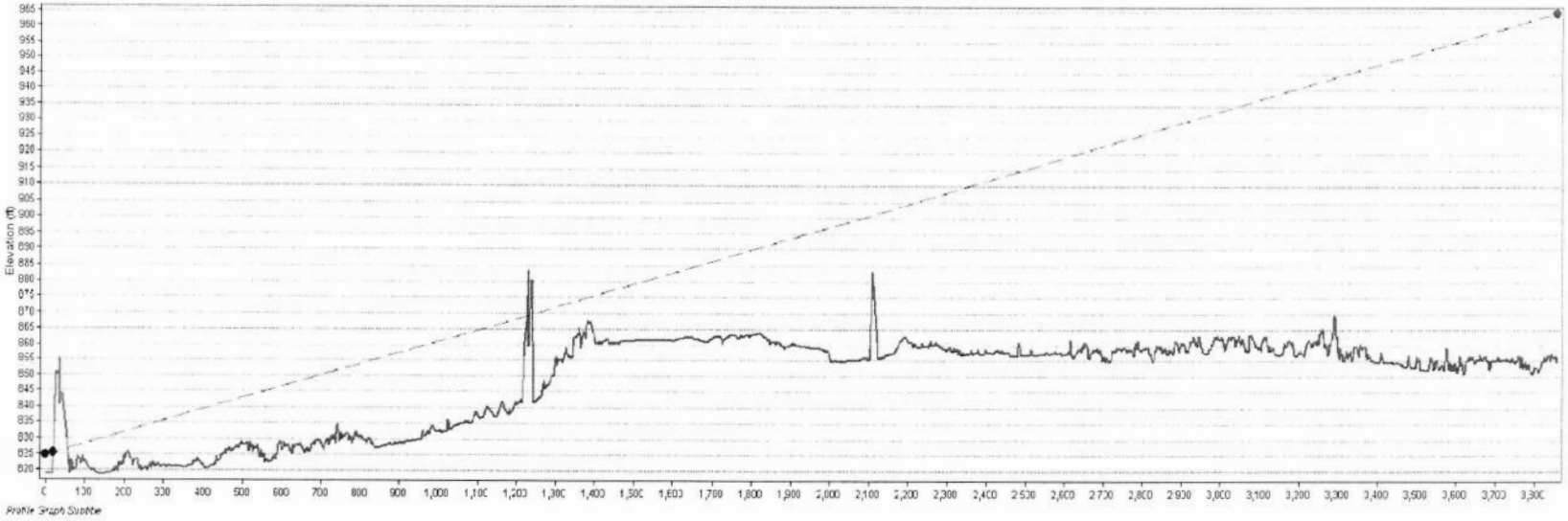
Driveway Observation Point Profile



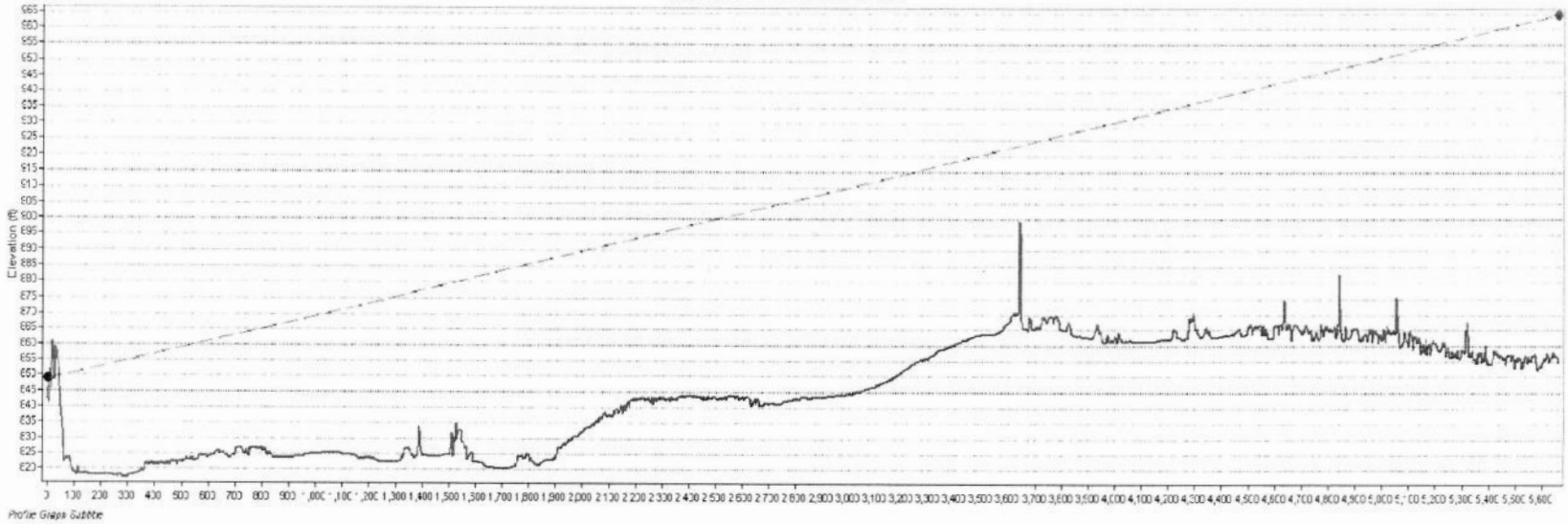
Kunia Drive Observation Point Profile



Driveway Observation Point Profile



Kunia Drive Observation Point Profile



DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
745 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF:

Directorate of Public Works MAR 2 4 2015

SUBJECT: Construction of a Power Plant and Installation of Power Poles at Schofield Barracks (SB) and Wheeler Army Airfield (WAAF); Tax Map Key: 1-07-07-001;Waianae Uka Honouliuli and Waikele Ahupua'a in Wahiawa and 'Ewa Districts, Oahu Island.

Ms. Caroline D. Hall, Assistant Director, Federal Property Management Section
Office of Federal Agency Programs, Advisory Council on Historic Preservation
401 F Street, Suite 308
Washington, DC 20001-2637

Dear Ms. Hall:

The Directorate of Public Works, United States Army Garrison, Hawaii (USAG-HI) is writing to continue consultation with you pursuant to Section 106 of The National Historic Preservation Act of 1966, as amended (54 USC §306108), on the proposed construction of a new power plant on the South Range of SB which is located on the central plateau on the Island of Oahu, Hawaii. The construction of this power plant is a joint venture between the USAG-HI and the Hawaiian Electric Company (HECO). The full description of the undertaking and supporting information is contained in our initial consultation letter to you (December 17, 2014). The Advisory Council on Historic Preservation requested to be informed of the outcome of consultation to make a decision on your participation (Enclosure 1).

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The State Historic Preservation Division (SHPD) responded in a letter dated November 18, 2014 (Enclosure 2) with a request for additional details and a meeting between HECO, SHPD, USAG-HI, the Historic Hawaii Foundation (HHF), and interested parties to discuss design alternatives on the placement of the 47 steel electrical poles.

Consulting parties agreed at a meeting (December 5, 2014) that the only remaining issues of potential effect were those questions regarding potential intrusive visual effects to the historic districts along the route of the electrical lines to be upgraded. SHPD and HHF staff expressed particular concerns about the visual effect

of the poles along Kunia Road and Wilikina Drive (Enclosure 3). These concerns centered on: Poles 11-13 along the Stryker Avenue neighborhood; Poles 14-18 at the WAAF historic Garden City Loops (Langley Loop); Poles 21-22 next to Building E at Wheeler Elementary and Intermediate School (School); and Poles 23-30 next to the Sperry Loop neighborhood. Furthermore, Poles 42-47 are located near to the small, two-bedroom stucco/mission style homes adjacent to Ralston Field at SB.

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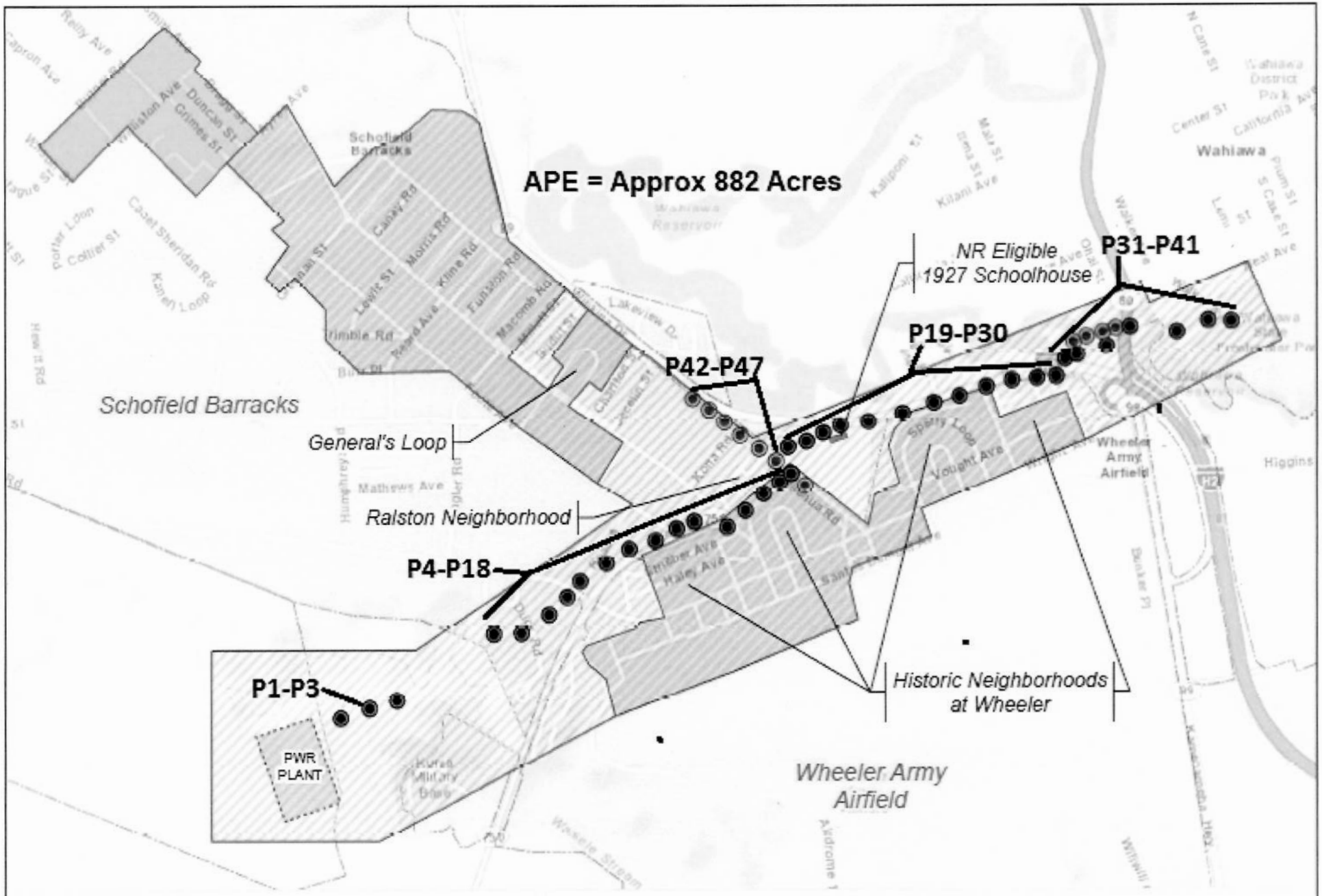
The Army determined that with the incorporated measures to diminish the potential visual prominence of the new poles and electric lines in the vicinity of the historic districts, the proposed project will have *no adverse effect* per 36 CFR 800.5(b). We request your comments on this determination. If you have any questions, you may contact Richard Davis, the Cultural Resources Manager of the Directorate of Public Works at 808-655-9709.

Sincerely,

Steven M. Raymond
Director of Public Works

Enclosures



AREA OF POTENTIAL EFFECT FOR
VISUAL IMPACTS TO THE HISTORIC RESOURCES
AT SCHOFIELD BARRACKS AND
WHEELER ARMY AIRFIELD

HECO Poles
- Existing
- Proposed

- Future Power Plant
- Historic District
- Installation Area
- Area of Potential Effect

ENCL 1

Schofield Generating Station
Preferred Overhead 46kV Route

- New Pole on Army Land
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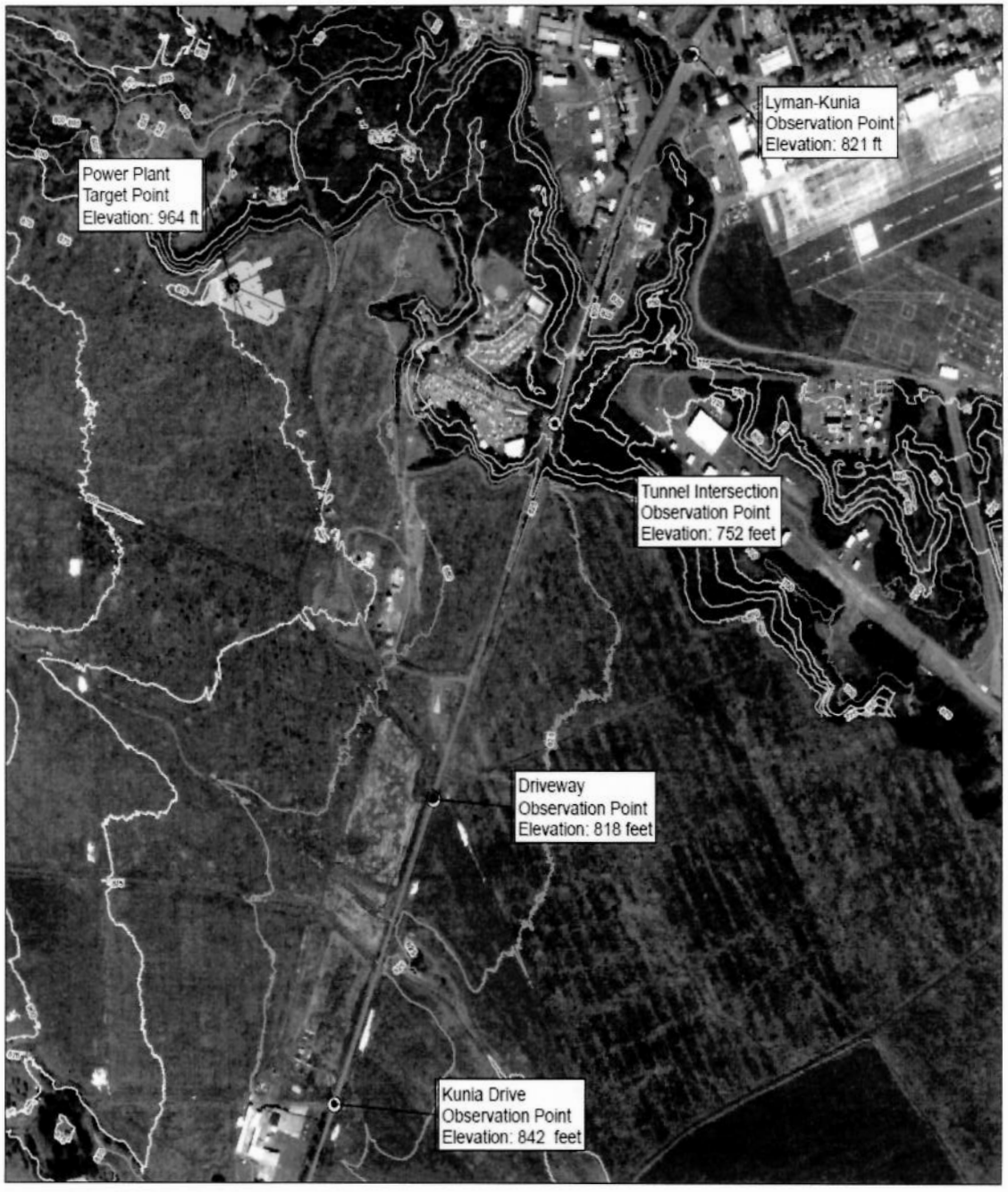
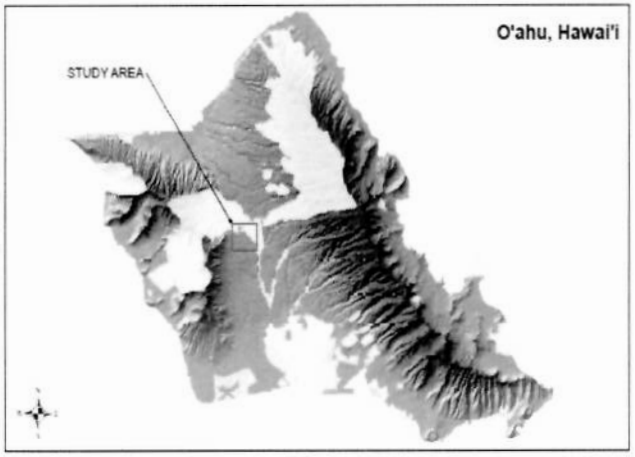
Figure 2-2





Schofield Power Plant

Line of Sight Analysis

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US Army Corps of Engineers®
Honolulu District

NOAA 2013 LIDAR Oahu Collection Source of elevation data from MSL
Coordinate System: NAD 1983 HARN StatePlane Hawaii 3 FIPS 5103 Feet
Projection: Transverse Mercator
Horizontal Datum: North American 1983 HARN

Schofield Power Plant Methodology

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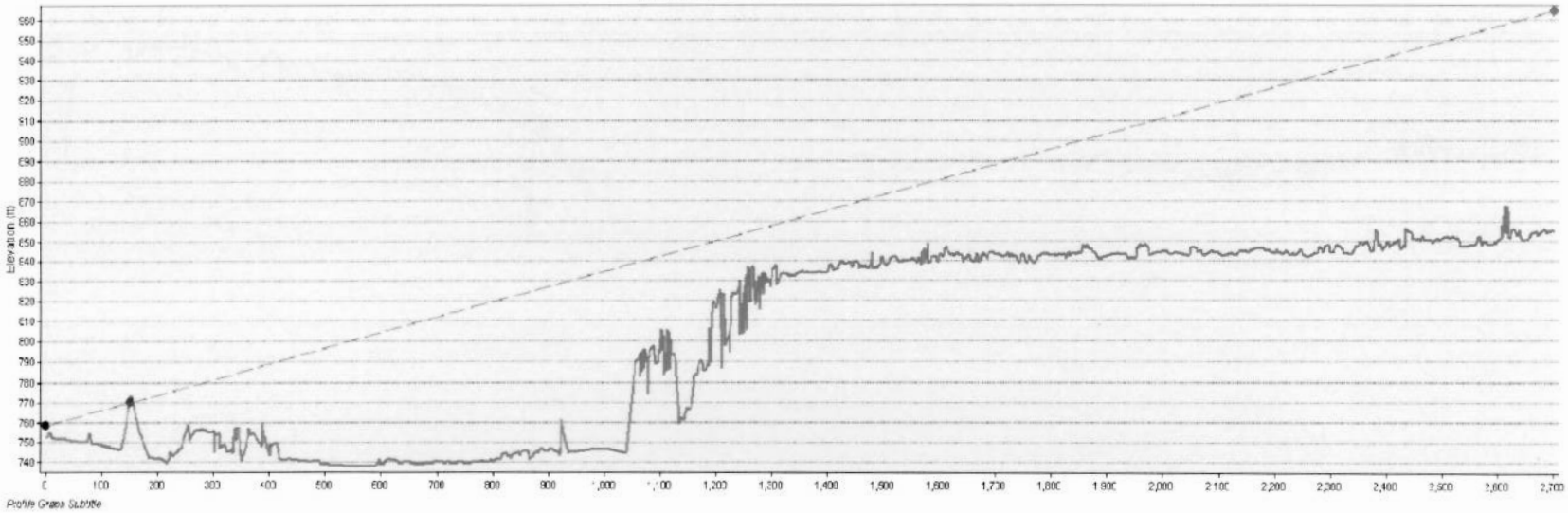
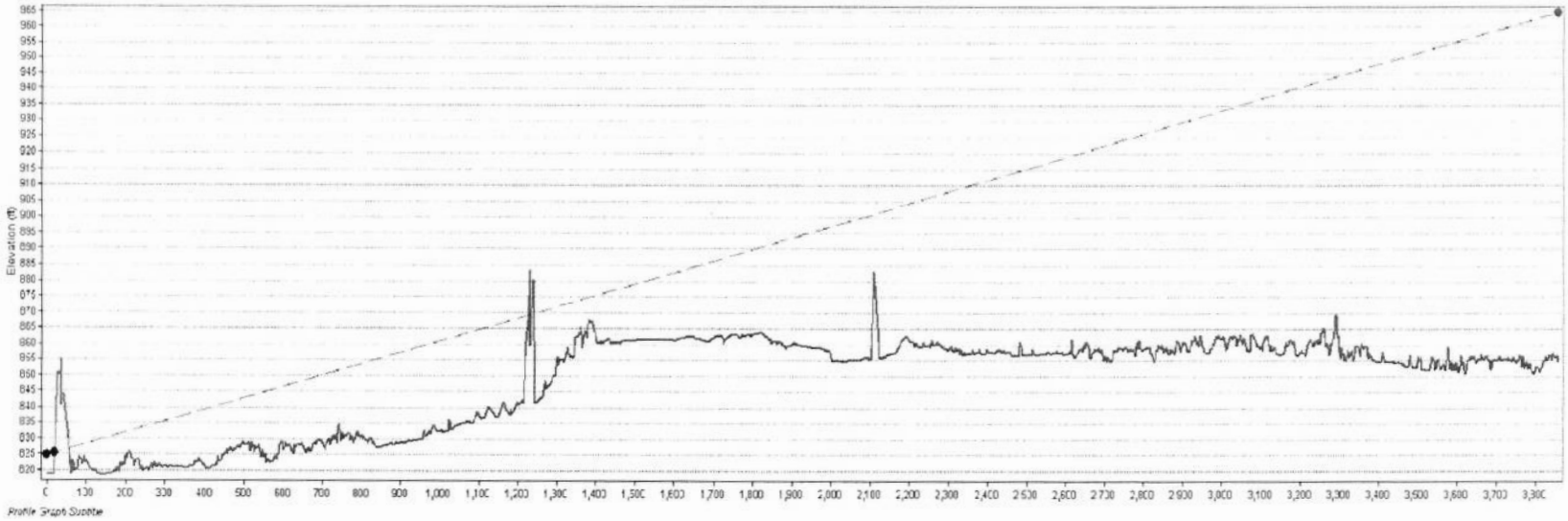
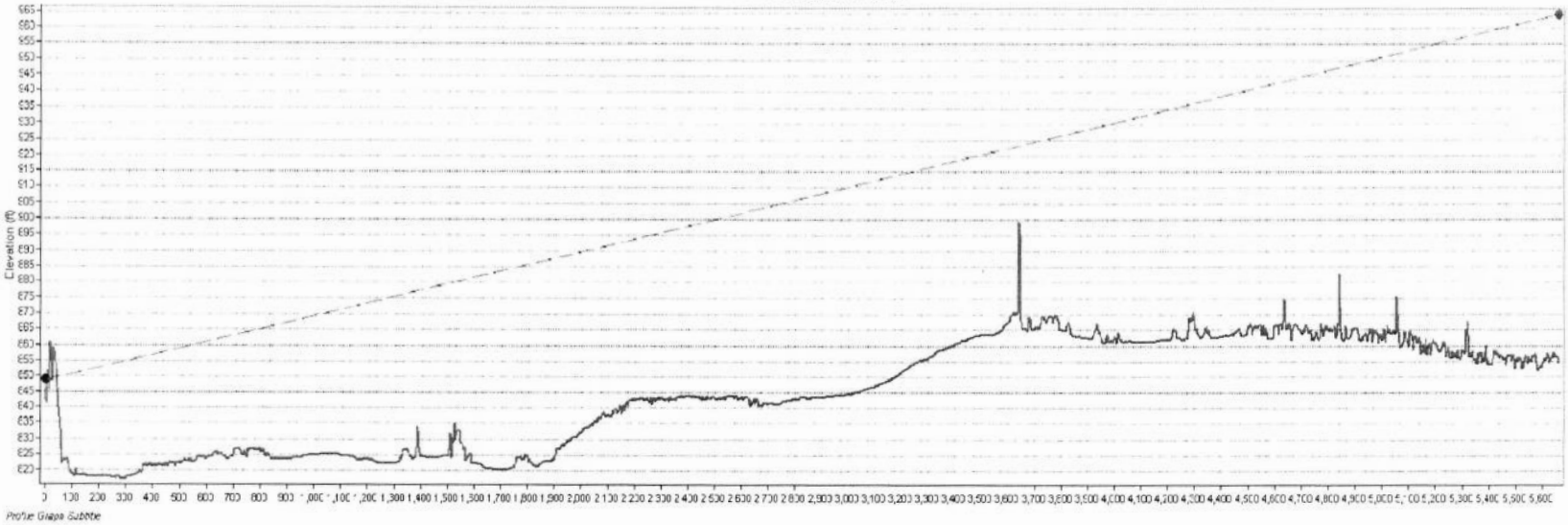
Tunnel Intersection Observation Point Profile



Driveway Observation Point Profile



Kunia Drive Observation Point Profile



DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
745 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF:

Directorate of Public Works

MAR 2 4 2015

SUBJECT: Construction of a Power Plant and Installation of Power Poles at Schofield Barracks (SB) and Wheeler Army Airfield (WAAF); Tax Map Key: 1-07-07-001;Waianae Uka Honouliuli and Waikele Ahupua'a in Wahiawa and 'Ewa Districts, Oahu Island.

Ms. Kiersten Faulkner, Executive Director
Historic Hawaii Foundation
The Dole Cannery, 680 Iwilei Road
Dole Office Building Tower, Suite 690
Honolulu, HI 96817

Dear Ms. Faulkner:

The Directorate of Public Works, United States Army Garrison, Hawaii (USAG-HI) is writing to continue consultation with you pursuant to Section 106 of The National Historic Preservation Act of 1966, as amended (54 USC §306108), on the proposed construction of a new power plant on the South Range of SB, located on the central plateau on the Island of Oahu, Hawaii. The construction of this power plant is a joint venture between the USAG-HI and the Hawaiian Electric Company (HECO). The full description of the undertaking and supporting information is contained in our initial consultation letter to you (July 6, 2011, Enclosure 1).

The proposal includes leasing 8.13 acres of US Army land and granting a 2.5-acre interconnection easement on SB and WAAF to HECO to construct, operate, and maintain a 50-megawatt-capacity, renewable energy power plant. HECO will install power poles, high-tension power lines, and related equipment and facilities. The Area of Potential Effect for this undertaking is approximately 882 acres of land which includes the SB Historic District (listed on July 31, 1998), the WAAF National Historic Landmark District (listed 1987), and the adjacent WAAF Garden City Historic District, considered eligible (2010).

The State Historic Preservation Division (SHPD) requested a meeting between HECO, SHPD, USAG-HI, the Historic Hawaii Foundation (HHF), and interested parties to discuss design alternatives on the placement of the 47 steel electrical poles. The Advisory Council on Historic Preservation requested to be informed of the outcome of consultation to make a decision on their participation (Enclosure 2).

Consulting parties agreed at a meeting (December 5, 2014) that the only remaining issues of potential effect were those questions regarding potential intrusive visual effects to the historic districts along the route of the electrical lines to be upgraded. SHPD and HHF staff expressed particular concerns about the visual effect of the poles along Kunia Road and Wilikina Drive (Enclosure 3). These concerns

centered on: Poles 11-13 along the Stryker Avenue neighborhood; Poles 14-18 at the WAAF historic Garden City Loops (Langley Loop); Poles 21-22 next to Building E at Wheeler Elementary and Intermediate Schoo (School); and Poles 23-30 next to the Sperry Loop neighborhood. Furthermore, Poles 42-47 are located near to the small, two-bedroom stucco/mission style homes adjacent to Ralston Field at SB.

SHPD and HHF staff inquired why Poles 11-28 along Kunia Road and Wilikina Road could not be relocated to other areas or underground. HECO explained that relocating them was precluded by existing infrastructure, technical, and code reasons. HECO provided alternatives that SHPD and HHF staff found acceptable to avoid adverse effects, such as painting the poles to blend in with the environment, and planting trees compatible with the historic districts to limit and screen their views. The Army recommends using colors and trees that are appropriate for the WAAF neighborhoods. USAG-HI will submit a lists of colors for the poles and a tree-location plan for your review.

Although the SHPD and HHF staff has not expressed concerns that the power plant will affect any historic properties since it is not in close proximity to the historic districts, we would like to inform you that the originally proposed 75-foot-high power plant exhaust stacks will now be 95 feet high (Enclosure 4). Furthermore, Pole 18 that was originally on the School's property was moved to another location on the opposite side of Kunia Road, and the pole heights were changed from 80 feet to 60 feet. These changes will further diminish visual impacts to the historic neighborhoods. Since the Ralston neighborhood has existing 60-foot-tall poles to be changed with poles of the same height, we do not foresee visual impacts to this neighborhood.

The Army determined that with the incorporated measures to diminish the potential visual prominence of the new poles and electric lines in the vicinity of the historic districts, the proposed project will have *no adverse effect* per 36 CFR 800.5(b). We request your comments on this determination.

If you have any questions, you may contact Richard Davis, the Cultural Resources Manager of the Directorate of Public Works at 808-655-9709.

Sincerely,

Steven M. Raymond
Director of Public Works

Enclosures

DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND, PACIFIC REGION
HEADQUARTERS, UNITED STATES ARMY GARRISON, HAWAII
851 WRIGHT AVENUE, WHEELER ARMY AIRFIELD
SCHOFIELD BARRACKS, HAWAII 96857-5000

REPLY TO
ATTENTION OF:

JUL 0 6 2011

Office of the Garrison Commander

Ms. Kirsten Faulkner
Executive Director
Historic Hawaiian Foundation
681 Iwilei Road, Suite 690
Honolulu, HI 96817

Dear Ms. Faulkner:

On behalf of the Commander of the US Army Garrison, Hawaii (USAG-HI), I am writing to open consultation with you under Section 106 of the National Historic Preservation Act of 1966, as amended, for an undertaking involving an outgrant of an approximately 10-acre parcel to Hawaiian Electric Company (HECO) for construction of a 52 megawatt (MW) power generation plant and a fuel storage system located at Schofield Barracks, South Range Land Acquisition Area (SRLA), Wahiawā, O'ahu Island, TMK: 1-9-2-005:011. An outgrant is an easement, lease or real estate agreement to allow the use of Army land by a third party. The HECO outgrant term will be 25 years with options to renew. The area of potential effect (APE) is shown in Enclosure 1.

Archaeological inventory survey of the SRLA (delineated in black in Enclosure 1) was conducted by Scientific Consultant Services/Cultural Resources Management Services (SCS/CRMS) in 1996, Garcia and Associates (GANDA) in 2002 and 2003 and Cultural Surveys Hawaii, Inc. (CSH) from March to April 2009. Archaeological inventory survey of the APE was conducted by CSH during their 2009 survey. No archaeological or cultural resources other than historic plantation equipment were identified within the CSH survey area. Additionally, 30 test units were hand excavated within the CSH survey area. No subsurface archaeological/cultural resources were identified.

There are no known archaeological/cultural resources located in the vicinity of the APE. A total of 45 sites were identified within SRLA during the SCS/CRMS and GANDA surveys, of which Site 6463, a post-contact complex, is located more than 4,593 feet (1,400 meters) from the APE. The closest known site to the APE, a terrace facing, Site 3 (not designated a SIHP number), is located more than 1,312 feet (400 meters) north of the APE. Additionally, the post cemetery, which is not designated a SIHP number, is also located approximately 1,312 feet (400 meters) north of the APE. Site 3 and the post cemetery are shown in Enclosure 1.

ENC.1

Preserving America's Heritage

December 17, 2014

Colonel Richard A. Fromm
Office of the Garrison Commander
U.S. Army Garrison-Hawaii
851 Wright Avenue, Building 106
Schofield Barracks, HI 96857

Ref: Leasing of Land to, Granting an Interconnection Easement to, and the Construction, Operation, and Maintenance of a 50-Megawatt Schofield Generating Station by the Hawaiian Electric Company, United States Army Garrison- Hawaii
Schofield Barracks and Wheeler Army Airfield, Honolulu County, Hawaii

Dear COL Fromm:

The Advisory Council on Historic Preservation (ACHP) is in receipt of notification by the United States Army Garrison, Hawaii (USAG-HI) for the leasing of 8.13 acres, granting a 2.5 acre interconnection easement, and the construction, operation, and maintenance of a new 50-megawatt (MW) capacity renewable energy power plant, to be known as the Schofield Generating Station. Documentation provided included a letter regarding a similar project proposed by the Hawaiian Electric Company in 2011.

The ACHP is requesting additional information regarding the outcome of the 2011 consultation, including information on the apparent suspension of project development at that time. In addition, we require clarification regarding the current effect finding for this undertaking. Specifically, please clarify if USAG-HI is making a determination of effect or if this is an early notification to the ACHP. This information will enable the ACHP to determine if our participation is warranted. Upon receipt of the additional information, we will notify you within 15 days of our decision on participation.

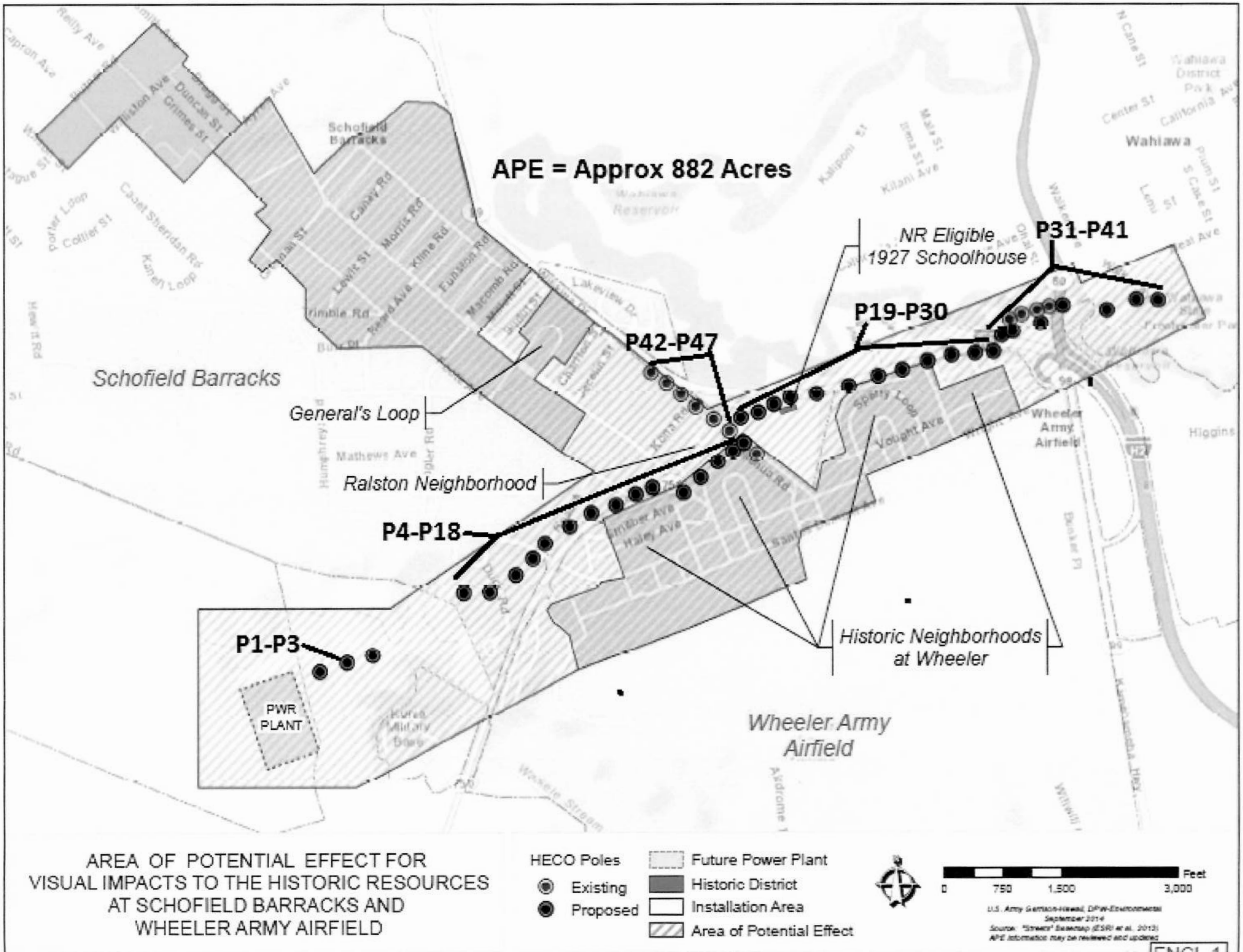
If you have any questions, please contact Ms. Katharine R. Kerr who can be reached at (202) 517-0216 or via email at kkerr@achp.gov.

Sincerely,

Caroline D. Hall
Assistant Director
Federal Property Management Section
Office of Federal Agency Programs

ADVISORY COUNCIL ON HISTORIC PRESERVATION
401 F Street, Suite 308 • Washington, DC 20001-2637
Phone: 202-517-0200 • Fax: 202-517-6381 • achp@achp.gov • www.achp.gov

ENC. 2

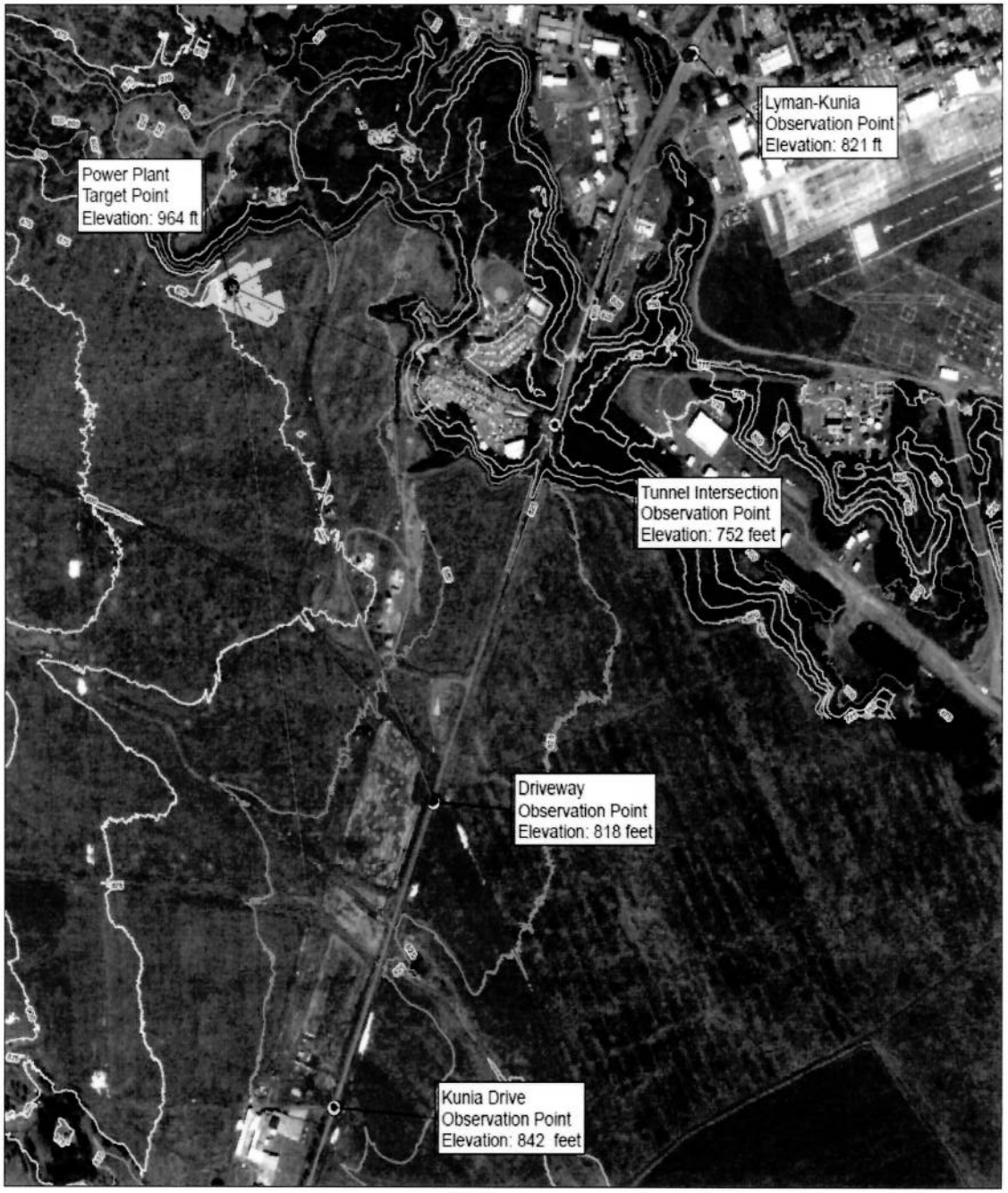


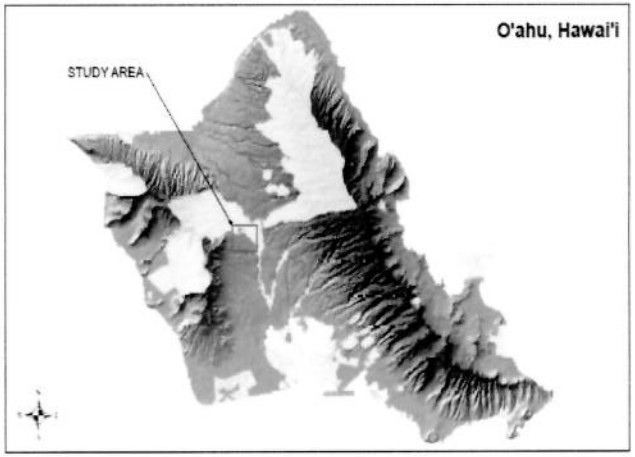
AREA OF POTENTIAL EFFECT FOR
VISUAL IMPACTS TO THE HISTORIC RESOURCES
AT SCHOFIELD BARRACKS AND
WHEELER ARMY AIRFIELD

ENCL 1

ENC 3

Figure 2. Area of Potential Effect for Schofield Generating Station, including transmission corridor improvements.





Schofield Power Plant

Line of Sight Analysis

LEGEND

- Target Location
- Observer Location
- Obstruction Point
- Not Visible
- Visible
- Power Plant

Contour Lines

- 700 feet
- 750 feet
- 800 feet
- 850 feet
- 900 feet

N

0 500 1,000 2,000 Feet

US Army Corps of Engineers
Honolulu District

NOAA 2013 LIDAR Oahu Collection Source of elevation data from MSL
Coordinate System: NAD 1983 HARN StatePlane Hawaii 3 FIPS 5103 Feet
Projection: Transverse Mercator
Horizontal Datum: North American 1983 HARN

ENC 4

Schofield Power Plant Methodology

1) Coordinate System

The Line of Sight analysis and the associated data were created using ArcGIS's ArcCatalog and ArcMap software. A new file based geodatabase was created in ArcCatalog. The Coordinate System used is NAD 1983 HARN StatePlane Hawaii 3 FIPS 5103, in feet. Projection is the Transverse Mercator, and the Horizontal Datum is the North American 1983 HARN. No Z-factor was used.

2) Terrain to TIN

A feature dataset was created in the new geodatabase. The study area boundary feature was imported into the feature dataset. The boundary feature was used as a hard clip surface feature to limit the area that contained the LiDAR data. The LiDAR data (LAS files) were converted into multipoints, a collection of points that can be used to store a collection of point-based information, using 3DAnalyst tool in ArcCatalog. Multipoints for bare earth and first returns were converted from the same LAS files. For the bare earth terrain, class code 2 was the only one used in the conversion of multipoints. For the first returns, class codes 1, 4,5,6 were used (See Figure 1). A bare earth and first return terrain were produced using the boundary feature and the multipoints.

ASPRS Standard LiDAR Point Classes

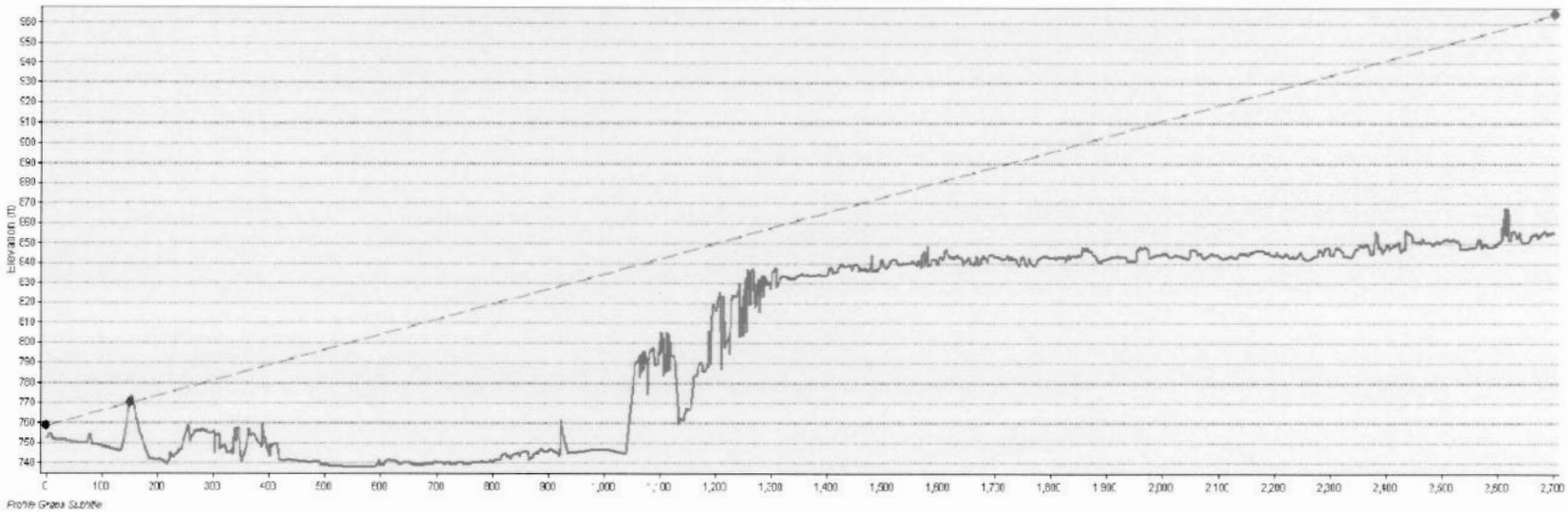
Classification Value	Meaning
0	Created, never classified
1	Unclassified
2	Ground
3	Low Vegetation
4	Medium Vegetation
5	High Vegetation
6	Building
7	Low Points (noise)
8	Model Key-Points (mass points)
9	Water
10	Reserved for ASPRS Definition
11	Reserved for ASPRS Definition
12	Overlap Points
13-31	Reserved fro ASPRS Definition

Figure 1. ASPRS Standard LiDAR Point Class Codes (ESRI Support)

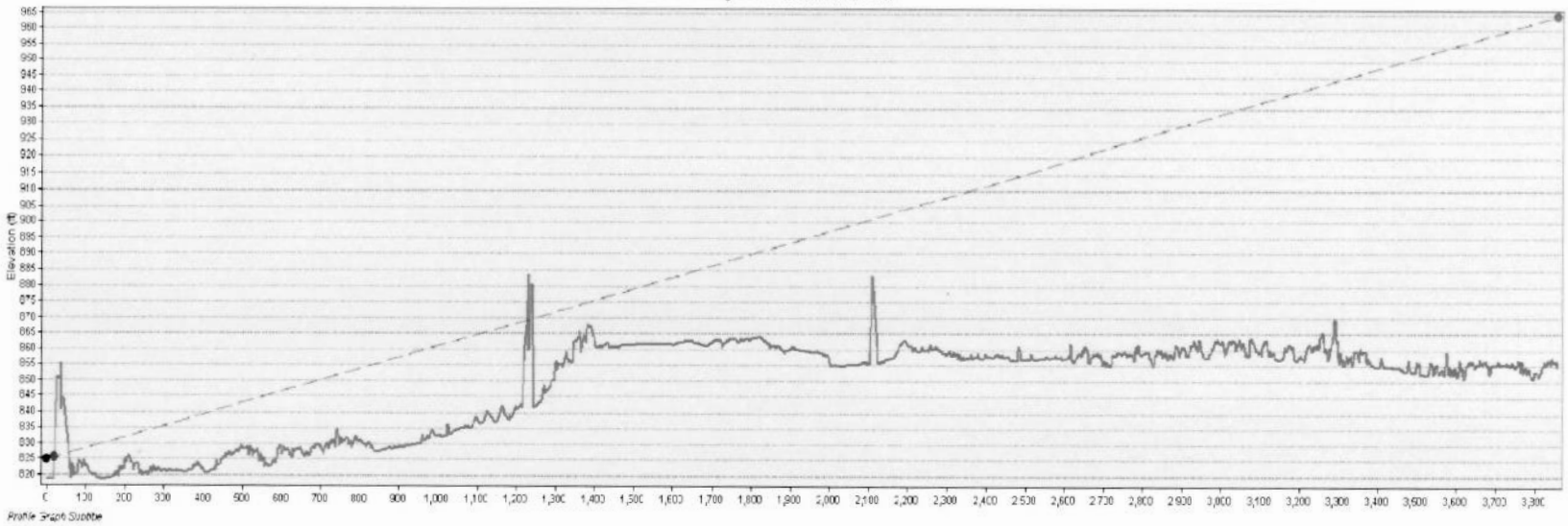
In order to do a Line of Sight analysis, the first return terrain was converted into a triangulated irregular network (TIN) using the 3DAnalyst tool. The TIN was created by triangulating the terrain's surface using nodes.

Lyman-Kunia Observation Point Profile

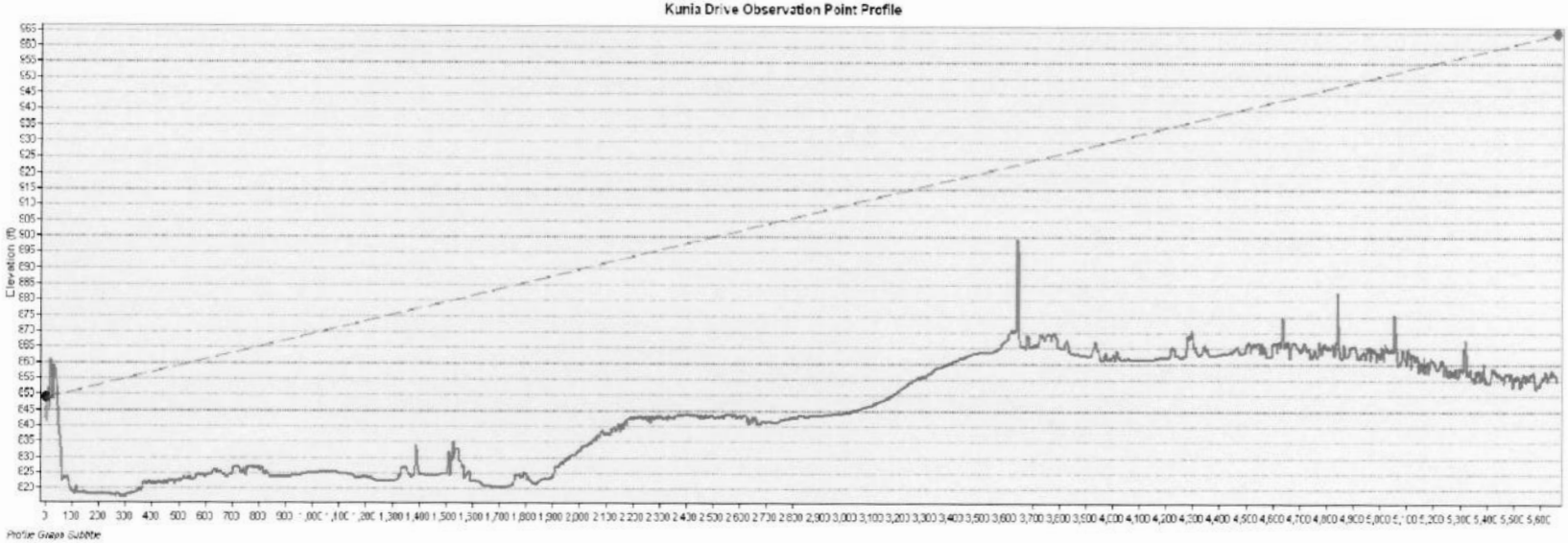
Tunnel Intersection Observation Point Profile



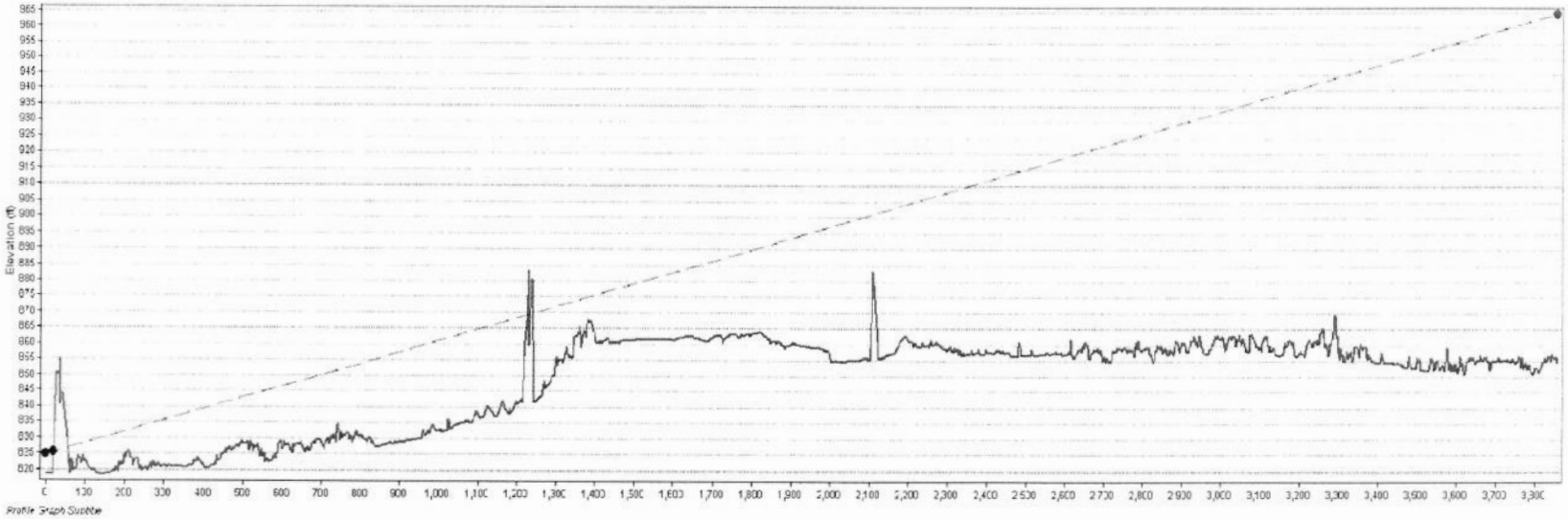
Driveway Observation Point Profile



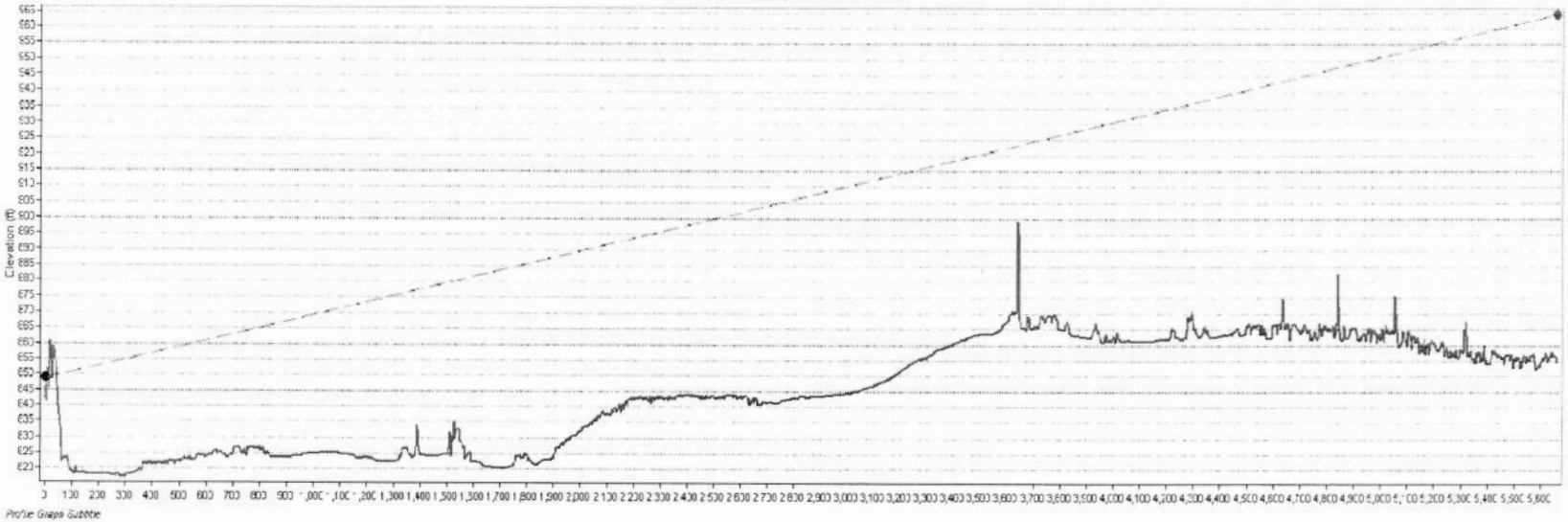
Kunia Drive Observation Point Profile



Driveway Observation Point Profile



Kunia Drive Observation Point Profile



DRAFT—Archaeological Inventory Survey for Schofield Generating Station Project, Waiʻanae Uka, Honouliuli, and Waikele Ahupuaʻa in Wahiawā and ʻEwa Districts, Oʻahu Island, Hawaiʻi

TMKs (1) 7-7-001:001, 9-2-005:026, and 9-4-012:003

Prepared For:

Tetra Tech Inc.
10306 Eaton Place, Ste. 340
Fairfax, VA 22030

TETRA TECH, INC.

Prepared By:

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Jolie Liston, PhD
and
Michael Desilets, MA, RPA

Garcia and Associates
146 Hekili St., Suite 101
Kailua, Hawaiʻi 96734

GANDA Report No. 2268-1

GANDA

June 2014

MANAGEMENT SUMMARY

At the request of Tetra Tech, Inc., Garcia and Associates conducted an archaeological inventory survey (AIS) in support of a joint Federal/State Environmental Impact Statement (EIS) for the Schofield Generating Station Project in the western portion of O‘ahu’s central plateau. The AIS included excavation of eight test trenches in a 8.1-acre generating station parcel and 13 test pits along a 3.7-kilometer transmission corridor. Test trenches and test pits produced no evidence of traditional Hawaiian or early historic cultural deposition.

AIS data indicate that the Schofield Generating Station Project is very unlikely to affect archaeological sites. Test excavation results confirm that the Area of Potential Effect (APE) has a very low probability for containing archaeological deposits. Extensive land modifications associated with a century of commercial cultivation, ranching, U.S. military activity, and urbanization has likely destroyed most of the tangible evidence of the traditional Hawaiian and early historic past in this area.

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1.0 INTRODUCTION

At the request of Tetra Tech, Inc., Garcia and Associates conducted an archaeological inventory survey (AIS) in support of a joint Federal/State Environmental Impact Statement (EIS) for the Schofield Generating Station Project. The Schofield Generating Station Project is in the western portion of Oʻahu's central plateau and includes portions of Waiʻanae Uka Ahupuaʻa in Waiʻanae District and Waikele and Honouliuli Ahupuaʻa in ʻEwa District (TMKs (1) 7-7-001:001, 9-2-005:026, and 9-4-012:003) (Figure 1). The primary objective of the AIS was to identify and document pre-Contact and post-Contact properties within the project's Area of Potential Effect (APE) using a sampling strategy proportionate to the archaeological sensitivity of the area.

1.1 Proposed Action

The Schofield Generating Station Project, a project of the U.S. Army's Energy Initiatives Task Force is being undertaken in furtherance of the state of Hawaiʻi's and the Army's renewable energy goals and to enhance energy security for Army installations as well as the island of Oʻahu. U.S. Army Garrison-Hawaii proposes to lease Hawaiian Electric Company a 8.1-acre parcel on Schofield Barracks Military Reservation's (SBMR) Kunia Maneuver Training Area (KMTA) to construct a 50-megawatt biofuel-capable power generation plant (Figure 2).

To connect the generating station to the existing Hawaiian Electric Company grid at Wheeler Army Airfield (WAAF) and Wahiawā substations, U.S. Army Garrison-Hawaii and the State of Hawaiʻi will provide Hawaiian Electric Company a 3.7-kilometer interconnection easement for a 46-kilovolt aboveground transmission line. The transmission line will extend from the east side of the new power plant, across Waiʻeli Gulch, and onto the southwest corner of Schofield Barracks' cantonment. The line will then continue along the southwestern extremity of the cantonment, and cross Duck Road, Lyman Road, and Lyman Gate following the Schofield Barracks-Kunia Road fenceline. It will then cross Kunia Road and enter WAAF between Waiʻanae Avenue and Eastman Road. At the U.S. Army's Wheeler Substation, the line will split with one line running northwest onto the Schofield Barracks cantonment (terminating at Ralston Field) and the other running east along Wilikina Drive. The Wilikina line will extend over the south fork of Wahiawā Reservoir (Lake Wilson) and terminate at Hawaiian Electric Company's Wahiawā Substation.

A series of 47 electrical poles will support the transmission line. The poles will be 60 to 80 feet high and 24 inches in diameter. Of the 47 poles, 36 will be newly installed, 7 will be replacements for existing poles, and 4 will be existing poles (Figure 2).

1.2 Regulatory Authority

Evaluation of impacts to cultural and historic resources for the Schofield Generating Station Project is required by the U.S. Army's implementing regulations (Title 32 of the *Code of Federal Regulations* [CFR] Part 651, *Environmental Analysis of Army Actions*) of the National Environmental Policy Act (NEPA) [Title 42 of *United States Code* (U.S.C.) Sections 4321 to 4370 (f)], NEPA regulations (40 CFR Parts 1500-1508), and the Hawaiʻi Environmental Policy Act (HEPA) as codified in Hawaiʻi Revised Statues Chapter 343, *Environmental Impact Statements*.

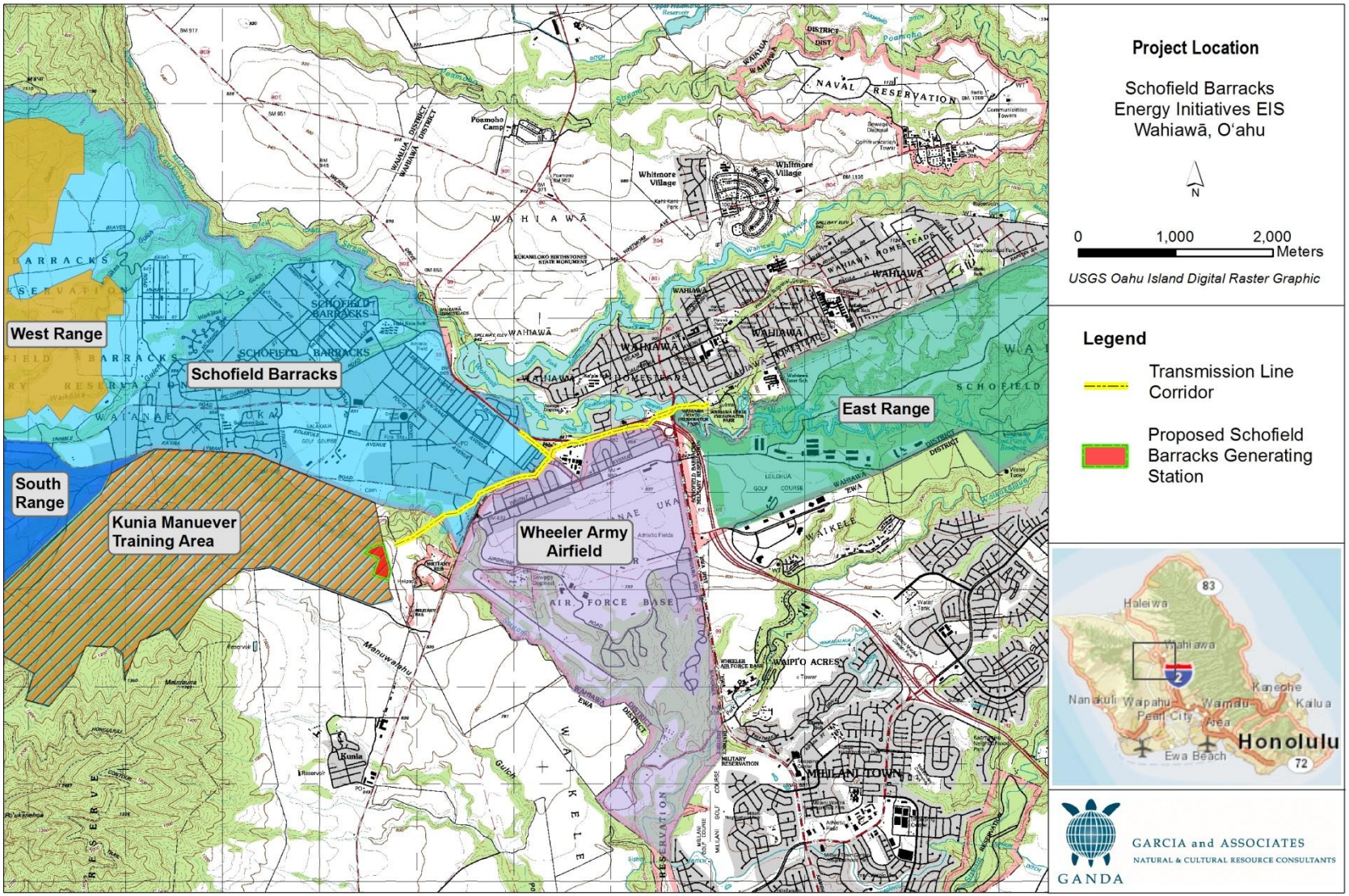

Figure 1. Location of the Schofield Generating Station Project.

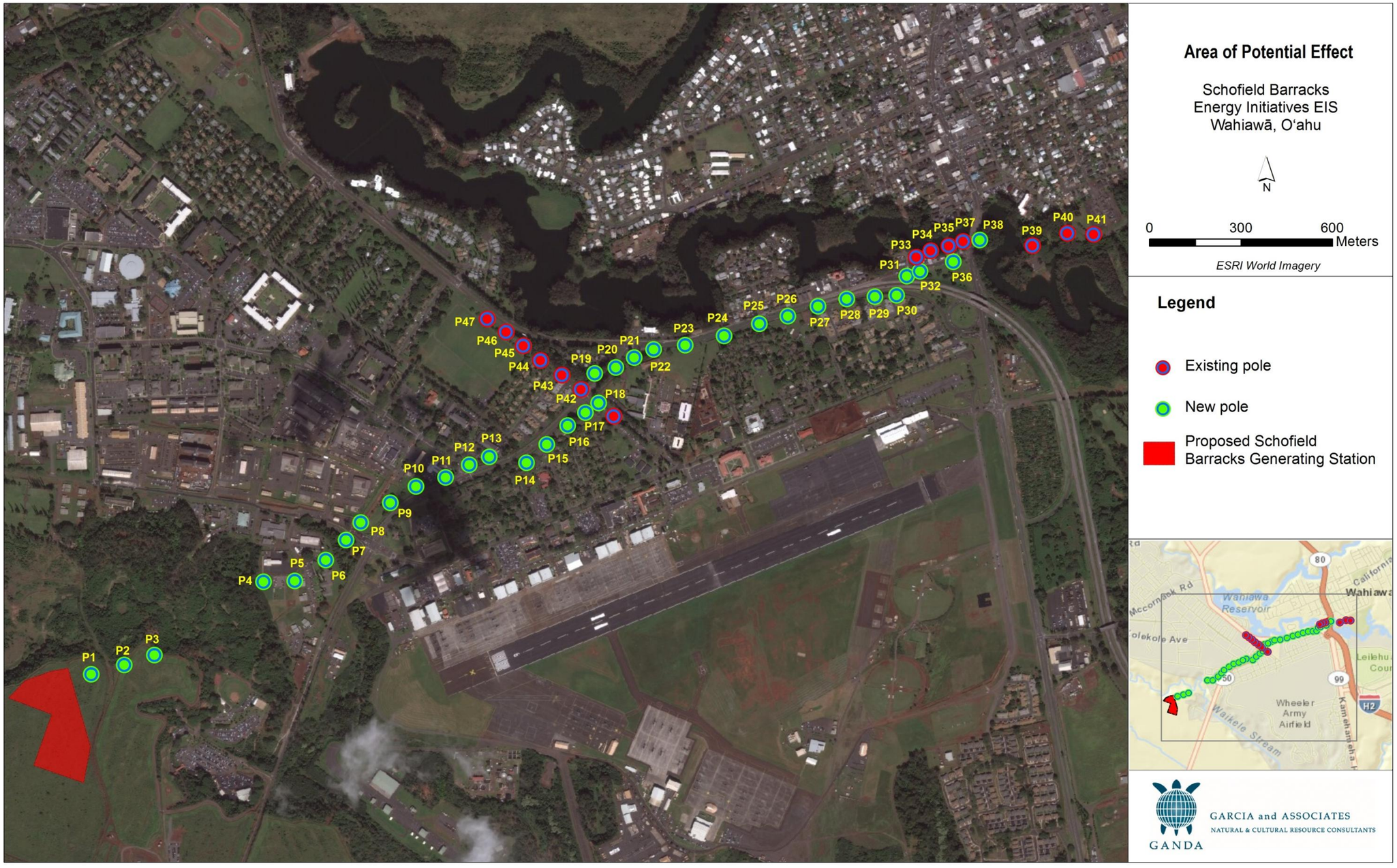

Figure 2. Area of Potential Effect for Schofield Generating Station, including transmission corridor improvements.

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Under NEPA and HEPA regulations, an EIS must consider the effects of the proposed action on the *human environment*, which 40 CFR 1508.14 defines as "the natural and physical environment and the relationship of people with that environment." The human environment, therefore, includes important scientific, archaeological, and other tangible and intangible cultural resources, including historic properties listed or eligible for the National Register of Historic Places (NRHP) and sacred sites (Executive Order 13007).

Under the contractual and organizational arrangements negotiated for this project, Tetra Tech, Inc. and Garcia and Associates are responsible for the cultural resources component of the EIS, and U.S. Army Garrison-Hawaii is responsible for compliance with Section 106 of the National Historic Preservation Act (NHPA). This AIS is, however, designed to assist U.S. Army Garrison-Hawaii in their Section 106 consultation and to provide data suitable for both NEPA/HEPA and NHPA compliance.

1.3 Area of Potential Effect

The APE for the Schofield Generating Station Project falls largely within SBMR property, but also extends onto properties owned or leased by the State of Hawai'i's Departments of Agriculture, Transportation, and Land and Natural Resources. As stated above, the generating station will be sited on a 8.1-acre parcel on the western edge of KMTA in Honouliuli Ahupua'a, and a 3.7-kilometer overhead transmission line will connect the power plant to the Army's WAAF and the Hawaiian Electric Company's Wahiawā substations (Figure 1).

The project's APE includes the generating station's footprint as well as all locations at which new power poles will be installed. Although the APE for direct effects of generating station construction is technically limited to the construction footprint, this AIS evaluates the entire 8.1-acre parcel for archaeological sites to account for potential design changes. New pole installation will involve excavating boreholes sufficiently wide to support 24-inch-diameter power pole bases. The boreholes will extend 2.75 meters (9 feet) beneath the surface. As mentioned previously, there will be 36 new poles installed at the locations shown in Figure 2. These 36 pole locations, in addition to the generating station footprint, constitute the APE for direct effects of the project. Installation of replacement poles will utilize the holes remaining from the removal of old poles and will not involve new ground disturbance.

To keep construction impacts to a minimum, there will be no vegetation grubbing during new pole installation or during periodic line maintenance. No roads will be constructed through the gully to access pole installation locales. Indirect effects are therefore not anticipated for new pole installation or maintenance.

With respect to U.S. Army Garrison-Hawaii's NHPA consultation, it should be noted that the project's Section 106 APE also includes the viewshed within which the new poles and lines are visible. Evaluation of the visual effects of new poles and lines on historic properties and historic districts is being undertaken by U.S. Army Garrison-Hawaii concurrent with this AIS.

1.4 Personnel and Schedule

Archaeological fieldwork was conducted over a 4-day period between 18 February and 4 March 2014. Jolie Liston, PhD, served as the project's Principal Investigator, and Amanda Sims,

BA, conducted the field investigations. Dr. Liston meets the Secretary of the Interior's Professional Qualifications Standards for Archaeology (36 CFR Part 61) as well as the professional qualifications outlined in Hawai‘i Administrative Rules Section 13-281-3. She is permitted to conduct archaeological investigations in Hawai‘i under State Historic Preservation Division Permit No. 14-12.

2.0 ENVIRONMENTAL, HISTORICAL, AND ARCHAEOLOGICAL CONTEXT

This section presents the environmental, ethnohistorical, and archaeological context of the project area. Anticipated archaeological findings based on a critical assessment of the archival research are presented. A more detailed description of the historic context of O'ahu's central plateau is found in Desilets et al. (2011), Tomonari-Tuggle (1997), and Tomonari-Tuggle and Bouthillier (1994).

The contextual research focuses on the lowlands of Oʻahu's central plateau in Waiʻanae Uka Ahupuaʻa in the Waiʻanae District, and Waikele and Honouliuli Ahupuaʻa in the ʻEwa District where the project is located. However, the traditional history of the upland region of the central plateau and the surrounding plains are included to provide a more thorough context.

2.1 Environment

The APE is on the fairly level central plateau of Oʻahu Island within the broad saddle between the Koʻolau and Waiʻanae mountain ranges. The project area ranges in elevation from approximately 160 to 268 meters (525 to 880 feet) above mean sea level.

Annual rainfall averages 96 centimeters (Giambelluca et al. 2013), with temperatures ranging from 59 to 87 degrees Fahrenheit (Armstrong 1983:56). Significant annual rainfall along the upper elevations of the Waiʻanae Range exceeding 250 centimeters contributes to the tributaries descending the steep, amphitheater-headed slopes of the mountains to form meandering and incised valleys within the lower plateau lands. Although represented on the U.S. Geological Survey (USGS) quadrangle maps as permanent watercourses, these streams flow intermittently in response to heavy rains.

The gulch formed by Waiʻeli Stream separates KMTA, on the south, from Schofield Barracks cantonment to the north. This seasonal stream flows southeast to join with Waikakalaua Stream at WAAF's southern border and become Waikele Stream. Construction of WAAF altered the stream course east and downstream of the project area (Tomonari-Tuggle and Bouthillier 1994:9). Waikele continues on to Oʻahu's south coast to empty into Pearl Harbor's western embayment (the West Loch).

Kaukonahua Stream roughly bounds Schofield Barracks cantonment's northeast edge before flowing northward to drain into the ocean at Waialua. In about 1905, a dam was constructed across the convergence of the north and south forks of the Kaukonahua Stream to supply irrigation water to the surrounding cultivated fields. This resulted in the formation of Lake Wilson (Wahiawā Reservoir), Oʻahu's largest freshwater impoundment. At the east end of the APE, along the south fork of Lake Wilson and Kaukonahua Stream, is the Department of Land and Natural Resources-managed Wahiawā State Freshwater Park.

The project area contains the following major soil series: Wahiawa silty clay (WaA), Manana silty clay (MoB), Helemano silty clay (HLMG), Kunia silty sands (KyA, KyC), and Kawaihapai clay loam (KlB) (Figure 3). The Wahiawa Series is the most prevalent, extending across the APE, with the Manana Series near the middle of the transmission corridor, and the Helemano Series

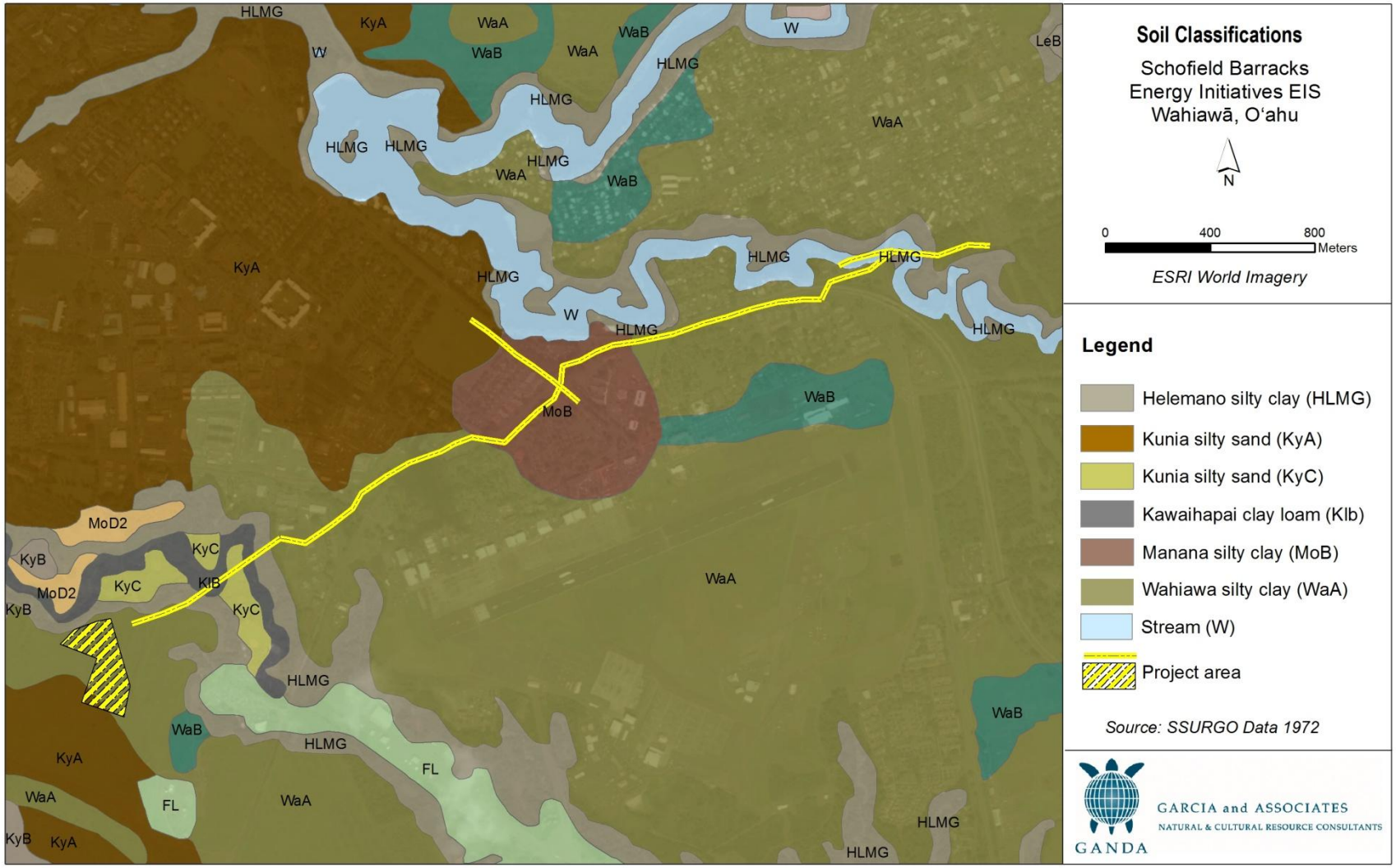

Figure 3. Soil types in the vicinity of the Area of Potential Effect.

found around the streams and gulches. The Kunia Series and Kawaihapai Series are in the western portion of the project area.

All the soils in the APE are well drained and have a fine texture. The Wahiawa silty clays develop in residuum and old alluvium derived from basic igneous rocks and form nearly level to moderately steep soils (Foote et al. 1972). Runoff is slow with very little erosion. The Manana silty clays develop in material weathered from basic igneous rocks. Runoff is medium with a moderate amount of erosion. The Helemano Series is found on alluvial fans and colluvial slopes in gulches. Developing in alluvium and colluvium derived from basic igneous rock, these silty clays are often steep to extremely steep and form extremely eroded areas.

The Kunia Series develops in old gravelly alluvium and tends to develop on upland terraces and fans. Kunia silty sand (KyA) is found on the cantonment's flat lands while Kunia silty sand (KyC) occurs along the banks of Waiʻeli Gulch. The Kawaihapai Series is found at the base of Waiʻeli Gulch.

The plateau lands were likely once covered in native forest, including *koa* (*Acacia koa)* and sandalwood (*Santalum* spp.), and used for bird hunting and collecting wood and other forest products. Because of the highly disturbed and artificially landscaped environment, current vegetation in the APE is largely composed of introduced species.

Historically, KMTA was under pineapple cultivation with its termination only after the recent military acquisition of the land. Regrowth consists of mostly non-native shrubs, grasses, and secondary saplings. The lands on or near the military installations are manicured and landscaped grounds consisting of non-native grasses, trees, and shrubs with a few stands of ti (*Cordyline terminalis*) near residential houses. The right-of-way along the major thoroughfares is manicured lawn while the Wahiawā State Freshwater Park is wooded in both native and introduced species.

2.2 Traditional History

Traditional history, along with archaeological evidence, indicates that Oʻahu's central plateau is politically and spiritually important. The ancient lands of Līhuʻe—south of Schofield Barracks on the eastern slopes of the Waiʻanae Range—and portions of Wahiawā overlap in the lower reaches of the central plateau to encompass the entire APE.

The Chant for Kapawa exemplifies the connectedness of the various central plateau regions and sites:[1]

ʻO Kapawa, ʻo ke aliʻi o Waiʻalua	Kapawa, the chief of Waiʻalua,
I hanau i Kūkaniloko	Was born at Kūkaniloko;
ʻO Wahiawā ke kahua	Wahiawā the foundation;
ʻO Līhuʻe ke ewe	At Līhuʻe the placenta, (taken away)

[1] Chant and translation provided by the historian of the Wahiawā Hawaiian Civic Club, August 2009 (Desilets et al. 2011:40).

ʻO Kaʻala ka piko	At Kaʻala the navel cord, (buried)
ʻO Kapukapuakea ka aʻa	At Kapukapuakea (Heiau) the caul,
ʻO Kaiaka i Maeaea	(Heiau) of Kaiaka at Maeaea;
Haʻulei i Nukea i Wainakia	He died at Nukea at Wainakia
IʻAʻaka i Haleu	Through (the surf of) ʻAʻaka at Haleu,
I ka laʻi malino o Hauola	Through the calm stillness of Hauola,
Ke liʻi ʻo Kapawa hoʻi no	The chief Kapawa was taken,
Hoʻi no i uka ka waihona	Returning the organs to the uplands of Iʻao
Hoʻi no i ka pali kapu o na liʻi	Taken to the sacred pali of the chiefs,
He kiaʻi Kalahiki no Kakaʻe	Kalahiki is the "Watchman" of Kakaʻe,
ʻO Heleipawa ke keiki a Kapawa	Heleipawa was the son of Kapawa,
He keiki aliʻi no Waiʻalua i Oʻahu	A chiefly child of Waiʻalua, Oʻahu

Līhuʻe is most often referred to as the "uplands," although that could mean the whole central plateau, which, relative to coastal areas, is upland. In its literal translation, *Līhuʻe* means "cold chill" (Pukui et al. 1974:132), a quality often referred to in the traditional literature of Līhuʻe, Kalena, and Haleʻauʻau. Although not evidence of a strictly upland, mountainous boundary, it does point to a tendency in the literature to focus on the higher elevation upland portion of the Līhuʻe lands.

Honouliuli Ahupuaʻa, whose northern tip will support the proposed Schofield Generating Station, is Oʻahu's largest *ahupuaʻa*, encompassing most of the western half of the ʻEwa District. *Honouliuli* means "dark bay" (Pukui et al. 1974:51), apparently named after the West Loch bordering what is now Pearl Harbor. Honouliuli is known as the first place where human beings landed on Oʻahu (Beckwith 1970:343) and a place where *ʻulu* (breadfruit; *Artocarpus altilis*) was first introduced to Hawaiʻi (Burgett and Rosendahl 1992: Appendix E).

The proposed generating station and the west end of the transmission line are in two historically referenced *ʻili*[2], Paupauwela in Honouliuli Ahupuaʻa and Pouhala in Waikele Ahupuaʻa (Figure 4). Paupauwela is also written as *Popouwela* or *Poupowela* (Sterling and Summers 1978; ʻĪʻī 1959:97). *Pouhala ʻIli*, translated as "pandanus post," (Pukui et al. 1974:190), is also a named place in southern Waikele next to "an important fishpond" and *loʻi* or *kalo* patches called Kapalaha (Sterling and Summers 1978:29). The upland *ʻili* is referenced as "Pouhala Uka" in late 19th century land documents (Tomonari-Tuggle and Bouthillier 1994:20).

Waikele, translated as "muddy water," also refers to a stream formed by the convergence of Waiʻeli Stream north of the generating station and Waikakalaua Stream to the southeast. Waiʻeli Stream is sometimes written as *Waikele Stream* on more recent USGS maps and as Waieli, meaning "dug water" (Pukui et al. 1974:221), on a late 19th century Oʻahu Island map (Hawaiian Government Survey 1881).

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[2] An *ʻili* is a traditional land unit that is within the larger *ahupuaʻa*.

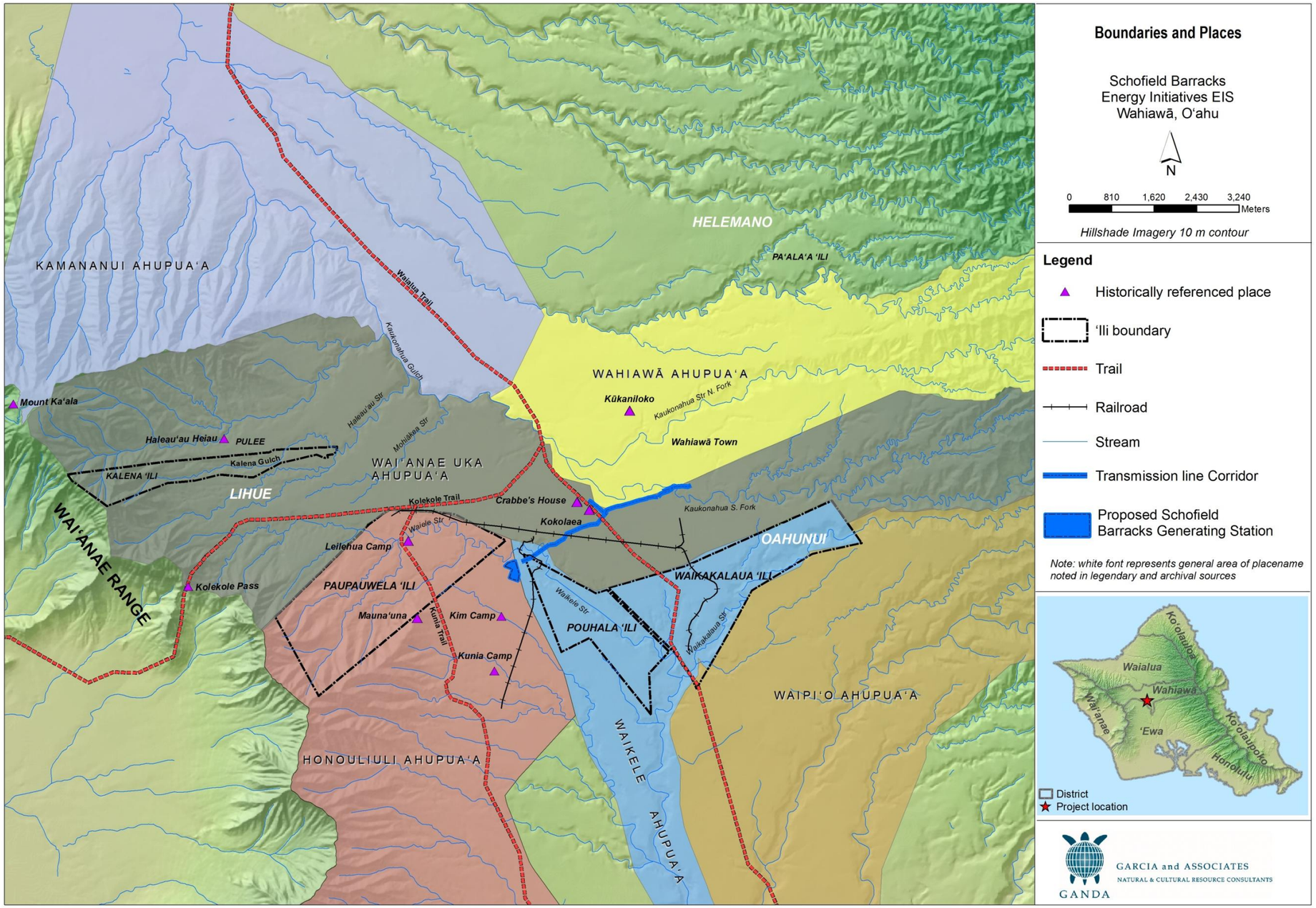

Figure 4. Traditional and historic boundaries and place names near the Schofield Generating Station Project.

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The majority of the transmission line is in the lower elevations of Waiʻanae Uka Ahupuaʻa. The names and borders of any smaller traditional divisions once in this area are unknown. One of Oʻahu's largest *ahupuaʻa*, Waiʻanae Uka Ahupuaʻa, is landlocked and extends from the tablelands across the crests of the Waiʻanae and Koʻolau mountain ranges. Hawaiian deities guarded the boundary between Waiʻanae Uka and the *ahupuaʻa* to the west (Lualualei and Waiʻanae Uka). Mount Kaʻala is the home of the kind goddess Kaiona who harmed no one. The mountain goddess Kolekole protected the mountain pass (Sterling and Summers 1978:133–135). A likely ancient pass through the saddle is afforded at Kolekole (ʻĪʻī 1959:99), by Mount Kaʻala, the highest point on the island.

2.2.1 Settlement

Traditionally, Honouliuli Ahupuaʻa contained a large permanent settlement around what is now the West Loch, scattered fishing encampments elsewhere on the coast, and small permanent settlements and associated agricultural plots (Tuggle 1995:100). Initial settlement on the eastern slopes of the Waiʻanae Mountains and the central plains was likely mainly temporary and might have been related to the collection of forest and inland resources.

Permanent Hawaiian settlement of Waiʻanae Uka might have started as early as AD 1250, as populations expanded into central Oʻahu (Roberts et al. 2004:6). Two charcoal samples derived from pondfield contexts in an irrigated agricultural complex (State Inventory of Historic Places [SIHP] No. 5394) in upland Līhuʻe produced calibrated date ranges of AD 1120–1430 and AD 1280–1420 (Carson and Yeomans 2000:18). A similar calibrated date range of AD 1290–1470 was returned from agricultural deposits at nearby SIHP No. 5392 (Robins and Spear 2002a: Appendix C-2).

These dates suggest that by about the 13th century, irrigated pondfields were developed along Waiʻeli Stream (and in other similar stream valleys) (Robins and Spear 1997b:7). Although a variety of ceremonial, habitation, burial, and agricultural sites have been identified in the uplands west of the APE, the distribution of sites suggest that intensive agriculture in the stream valleys was a focus of Hawaiian activity. Despite the lack of direct archaeological evidence resulting from extensive historic land disturbances, traditional Hawaiian land use in the neighboring tablelands of Honouliuli, Waiʻanae Uka, and Waikele are presumed to have followed the same pattern of cultivation and associated permanent habitation.

Handy et al. (1972:465) refer to a famous traditional place named Kukui-o-Lono, where the high chief Kūkaniloko is said to have made the first *loʻi*. Kukui-o-Lono might correspond to one of the cultivated watersheds in western Waiʻanae Uka (such as Kalena, Mohiākea, or Haleʻauʻau Streams) because the location is described as "above and west" of the present Wahiawā Town.

Another traditional place name near the APE is Kokoloea, the location of a benchmark in the late 1800s Crown Lands surveys and a USGS benchmark (271 meters, or 888 feet, above sea level) (Figure 4). Located on the south side of what is now Lake Wilson, near Wilikina Drive, the 1876 Boundary Commission testimonies describe an ancient *ʻulu maika* field or *kahua maika* named Kapalauauai (ʻĪʻī 1959:99) as being at Kokoloea (Figure 5). Kokoloea was the name of a chief of the *Lo* class and the site of the "old Dowsett ranch house" (Tomonari-Tuggle 1997:13).

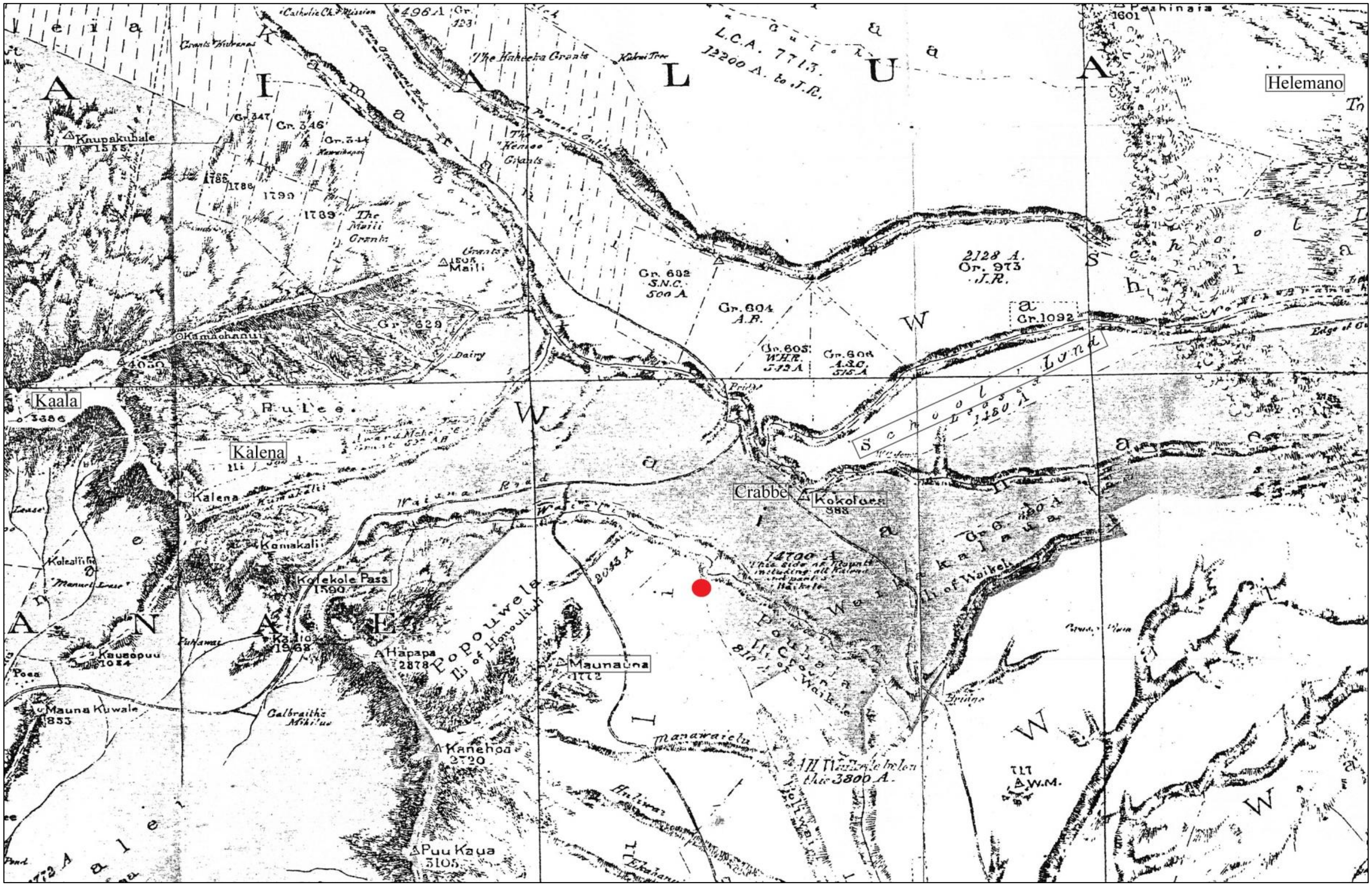

Figure 5. Enlarged detail of an 1881 Oʻahu Island map with proposed Schofield Generating Station marked in red and boxes around place names mentioned in text (Hawaiian Government Survey, W.D. Alexander – General Surveyor).

Traditional access to the settlement areas in central Oʻahu was provided by the three main travel routes recorded by mid-18th century Hawaiian scholar John Papa ʻĪʻī (1959) (Figure 4). One of the routes (Kolekole Trail) passed through western Waiʻanae Uka across the Waiʻanae Mountains at Kolekole Pass. The other two trails extended in northerly directions from the south coast of the island to Waialua (Waialua Trail) and Waiʻanae Uka (Kunia Trail). On its way to Kūkaniloko, Waialua Trail passes under the transmission line just west of the intersection of Kunia Road and Wilikina Drive. The following extended excerpt explains the trail system, and references a number of important cultural sites and place names. Some of the place names are found in the 1881 Hawaiian Government (Figure 5) and 1902 Hawaiʻi Territory Survey (Figure 6) maps.

> They went down to the water and up, going above the group of taro patches of Waiau, to the stream of Kukehi, up to the two maika fields, Puehulunui and Haupuu. Puehulu lies at the crossroads, where one [trail] leads to Waialua and the other branches off to Honouliuli, and to Waianae. . . . There were three roads there at Puuokapolei, Pohakea, and **Kolekole**, from Kunia, the plain of Keahumoa, up to **Maunauna** and by Paupauwela where they join with the road from **Wahiawā** and the one from Waialua**,** on the west side of Mahu to Malamanui, to which spot one can look down from **Kolekole**, to Pokiʻi and Waianae-uka. There was a long cliff road, Eloui, from **Kalena** and **Haleʻauʻau**, on the east side of **Kaʻala**, coming down here to Waianae. There was also a trail going up and then down Makaha-uka, called Kumaipo. Below that trail was a fortress in the olden days, named Kawiwi. At the time of battle a boy was set as a guard every night [with no food--which led to turning over to rebels] . . . From the stream of Anahulu and from Kamani, above the homes, and taro patches a trail lies in front of Kuokoa's houselot and the church, which goes on to meet the creeks of Opaeula and **Halemano**, the sources of the stream of **Paalaa**, on down to the stream of Pooamoho, and go to the crossroad which branches from Mokuleia to Kamananui and Kewaaihe, The kukui grove of Kahewahewa lies below the trail to **Kūkaniloko** where visitors gathered. It goes to the stream of Paka, and the maika playing field of Kapalauauai which lies above the pond belonging to the village. There the trail meets with the one from **Kolekole** and goes on to the stream of Waikakalaua, Piliamoo, the plain of Punaluu to a rise, then down to Kïpapa to Kehaulele, A trail runs off from this long trail to Kalakoa, **Oahunui** and other places much visited, like **Kūkaniloko**, and from there to the digging place of Kahalo. [ʻĪʻī 1959:99; emphasis added]

2.2.2 The Lō Aliʻi and Kūkaniloko

Oʻahu's central plateau has long been an important Hawaiian religious center with the establishment of an *aliʻi* birthplace at Kūkaniloko, *heiau*, such as Haleʻauʻau and Kalena Heiau in western Waiʻanae Uka, and the Maunauna site in Waikele Ahupuaʻa east of the project parcel (Figure 4). The *lō aliʻi*, in conjunction with Kūkaniloko, are central to the traditional Hawaiian lore of the Līhuʻe-Wahiawā region of the central plateau and its mountainous periphery. The *lō aliʻi* were a specific class of *aliʻi* tied by birth and practice of strict *kapu* to the Līhuʻe-Wahiawā-Helemano region of Oʻahu's central plateau. A description of the *lō aliʻi* class is provided by Kamakau (1964):

> The chiefs of Līhuʻe, Wahiawā, and Halemano on Oʻahu were called *lō aliʻi*. Because the chiefs at these places lived there continually and guarded their

Figure 6. Enlarged detail of 1902 O'ahu Island map with proposed Schofield Generating Station marked in red and boxes around place names mentioned in text (Hawai'i Territory Survey, Walter E. Wall – Surveyor).

> *kapu*, they were called *lō ali‘i* [from whom a “guaranteed” chief might be obtained, *loa‘a*]. They were like gods, unseen, resembling men. [Kamakau 1964:40]
>
> 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. The men had kapus, and the women had kapus, and when they joined their kapus and children were born, the children preserved their 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. Kauakahi‘ailani, Ma‘ilikukahi, Kalona, Piliwale, Kukaniloko, Pa‘akakanilea {Pa‘akanilea}, Ka‘akauualani, Ka‘au, Lale, Paoakalani, Pakapakakuaua, Nononui, Kokoloea, and a great many others were *Lo* chiefs. [Kamakau 1964:5][3]

The emergence of the *lō ali‘i* in central O‘ahu probably has its origin in the sacred birthing site of Kūkaniloko, on the Waialua side of Kaukonahua Gulch. Around the 13th and 14th centuries, Kūkaniloko was established by Nanakāoko and his wife Kahihiokalani for the birth of their son, Kapawa. In a chant commemorating Kapawa, Līhu‘e and nearby lands are referenced as metaphors for his birth at Kūkaniloko (Kamakau 1991:136):

> Kapawa, the chief of Wai‘alua
> Was born at Kukaniloko
> Wahiawa the site;
> At Lihue the placenta
> At Ka‘ala the naval cord,
> At Kapukapuakea [heiau] the caul

Kūkaniloko was one of two sacred places in the Hawaiian Islands where *kapu* chiefesses went to give birth (Handy et al. 1972:465; McAllister 1933:134–135; see also Cordy 1996:596; Fornander 1996:20; Kamakau 1991:136). Kūkaniloko can be translated as "an inland area from which great events are heralded" and "to anchor the cry within." According to Kamakau (1991:53), “Chiefs born at Kūkaniloko were the *akua* [gods, spirits] of the land and were *ali‘i kapu* as well.”

The sacred drums of Opuku and Hawea, which announced the birth of an *ali‘i*, were stored in the nearby *heiau* Ho‘olonopahu. By 1933, however, pineapple cultivation had obliterated the *heiau* (McAllister 1933:137). Remnants of the *heiau* are said to be in the gulch to the south of the birth site (D. Au, personal communication), although McAllister (1933:57) places the *heiau* to the north of Kıkaniloko.

During the long period of island-wide rule by Līhu‘e chiefs, and continuing into the succeeding years, birth at Kūkaniloko remained a powerful status symbol. In 1797 Kamehameha arranged to have his son Liholiho born at Kūkaniloko, but the plan was foiled by the sickness of

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[3] An almost identical passage is found in the Appendix of *Kepelino’s Traditions of Hawaii* (Beckwith 2007:196).

Queen Keopuolani. It is notable that even by this date, the site had already "fallen into decay" (Sterling and Summers 1978:140).

Kūkaniloko also served as a *pu'uhonua*, or place of refuge. According to 'Ī'ī (1959:138), ". . . Kūkaniloko in Wahiawa, Oahu; and Holoholoku in Wailua, Kauai, were places to which one who had killed could run swiftly and be saved." Other evidence is present in the story of Lā'ieikawai. Early in this story we learn that, "Now, Kapukaihaoa took Laielohelohe to the uplands of Wahiawa, to the place called Kukaniloko" (Haleole 2006). Kapukaihaoa, a priest, took Laielohelohe to Kūkaniloko because the baby girl would have been killed by her father (or his executioner) if he discovered she had been born.

Another story of the central plateau's traditional importance is set in Helemano, at O'ahunui (east of the project area), said to have been a residence of high chiefs. However, it was abandoned during the reign of the chief, O'ahunui, who was turned to stone when he became a cannibal and ate the two sons of his brother-in-law, Lehuanui (Nakuina 1897:90).

> Lo-Aikanaka is the name given to a family of South Sea chiefs who are driven from the plains of Mokuleia into the hills to a place called Hele-mano, where they are received by the chief Oahu-nui east of that locality and the two chiefs exchange courtesies. Oahu-nui develops a passion for human flesh and finally the two chubby sons of his sister Kilikiliula, wife of Lehua-nui, are sacrificed to his appetite during the absence of their father. Warned by a vision, the father returns, puts to death the chief and his sister, and abandons the place with his men. A curse hangs over the place...None has ever dared to live there since (T. Thrum quoted in Beckwith 1970:342).

Desilets et al. (2011:13) describe the sociopolitical and cultural importance of O'ahu's central plateau:

> Around AD 1300, district (*moku*) level organization appears to have arisen on O'ahu. By about AD 1320 to 1340, the *moku* of 'Ewa, Kona, and Ko'olaupoko were ruled by the sons of Maweke (Cordy 2002:22). 'Ewa, including not only 'Ewa proper, but Wai'anae and Wai'alua as well, was ruled by the Maweke-Kumuhonua line. It is possible that Maweke's grandson, Kumuhonua, ruled the entirety of O'ahu between AD 1340 and 1360 from his seat of power in Līhu'e on the central plateau. Kumuhonua's 'Ewa lands would have included the sacred birthing place Kūkaniloko and it is likely that Līhu'e was the primary ruling center for all of O'ahu. Although most chiefly classes were not regionally based, Līhu'e was exceptional and was home to chiefs with the specific designation of *lō ali'i* during this time. This class of chiefs populated the Central Plateau between the Ko'olau and Wai'anae ranges, including all of what is today referred to as Wai'anae Uka Ahupua'a. The high status of the *lō ali'i* chiefs was likely derived from birthing at Kūkaniloko, interbreeding, and strict *kapu* observance.

2.2.3 Warfare

Paupauwela, Kalena, Pulee, and Malamanui were noted battlefields between the island chief Kuali'i and rival island chiefs from the 'Ewa and Waialua districts (Fornander 1996:280–281).

Fornander (1996:393) provides a translation of *Ka inoa o Kualiʻi* or Chant of Kualiʻi recounting the famous battle at Kalena:

> Where, where was the field
> [on which] the warriors fought?
> Lo! The field is at Kalena;
> Scattered about, overflowing
> Poured out is the godly fluid

At Maunaʻuna, the Waiʻanae chief Kuiaia avoided a battle with Kualiʻi, as well as impending slaughter, by heeding a warning from his advisor and performing a chant to the god Kū:

> Mauna-una…Kuiaia, the chief of Wai-anae, came with his forces to meet Kualii on the battleground here mentioned. His kahu, forewarned, told him when coming to battle he should find a knotted ti leaf on the road he would know he was in danger and surrounded by an ambush which would cut off his whole force. On finding this knotted ti leaf, he began and chanted this mele from the beginning to end, to the honor of Ku. All on both sides laid down in reverence. Ku gave the signal of reconciliation, and the slaughter was averted. [Fornander 1969, cited in Sterling and Summers 1978:38]

According to the Legend of Kualiʻi (Beckwith 1970:395), it was after the battles in Malamanui, Pulee, and Paupauwela that Kualiʻi "subdues the whole island" and reestablishes paramount rule between around AD 1720 and 1740 (Cordy 2002:32). Beckwith (1970:396–398) suggests the Kualiʻi tradition might represent a political movement led in the name of Kū, rather than signifying the efforts of a single chief.

The chiefly residents of Līhuʻe were recognized for their skills in spear throwing and were known as excellent teachers of the skill (Kamakau 1991:50). *Lua*, a battle method of dislocating joints of opponents, was also practiced on unsuspecting travelers crossing over the western boundary of Waiʻanae Uka at Kolekole Pass (Sterling and Summers 1978:134–135), as well as on the "plains of Leilehua" (Stokes n.d., cited in Sterling and Summers 1978:135), an historic reference to Western Waiʻanae Uka.

2.3 Post-Contact History

2.3.1 Initial Impacts

By western contact, when history started being recorded, the central Oʻahu plateau was dotted with villages. The location of schools provides insight into the size of central plateau settlements soon after contact.

> Kamakau (1992:424) writes that during the reign of Kamehameha III (1825-1854), "schools were built in the mountains and in the crowded settlements...At Kahalepoʻai, Hauone, Kalakoa, Wahiawa, Halemano, and Kanewai, there were large villages with teachers and schoolhouses; so at Lihuʻe, Kalena, Maunauna, Kake, and Puʻukuʻu." This probably occurred sometime after 1840 when a law establishing government schools was passed. This law required "that a school should be maintained in every community where there were fifteen or more children of suitable age" (Kuykendall 1968:347). Given that rural areas throughout the islands were

> being abandoned in the early 1800s as a result of factors such as population collapse or out-migration to Honolulu, the fact that these settlements could support government schools at mid-century suggests that they had been of substantial size and/or stability at contact. [Tomonari-Tuggle 1997:15]

School land, leased to W.C. Jones, is shown in the 1881 O‘ahu map drafted as part of the Hawaiian Government Survey by W.D. Alexander, General Surveyor, in the area of what would become Wahiawā Town, north of the project area (Figure 5). The map also displays much of the plateau as undeveloped and devoid of forest land.

Like elsewhere in the Hawaiian Islands, the native population of central O‘ahu experienced a major decline due to the spread of foreign diseases and movement away from remote localities to the shipping ports and business centers, such as Honolulu. Reverend Artemis Bishop recounts the quick and devastating effects of a measles epidemic he observed in 1848–1849 on the Wai‘anae and ‘Ewa residents:

> The past has been a year of trials and sorrows among my people in passing through scenes of sickness and death, beyond what I had ever witnessed…how strikingly their former athletic frames and warlike habits contrast with their enfeebled and effeminate corpses.
>
> Middle of October the measles broke out like wildfire…burning the dead was the great work, all other occupations were suspended and people staggered about like walking corpses. [Bishop 1849 and 1851: Mission letters]

Not long after western contact (ca. 1815–1826), ‘*iliahi* or sandalwood was extensively harvested from the Hawaiian Islands, resulting in the decimation of much of the native forests, particularly in the lower, more accessible elevations. Central O‘ahu was undoubtedly affected by the over-harvesting of sandalwood because Wahiawā was famous for its large sandalwood trees (Kamakau 1992:251–252). In pursuit of the riches gained in the sandalwood trade, chiefs ordered the *maka‘āinana* (commoners) to devote all their time to cutting sandalwood. As a consequence, subsistence practices were abandoned, such as farming and fishing, and famine was experienced throughout the islands (McGrath et al. 1973:18). Foreign contact also led to the over-harvesting of other forest trees used as fuel on whaling ships to render whale blubber into oil (Cuddihy and Stone 1990:38).

The establishment of Christian mission stations in Waialua, Wai‘anae, and ‘Ewa resulted in transportation route improvements for easier travel between settlements. In 1837 Reverend Emerson reported improvements to the Kolekole Trail:

> During the year past, a number of patches of road have been made, which considerably facilitate our access to some remote parts of the station and to Waianae. The pali between Waialua and Waianae, which formerly rendered the latter place inaccessible from Waialua except on foot, has been so improved that a horse can be rode up and down without difficulty (Emerson 1837: Mission letters).

Historical documents and archival data for the central Oʻahu region indicate that Native Hawaiians continued to live and cultivate crops during the mid- to late-1800s, particularly along Mohiākea and Kalena ʻIli, and along Wai'eli Stream which runs through the study area (Robins and Spear 2002a:23, 24, 31, and 32). An 1886 photograph with Kolekole Pass in the background shows the location of a homestead and active pondfields (likely *loʻi kalo*) along a portion of Waiʻeli Stream to the west of the project area (Figure 7). It is presumed that the rectangular features represent fenced boundaries of traditional features, such as dwellings and active or recently active croplands.

2.3.2 Land Tenure

In the mid-1800s Māhele, all of Waiʻanae Uka Ahupuaʻa, with the exclusion of Kalena ʻIli, was designated as Crown Land. Honouliuli Ahupuaʻa was awarded to Kekauʻohoni, grandchild of Kamehameha I. Upon her death in 1851, her husband Levi Haʻalelea inherited the majority of the land, and later (1864) passed it on to his wife at the time, Amoe Haʻalelea. Haʻalelea sold it to her brother-in-law John Harvey Coney. The land has since been passed on through ranching, cultivation practices, and U.S. military activities.

2.3.3 Ranching

Honoluliuli

In 1877 James Campbell purchased the portion of Honouliuli retained by John Harvey Coney (about 43,640 acres) and established a cattle ranch under the namesake of Honouliuli Ranch. Before the purchase, John Meek and James Dowsett leased portions of Honouliuli for cattle grazing and stock running. Meek and Dowsett "introduced grazing in areas too high or dry for agriculture" (Burgett and Rosendahl 1992:E-7). Meek was known to have leased over 3,000 acres in the ʻEwa District, including Waikakalaua Gulch, and had 4,000–5,000 head of cattle (Tomonari-Tuggle and Bouthillier 1994:19). By 1881 Honouliuli Ranch was a successful ranch with 10,000 acres devoted to agriculture. Some of the cultivated land may have encompassed the project area.

Waiʻanae Uka

Meek was the first individual to ranch cattle at Waiʻanae Uka. In 1851 Kalena ʻIli was conveyed to Meek by Reverend Bishop (Bureau of Conveyances, Book 17:148), who described the parcel as having "taro patches for 4 or 5 families" (Department of the Interior, n.d.). By 1875 his heirs leased the entire *ahupuaʻa* of Waiʻanae Uka.

Meek's affluence in Oʻahu society is remembered by A.P. Taylor (1922:223):

> The days are recalled, also, when Captain Meek controlled Lihue and Wahiawa on Oahu under lease from the government. He raised thoroughbred horses, and his daughters rode the finest in the islands…

A ranch house once likely occupied by Meek's daughter Elizabeth Meek Crabbe and husband Horation Crabbe is shown on a late 19th century map as "Crabbe" (Hawaiian Government Survey 1881) (Figure 4, Figure 5). Between the period of 1875 and 1889, Waiʻanae Uka was leased to various westerners for cattle ranching, including a shared lease between Meek (and his heirs) and Dowsett.

Figure 7. 1886 photograph showing homestead and active crops in Wai‘eli Stream (Bishop Museum Archives, Neg. CP117, 503), from Robins and Spear (2002a:31).

In 1882 King Kalākaua and C.H. Judd purchased two-thirds of Wai‘anae Uka, under whom the lands were named Leilehua Ranch (Tomonari-Tuggle and Bouthillier 1994:22; Figure 4, Figure 6). Kalākaua and Judd built a hunting lodge, Malamanui, to use as a retreat and place to entertain influential people (Nedbalek 1984:13). In 1889 Dowsett purchased the lease and Leilehua Ranch assets, which consisted of more than 20,000 acres and 3,000 head of cattle and other stock (Tomonari-Tuggle and Bouthillier 1994:24). Wai‘anae Uka remained under Dowsett Ranch until the U.S. military took over in the early 1900s.

Tomonari-Tuggle (1997:24) describes the significant effect of more than 20 years of cattle ranching on the central plateau as follows:

> the probable final demise of native plants as the dominant vegetation of the area. Cattle are known to have opened up native forests through foraging, trampling of the forest understory, and spreading of alien grasses. In addition, associated human activities exacerbated the actions of the cattle. Logging often preceded ranch operations or was used to expand existing pastures. Timber was cut for fencing or ranch buildings. Some native plants were considered “noxious” and removed to encourage pasture growth and facilitate the movement of cattle (Cuddihy and Stone 1990:62).

2.3.4 Commercial Agriculture

In 1897 the Oahu Sugar Company was established on the ‘Ewa Plains by the predecessor of Amfac, H. Hackfield & Co. (Wilcox 1996:98). In 1898 a group of homesteaders began settling the

Wahiawā Colony Tract, which the Land Act of 1895 designated as a homestead land (Nedbalek 1984:18). Clearly shown in the 1902 survey map, W.C. Jones' leased land has been split into 17 homesteads roughly bounded by the north and south forks of Kaukonahua Stream (Figure 6).

James B. Dole began growing pineapple in the Wahiawā Tract in 1900 for his canning operation, the Hawaiian Pineapple Company. The east part of the military reservation, as well as the school land leased to W.C. Jones, is shown as pineapple land in the 1902 map (Figure 6).

The Wahiawā Colony organized the Wahiawa Water Company, which by 1902 built a network of flumes, ditches, and tunnels to provide water to the homesteads and cultivated fields (Nedbalek 1984:28). The water company completed a dam across Kaukonahua Gulch in 1906 to form the reservoir now known as Lake Wilson (Haile 1976). By the 1920s more than 71 artesian wells had been dug in Honouliuli, which produced more than 100 million gallons of water per day (Burgett and Rosendahl 1992: Appendix E). Within a decade, thousands of acres of pineapple fields were being cultivated in central O'ahu.

In 1906 the Oahu Rail and Land Company (OR&L) extended their railway from Waipahu to Wahiawā, through what would become WAAF, so that pineapples could be transported from the fields to the new Dole cannery constructed at Iwilei in Honolulu. These rail lines expanded over the decades to keep up with the commercial growth of the central plateau (Figure 4).

Between 1910 and 1920 a number of smaller plantations were established in central O'ahu, mostly by Japanese immigrants. Masanari Saito was one of the independent growers who, in 1913, first planted pineapple on leased fields near Kunia using pineapple tops discarded by another grower (Nedbalek 1984:56). Saito decided to move his plantation from Kunia to "Leilehua…in the valley west of Schofield," which proved to be a difficult undertaking:

> He and his friend Tamotsu Ono traveled by horse and began clearing a path as they moved along. At Leilehua first he built something that looked like a chicken coop and slept there. Then he built a kitchen and slept there and finally he made the main rooms. After the land had been cleared, plowed and planted he bought passage on a ship and returned to Japan for the woman who would be his bride. [Nedbalek 1984:56]

North of the project area, a plantation camp labeled as "Leilehua" might correspond to Saito's early plantation that Nedbalek (1984) also refers to as Leilehua (Figure 6).

Large corporations, including Dole and Hawaiian Islands Packing Company, established labor camps near the fields, including the Kim and Kunia Camps located southeast of the present study area. Small stores and itinerant peddlers served these outlying communities and isolated plantations.

By the 1920s mechanized pineapple farming and military occupation of the central plateau at Schofield Barracks and WAAF contributed to economic expansion centered in Wahiawā that gradually promoted infilling development and an even greater expansion of pineapple farming throughout the central plateau. USGS maps from the 1920s to 1953 indicate that all of the upper

plateau lands and broad ridge tops were cultivated in pineapple, and a network of roads were established for access between the fields (Figure 8, Figure 9).

Pineapple cultivation continued in and around KMTA under various companies (Roberts et al. 2004:6) until Del Monte Pineapple Company abruptly shut down operations in November 2006. An aerial photo of Schofield Barracks cantonment dated to 1926 shows the area of the Schofield Generating Station, in the left foreground below Waiʻeli Stream, planted in pineapple (Figure 10). A photo of anti-aircraft training amidst pineapple fields in Oʻahu's central plateau during World War II also shows the extent of commercial cultivation (Figure 11).

2.3.5 U.S. Military

Following annexation of the Hawaiian Islands by the United States, former Crown Lands, including Waiʻanae Uka, became the property of the federal government. In 1899 Waiʻanae Uka (excluding Kalena ʻIli) was set aside as a military reservation. In the 1902 Hawaiʻi Territory Survey map by Walter E. Wall, Surveyor, much of the central plateau, with the exception of Kalena, is shown as U.S. Military Reservation (Figure 6). The military reservation was not occupied until 1909 when it was mandated to be the base for Oʻahu's mobile defense troops because of its strategic central location.

The landscape of the project area is described in a report on the adequacy of the central plateau for a military post:

> The main road across the island runs across the tract, cutting it into two pieces of 8,000 and 6,000 acres respectively. The west section is cultivated with pineapples and is the smaller of the two and in my opinion the other tract is amply large for all purposes and not having been broken up, is covered with sod which is a very great advantage as the red dirt here is beastly dusty in dry weather and equally vile in wet. The site is an ideal one for a post being a level or practically level place, but there is not a tree on the tract. [Foster 1908, cited in Tomonari-Tuggle 1997:25]

Initially called either Leilehua Barracks or Castner Village, the latter named for the construction supervisor Captain Castner, Schofield Barracks was first occupied by 473 soldiers from the 5th Cavalry Regiment (Alvarez 1982:16). In April 1909 the military base was formally named Schofield Barracks in honor of Lt. General John M. Schofield, a former Civil War hero and Commander of the Army's Pacific Division. Although World War I halted construction, most major construction for Schofield Barracks (General Officers housing, new barracks for artillery troops, new infantry barracks, and additional Officers Quarters for the infantry and cavalry sections) was finished in the early 1920s (Robins and Spear 1997a:39–42). A 1909–1919 military survey map suggests initial development of Schofield Barracks was centered immediately north of the study area at a place called Leilehua along the north boundary. An OR&L railroad track terminating at several structures in Leilehua might be the original track that was extended into the military reservation in 1906.

During early development of Schofield Barracks, water was scarce and was apparently derived from one primary source at a "spring on the slopes of the Waianae Mountains Range"

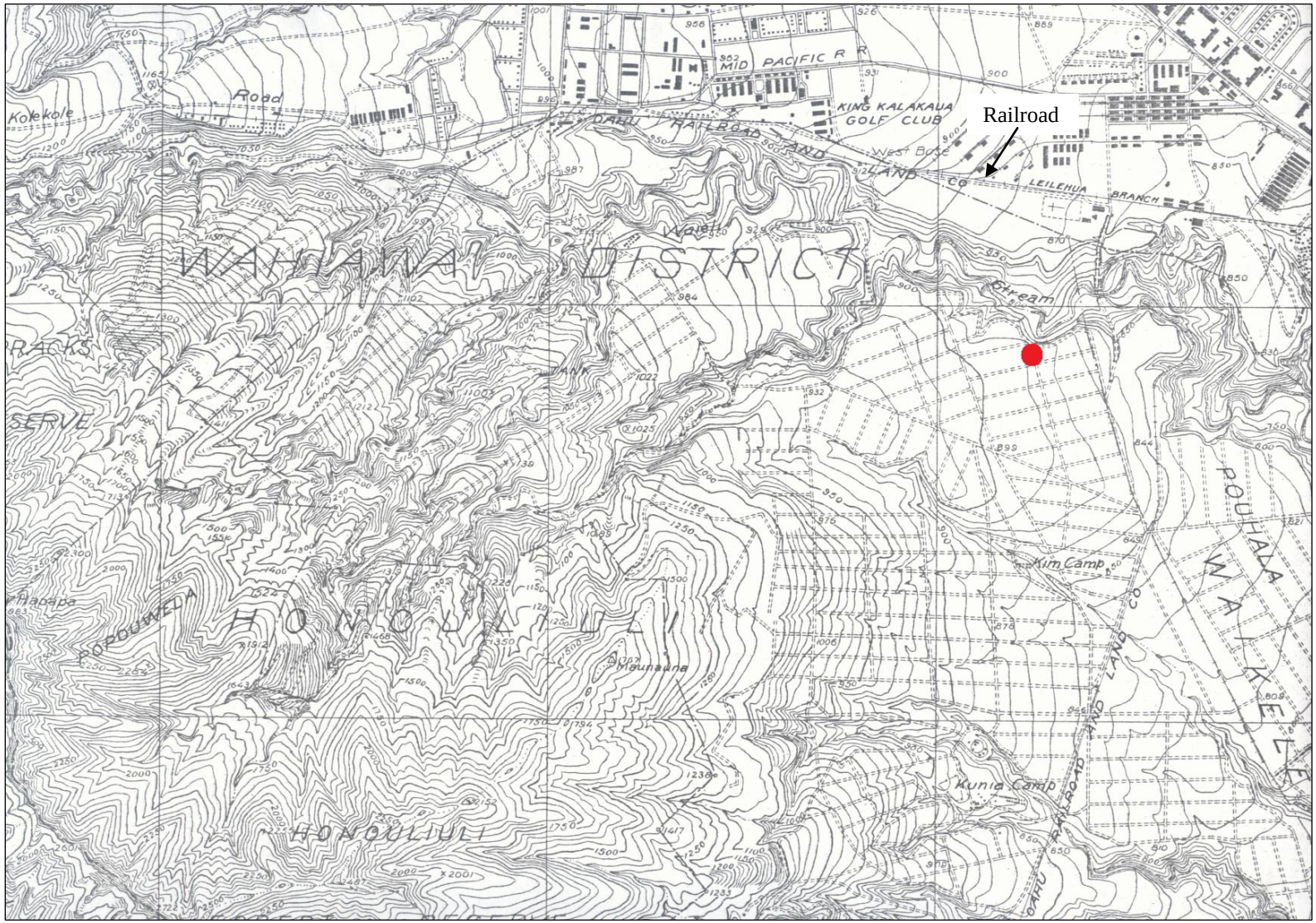

Figure 8. Enlarged detail of the 1927–1930 USGS Schofield Quadrangle with proposed Schofield Generating Station marked. Dashed lines around marked area indicate one-lane roads through cultivated fields.

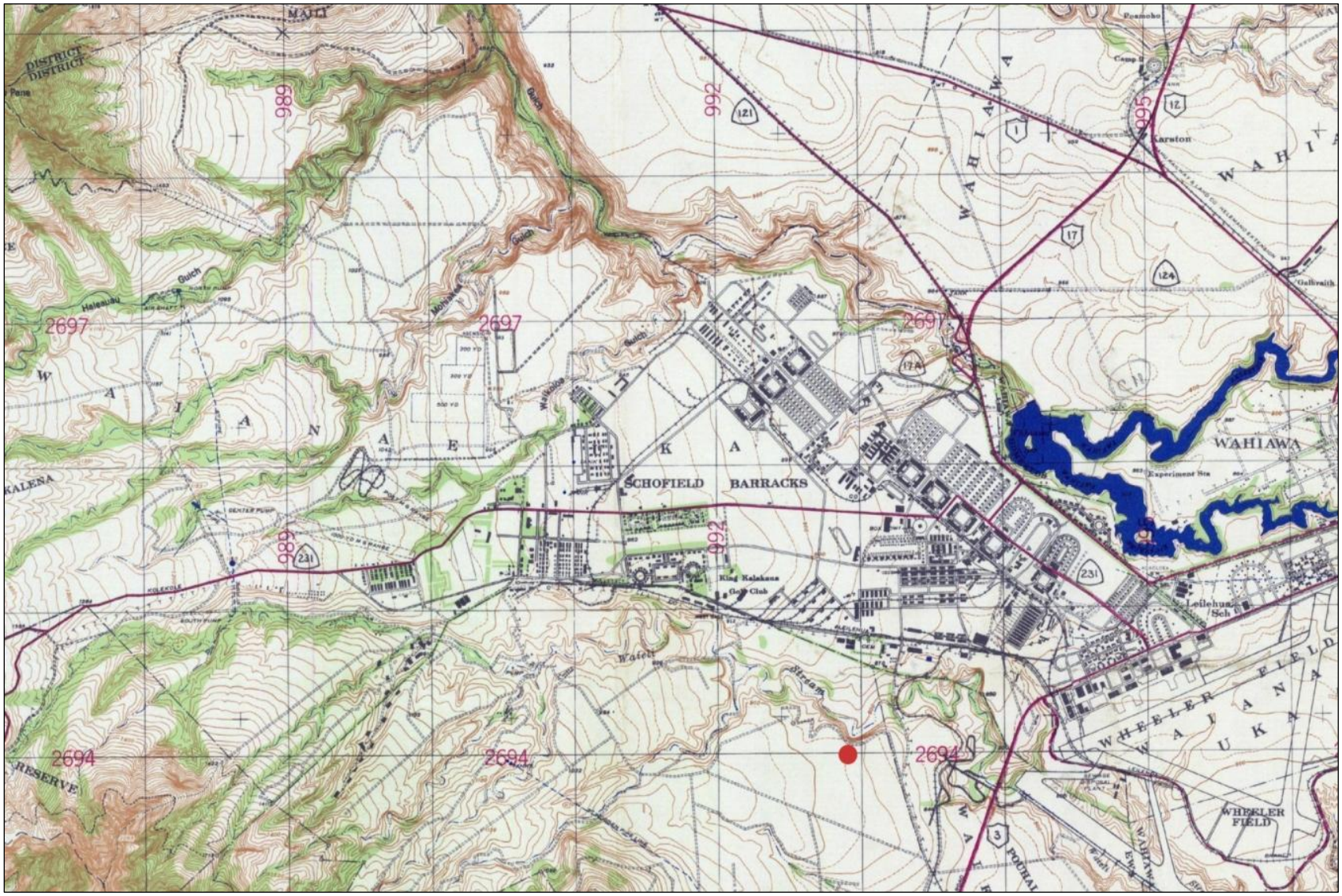

Figure 9. Enlarged detail of the 1943 USGS Schofield Quadrangle with proposed Schofield Generating Station marked.

Figure 10. 1936 aerial photograph of Schofield Barracks showing surrounding pineapple fields (Tropic Lighting Museum).

Figure 11. Anti-aircraft training amidst pineapple fields in central O‘ahu during World War II (From Paradise of the Pacific 1944:49).

(Nedbalek 1984:59). Photographs taken in 1909 show water tanks and a water supply camp in western Wai‘anae Uka that might correlate with the location of a probable pump house identified as SIHP Site No. 6557 in Hale‘au‘au Stream (Robins et al. 2005:16). A water shortage continued at Schofield Barracks until 1925 when Ku Tree Reservoir was constructed in eastern Wai‘anae Uka (Nedbalek 1984:60) and a deep well was excavated in 1938 (Addleman 1940, cited in Spencer Mason Architects 1997).

A northwestern extension of the OR&L line connected the lower post with the artillery area in the 1920s and 1930s. The USGS Schofield Barracks Quadrangle map of 1927–1930 displays two rail companies extending through the plateau; the OR&L and the Mid Pacific Railroad (Figure 8). Both companies have rails leading to the cantonment area. The same shows the Leilehua Ranch house is now identified as the King Kalākaua Golf Club.

WAAF was established as a military installation in 1922 on land included in the 1909 Executive Order establishing Schofield Barracks. Initially used for mounted cavalry training, WAAF was constructed in the 1920s by a detachment from the Army Air Service based at Luke Field on Ford Island. During the 1930s the field was upgraded and new buildings were constructed, including houses, hangars, and a fire station. At the same time, the OR&L relocated their railroad tracks to avoid the aviation field that was under construction.

During the 7 December 1941 Japanese attack on Pearl Harbor, Schofield Barracks was subject to Japanese air fire. Troops returned fire from the quadrangle roofs, shooting down two Japanese planes and one U.S. plane (Alvarez 1982:64). No significant damage was incurred at Schofield Barracks during the attack; however, nearby WAAF was hit hard. Schofield Barracks was used as a major training camp during the Pacific campaign of World War II. The Ranger Combat Training School at Schofield Barracks was established in 1942 and was intended to train the troops for jungle warfare (Alvarez 1982:68). In 1947 WAAF was moved to U.S. Air Force control and then put in caretaker status from 1948 until 1951, when the Korean War began.

While the number of troops and level of activity at Schofield Barracks has varied considerably since the close of World War II, the reservation has continued in its importance as a training center and post for the U.S. Army’s 25th Infantry Division. WAAF remained in U.S. Air Force control until 1993, when it was returned to the U.S. Army. The 1943 USGS map displays few changes from the 1930 USGS map (Figure 9). There are a few more permanent structures. Mid Pacific Railroad is no longer displayed; and WAAF is established.

In 2005 the U.S. Army purchased 1,402 acres south of the Schofield Barracks cantonment and east of the South Range from the Campbell Estate. The northernmost of the three parcels, composing the South Range Acquisition Area, would become KMTA. At the time of purchase, the lands, including broad ridges and stream floors, were still under pineapple cultivation as they had been for almost a century.

2.4 Previous Archaeological Investigations

Largely stimulated by SBMR’s Federal Section 106 requirements, a number of archaeological investigations have occurred in the APE. These began with McAllister’s (1933) first archaeological investigations of O‘ahu and culminated with the recent assessment of the

potential for portions of the SBMR to be a NRHP archaeological district, ethnographic landscape, or traditional cultural property (Desilets et al. 2011). The following overview of previous archaeological investigations focuses on those projects directly related to the APE (Table 1; Figure 12). Robins et al. (2007) and Desilets et al. (2011) provide a comprehensive summary of SBMR archaeological investigations.

Sterling and Summers (1978) compiled information on O‘ahu’s recorded cultural and archaeological sites. For the central plateau, they summarized McAllister’s archaeological survey (McAllister 1933), government documents, and ethnohistoric records. One of the most significant of these sites is the Kūkaniloko birthstones (SIHP No. 50-80-04-218) and Ho‘olonopahu Heiau (SIHP No. 50-80-04-219) to the north of the project area on the east side of Kaukonahua Stream (Figure 4). Tomonari-Tuggle and Bouthillier (1994:75) suggest that Kūkaniloko might have extended as far south as Waikalalaua and would therefore encompass some of the project area. Listed on the NRHP (Register No. 73000674), the Kūkaniloko birthstones was one of two places for the birth of children of high chiefs (Henry et al. 1992; McAllister 1933:134). The sacred drums that announced the birth of *ali‘i* children were kept at Ho‘olonopahu Heiau, which is now destroyed (McAllister 1933:137).

2.4.1 Schofield Barracks Cantonment and Wheeler Army Airfield

Work in the Schofield Barracks cantonment and WAAF area has primarily involved recording and assessment of the 20th century historic structures. The SBMR was first archaeologically surveyed by the B.P. Bishop Museum as a component of an EIS for several of Hawai‘i’s U.S. Army installations (Rosendahl 1977). A mostly vehicular reconnaissance survey of 741 acres documented six of McAllister’s sites as being destroyed; relocated the Kolekole Pass Stone (Site 214); and recorded two new historic sites (SIHP No. 50-80-08-9527 and 9528), both in poor condition.

As a component of a master planning effort, a thorough cultural assessment of WAAF accompanied by a historical building and other resources survey was conducted (Tomonari-Tuggle and Bouthillier 1994). Four of the five archaeological sites identified are U.S. military features, although they might be recently modified ranching or traditional features. Only the remains of the OR&L Waipahu-to-Wahiawā line were evaluated as historically significant. Fifty-four buildings were assessed for their historic architectural value, with five considered of major importance and 25 important. The study concluded that WAAF is significant as a U.S. military installation, although the traditional Hawaiian and ranching period significance of the area relates to “its context within a larger geographic area” (Tomonari-Tuggle and Bouthillier 1994:75) due to the modern military-related landscape disturbance.

McIntosh et al. (1995a) conducted archaeological survey and subsurface testing at the McMahon and Ayres sites along the upper south bank of Kaukonahua Stream. No traditional cultural remains were encountered; however, the McMahon site contained modern construction debris along with railroad material that was probably related to the historic OR&L line. Descending to a depth of 1.2 to 2.0 meters, the 15 shovel test pits and 14 backhoe trenches revealed a heavily bulldozed landscape. Additional shovel tests placed in the southeast corner of

Table 1. Archaeological Investigations In and Near the Area of Potential Effect

Reference	General Location	Study	Findings
McAllister 1933	Waiʻanae Range	Survey	Seven sites: Sacred stones (Kolekole Pass, Oahunui), *heiau*, fishpond
Rosendahl 1977	SBMR	Survey	Six sites previously discovered and reported destroyed: SIHP No. 204, 213, 215, 216, 217, 9516; Two historic sites: SIHP No. 9527, 9528; Kolekole Pass Stone: Site 214
Griffin and Yent 1977	Wahiawā Freshwater State Park	Survey	Railroad trestle, nonagricultural terraces
Watanabe 1987	Field Station Kunia	Survey	No findings
O'Hare et al. 1993	SBMR	Survey	Documentation of 374 historic structures
Tomonari-Tuggle and Bouthillier 1994	Wheeler Army Airfield (WAAF)	Survey, assessment	Historic buildings, railroad bed (SIHP No. 9714), military structures
McIntosh et al. 1995a, 1995b	SBMR and WAAF	Survey, excavation	Bunker (SIHP No. 5082)
Bouthillier et al. 1995	SBMR	Survey, excavation	Historic dump site
Williams et al. 1995	SBMR	Survey, excavation	Historic debris
Tomonari-Tuggle 1997	Schofield Barracks Cantonment	Assessment	-
Carson and Yeomans 2000	Schofield Barracks East and South Ranges	Excavation, detailed recording	Phase III Excavation of 15 Hawaiian sites recorded and tested by Robins and Spear (2002a, 2002b)
Robins and Spear 2002a, 2002b	Schofield Barracks South, portions of, East and West Ranges	Survey, testing	73 primarily traditional sites: habitations, burials, irrigated and nonirrigated agriculture, historic roads, reservoir, military structures
Roberts et al. 2004	Schofield Barracks South Range	Survey	43 Hawaiian, post-Contact, military sites: habitations, ceremonial, agriculture, possible burials, homesteads, roads, military structures
Robins et al. 2007	South Range Land Acquisition	Survey	45 Hawaiian, post-Contact, military sites: agriculture, habitation, ceremony, possible burial
Desilets et al. 2011	SBMR, Helemano Military Reservation	Assessment	Western SBMR (Līhuʻe), above ca. 1,000 feet elevation, qualifies as NRHP-eligible traditional cultural places (TCP), ethnographic landscape, and archaeological district
Tulchin and Hammatt 2013	South Range Land Acquisition	Survey, testing	No findings

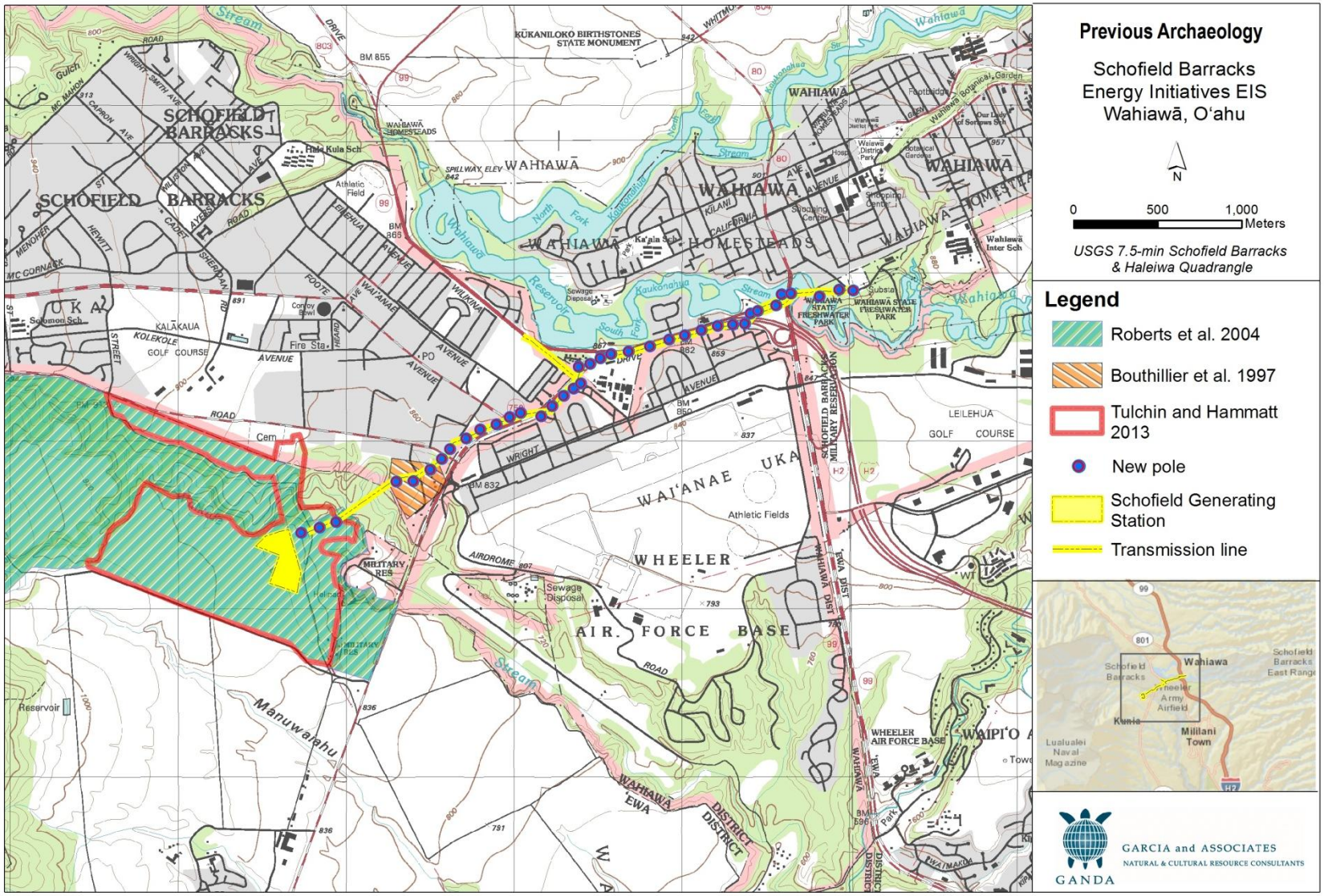

Figure 12. Previous archaeological investigations overlapping the west portion of the Area of Potential Effect.

the cantonment, in the vicinity of Carter Gate, which was Schofield Barracks' original entrance, unearthed modern trash relating to the recently demolished family housing (McIntosh et al. 1995b).

In 1995 Williams et al. (1995) conducted archaeological survey and testing of seven locations in the cantonment. They encountered a 20th century rock facing (Site 3) on the Waiʻeli Stream bank south of Martinez Field and a localized area of coral fill that they interpreted as a potential historic house foundation. Despite the significant amount of concrete debris and gravel deposits identifying considerable historic land alteration, Williams et al. (1995) propose that isolated traditional or early military deposits might remain in the cantonment's developed areas.

Bouthillier et al. (1995) conducted archaeological survey and augur boring of three housing areas (A, U, and V) and Duck Field (west of Lyman Gate). The investigations encountered a large post-Contact trash deposit at the top edge of a slope leading to Waikele Stream at the west end of Duck Field. Although having just been pot hunted, the glass bottles and fragments, ceramics, metal, and recent trash were interpreted as associated with a 1908 campsite occupied during the initial construction of Schofield Barracks (Bouthillier et al. 1995:54). Auger tests indicated that construction fill deposits descend up to a meter deep and overlie truncated B horizon soils. Like Williams et al. (1995), Bouthillier et al. (1995) concluded that the extensive land alterations in the cantonment have dramatically affected the subsurface deposits.

Tomonari-Tuggle (1997) conducted background archival research, limited field assessment, and data analysis of the Schofield Barracks containment area. She examined three areas of historical interest during the survey: (1) a 1918 culvert under Waiʻanae Avenue, (2) the post cemetery, and (3) the area around the Kalkaua Golf Course clubhouse. Tomonari-Tuggle (1997:iv) concluded that:

> virtually all of the cantonment (even open space areas) has been intensively developed over 85 years of military use, and that the likelihood of intact and significant archaeological remains is extremely low . . . . Only those areas adjacent to gulches and ravines in the cantonment are evaluated to be archaeologically sensitive.

Cultural Surveys Hawaiʻi Inc. (CSH) examined the post-Contact trash deposit recorded by Bouthillier et al. (1995) and the stacked-stone terrace and concrete ditch documented by Williams et al. (1995). The historic trash feature was determined to be a secondary deposit and the latter site (Site 3) a group of mid-20th century drainage control features significantly impacted by modern development, trash dumping, and natural processes. Because neither cultural resource retained their integrity, they were evaluated as not meeting the significance criteria for inclusion on the Hawaiʻi Register or the NRHP.

2.4.2 South and East Ranges, and Kunia Maneuver Training Area

Griffin and Yent (1977) conducted an archaeological survey in anticipation of construction of the Wahiawā Freshwater State Park. They encountered a portion of the OR&L railroad trestle and a series of low step-terraces containing a concrete stair and a basalt alignment among the historic debris littering the parcel. A core was placed in the lower terrace to determine if the terraces were used for agriculture. The continuous layer of red silty clay encountered in the core suggests that the terraces were not cultivated and might have been constructed to prevent erosion.

Watanabe's (1987) survey of five areas in the U.S. Army Field Station Kunia on the south slopes of Waikele Stream found the parcels to have been graded or filled. No cultural remains remained in these areas impacted by historic and modern development and cultivation.

Scientific Consultant Services, Inc. (SCS) completed surveys and site excavation at select areas of the South Range, West Range, and East Range (Carson and Yeomans 2000; Robins and Spear 2002a; 2002b). The SCS surveys identified 92 sites associated with Hawaiian habitation, agriculture and burial, historic roads, and military structures. Radiocarbon assays suggest these sites were occupied on a temporary basis from AD 1290 to 1450 and on a permanent basis from AD 1440 to 1950 (Carson and Yeomans 2000:84–85; Robins and Spear 2002a:248). Although the occupational date ranges overlap into the post-Contact and modern era, the absence of post-Contact cultural materials suggests the occupation was primarily pre-Contact and early post-Contact in use. Radiocarbon dating of agricultural soils from three wetland and two dryland sites indicates the development of croplands began as early as AD 1170 and cultivation continued throughout the pre-Contact and post-Contact era (Carson and Yeomans 2000:79–80; Robins and Spear 2000b:244).

Following the SCS work, Garcia and Associates conducted Phase I and II archaeological investigations in the South Range Land Acquisition Area (Roberts et al. 2004; Robins et al. 2007). During the initial work, many of the pineapple fields in the South Range were still being cultivated. Forty-five sites including more than 261 features and feature clusters were recorded in the project area. These sites include 28 traditional Hawaiian sites, 12 commercial pineapple (plantation) sites, two U.S. military training sites, and three sites with undetermined cultural affiliations. The Hawaiian sites include structural components indicative of dryland agriculture, habitation, ceremony, and a possible burial feature.

All of the properties recorded by Garcia and Associates are on the west half of KMTA in the higher elevations that were not under historic and modern cultivation. Although some sites were in the gulches, Roberts et al. (2004:85) noted, "historic and modern land alterations have contributed to increases in slope erosion, accelerated siltation and down cutting of stream channels that have affected site formation processes and integrity within the valleys."

Garcia and Associates assessed the SBMR and the Helemano Military Reservation for their potential to contain NRHP-eligible traditional cultural places (TCP), ethnographic landscapes, or archaeological districts (Desilets et al. 2011). Their findings indicate that the western portion of the SBMR, above ca. 1,000 feet elevation, can be defined as a Līhuʻe Uplands TCP, or as a discontiguous archaeological district, within the historic context of Hawaiian Occupation and *Lō Aliʻi* Social Organization AD 1100–1778. This same upland area, and potentially a larger region including Kūkaniloko to the east, might also qualify as an NRHP-eligible ethnographic landscape. Desilets et al. (2011) found no evidence to support the presence of NRHP-eligible TCPs, ethnographic landscapes, or archaeological districts within the lower elevations of Līhuʻe—where the current project is located—or within the Helemano Military Reservation.

CSH conducted an AIS for construction-related activities associated with the Grow the Army initiative in the SBMR (Tulchin and Hammatt 2013). Their investigations included a pedestrian survey and excavation of a series of test units in the former pineapple fields in KMTA, and further

examination of two previously documented post-Contact sites in the cantonment (Section 2.4.1). Pedestrian survey of the formerly cultivated tablelands identified no surface cultural resources.

CSH's subsurface testing of these tablelands did not encounter any buried cultural resources (Tulchin and Hammatt 2013). Their Test Units 10, 11, and 13 are within the proposed generating station parcel, while Test Units 8 and 9 are close to Poles 1 and 2 in the Department of Agriculture land. These units displayed a similar stratigraphic sequence consisting of naturally deposited clay loam impacted by decades of agricultural grading and plowing overlying the same natural deposit that was not impacted by previous cultivation activities, all of which capped decomposing basalt bedrock.

2.4.3 Assessment of Archaeological Resources

Commercial pineapple cultivation and residential, commercial, and military development have made it unlikely that archaeological and cultural sites are present in the Schofield Barracks cantonment, WAAF, the lower elevations of the South and East Ranges, and KMTA. Archaeological investigations have encountered no remaining surface or subsurface pre-Contact or 19th century cultural properties in these lowland areas. The few identified archaeological sites all appear to relate to military development, with a substantial number of historic structures found in the cantonment and in WAAF.

Although not yet thoroughly investigated, even the lower gulches and drainages show no evidence of traditional Hawaiian modification for agricultural use or occupation. Some of the broader gulch bottoms were also planted in pineapple, thus destroying any features that might have once been present.

Despite portions of the uplands being subjected to artillery bombardment, the remote location and restricted development of much of the uplands west of the APE has resulted in the preservation of many traditional cultural properties, particularly in the deep, upper elevation gulches and valleys. Here, documented cultural sites comprise mostly Hawaiian structures associated with habitation, animal husbandry, wetland and dryland agriculture, ceremonial activities, and possible burials. Historic roads and military structures were also identified that were associated with training and development of Schofield Barracks.

Desilets et al. (2011) conclude that:

> The best site preservation is found in the deep, upper elevation gulches within both the South and West Ranges. Phase I and II surveys of the newly acquired South Range area (Roberts et al. 2004; Robins et al. 2007) indicate that the lower reaches, which were almost entirely in pineapple until very recently, have no remaining surface features. This is also true of some of the broad, upper elevation ridges. Pineapple was planted on any commercially feasible acreage within the South Range, extending right up to the current forest reserve boundary. Within the more inaccessible parts of the South Range, however, such as deep drainages, Hawaiian sites are quite plentiful and, in some cases, form extended complexes. Higher elevation valleys in the South Range also contain relatively large and well-preserved ceremonial sites (e.g., Site 50-80-08-6479). [Desilets et al. 2011:69]

3.0 FIELD METHODOLOGY

The AIS included excavation of eight test trenches at the proposed generator site in KMTA and thirteen test pits along the transmission line. The intensity of the archaeological testing effort was based on the results of the archaeological background research and consultation with U.S. Army Garrison-Hawaii and the Hawai‘i State Historic Preservation Division. Because the region surrounding the project APE has been shown to have a very low probability for subsurface archaeological deposits, the AIS sampling strategy was designed to provide broad coverage, but not to including every individual locale at which ground-disturbing construction activities might occur. Testing along the transmission line, in particular, was designed to sample the route generally and includes specific evaluation of 13 of the 28 new pole locations (a 46 percent sample).

3.1 Generating Station

Archaeological testing at the generator site included excavating eight test trenches using a Komatsu PC35MR excavator (Figure 13). Test trenching was completed on 18 and 19 February 2014. All excavated sediment was inspected for evidence of cultural material and the sidewalls of all excavations were inspected for evidence of cultural deposition. A representative stratigraphic profile was recorded for each trench. Trench dimensions averaged 7.40 meters long, 0.57 meters wide, and 1.26 meters deep.

Trenches were distributed across the generating station parcel as evenly as possible. Heavy vegetation growth, large polyvinyl chloride (PVC) pipes, soil piles, and trees blocked entry to large areas. As Figure 14 shows, trenches are concentrated along the northern and eastern perimeter of the parcel. Despite the somewhat uneven coverage, the trench results are more than sufficient to evaluate the archaeological potential of the parcel.

Test trenches were excavated down to intact native subsoil and were terminated at a depth the archaeologist determined to be beyond the reasonable potential for archaeological deposits, typically well into intact B-horizon or saprolite layers.

3.2 Transmission Line

Archaeological testing along the transmission line included excavation of 13 test pits using a Komatsu PC35MR excavator. Fieldwork for the pits was completed on 21 February and 4 March 2014. As with the test trenches, all excavated sediment was inspected for evidence of cultural material, and the sidewalls of all excavations were inspected for evidence of cultural deposition. Pit dimensions averaged 1.06 centimeters long, 0.88 meters wide, and 0.79 meters deep.

Test pits were excavated near new pole locations spaced evenly along the 3.7-kilometer transmission line (Figure 15). In addition to even spacing, pole locations that exhibited a lower likelihood of previous ground disturbance were preferred during the selection process. Finally, Test Pits 1, 2, and 3 were selected because of their location on the edge of Wai‘eli Gulch. Background research indicates that such gulches were the preferred locations for pre-Contact and early historic habitation and subsistence. They therefore may have a relatively higher probability for containing archaeological resources.

Figure 13. Komatsu PC35MR backhoe excavating at Trench 3.

As with the test trenches, test pits were generally excavated to intact native subsoil and were terminated at a depth the archaeologist determined to be beyond the reasonable potential for archaeological deposits. Some of the excavations did not reach native subsoil because electrical conduits were unexpectedly encountered.

3.3 Documentation

Standards of documentation, recording, and analysis were in accordance with Hawai‘i Administrative Rules Section 13-276 and with the Secretary of the Interior’s Standards for Archaeological Documentation. Field recording included drawing stratigraphic profiles and digital photography of exposed sidewalls. Stratigraphic profiles were recorded to document archaeological deposition and to convey the general stratigraphy of the area. All profiles were prepared according to National Soil Survey Center standards and using the Munsell Color Notation reference system.

Figure 14. Test trenches at generating station parcel.

Figure 15. Test pits along transmission line.

4.0 FIELDWORK RESULTS

This section presents the results of the AIS fieldwork including documentation and findings for eight test trenches at the proposed generator site and 13 test pits along the transmission line.

4.1 Trenches

Eight trenches were excavated to test for the presence or absence of traditional Hawaiian or historic cultural material (Figure 14). Each trench is discussed below in sequential order.

Table 2 provides technical soil descriptions for all trenches and Figure 16 illustrates all recorded trench profiles. Each description concludes with a statement of cultural material findings.

Trench 1

Trench 1 measured 8.3 meters long by 0.6 meters wide and was excavated to a maximum depth of 1.0 meter. The trench contained three stratigraphic layers designated Layers I–III (Figure 17).

Layer I extended from 0 to 50 centimeters below surface (cmbs). The layer was dark reddish-brown silty clay with a few basalt pebbles, charcoal, and fragments of black plastic. Layer II extended from 50 to 95 cmbs. The layer was compact, dark red silty clay mottled with orange clay at its lower boundary. Layer III extended from 90 to 100 cmbs. The layer was dark red silty clay mottled with yellowish-brown clay chunks.

Trench 1 produced no evidence of traditional Hawaiian or early historic cultural deposition.

Trench 2

Trench 2 measured 8.0 meters long and 0.6 meters wide and was excavated to a maximum depth of 156 cmbs. The trench contained three stratigraphic layers, designated Layers I through III (Figure 18).

Layer I extended from 0 to 50 cmbs. The Layer was dark reddish-brown silty clay with charcoal fragments and black plastic. Layer II extended from 50 to 143 cmbs. It was dark reddish-brown silty clay mottled orange clay at the lower boundary. Layer III extended from 143 to 156 cmb. It was a reddish-brown silty clay mottled with yellowish-brown clay.

Trench 2 produced no evidence of traditional Hawaiian or early historic cultural deposition.

Trench 3

Trench 3 measured 7.3 meters long by 0.6 meters wide and was excavated to a maximum depth of 127 cmbs. The trench contained three stratigraphic layers, designated Layers I through III (Figure 19).

Layer I extended from 0 to 46 cmbs. It was dark reddish-brown silty clay with charcoal fragments and black plastic material. Layer II extended from 46 to 114 cmbs. It was compact, dark

Table 2. Backhoe Trench Stratigraphy

Trench	Layer	Depth (cmbs)	Description	Interpretation
1	I	0–50	2.5YR 2.5/4 (dark reddish-brown) silty clay; moist; cohesive; med. plasticity; fine to medium subangular blocky; few basalt pebbles; some small roots; bits of charcoal and plastic; humic material; distinct lower boundary.	Culturally modified - pineapple farming remnants
	II	50–95	2.5YR 3/6 (dark red) silty clay; moist; compact; cohesive; med. plasticity; fine subangular blocky; no cobbles or roots; some orange clay mixed in bottom 15centimeters; diffuse lower boundary.	Intact native soil
	III	90–100	2.5YR 3/6 (dark red) silty clay modeled with 10YR 5/8 (yellowish-brown) clay chunks (40%); compact; cohesive; low plasticity; fine subangular blocky; no cobbles or roots.	Saprolite
2	I	0–50	2.5YR 2.5/4 (dark reddish-brown) silty clay; moist; cohesive; med. plasticity; fine to medium subangular blocky; few basalt pebbles; some small roots; bits of charcoal and plastic; humic material; distinct lower boundary.	Culturally modified - pineapple farming remnants
	II	50–143	2.5YR 3/4 (dark reddish-brown) silty clay; moist; compact; cohesive; med. plasticity; fine subangular blocky; no cobbles or roots; some orange clay mixed in bottom 10 centimeters; diffuse lower boundary.	Intact native soil
	III	143–156	2.5YR 3/4 (dark reddish-brown) silty clay modeled with 10YR 5/8 (yellowish-brown) clay chunks (25%); compact; cohesive; low plasticity; fine subangular blocky; no cobbles or roots.	Saprolite
3	I	0–46	2.5YR 2.5/4 (dark reddish-brown) silty clay; moist; cohesive; med. plasticity; fine to medium subangular blocky; few basalt pebbles; lots of small roots; bits of charcoal and plastic; humic material; distinct lower boundary.	Culturally modified - pineapple farming remnants
	II	46–114	2.5YR 3/4 (dark reddish-brown) silty clay; moist; compact; cohesive; med. plasticity; fine subangular blocky; some roots; no cobbles; some orange clay mixed in bottom 10 centimeters; diffuse lower boundary.	Intact native soil
	III	114–127	2.5YR 3/4 (dark reddish-brown) silty clay modeled with 10YR 5/8 (yellowish-brown) clay chunks (25%); compact; cohesive; low plasticity; fine subangular blocky; no cobbles or roots.	Saprolite
4	I	0–42	2.5YR 2.5/4 (dark reddish-brown) silty clay; moist; cohesive; med. plasticity; fine to medium subangular blocky; few basalt pebbles; lots of small roots; bits of charcoal and plastic; humic material; distinct lower boundary.	Culturally modified - pineapple farming remnants
	II	42–130	2.5YR 3/6 (dark red) silty clay; moist; compact; cohesive; med. plasticity; fine subangular blocky; some roots; no cobbles; diffuse lower boundary.	Intact native soil
	III	130–136	2.5YR 3/6 (dark red) silty clay modeled with 10YR 5/8 (yellowish-brown) clay chunks (25%); compact; cohesive; low plasticity; fine subangular blocky; no cobbles or roots.	Saprolite

Table 2. (cont.)

Trench	Layer	Depth (cmbs)	Description	Interpretation
5	I	0–46	2.5YR 3/3 (dark reddish-brown) silty clay; moist; cohesive; med. plasticity; fine to medium subangular blocky; few basalt pebbles; lots of small roots; bits of charcoal and plastic; humic material; distinct lower boundary.	Culturally modified – pineapple farming remnants
	II	46–124	2.5YR 3/6 (dark red) silty clay; moist; compact; cohesive; med. plasticity; fine subangular blocky; few roots in top 10 centimeters; no cobbles; some orange clay mixed in bottom 10 centimeters; diffuse lower boundary.	Intact native soil
	III	124–136	2.5YR 3/6 (dark red) silty clay modeled with 10YR 5/8 (yellowish-brown) clay chunks (40%); compact; cohesive; low plasticity; fine subangular blocky; no cobbles or roots.	Saprolite
6	I	0–47	2.5YR 2.5/4 (dark reddish-brown) silty clay; moist; cohesive; med. plasticity; fine to medium subangular blocky; few basalt pebbles; lots of small roots; bits of charcoal and plastic; humic material; distinct lower boundary.	Culturally modified – pineapple farming remnants
	II	47–108	2.5YR 3/4 (dark reddish-brown) silty clay; moist; compact; cohesive; med. plasticity; fine subangular blocky; few roots in top 10 centimeters; no cobbles; diffuse lower boundary.	Intact native soil
	III	108–114	2.5YR 3/4 (dark reddish-brown) silty clay modeled with 10YR 5/8 (yellowish-brown) clay chunks (20%); compact; cohesive; low plasticity; fine subangular blocky; no cobbles or roots.	Saprolite
7	I	0–40	2.5YR 2.5/4 (dark reddish-brown) silty clay; moist; cohesive; med. plasticity; fine to medium subangular blocky; few basalt pebbles; lots of small roots; bits of charcoal and plastic; humic material; distinct lower boundary.	Culturally modified – pineapple farming remnants
	II	40–100	2.5YR 3/6 (dark red) silty clay; moist; compact; cohesive; med. plasticity; fine subangular blocky; few small roots in top 10 centimeters; no cobbles.	Intact native soil
8	I	0–15	2.5YR 2.5/3 (dark reddish-brown) silty clay; moist; cohesive; med. plasticity; fine to medium subangular blocky; few basalt pebbles; lots of small roots; bits of charcoal and plastic; humic material; distinct lower boundary.	Culturally modified – pineapple farming remnants
	II	15–125	2.5YR 3/4 (dark reddish-brown) silty clay; moist; compact; cohesive; med. plasticity; fine subangular blocky; few small roots in top 20 centimeters; no cobbles; diffuse lower boundary.	Intact native soil
	III	125–135	2.5YR 3/3 (dark reddish-brown) silty clay; moist; compact and gets more compact in bottom 10 centimeters; cohesive; med. plasticity; fine subangular blocky; no cobbles or roots; some orange clay mixed in bottom 5 centimeters.	Intact native soil

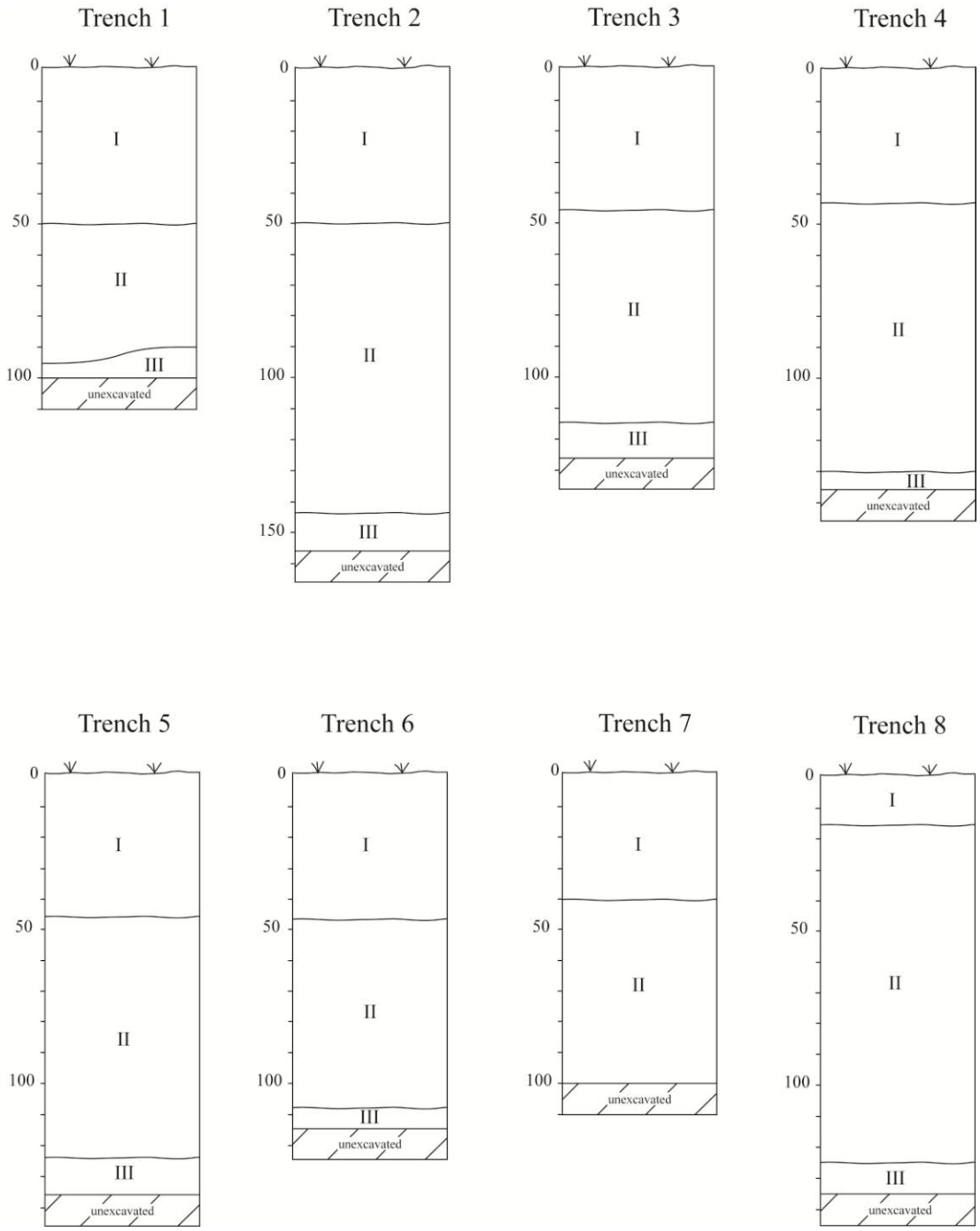

Figure 16. Trench profiles.

Figure 17. Trench 1, facing north.

Figure 18. Trench 2, facing north.

Figure 19. Trench 3, facing north.

reddish-brown silty clay mottled with orange clay at the lower boundary. Layer III extended from 114 to 127 cmbs. It was compact, dark reddish-brown silty clay mottled with yellowish-brown clay.

Trench 3 produced no evidence of traditional Hawaiian or early historic cultural deposition.

Trench 4

Trench 4 measured 7.2 meters long by 0.6 meters wide and was excavated to a maximum depth of 136 cmbs Three stratigraphic layers were identified in the trench and designated Layers I through III (Figure 20).

Layer I extended from 0 to 42 cmbs. It was dark reddish-brown silty clay with charcoal and fragments of black plastic. Layer II extended from 42 to 130 cmbs. It was compact, dark red silty clay. Layer III extended from 130 to 136 cmbs. It was compact, dark red silty clay mottled with yellowish-brown clay.

Trench 4 produced no evidence of traditional Hawaiian or early historic cultural deposition.

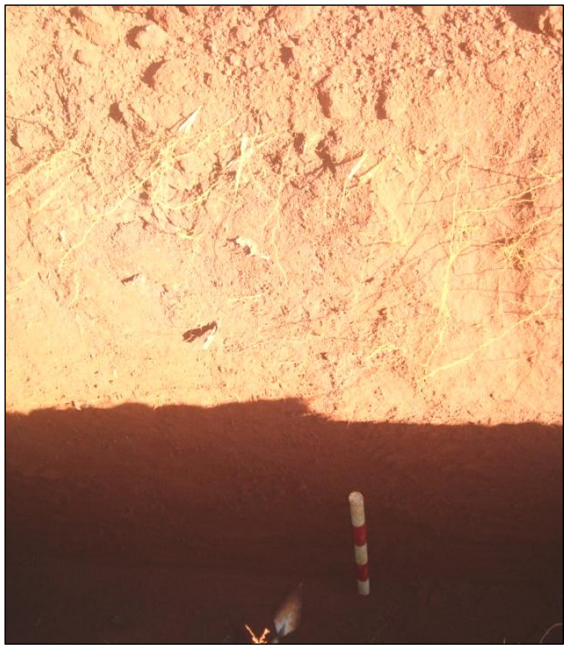

Figure 20. Trench 4, facing north.

Trench 5

Trench 5 measured 7.5 meters long by 0.5 meters wide and was excavated to a maximum depth of 136 cmbs. The trench contained three stratigraphic layers, designated Layers I through III (Figure 21).

Layer I extended from 0 to 46 cmbs. It was dark reddish-brown silty clay with charcoal and fragments of black plastic. Layer II extended from 46 to 124 cmbs. It was compact, dark red silty clay mottled with orange clay at the lower boundary. Layer III extended from 124 to 136 cmbs. It was compact, dark red silty clay mottled with yellowish-brown clay.

Trench 5 produced no evidence of traditional Hawaiian or early historic cultural deposition.

Trench 6

Trench 6 measured 7.2 meters long by 0.6 meters wide and was excavated to a maximum depth of 114 cmbs. The trench contained three stratigraphic layers, designated Layers I through III (Figure 22).

Layer I extended from 0 to 47 cmbs. It was dark reddish-brown silty clay charcoal and fragmented black plastic. Layer II extended from 47 to 108 cmbs. It was compact dark reddish-brown silty clay. Layer III extended from 108 to 114 cmbs. It was compact, dark reddish-brown silty clay mottled with yellowish-brown clay.

Trench 6 produced no evidence of traditional Hawaiian or early historic cultural deposition.

Figure 21. Trench 5, facing north.

Figure 22. Trench 6, facing north.

Trench 7

Trench 7 measured 6.5 meters long by 0.5 meters wide and was excavated to a maximum depth of 100 cmbs. The trench contained two stratigraphic layers, designated Layers I through III (Figure 23).

Layer I extended from 0 to 40 cmbs. It was dark reddish-brown silty clay with charcoal and fragments of black plastic. Layer II extended from 40 to 100 cmbs. It was compact, dark red silty clay.

Trench 7 produced no evidence of traditional Hawaiian or early historic cultural deposition.

Trench 8

Trench 8 measured 7.0 meters long by 0.6 meters wide and was excavated to a maximum depth of 135 cmbs. The trench contained three stratigraphic layers, designated Layers I through III (Figure 24).

Layer I extended from 0 to 15 cmbs. It was dark reddish-brown silty clay with charcoal and fragments of black plastic. Layer II extended 15 to 125 cmbs and consisted of dark reddish-brown silty clay. Layer III extended 125 to 135 cmbs. It was compact, dark reddish-brown silty clay mottled with orange clay at the lower boundary.

Trench 8 produced no evidence of traditional Hawaiian or early historic cultural deposition.

Figure 23. Trench 7, facing northeast.

Figure 24. Trench 8, facing northwest.

4.2 Test Pits

Thirteen test pits were excavated along the transmission line corridor near proposed new pole locations (Figure 15). The test pits are designated in sequential order from east to west (1–13) (Table 3).

Test Pit 1

Test Pit 1 was on Hawai‘i Department of Agriculture land, 50 meters south of Waikele Stream gulch and 1.5 meters west of a dirt cane road running the perimeter of the field. It measured 126 centimeters long and 96 centimeters wide, with a depth of 102 cmbs. The profile contained three stratigraphic layers (Layers I–III) (Figure 25).

Layer I, from 0 to 81 cmbs, is composed of moist, cohesive, dark reddish-brown silty clay. It has medium plasticity, fine to medium subangular blocky peds, a few basalt pebbles, abundant small roots, bits of charcoal and plastic, humic material, and a distinct lower boundary. Layer II is a compact layer from 81 to 90 cmbs and is composed of moist, cohesive, dark red silty clay. It has medium plasticity, fine subangular blocky peds, no cobbles or roots, and a distinct lower boundary. Layer III is a hard, crumbly layer from 90 to 102 cmbs and is composed of non-cohesive, dark red silty clay modeled with yellowish-brown clay chunks (10 percent). It has low plasticity, fine to medium subangular blocky peds, some degraded basalt, and no roots.

Test Pit 1 produced no evidence of traditional Hawaiian or early historic cultural deposition.

Table 3. Test Pit Stratigraphy

Test Pit	Layer	Depth (cmbs)	Description	Interpretation
1	I	0–81	2.5YR 3/3 (dark reddish-brown) silty clay; moist; cohesive; med. plasticity; fine to medium subangular blocky; few basalt pebbles; lots of small roots; bits of charcoal and plastic; humic material; distinct lower boundary.	Culturally modified – pineapple farming remnants
	II	81–90	2.5YR 3/6 (dark red) silty clay; moist; compact; cohesive; med. plasticity; fine subangular blocky; no cobbles or roots; distinct lower boundary.	Intact native soil
	III	90–102	2.5YR 3/6 (dark red) silty clay modeled with 10YR 5/8 (yellowish-brown) clay chunks (10%); crumbly; hard; non-cohesive; low plasticity; fine to medium subangular blocky; degraded lava rock pieces; no roots.	Saprolite
2	I	0–27	5YR 2.5/2 (dark reddish-brown) silty clay; dry; cohesive; low plasticity; fine to medium subangular blocky; lots of small roots and one large root; distinct lower boundary.	Topsoil
	II	14–59	2.5YR 3/4 (dark reddish-brown) silty clay; moist; compact; cohesive; med. plasticity; fine to medium subangular blocky; some small roots; few cobbles; mixed with Layer III; diffuse lower boundary.	Intact native soil
	III	53–75	5YR 3/3 (dark reddish-brown) silty clay; moist; compact; cohesive; med. plasticity; medium subangular blocky; no roots; hard red chunks.	Eroded bedrock
3	I	0–10	5YR 3/2 (dark reddish-brown) silty clay; dry; cohesive; low plasticity; fine to medium subangular blocky; lots of small roots; distinct lower boundary.	Topsoil
	II	10–67	2.5YR 2.5/4 (dark reddish-brown) silty clay; moist; compact; cohesive; med. plasticity; fine to medium subangular blocky; few tiny roots; no cobbles.	Intact native soil
4	I	0–12	5YR 3/2 (dark reddish-brown) silty clay; dry; cohesive; low plasticity; fine to medium subangular blocky; lots of small roots; distinct lower boundary.	Topsoil
	II	12–62	2.5YR 2.5/4 (dark reddish-brown) silty clay; moist; compact; cohesive; med. plasticity; fine to medium subangular blocky; few tiny roots; no cobbles.	Intact native soil
5	I	0–24	2.5YR 2.5/4 (dark reddish-brown) silty clay mixed with Layer II in lower 12 centimeters; moist; cohesive; medium plasticity; fine to medium subangular blocky; some coral fill; lots of small roots; diffuse lower boundary.	Topsoil and introduced material for landscaping
	II	24–64	7.5YR 2.5/2 (very dark brown) silty clay; hard; non-cohesive; low plasticity; fine to medium subangular blocky; few small black rocks and glass; 30% crushed coral and coarse sand throughout with coral fill band between 41–46 centimeters; very few roots; distinct lower boundary.	Fill material to level ground surface
	III	64–84	2.5YR 2.5/4 (dark reddish-brown) silty clay; moist; compact; cohesive; med. plasticity; fine to medium subangular blocky; few tiny roots; no cobbles.	Intact native soil

Table 3. (cont.)

Test Pit	Layer	Depth (cmbs)	Description	Interpretation
6	I	0–22	2.5YR 2.5/4 (dark reddish-brown) silty clay; moist; cohesive; med. plasticity; fine to medium subangular blocky; lots of small to medium roots; few pebbles; distinct lower boundary.	Topsoil and introduced material for landscaping
	II	22–27	7.5YR 3/1 (very dark gray) silt; crumbly; non-cohesive; low plasticity; fine subangular blocky; some coarse sand (20%); ash-like; few small roots; many gray pebbles; distinct lower boundary.	Fill
	III	27–35	10YR 8/4 (very pale brown) coral fill with coarse sand; dry; crumbly; non-cohesive; low plasticity; fine to medium subangular blocky; few gray pebbles and small roots; wavy lower boundary.	Fill
	IV	30–55	5YR 3/4 (dark reddish-brown) (70%), 2.5YR 2.5/4 (dark reddish-brown) (20%), 5YR 5/8 (yellowish-red) (10%) silty clay; mottled; cohesive; medium plasticity; fine to medium subangular blocky; few small roots; distinct lower boundary.	Fill material to level ground surface
	V	55–63	7.5YR 2.5/1 (black) degraded asphalt; dry; chunky; non-cohesive; low plasticity; medium subangular blocky; no roots; distinct lower boundary.	Asphalt surface
	VI	58–71	7.5YR 3/1 (very dark gray) silt; crumbly; non-cohesive; low plasticity; fine subangular blocky; ash-like; no roots; many gray pebbles; diffuse lower boundary.	Fill
	VII	71–90	2.5YR 2.5/4 (dark reddish-brown) silty clay; moist; compact; cohesive; medium plasticity; fine to medium subangular blocky; no roots or cobbles.	Intact native soil
7	I	0–11	2.5YR 2.5/3 (dark reddish-brown) silty clay; moist; cohesive; medium plasticity; fine to medium subangular blocky; 30% gravel; lots of small roots; few coral pieces; diffuse lower boundary.	Topsoil
	II	11–14	7.5YR 4/1 (dark gray) gravel (80%) mixed with Layer I; dry; crumbly; non-cohesive; low plasticity; fine to medium subangular blocky; lots of small roots; diffuse lower boundary.	Introduced material to stabilize ground surface
	III	14–32	2.5YR 2.5/3 (dark reddish-brown) silty clay; moist; cohesive; medium plasticity; fine to medium subangular blocky; 5% gravel; few small roots; few coral pieces; distinct lower boundary.	Introduced material to stabilize ground surface
	IV	23–75	2.5YR 2.5/4 (dark reddish-brown) silty clay; moist; cohesive; medium plasticity; fine to medium subangular blocky; few small roots.	Intact native soil
8	I	0–14	2.5YR 3/3 (dark reddish-brown) silty clay; moist; cohesive; medium plasticity; fine to medium subangular blocky; lots of small roots; few pebbles and coral pieces; diffuse lower boundary.	Topsoil and introduced material for landscaping
	II	14–74	2.5YR 3/4 (dark reddish-brown) silty clay; compact; moist; cohesive; medium plasticity; fine to medium subangular blocky; few small roots.	Intact native soil

Table 3. (cont.)

Test Pit	Layer	Depth (cmbs)	Description	Interpretation
9	I	0–17	5YR 2.5/2 (dark reddish-brown) silty clay; moist; cohesive; low plasticity; fine to medium subangular blocky; lots of small roots and small rocks; few large rocks; distinct lower boundary.	Topsoil
	II	13–37	2.5YR 3/3 (dark reddish-brown) silty clay mixed with Layer III; cohesive; compact; medium plasticity; fine to medium subangular blocky; few medium rocks and small roots, diffuse lower boundary.	Fill material to level ground surface
	III	37–81	10YR 2/2 (very dark brown) silty clay; non-cohesive; low plasticity; fine to medium subangular blocky; loose; crumbly; few medium rocks and small roots; 3-inch gray PVC pipe at 61 cmbs in center of pit running parallel to Kunia Road (electrical conduit).	Fill material around PVC pipe
10	I	0–8	5YR 3/3 (dark reddish-brown) silty clay; moist; cohesive; low plasticity; fine to medium subangular blocky; lots of grass roots; few medium roots; distinct lower boundary.	Topsoil
	II	8–42	2.5YR 3/2 (dusky red) (80%), 5YR 3/2 (dark reddish-brown) (20%) silty clay; dry; crumbly; hard; non-cohesive; low plasticity; medium subangular blocky; 30% small-medium rocks; few medium roots; few glass pieces, coral, and degraded lava; diffuse lower boundary.	Fill material to stabilize ground surface
	III	42–80	5YR 3/2 (dark reddish-brown) modeled with 10YR 5/8 (yellowish-brown) clay (10%); dry; crumbly; very hard; non-cohesive; low plasticity; medium subangular blocky; 40% medium-large rocks; few small roots; cement block at 60 cmbs; large tree root at base of west wall.	Fill material to level ground surface
11	I	0–8	5YR 3/3 (dark reddish-brown) silty clay; moist; cohesive; low plasticity; fine to medium subangular blocky; lots of small roots; diffuse lower boundary.	Topsoil
	II	8–24	10R 3/4 (dusky red) silty clay; moist; cohesive; medium plasticity; fine to medium subangular blocky; few small roots; lots of small rocks; distinct lower boundary.	Fill material to stabilize ground surface
	III	24–54	2.5YR 3/4 (dark reddish-brown) silty clay; crumbly; non-cohesive; low plasticity; fine to medium subangular blocky; few small roots; lots of small-medium rocks; 1-inch-thick black cable 40 cmbs in north wall; diffuse lower boundary.	Fill material to level ground surface
	IV	54–74	2.5YR 4/6 (red) (50%), 5YR 3/3 (dark reddish-brown) (50%) silty clay; dry; crumbly; cohesive; low plasticity; fine to medium subangular blocky; very few roots; lots of small rocks.	Intact native soil
12	I	0–14	5YR 3/3 (dark reddish-brown) silty clay; moist; cohesive; low plasticity; fine to medium subangular blocky; lots of small roots; few small rocks; distinct lower boundary.	Topsoil
	II	14–19	7.5YR 3/3 (dark brown) silty clay; crumbly; non-cohesive; low plasticity; fine to medium subangular blocky; lots of small roots; chalky feel; distinct lower boundary.	Fill material to stabilize ground surface

Table 3. (cont.)

Test Pit	Layer	Depth (cmbs)	Description	Interpretation
12	III	19–21	10R 3/3 (dusky red) silty clay; cohesive; medium plasticity; fine to medium subangular blocky; few small roots; distinct lower boundary.	Fill material
	IV	21–25	2.5YR 4/4 (reddish-brown) silty clay; crumbly; cohesive; low plasticity; fine subangular blocky; few small roots; distinct lower boundary.	Fill material to stabilize ground surface
	V	25–67	10R 3/3 (dusky red) silty clay; cohesive; medium plasticity; fine to medium subangular blocky; very few roots; 3-inch gray PVC pipe at base of excavation (electrical conduit).	Fill material around PVC pipe
13	I	0–9	5YR 3/3 (dark reddish-brown) silty clay; moist; cohesive; low plasticity; fine to medium subangular blocky; lots of small roots; diffuse lower boundary.	Topsoil
	II	9–96	7.5YR 4/3 (brown) (60%), 5YR 4/6 (yellowish-red) (20%), 10R 3/4 (dusky red) (10%), 10YR 3/2 (very dark grayish brown) (10%) silty clay; loose; crumbly; semi-moist; cohesive; low plasticity; fine to medium subangular blocky; few small roots; some small rocks; crushed Schiltz can 14 cmbs; 3-inch gray PVC pipe 60 cmbs in south wall (electrical conduit).	Fill material for road

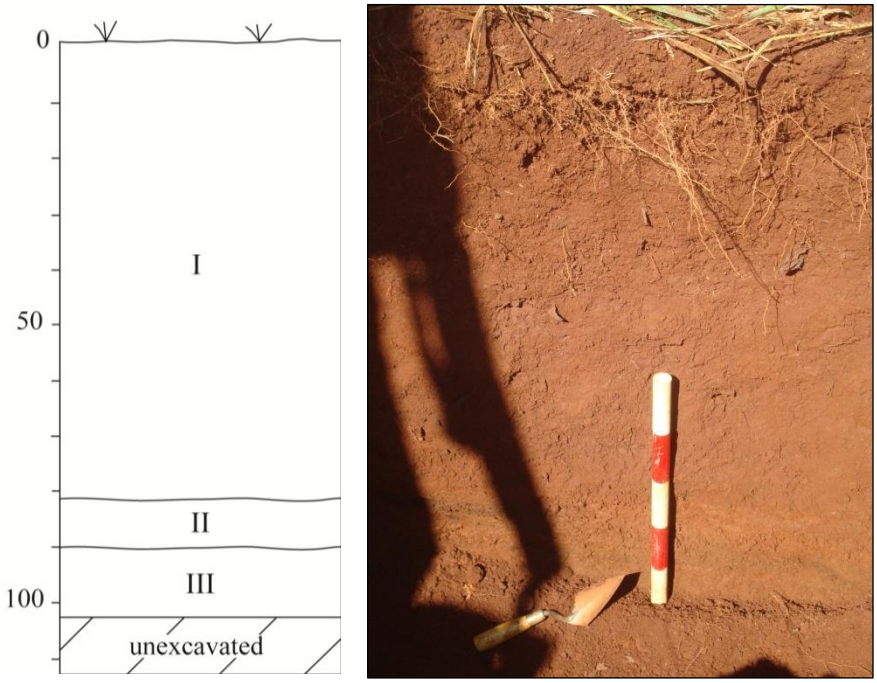

Figure 25. Test Pit 1 profile, facing northwest.

Test Pit 2

Test Pit 2 was on Hawai‘i Department of Agriculture land, 3.0 meters south of Waikele Stream gulch and 1.5 meters north of the dirt cane road running the perimeter of the field. It measured 110 centimeters long and 100 centimeters wide, with a depth of 75 cmbs and azimuth of 36 degrees. The profile was on the north wall and contained three stratigraphic layers (Layers I–III) (Figure 26).

Layer I, from 0 to 27 cmbs, is composed of dry, cohesive, dark reddish-brown silty clay. It has low plasticity, fine to medium subangular blocky peds, abundant small roots and one large root, and a distinct lower boundary. Layer II is a compact layer from 14 to 59 cmbs and is composed of moist, cohesive, dark reddish-brown silty clay mixed with Layer III (10 percent). It has medium plasticity, fine to medium subangular blocky peds, few small roots, few cobbles, and a diffuse lower boundary. Layer III is a compact layer from 53 to 75 cmbs and is composed of moist, cohesive, dark reddish-brown silty clay with hard red chunks. It has medium plasticity, medium subangular blocky peds, and no roots.

Test Pit 2 produced no evidence of traditional Hawaiian or early historic cultural deposition.

Test Pit 3

Test Pit 3 was off Duck Road on the SBMR, 7.2 meters southwest of the southwest corner of the fueling station perimeter fence. It measured 110 centimeters long and 90 centimeters wide, with a depth of 67 cmbs and azimuth of 96 degrees. The profile was in the north wall and contained two stratigraphic layers (Layers I and II) (Figure 27).

Layer I, from 0 to 10 cmbs, is composed of dry, cohesive, dark reddish-brown silty clay. It has low plasticity, fine to medium subangular blocky peds, abundant small roots, and a distinct lower boundary. Layer II is a compact layer from 10 to 67 cmbs and is composed of moist, cohesive, dark reddish-brown silty clay. It has medium plasticity, fine to medium subangular blocky peds, few rootles, and no cobbles.

Test Pit 3 produced no evidence of traditional Hawaiian or early historic cultural deposition.

Test Pit 4

Test Pit 4 was off Duck Road on the SBMR, 7.0 meters west of Duck Road and near the southeast corner of the fueling station perimeter fence. It measured 110 centimeters long and 85 centimeters wide, with a depth of 62 cmbs and azimuth of 210 degrees. The profile was in the northwest wall and contained two stratigraphic layers (Layers I and II) (Figure 28).

Layer I, from 0 to 12 cmbs, is composed of dry, cohesive, dark reddish-brown silty clay. It has low plasticity, fine to medium subangular blocky peds, abundant small roots, and a distinct lower boundary. Layer II is a compact layer from 12 to 62 cmbs and is composed of moist, cohesive, dark reddish-brown silty clay. It has medium plasticity, fine to medium subangular blocky peds, few rootlets, and no cobbles.

Test Pit 4 produced no evidence of traditional Hawaiian or early historic cultural deposition.

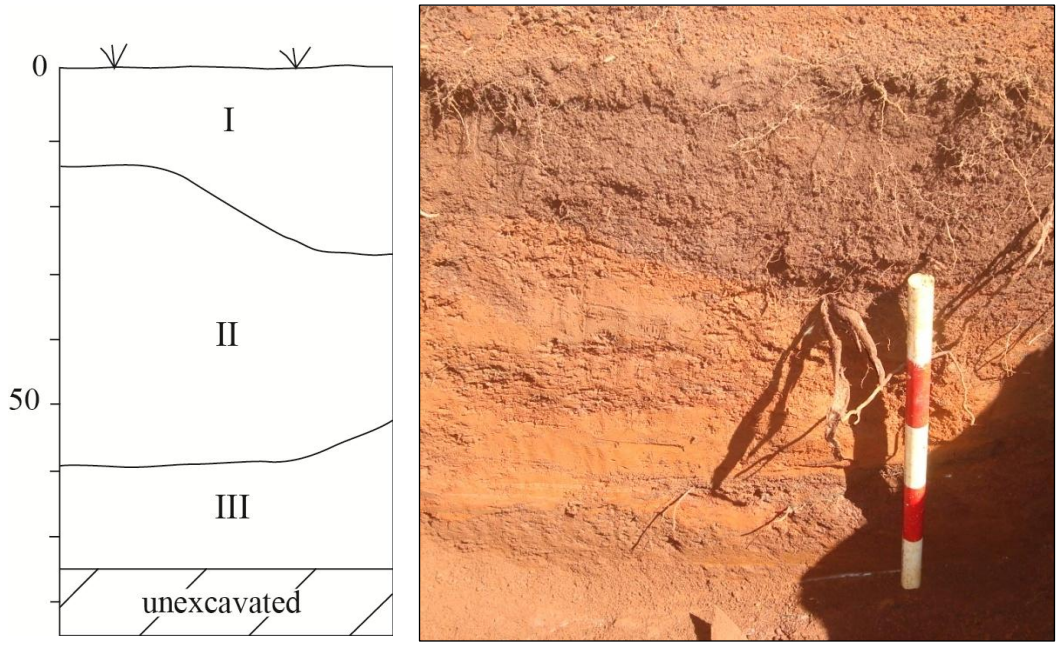

Figure 26. Test Pit 2 profile, facing north.

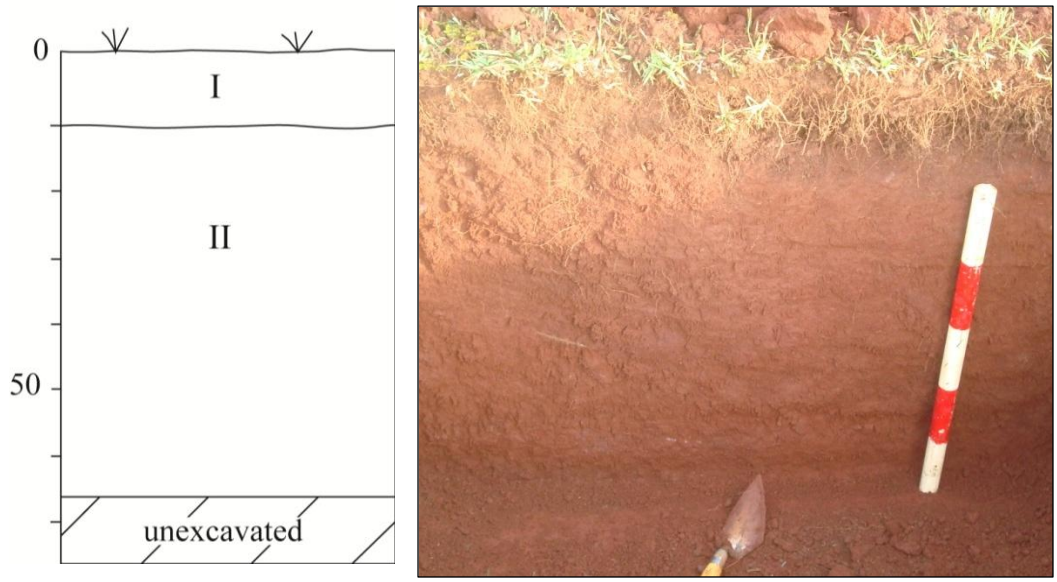

Figure 27. Test Pit 3 profile, facing north.

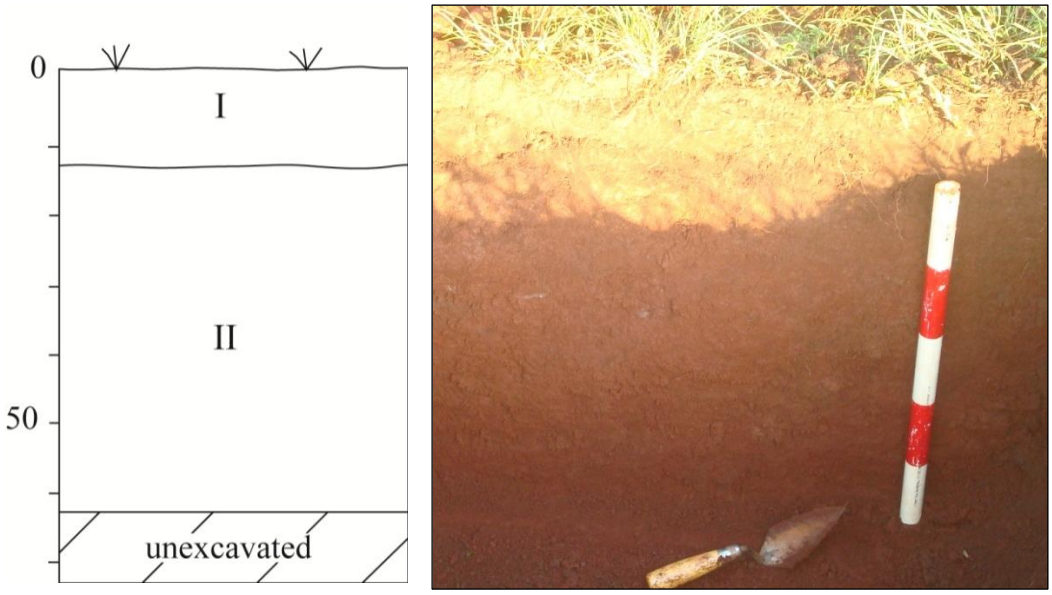

Figure 28. Test Pit 4 profile, facing northwest.

Test Pit 5

Test Pit 5 was off A Road on the SBMR, approximately 50 meters north of Lyman Road and the A Road intersection, and 7.0 meters northeast of the fenceline corner. It measured 106 centimeters long and 90 centimeters wide, with a depth of 84 cmbs and azimuth of 40 degrees. The profile was in the northwest wall and contained three stratigraphic layers (Layers I–III) (Figure 29).

Layer I, from 0 to 24 cmbs, is composed of moist, cohesive, dark reddish-brown silty clay mixed with Layer II in the lower 12 centimeters. It has medium plasticity, fine to medium subangular blocky peds, some coral fill, abundant small roots, and a diffuse lower boundary. Layer II is a compact layer from 24 to 64 cmbs and is composed of non-cohesive, very dark brown silty clay with crushed coral and coarse sand (30 percent). It has low plasticity, fine to medium subangular blocky peds, few small black rocks and glass, very few roots, a coral fill band between 41 to 46 centimeters, and a distinct lower boundary. Layer III is a compact layer from 64 to 84 cmbs and is composed of moist, cohesive, dark reddish-brown silty clay. It has medium plasticity, fine to medium subangular blocky peds, few rootlets, and no cobbles.

Test Pit 5 produced no evidence of traditional Hawaiian or early historic cultural deposition.

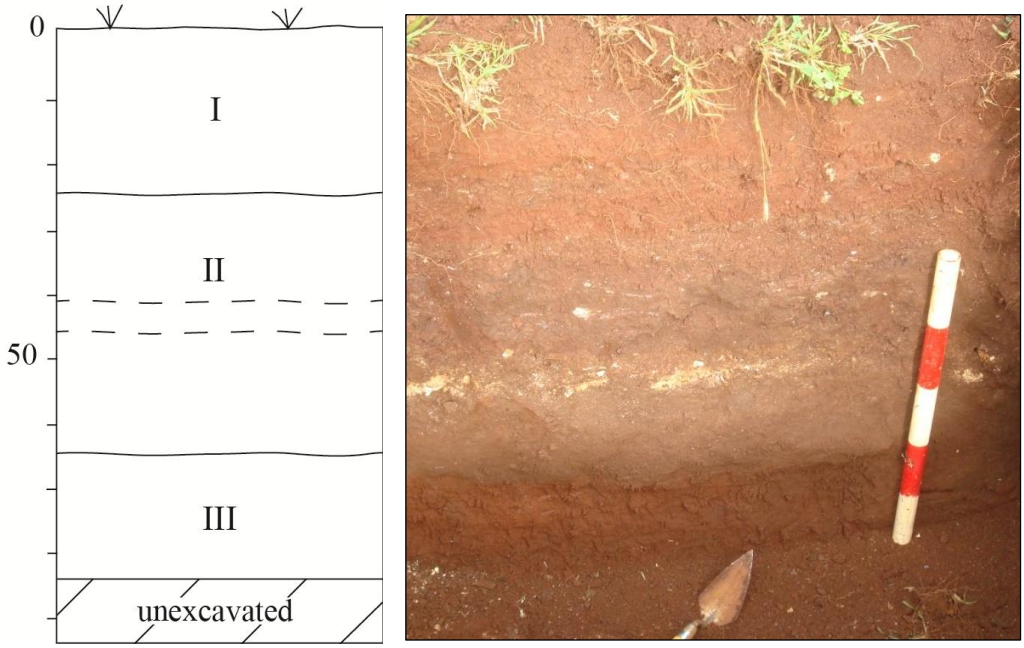

Figure 29. Test Pit 5 profile, facing northwest.

Test Pit 6

Test Pit 6 was near Car Care Center on the SBMR, 11.5 meters southwest of the southwest corner of the gas station fence. It measured 100 centimeters long and 96 centimeters wide, with a depth of 90 cmbs and azimuth of 224 degrees. The profile was in the northwest wall and contained seven stratigraphic layers (Layers I–VII) (Figure 30).

Layer I, from 0 to 22 cmbs, is composed of moist, cohesive, dark reddish-brown silty clay. It has medium plasticity, fine to medium subangular blocky peds, abundant small and medium roots, few pebbles, and a distinct lower boundary. Layer II is a crumbly layer from 22 to 27 cmbs and is composed of non-cohesive, very dark gray silt with some coarse sand (20 percent). It has low plasticity, fine subangular blocky peds, many gray pebbles, few small roots, an ash-like feel, and a distinct lower boundary. Layer III is a crumbly layer from 27 to 35 cmbs and is composed of dry, non-cohesive, very pale brown coral fill with coarse sand. It has low plasticity, fine to medium subangular blocky peds, few gray pebbles and small roots, and a wavy lower boundary. Layer IV is from 30 to 55 cmbs and is composed of a cohesive, dark reddish-brown silty clay with some yellowish-red silty clay (10 percent), It has a mottled appearance, medium plasticity, fine to medium subangular blocky peds, few small roots, and a distinct lower boundary. Layer V is from 55 to 63 cmbs and is composed of dry, chunky, non-cohesive, black degraded asphalt. It has low plasticity, medium subangular blocky peds, no roots, and a distinct lower boundary. Layer VI is a crumbly layer from 58 to 71 cmbs and is composed of non-cohesive, very dark gray silt. It has low plasticity, fine subangular blocky peds, many gray pebbles, no roots, an ash-like feel, and a diffuse

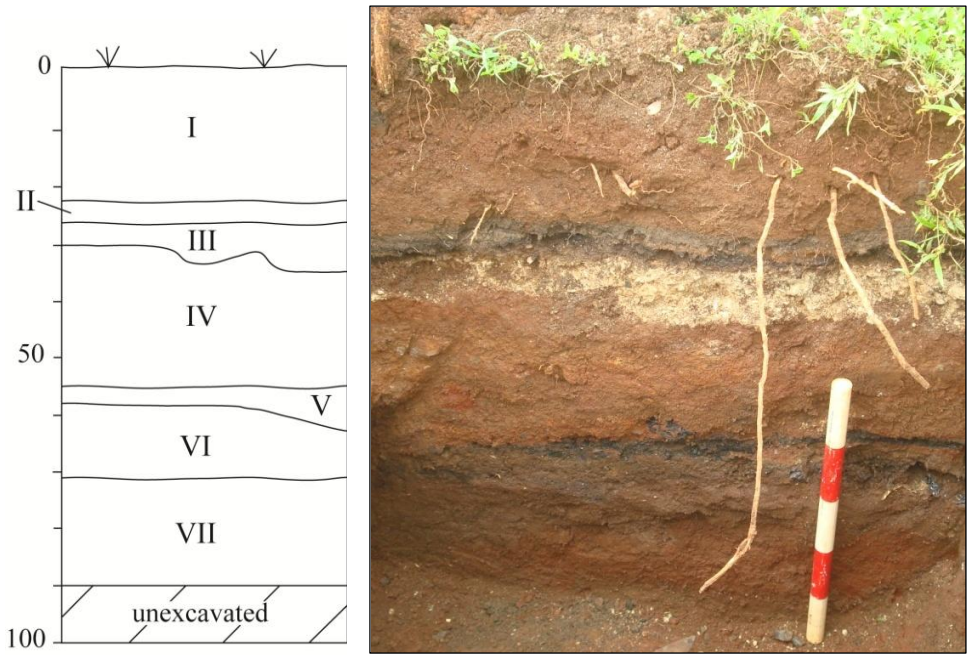

Figure 30. Test Pit 6 profile, facing northwest.

lower boundary. Layer VII is a compact layer from 71 to 90 cmbs and is composed of moist, cohesive, dark reddish-brown silty clay. It has medium plasticity, fine to medium subangular blocky peds, and no roots or cobbles.

Test Pit 6 produced no evidence of traditional Hawaiian or early historic cultural deposition.

Test Pit 7

Test Pit 7 was 9.2 meters southeast of the southeast corner of the 500th Military Intelligence Brigade Building 130 on the SBMR. It measured 94 centimeters long and 84 centimeters wide, with a depth of 75 cmbs and azimuth of 56 degrees. The profile was in the north wall and contained four stratigraphic layers (Layers I–IV) (Figure 31).

Layer I, from 0 to 11 cmbs, is composed of moist, cohesive, dark reddish-brown silty clay with 30 percent gravel. It has medium plasticity, fine to medium subangular blocky peds, abundant small roots, few coral pieces, and a diffuse lower boundary. Layer II is a crumbly layer from 11 to 14 cmbs and is composed of dry, non-cohesive, dark gray gravel mixed with Layer I (20 percent). It has low plasticity, fine to medium subangular blocky peds, lots of small roots, and a diffuse lower boundary. Layer III is from 14 to 32 cmbs and is composed of moist, cohesive, dark reddish-brown silty clay with 5 percent gravel. It has medium plasticity, fine to medium subangular blocky peds, few small roots and coral pieces, and a distinct lower boundary. Layer IV is from 23 to 75 cmbs and is composed of moist, cohesive, dark reddish-brown silty clay. It has medium plasticity, fine to medium subangular blocky peds, and few small roots.Layer IV is

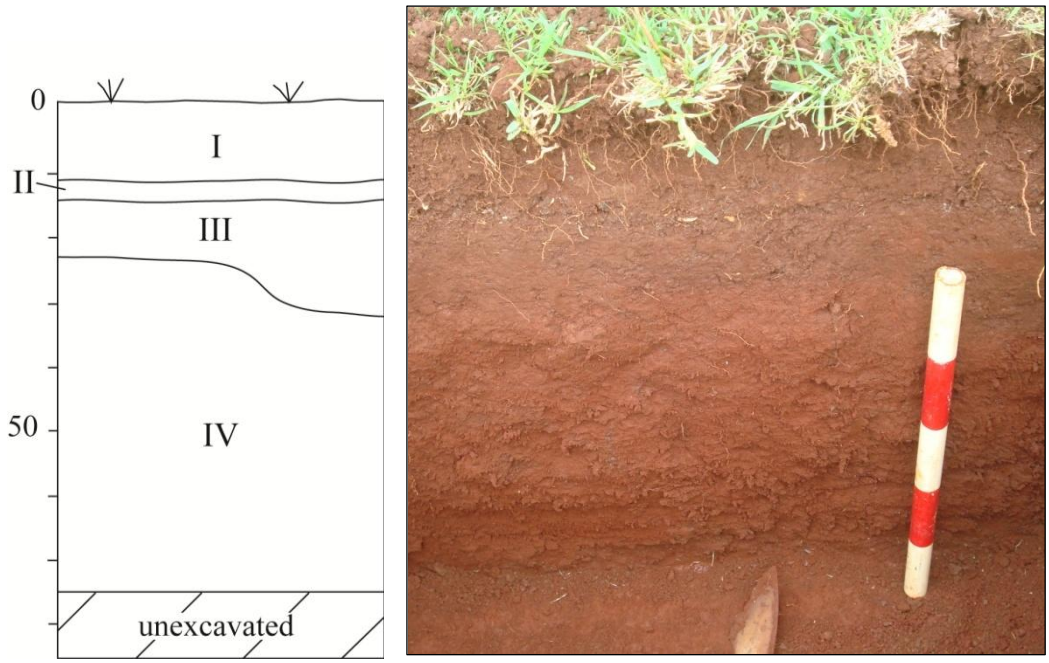

Figure 31. Test Pit 7 profile, facing north.

composed of a moist, cohesive, dark reddish-brown silty clay. It has a medium plasticity, fine to medium subangular blocky peds and few small roots.

Test Pit 7 produced no evidence of traditional Hawaiian or early historic cultural deposition.

Test Pit 8

Test Pit 8 was off the northwest curve of Eastman Road on WAAF, 7.6 meters west of a hedge demarking a parking area near Waiʻanae Avenue. It measured 93 centimeters long and 87 centimeters wide, with a depth of 74 cmbs and azimuth of 144 degrees. The profile was on the northeast wall and contained two stratigraphic layers (Layers I and II) (Figure 32).

Layer I, from 0 to 14 cmbs, is composed of moist, cohesive, dark reddish-brown silty clay. It has medium plasticity, fine to medium subangular blocky peds, abundant small roots, few pebbles and coral pieces, and a diffuse lower boundary. Layer II is a compact layer from 14 to 74 cmbs and is composed of moist, cohesive, dark reddish-brown silty clay. It has medium plasticity, fine to medium subangular blocky peds, and few small roots.

Test Pit 8 produced no evidence of traditional Hawaiian or early historic cultural deposition.

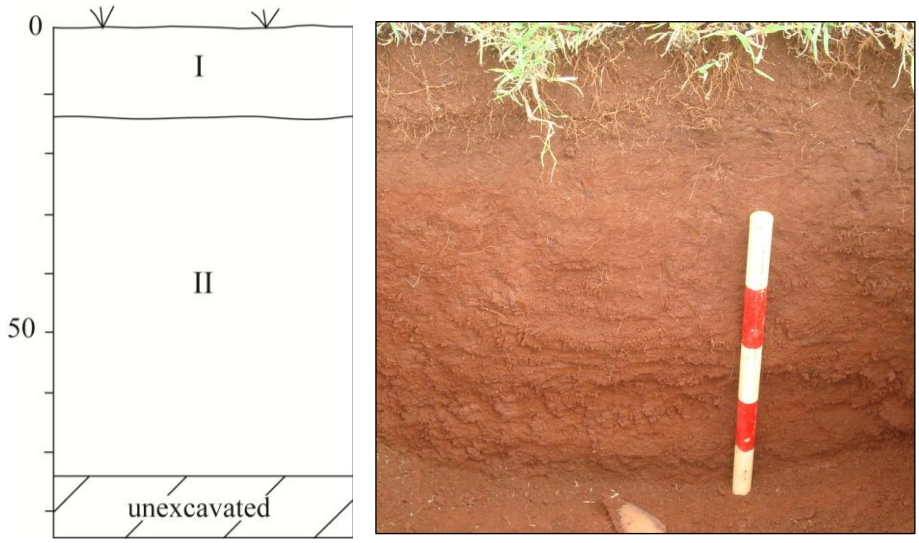

Figure 32. Test Pit 8 profile, facing northeast.

Test Pit 9

Test Pit 9 was in the right-of-way on the west side of Kunia Road, approximately 100 meters southwest of the Wilikina Drive intersection and 9.0 meters southwest of the Kokoloea Place intersection. It measured 105 centimeters long and 85 centimeters wide, with a depth of 81 cmbs. The profile was in the northwest wall and contained three stratigraphic layers (Layers I–III) (Figure 33).

Layer I, from 0 to 17 cmbs, is composed of moist, cohesive, dark reddish-brown silty clay. It has low plasticity, fine to medium subangular blocky peds, abundant small roots and pebbles, few cobbles, and a distinct lower boundary. Layer II is a compact layer from 13 to 37 cmbs and is composed of cohesive, dark reddish-brown silty clay mixed with Layer III. It has medium plasticity, fine to medium subangular blocky peds, few cobbles and small roots, and a diffuse lower boundary. Layer III is a loose, crumbly layer from 37 to 81 cmbs and is composed of non-cohesive, very dark brown silty clay. It has low plasticity, fine to medium subangular blocky peds, few cobbles, and small roots. A 3-inch gray PVC pipe was encountered at 61 cmbs and parallel to Kunia Road.

Test Pit 9 produced no evidence of traditional Hawaiian or early historic cultural deposition.

Test Pit 10

Test Pit 10 was in the right-of-way on the south side of Wilikina Drive, 4.0 meters southwest of the second light pole east of the Kunia Road intersection. It measured 100 centimeters long and 88 centimeters wide, with a depth of 80 cmbs and azimuth of 84 degrees. The profile was in the north wall and contained three stratigraphic layers (Layers I–III) (Figure 34).

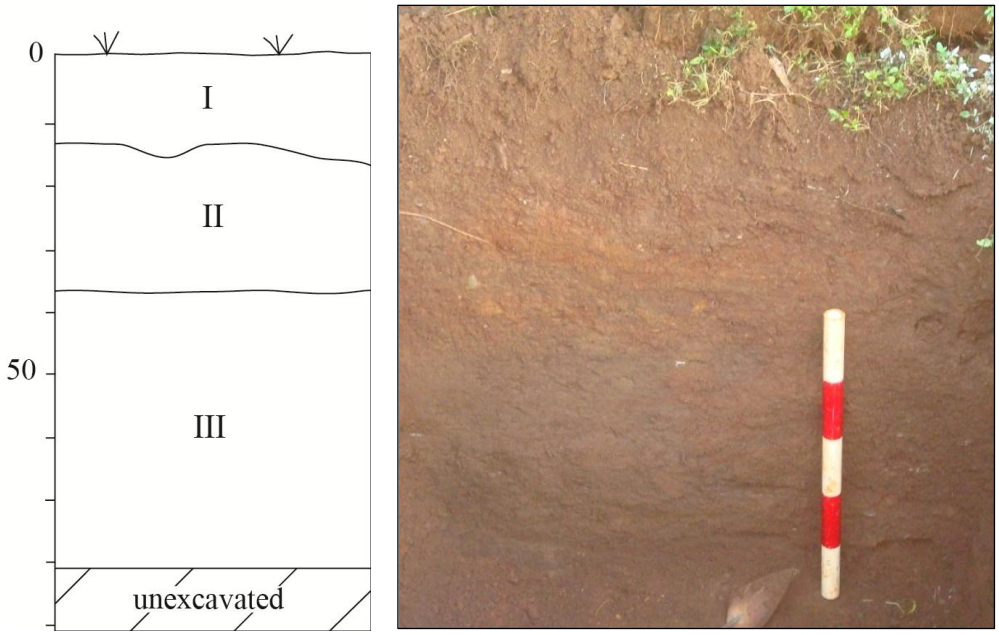

Figure 33. Test Pit 9 profile, facing northwest.

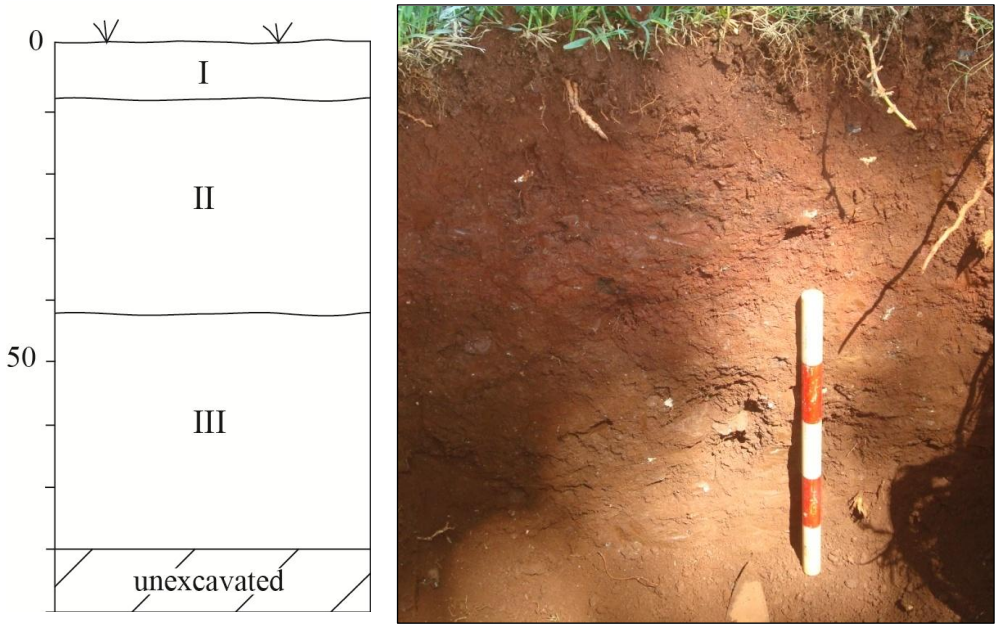

Figure 34. Test Pit 10 profile, facing north.

Layer I, from 0 to 8 cmbs, is composed of moist, cohesive, dark reddish-brown silty clay. It has low plasticity, fine to medium subangular blocky peds, abundant small roots, few medium roots, and a distinct lower boundary. Layer II is a crumbly, compact layer from 8 to 42 cmbs and is composed of dry, non-cohesive, dusky red silty clay mixed with dark reddish-brown silty clay (20 percent). It has low plasticity, medium subangular blocky peds, 30 percent small-medium rocks, few medium roots, few glass pieces, degraded basalt, few coral pieces, and a diffuse lower boundary. Layer III is a crumbly, compact layer from 42 to 80 cmbs and is composed of dry, non-cohesive, dark reddish-brown silty clay modeled with yellowish-brown clay (10 percent). It has low plasticity, medium subangular blocky peds, 40 percent medium-large cobbles, few small roots, cement block at 60 cmbs, and a large tree root at the base of the west wall.

Test Pit 10 produced no evidence of traditional Hawaiian or early historic cultural deposition.

Test Pit 11

Test Pit 11 was in the right-of-way on the south side of Wilikina Drive, 3.1 meters northeast of the third light pole east of the Kunia Road intersection. It measured 108 centimeters long and 90 centimeters wide, with a depth of 74 cmbs and azimuth of 80 degrees. The profile was in the south wall and contained four stratigraphic layers (Layers I–IV) (Figure 35).

Layer I, from 0 to 8 cmbs, is composed of moist, cohesive, dark reddish-brown silty clay. It has low plasticity, fine to medium subangular blocky peds, abundant small roots, and a diffuse lower boundary. Layer II, from 8 to 24 cmbs, is composed of moist, cohesive, dusky red silty clay. It has medium plasticity, fine to medium subangular blocky peds, abundant pebbles, few small roots, and a distinct lower boundary. Layer III is a crumbly layer from 24 to 54 cmbs and is composed of non-cohesive, dark reddish-brown silty clay. It has low plasticity, fine to medium subangular blocky peds, abundant medium-large cobbles, few small roots, and diffuse boundary. A 1-inch black cable was encountered at 40 cmbs in the north wall. Layer IV is a crumbly layer from 54 to 74 cmbs and is composed of dry, cohesive, dark reddish-brown and red silty clay. It has low plasticity, fine to medium subangular blocky peds, abundant pebbles, and very few roots.

Test Pit 11 produced no evidence of traditional Hawaiian or early historic cultural deposition.

Test Pit 12

Test Pit 12 was in the right-of-way on the south side of Wilikina Drive, 9.3 meters southwest of the sixth light pole east of the Kunia Road intersection. It measured 108 centimeters long and 78 centimeters wide, with a depth of 67 cmbs and azimuth of 62 degrees. The profile was in the south wall and contained five stratigraphic layers (Layers I–V) (Figure 36).

Layer I, from 0 to 14 cmbs, is composed of moist, cohesive, dark reddish-brown silty clay. It has low plasticity, fine to medium subangular blocky peds, abundant small roots, few pebbles, and a distinct lower boundary. Layer II is a crumbly layer from 14 to 19 cmbs and is composed of non-cohesive, dark brown silty clay. It has low plasticity, fine to medium subangular blocky peds, abundant small roots, a chalk-like feel, and a distinct lower boundary. Layer III, from 19 to 21 cmbs, is composed of cohesive, dusky red silty clay. It has medium plasticity, fine to medium subangular blocky peds, few small roots, and a distinct lower boundary.

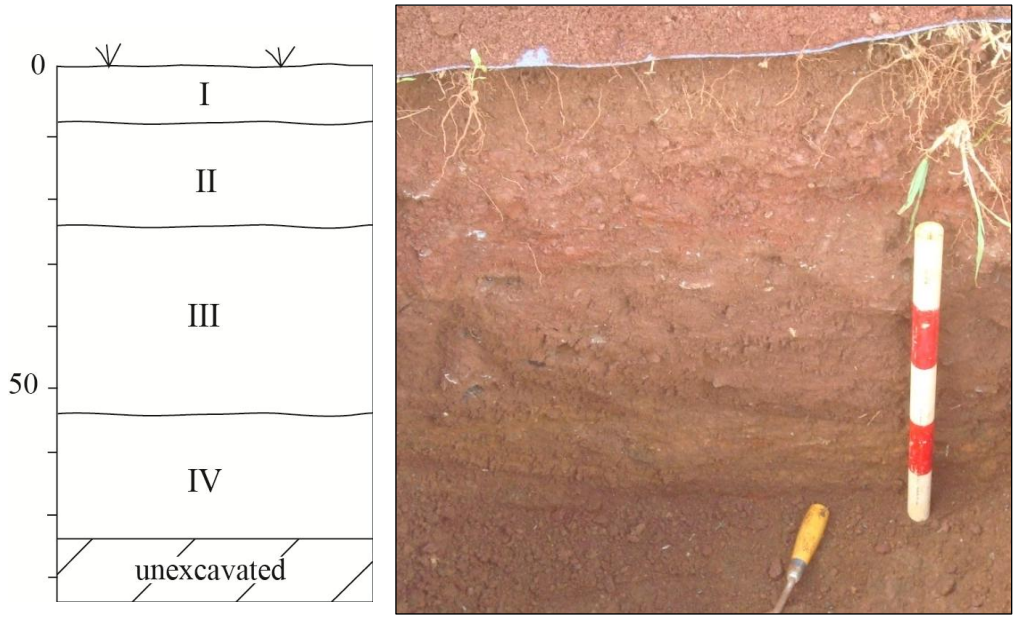

Figure 35. Test Pit 11 profile, facing south.

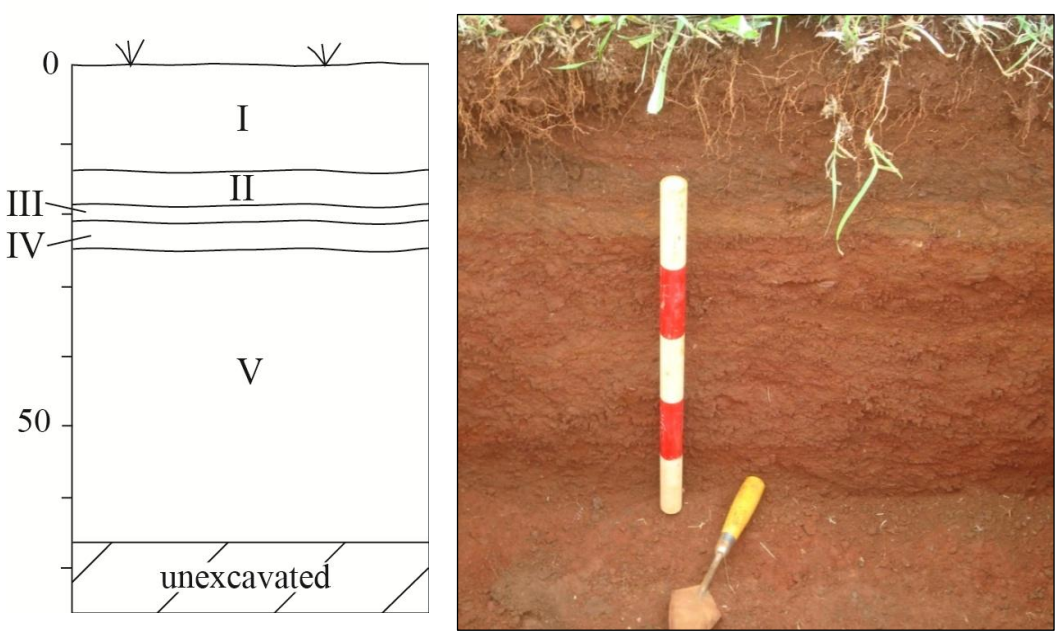

Figure 36. Test Pit 12 profile, facing south.

Layer IV is a crumbly layer from 21 to 25 cmbs and is composed of cohesive, reddish-brown silty clay. It has low plasticity, fine subangular blocky peds, few small roots, and a distinct lower boundary. Layer V, from 25 to 67 cmbs, is composed of cohesive, dusky red silty clay. It has medium plasticity, fine to medium subangular blocky peds, and very few roots. A 3-inch gray PVC pipe running parallel to Wilikina Drive was encountered at the base of excavation.

Test Pit 12 produced no evidence of traditional Hawaiian or early historic cultural deposition.

Test Pit 13

Test Pit 13 was in the right-of-way on the south side of Wilikina Drive, 11.0 meters west of the first light pole west of the Lakeview Circle intersection. It measured 110 centimeters long and 78 centimeters wide, with a depth of 96 cmbs and azimuth of 78 degrees. The profile was in the north wall and contained two stratigraphic layers (Layers I and II) (Figure 37).

Layer I, from 0 to 9 cmbs, is composed of moist, cohesive, dark reddish-brown silty clay. It has low plasticity, fine to medium subangular blocky peds, abundant small roots, and a diffuse lower boundary. Layer II is a loose, crumbly layer from 9 to 96 cmbs and is composed of semi-moist, cohesive, brown silty clay modeled with yellowish-red, dusky red, and very dark grayish-brown silty clay. It has low plasticity, fine to medium subangular blocky peds, few pebbles, and few small roots. A crushed Schlitz beer was encountered at 14 cmbs and a 3-inch gray PVC pipe, oriented parallel with Wilikina Drive, was observed at 60 cmbs in the south wall of the test pit.

Test Pit 13 produced no evidence of traditional Hawaiian or early historic cultural deposition.

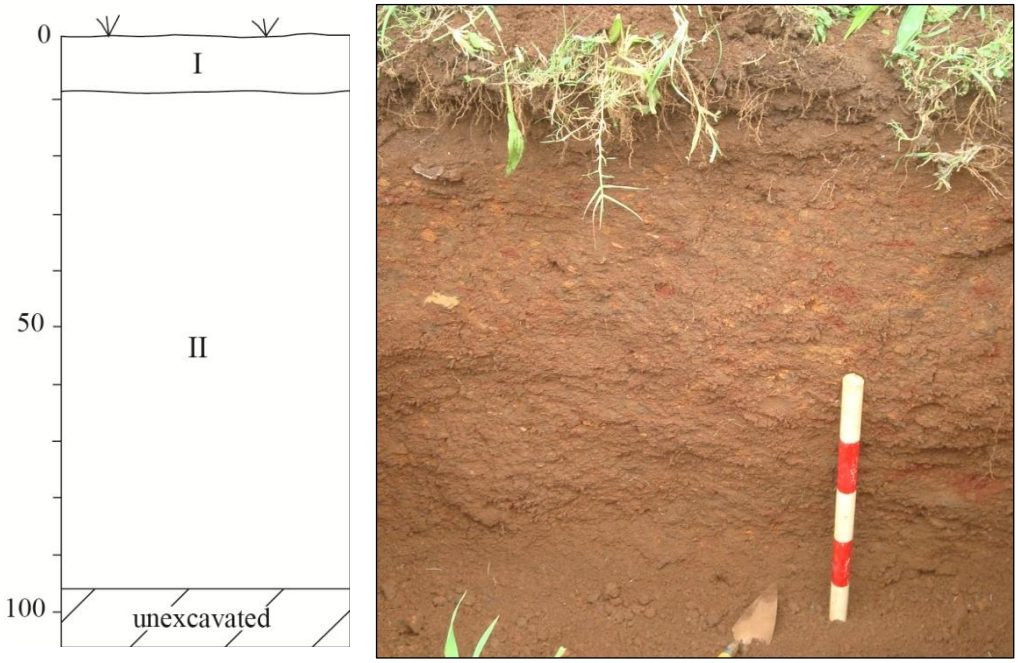

Figure 37. Test Pit 13 profile, facing north.

5.0 SUMMARY AND CONCLUSIONS

The primary objective of the AIS was to identify, document, and evaluate all pre-Contact and post-Contact properties within the Schofield Generating Station Project APE using a sampling strategy proportionate to the archaeological sensitivity of the area. Previous archaeological findings in the project vicinity indicate that the APE has a very low probability for archaeological resources. The 8.1-acre generator site, in particular, is on former pineapple fields where nearly a century of cultivation has likely destroyed most, if not all, cultural deposits. Furthermore, the upper plateaus used for pineapple were generally not preferred by pre-Contact Hawaiians of the Līhuʻe area for habitation or subsistence. Most of the known traditional Hawaiian sites in the region are found in gulch bottoms or on high-elevation ridges. The transmission line corridor likewise has a very low probability for archaeological deposits. The corridor, while less studied archaeologically, is largely within a heavily utilized right-of-way that has been subject to a great deal of modern disturbance.

Archaeological testing results support the findings of the background research. Excavation of eight test trenches and 13 test pits produced no evidence of traditional Hawaiian or early historic cultural deposition. Stratigraphic data from the generating station test trenches clearly indicate the presence of an extensive pineapple cultivation, or "plowzone," layer consisting of a weathered reddish-brown silty clay with charcoal flecking (presumably from field burns) and decomposing black plastic fragments.[4] The cultivation layer lies directly on intact native soil that shows no signs of anthropogenic disturbance. Similarly, test pit excavation at the new pole locations produced only construction fill overlying undisturbed volcanic soil. In some cases the intact soil was quite shallow, between 10 and 14 cmbs. It is reasonable to surmise that some degree of cutting, filling, and grading has occurred in this semi-urban corridor, and that we might therefore be observing truncated native soils.

Importantly, Test Pits 1, 2, and 3, intentionally selected because of their location on the edge of Waiʻeli Gulch, also contained no cultural deposits. Project activities along edges of Waiʻeli Gulch were raised as a special concern by U.S. Army Garrison-Hawaii archaeologists during early coordination meetings. Since pre-Contact and early historic habitation and subsistence in the region tended to be focused on the rich gulch bottomlands, it was felt that these locales had a higher probability for archaeological resources relative to the rest of the APE. All new pole locations along the edges of Waiʻeli Gulch were tested and produced negative results.

In conclusion, AIS data indicate that the Schofield Generating Station Project is very unlikely to affect archaeological sites. Test excavation results confirm that the APE has a very low probability for containing archaeological deposits. Extensive land modifications associated with a century of commercial cultivation, ranching, U.S. military activity, and urbanization has likely destroyed most of the tangible evidence of the traditional Hawaiian and early historic past in this area.

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[4] Black plastic sheeting is used in commercial pineapple cultivation to hinder weed growth and retain soil moisture.

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Appendix H
Cultural Impact Assessment

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Cultural Impact Assessment for Schofield Generating Station Project, Wai‘anae Uka, Honouliuli, and Waikele Ahupua‘a in Wahiawā and ‘Ewa Districts, O‘ahu Island, Hawai‘i

TMKs (1) 7-7-001:001, 9-2-005:026, and 9-4-012:003

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GANDA Report No. 2269-1

GANDA

June 2014

MANAGEMENT SUMMARY

At the request of Tetra Tech, Inc., Garcia and Associates conducted a Cultural Impact Assessment (CIA) in support of a joint Federal/State Environmental Impact Statement (EIS) for the Schofield Generating Station Project (SGSP) in the western portion of O‘ahu’s central plateau. Tetra Tech, Inc. is supporting the Army and Hawaiian Electric Company in preparation of the joint EIS. The CIA is being conducted in accordance with the requirements of the Hawai‘i Environmental Policy Act (HEPA) as codified in Hawai‘i Revised Statutes (HRS) Chapter 343, Environmental Impact Statements. The study’s objective is to assess the level of impact that would be caused by implementing the proposed project on traditional and current cultural practices and beliefs. This assessment was accomplished by gathering information through archival research and consulting with appropriate and knowledgeable community members to identify cultural practices and traditional land use in the project area.

The collected data indicate that that there will be no adverse impact to cultural resources, cultural practices, and traditional beliefs by the proposed SGSP. Although O‘ahu’s central plateau played a significant role in traditional Hawaiian sociopolitical development, warfare, and ceremonial activities, more than a century of commercial agriculture, military development, and urban growth have eliminated most, if not all, of the tangible evidence of pre-Contact cultural activity in the project area and have disassociated the Hawaiian community from traditional land use practices. There is no tangible or intangible evidence of any former or ongoing cultural activities occurring in the project area.

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TABLE

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1.0 INTRODUCTION

At the request of Tetra Tech, Inc., Garcia and Associates conducted a Cultural Impact Assessment (CIA) in support of a joint Federal/State Environmental Impact Statement (EIS) for the Schofield Generating Station Project (SGSP). Tetra Tech, Inc. is supporting the Army and Hawaiian Electric Company in preparation of the joint EIS. The SGSP is in the western portion of Oʻahu's central plateau and includes portions of Waiʻanae Uka Ahupuaʻa in Waiʻanae District and Waikele and Honouliuli Ahupuaʻa in ʻEwa District (TMKs (1) 7-7-001:001, 9-2-005:026, and 9-4-012:003) (Figure 1).

The objective of the CIA is to assess the level of impact that would be caused by implementing the proposed SGSP on traditional and current cultural practices and beliefs. The assessment was accomplished by collecting and analyzing data on cultural practices and traditional land use in the project area through a combination of archival research and consultation with appropriate community members.

1.1 Proposed Action

The SGSP, a project of the U.S. Army's Energy Initiatives Task Force, is being undertaken to increase production and integration of renewable energy and to provide energy security to Army installations. U.S. Army Garrison-Hawaii proposes to lease Hawaiian Electric Company an 8.13-acre parcel on Schofield Barracks Military Reservation's (SBMR) Kunia Training Area (KUNTA) to construct a 50-megawatt biofuel-capable power generation plant (Figure 2).

To connect the generating station to the existing Hawaiian Electric Company grid at Wheeler Army Airfield (WAAF) and Wahiawā substations, U.S. Army Garrison-Hawaii and the State of Hawaiʻi will provide Hawaiian Electric Company with a 3.7-kilometer interconnection easement for a 46-kilovolt aboveground transmission line. The transmission line will extend from the east side of the new power plant, across Waiʻeli Gulch, and onto the southwest corner of SBMR's cantonment. The line will then continue along the southwestern extremity of the cantonment and cross Duck Road, Lyman Road, and Lyman Gate following the SBMR-Kunia Road fence line. It will then cross Kunia Road and enter WAAF between Waiʻanae Avenue and Eastman Road. At the U.S. Army's Wheeler Substation, the line will split with one line running northwest onto the SBMR cantonment (terminating at Ralston Field) and the other running east along Wilikina Drive. The Wilikina line will extend over the south fork of Wahiawā Reservoir (Lake Wilson) and terminate at Hawaiian Electric Company's Wahiawā Substation.

A series of 47 electrical poles will support the transmission line. The poles will be 60 to 80 feet high and 24 inches in diameter. Of the 47 poles, 36 will be newly installed, 7 will be replacements for existing poles, and 4 will be existing poles (Figure 2).

1.2 Regulatory Authority

Evaluation of impacts to cultural and historic resources for the SGSP is required by the U.S. Army's implementing regulations (Title 32 of the *Code of Federal Regulations* [CFR] Part 651, *Environmental Analysis of Army Actions*) of the National Environmental Policy Act (NEPA) [Title 42 of the *United States Code* (U.S.C.) Sections 4321 to 4370 (f)], NEPA regulations (40 CFR Parts 1500–1508), and the Hawaiʻi Environmental Policy Act (HEPA) as codified in Hawaiʻi Revised Statutes (HRS) Chapter 343, *Environmental Impact Statements*.

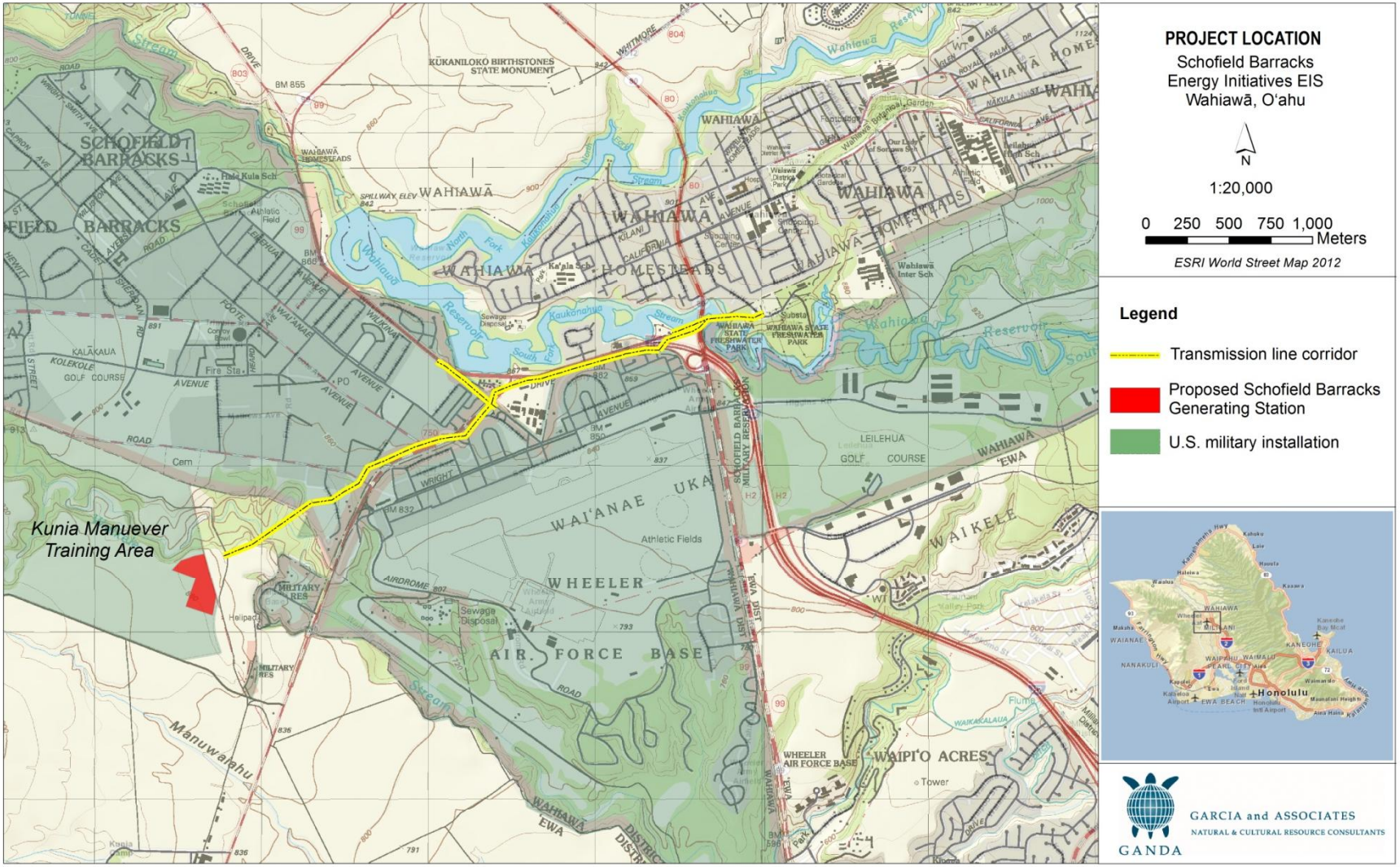

Figure 1. Location of the Schofield Generating Station Project.

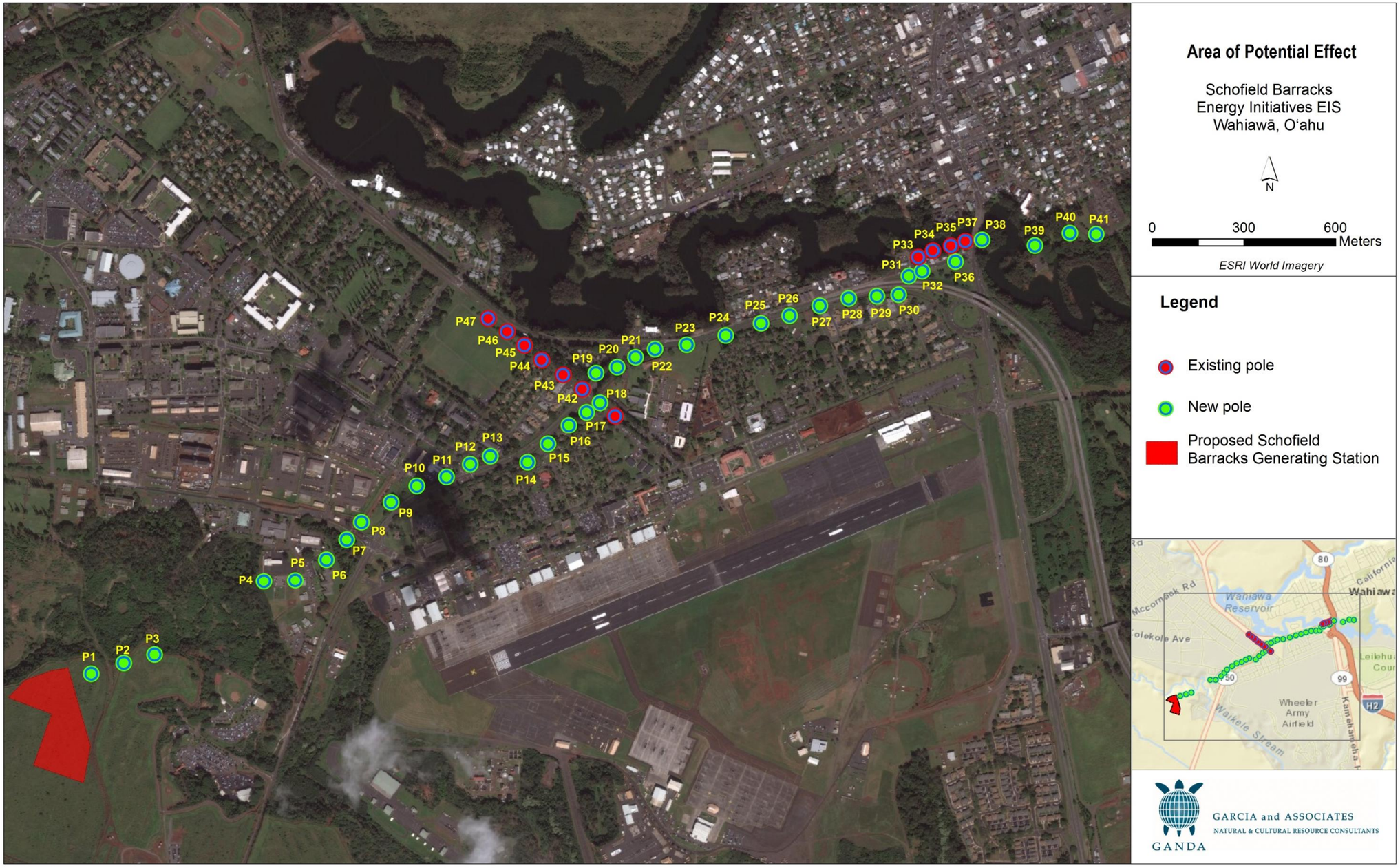

Figure 2. Area of Potential Effect (APE) for Schofield Generating Station, including transmission corridor improvements.

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Under NEPA and HEPA regulations, an EIS must consider the effects of the proposed action on the *human environment*, which 40 CFR 1508.14 defines as "the natural and physical environment and the relationship of people with that environment." The human environment includes important scientific, archaeological, and tangible and intangible cultural resources. Chapter 343, HRS, also requires consideration of a proposed action's effects on the cultural practices of the community and the State. The CIA was conducted in accordance with the State of Hawai'i Office of Environmental Quality Control's Guidelines for Assessing Cultural Impacts (1997).

1.3 Area of Potential Effect

The Area of Potential Effect (APE) is the surface and subsurface landscape that might be impacted by implementation of the proposed project. The APE for the SGSP falls largely within SBMR property, but also extends onto properties owned or leased by the State of Hawai'i's Departments of Agriculture, Transportation, and Land and Natural Resources. As stated above, the generating station will be sited on an 8.13-acre parcel on the western edge of KUNTA in Honouliuli Ahupua'a, and a 3.7-kilometer overhead transmission line will connect the power plant to Hawaiian Electric Company's WAAF and Wahiawā substations (Figure 1).

The project's APE includes the generating station's footprint and all locations at which new power poles will be installed. New pole installation will involve excavating boreholes sufficiently wide to support 24-inch-diameter power pole bases. The boreholes will extend 2.75 meters (9 feet) beneath the surface. As mentioned previously, 36 new poles will be installed at the locations shown in Figure 2. These 36 pole locations, and the 9 feet below ground, in addition to the generating station footprint, constitute the APE for direct effects of the project. Installation of replacement poles will use the holes remaining from the removal of old poles and will not involve new ground disturbance.

To keep construction impacts to a minimum, there will be no vegetation grubbing during new pole installation or during periodic line maintenance. No roads will be constructed through the gully to access pole installation locales. Indirect effects are therefore not anticipated for new pole installation or maintenance.

1.4 Personnel and Schedule

The CIA was carried out from January to April 2014. Jolie Liston, PhD, served as the project's Principal Investigator. She was assisted by Michael Desilets, MA, and Amanda Sims, BA. Dr. Liston has conducted oral history research extensively in Micronesia and has been conducting cultural resource management studies in Hawai'i for more than a decade.

2.0 ETHNOGRAPHIC SURVEY METHODS

The CIA focuses on identifying historic and extant traditional Hawaiian practices associated with subsistence, medicinal, religious, and cultural activities and beliefs in the project area. This information is used to assess the impact of the proposed action on the relationship of Hawaiian community members to the identified cultural resources, beliefs, and traditional land uses. Archival research and an ethnographic survey were the two methods used to collect information for the CIA.

2.1 Ethnographic Consultation Methods

Ethnographic consultation consisted of locating expert cultural practitioners and appropriate community members to interview, consulting with the knowledgeable individuals, and analyzing the ethnographic data provided.

2.1.1 Consultant Selection

The first step in the ethnographic consultation process is locating individuals who are knowledgeable about, and willing to share, cultural practices, *moʻolelo*, and traditional land use in the APE and the surrounding area. The selection of consultants was based on the following criteria:

- Had or has ties to the project location
- Known Hawaiian cultural expert
- Known Hawaiian traditional practitioner
- Referred by a cultural expert, traditional practitioner, or cultural resource professional

Appropriate organizations and individuals who met the criteria were contacted (Table 1). Efforts to locate individuals with traditional knowledge about the specific APE met with limited success because of the inherent limitations in conducting an ethnographic survey of the lands encompassed by the SGSP. Few people retain generational or first-hand information about the project area's traditional cultural practices and land use. This is due to the Hawaiian population not occupying or using these lands since the U.S. military acquired them at the turn of the 20th century or since they became large-scale commercial agricultural plantations soon after.

Project Consultants

Very few of the contacts were willing to participate in the ethnographic survey, citing a lack of information about the project area. Two cultural consultants, Mr. Thomas T. Shirai, Jr. and Mr. Shad S. Kane, however, agreed to be interviewed.

Mr. Shirai has limited knowledge of the area, although his *manaʻo* was taken into consideration. Mr. Kane provided a comprehensive overview of the traditional *moʻolelo* of the central plateau that he said relied heavily on archival literature and archaeological information.

Thomas T. Shirai, Jr., born in 1961 in Honolulu, is in the Kawaihapai *ʻohana* from Mokuleia and lives in Waialua. Mr. Shirai is a graduate of Waialua High School. He is the great-great grandnephew of Anton Kaʻoʻo (a noted hula master from Waialua). Currently a member of the North Shore Neighborhood Board and the Mokuleia Community Association, Mr. Shirai served on the Oʻahu Island Burial Council and the Office of Hawaiian Affairs Hawaiian Historic Preservation Council. Mr. Shirai was a consultant to U.S. Army Garrison-Hawaii for cultural resource matters associated with the Stryker Brigade Combat Team transformation project and various undertakings at Dillingham Airfield, Oʻahu.

Table 1. List of Organizations and Individuals Contacted for Ethnographic Survey

Name of Contact	Contact Method	Results of Contact	Referred To
Hawaiian Civic Club of Wahiʻawa	announcement at meeting(s), posting on club Internet site (by Jo-Lin Lenchanko)	one-sentence email response from Thomas Lenchanko	-
Maria Kaimipono Orr	email	referrals to others	Thomas T. Shirai, Jr.; Shad S. Kane
Jo-Lin Lenchanko Kalimapau	email, telephone	contacted Hawaiian Civic Club of Wahiʻawa	-
Keona Mark	email, telephone	suggested taking interested parties on tour of APE to elicit comments	-
Thomas T. Shirai, Jr.	visit for consultation	no traditional knowledge of SGSP area	-
Shad S. Kane	visit for consultation	provided the significant recorded oral histories of project area	-
Ginger Burch	telephone, visit for consultation	not able to connect	-

Shad S. Kane served 34 years as a Honolulu Police Department Metropolitan Lieutenant. He was born on February 23, 1945, in Honolulu and graduated from Kamehameha Schools in 1964. He then acquired his BA from the University of Hawaiʻi in 1976 and an MA in Public Administration from Central Michigan University in 1980. Mr. Kane lives in Kapolei where he is a charter member of the Kapolei Hawaiian Civic Club and chairman of the Committee on the Preservation of Historic Sites and Cultural Properties of the Oʻahu Council of Hawaiian Civic Clubs. He is also with the Royal Order of Kamehameha ʻEkahi, the Native American Advisory Group as a Native Hawaiian member, the Oʻahu Island Burial Council, the Makakilo/Kapolei Lions Club, and a member of the Historic Preservation Partner of the Navy Region Hawaiʻi.

2.1.2 Interview Process

Each interview was conducted at the convenience of the cultural consultant. Consultations were recorded on a digital audio recorder. A *makana*, or gift, was given to each consultant in keeping with traditional reciprocal protocol.

The consultation began with a brief overview of the nature and location of the SGSP. Topographic and satellite view maps of the project area were used to identify the exact location of the proposed generating station and electric poles. The cultural consultant was then given a consent or "agreement to participate" form to review and sign (see Appendix A).

Topics discussed included the cultural consultant's background, general knowledge of the project area, and information on past and current traditional land use, place names, legends, and stories. Research categories were addressed in the form of open questions that allowed the cultural

consultant to answer in the manner in which he was most comfortable. Follow-up questions were asked based on the consultant's responses or to clarify what was said. The interviews were largely based on a "talk-story" form of sharing information, although questions were asked more directly when necessary.

2.1.3 Analysis of Ethnographic Data

Because of the lack of consultant data directly relating to the APE, much of the traditional information presented in this report is garnered from extensive regionally based ethnographic reports (see Section 2.2). Section 6.0 provides the analysis and evaluation of consultation data.

2.2 Archival and Literature Research

Research was conducted to collect all available information on traditional and post-Contact history, land use, place names, cultural practices, and *moʻolelo* pertinent to the project APE and its surroundings. This information was used to develop a historical context of the project area and to identify any previously reported Hawaiian cultural properties or practices in the project area. Research included a review of Hawaiian historical accounts, legends, and traditions; Māhele documents; and previous oral history and archaeological studies. The study also examined maps, historical photographs, and documents on file at the Hawaiʻi State Archives, the Bernice P. Bishop Museum, the State Historic Preservation Division, the State Survey Office, the University of Hawaiʻi at Mānoa's Hamilton Library, and the Bureau of Conveyances.

3.0 ENVIRONMENTAL CONTEXT

The APE is on the fairly level central plateau of Oʻahu Island within the broad saddle between the Koʻolau and Waiʻanae mountain ranges. The project area ranges in elevation from approximately 160 to 268 meters (525 to 880 feet) above mean sea level.

Annual rainfall averages 96 centimeters (Giambelluca et al. 2013), with temperatures ranging from 59 to 87 degrees Fahrenheit (Armstrong 1983:56). Significant annual rainfall along the upper elevations of the Waiʻanae Range exceeding 250 centimeters contributes to the tributaries descending the steep, amphitheater-headed slopes of the mountains to form meandering and incised valleys within the lower plateau lands. Although represented on the U.S. Geological Survey (USGS) quadrangle maps as permanent watercourses, these streams flow intermittently in response to heavy rains.

The gulch formed by Waiʻeli Stream separates KUNTA, to the south, from the SBMR cantonment to the north. This seasonal stream flows southeast to join Waikakalaua Stream at WAAF's southern border and become Waikele Stream. WAAF construction altered the stream course east and downstream of the project area (Tomonari-Tuggle and Bouthillier 1994:9). Waikele continues on to Oʻahu's south coast to empty into Pearl Harbor's western embayment (the West Loch).

Kaukonahua Stream roughly bounds the SBMR cantonment's northeast edge before flowing northward to drain into the ocean at Waialua. In about 1905 a dam was constructed across the convergence of the north and south forks of the Kaukonahua Stream to supply irrigation water to the surrounding cultivated fields. This resulted in the formation of Lake Wilson (Wahiawā

Reservoir), O‘ahu’s largest freshwater impoundment. At the east end of the APE, along the south fork of Lake Wilson and Kaukonahua Stream, is the Department of Land and Natural Resources-managed Wahiawā State Freshwater Park.

This dam, along with other historic and modern land alterations, contributed to the current landscape by increasing slope erosion, accelerating siltation, and downcutting stream channels to form deep gulches.

Ethnohistoric documents relate O‘ahu’s plateau lands were once covered in forest. Serano Bishop, a resident of ‘Ewa in the 1830s, reported that:

> Beyond Kipapa gulch the upland was dotted with occasional groves of Koa tress. On the high plains ti plant abounded often so high as to intercept the view. No cattle then existed to destroy its succulent foliage. According to the statements of the natives a forest formerly covered the whole of the then nearly naked plains. [Bishop 1916:45, cited in Belt Collins Hawaii 2000:9-1]

Kamakau writes the following about the sandalwood (*Santalum* spp.) that covered the central plateau, especially the area around Wahiawā and likely the APE:

> At the completion of the fort [in 1816 at Honolulu] Ka-lani-moku and all the chiefs went to work cutting sandalwood at Wahiawa, Halemano, Pu‘ukapu, Kanewai, and the two Ko‘olaus. The largest trees were at Wahiawa, and it was hard work dragging them to the beach. [Kamakau 1992:207]

Koa (*Acacia koa*) and *lo‘ulu* (*Pritchardia* ssp.) probably also covered the plateau lands. Historically, KUNTA was under pineapple cultivation with its termination only after the recent military acquisition of the land. Regrowth consists of mostly non-native shrubs, grasses, and secondary saplings. The lands on or near the military installations are manicured and landscaped grounds consisting of non-native grasses, trees, and shrubs with a few stands of ti (*Cordyline terminalis*) near residential houses. The right-of-way along the major thoroughfares is manicured lawn, while the Wahiawā State Freshwater Park is wooded in both native and introduced species.

4.0 TRADITIONAL HISTORY AND MO‘OLELO

Traditional history, along with archaeological evidence, indicates that O‘ahu’s central plateau is politically and spiritually important. The ancient lands of Līhu‘e—south of SBMR on the eastern slopes of the Wai‘anae Range—and portions of Wahiawā overlap in the lower reaches of the central plateau to possibly encompass the entire APE.

The Chant for Kapawa exemplifies the connectedness of the various central plateau regions and sites[1]:

[1] Chant and translation provided by the historian of the Wahiawā Hawaiian Civic Club, August 2009 (Desilets et al. 2011:40).

ʻO Kapawa, ʻo ke aliʻi o Waiʻalua	Kapawa, the chief of Waiʻalua,
I hanau i Kūkaniloko	Was born at Kūkaniloko;
ʻO Wahiawā ke kahua	Wahiawā the foundation;
ʻO Līhuʻe ke ewe	At Līhuʻe the placenta, (taken away)
ʻO Kaʻala ka piko	At Kaʻala the navel cord, (buried)
ʻO Kapukapuakea ka aʻa	At Kapukapuakea (Heiau) the caul,
ʻO Kaiaka i Maeaea	(Heiau) of Kaiaka at Maeaea;
Haʻulei i Nukea i Wainakia	He died at Nukea at Wainakia
IʻAʻaka i Haleu	Through (the surf of) ʻAʻaka at Haleu,
I ka laʻi malino o Hauola	Through the calm stillness of Hauola,
Ke liʻi ʻo Kapawa hoʻi no	The chief Kapawa was taken,
Hoʻi no i uka ka waihona	Returning the organs to the uplands of Iʻao
Hoʻi no i ka pali kapu o na liʻi	Taken to the sacred pali of the chiefs,
He kiaʻi Kalahiki no Kakaʻe	Kalahiki is the "Watchman" of Kakaʻe,
ʻO Heleipawa ke keiki a Kapawa	Heleipawa was the son of Kapawa,
He keiki aliʻi no Waiʻalua i Oʻahu	A chiefly child of Waiʻalua, Oʻahu

This connectedness of the various central plateau regions was also recognized in an assessment of the SBMR and the Helemano Military Reservation for their potential to contain National Register of Historic Places (NRHP)-eligible traditional cultural places (TCPs), ethnographic landscapes, or archaeological districts (Desilets et al. 2011). The study found that the western portion of the SBMR, above ca. 1,000 feet elevation, can be defined as a Līhuʻe Uplands TCP or as a discontiguous archaeological district within the historic context of Hawaiian Occupation and *Lō Aliʻi* Social Organization AD 1100–1778. This same upland area, and potentially a larger region including Kūkaniloko to the east, might also qualify as an NRHP-eligible ethnographic landscape. Desilets et al. (2011) encountered no evidence to support the presence of NRHP-eligible TCPs, ethnographic landscapes, or archaeological districts within the lower elevations of Līhuʻe—where the current project is located—or within the Helemano Military Reservation.

4.1 Traditional Cultural Properties Identified in Archaeological Investigations

As Mr. Kane stated, much of the information on traditional land use is not contained in *moʻolelo* and personal histories, but is garnered from archaeological research. A summary of the results of archaeological investigations in the SBMR is provided to give a context for the remainder of the CIA because it highlights the degree of archaeological information that is no longer available in the project area. Robins et al. (2007) and Desilets et al. (2011) provide a comprehensive overview of the localized archaeological studies.

Commercial pineapple cultivation and residential, commercial, and military development have made it unlikely that archaeological and cultural sites are present in the SBMR cantonment, WAAF, the lower elevations of the South and East Ranges, and KUNTA. Archaeological investigations have encountered no remaining surface or subsurface pre-Contact or 19th century cultural properties in these lowland areas (Bouthillier et al. 1995; McIntosh et al. 1995; Tulchin and Hammatt 2013; Watanabe 1987). Cultural monitors working on the Stryker

Brigade Combat Team cultural resource management project observed no traditional Hawaiian resources or deposits in the sampling locations on the lower elevation tablelands (Desilets et al. 2011).

Regardless, an oral history study of the SBMR stated that, "According to Mr. Tom Lenchanko, there are numerous traditional properties in the SBMR area; however, for fear of exposing knowledge about their location, he would not disuses what these were or where they were located" (Social Research Pacific, Inc. 2004:23). Consultants interviewed during this project did not mention any tangible cultural properties remaining in or immediately adjacent to the APE.

Despite portions of the uplands being subjected to artillery bombardment, the remote location and restricted development of much of the higher elevations west of the APE has resulted in the preservation of many traditional cultural properties, particularly in the deep, upper elevation gulches and valleys. Mr. Kane noted some of these traditional sites while horseback riding along the gulches above the low tablelands. Documented upland cultural sites comprise mostly Hawaiian structures associated with habitation, animal husbandry, wetland and dryland agriculture, ceremonial activities, and possible burials. Historic roads and military structures associated with SBMR development and training were also identified.

Desilets et al. (2011) conclude that:

> The best site preservation is found in the deep, upper elevation gulches within both the South and West Ranges. Phase I and II surveys of the newly acquired South Range area (Roberts et al. 2004; Robins et al. 2007) indicate that the lower reaches, which were almost entirely in pineapple until very recently, have no remaining surface features. This is also true of some of the broad, upper elevation ridges. Pineapple was planted on any commercially feasible acreage within the South Range, extending right up to the current forest reserve boundary. Within the more inaccessible parts of the South Range, however, such as deep drainages, Hawaiian sites are quite plentiful and, in some cases, form extended complexes. Higher elevation valleys in the South Range also contain relatively large and well-preserved ceremonial sites (e.g., Site 50-80-08-6479). [Desilets et al. 2011:69] [refer to Figure 3 for locations]

For the purposes of this CIA, it is important to understand that these previous studies have unanimously concluded that more than a century of intensive impacts by military land use, urban development, and commercial agriculture have substantially altered the cultural landscape of the central plateau's tablelands. With the long-term destruction of traditional surface structures and little evidence of remaining subsurface deposits, the area's significance relates to "its context within a larger geographic area" (Tomonari-Tuggle and Bouthillier 1994:75).

4.2 Places and Place Names

The project APE is with the traditional lands of Līhuʻe, a broad regional term thought to include much of the central plateau, ranging from Helemano in the east to Kalena in the west. In its literal translation, *Līhuʻe* means "cold chill" (Pukui et al. 1974:132), a quality often referred to

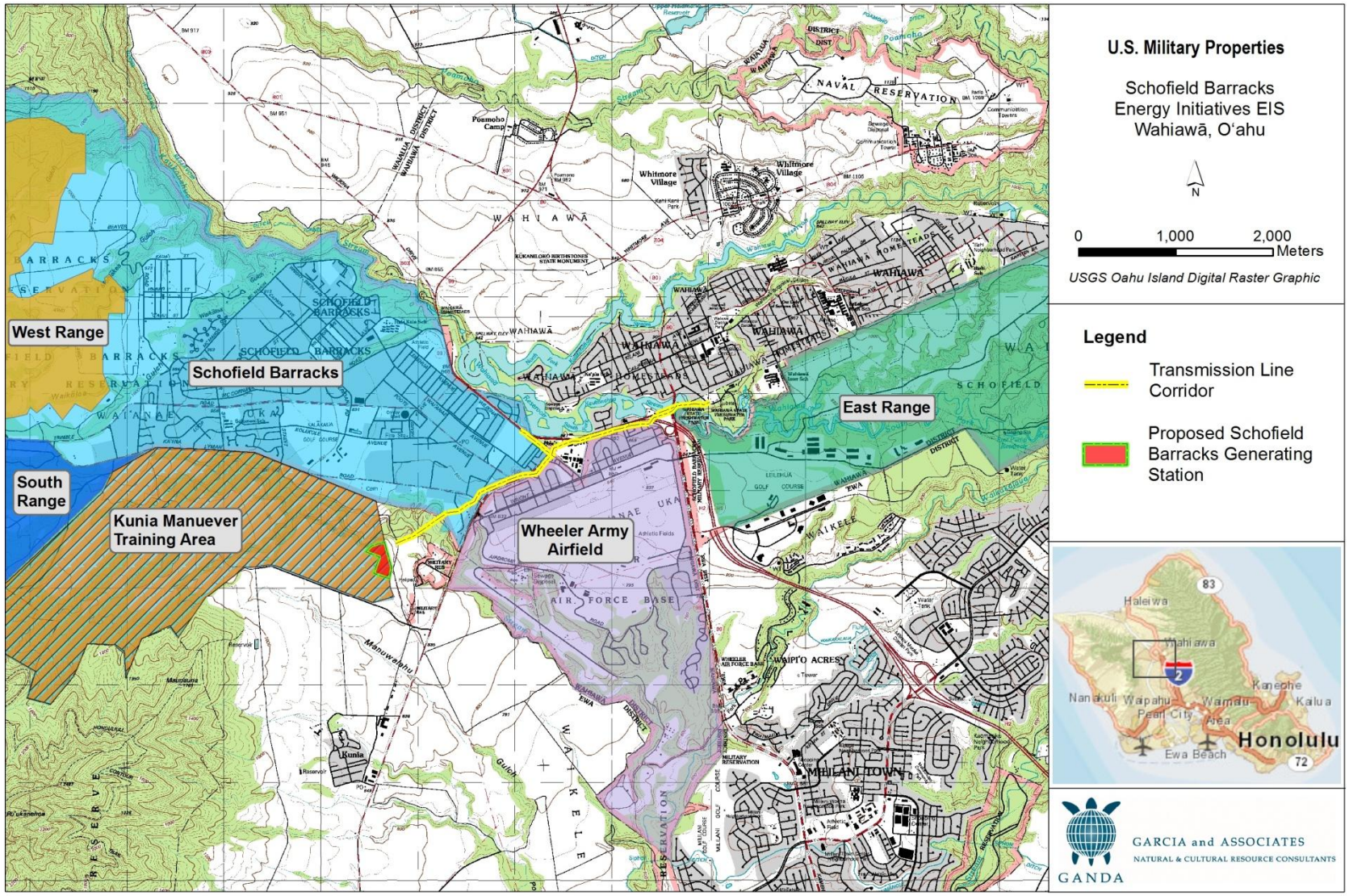

Figure 3. U.S. military properties around Schofield Generating Station with training ranges delineated.

in the traditional literature of Līhuʻe, Kalena, and Haleʻauʻau. Although not evidence of a strictly upland and mountainous boundary, it does point to the literature's tendency to focus on the higher elevation, upland portion of the Līhuʻe lands.

Honouliuli Ahupuaʻa, whose northern tip will support the proposed Schofield Generating Station, is Oʻahu's largest *ahupuaʻa*, encompassing most of the western half of the ʻEwa District. *Honouliuli* means "dark bay" (Pukui et al. 1974:51) and is apparently named after the West Loch bordering what is now Pearl Harbor. Honouliuli is known as the first place where human beings landed on Oʻahu (Beckwith 1970:343), and a place where *ʻulu* (breadfruit; *Artocarpus altilis*) was first introduced to Hawaiʻi (Burgett and Rosendahl 1992: Appendix E).

The proposed generating station and the west end of the transmission line are in two historically referenced *ʻili*, Paupauwela in Honouliuli Ahupuaʻa and Pouhala in Waikele Ahupuaʻa (Figure 4). Paupauwela is also written as *Popouwela* or *Poupowela* (ʻĪʻī 1959:97; Sterling and Summers 1978). *Pouhala ʻIli*, translated as "pandanus post" (Pukui et al. 1974:190), is also a named place in southern Waikele next to "an important fishpond" and *loʻi* or *kalo* patches called Kapalaha (Sterling and Summers 1978:29). The upland *ʻili* is referenced as "Pouhala Uka" in late 19th century land documents (Tomonari-Tuggle and Bouthillier 1994:20).

Waikele, translated as "muddy water," also refers to a stream formed by the convergence of Waiʻeli Stream north of the generating station and Waikakalaua Stream to the southeast. Waiʻeli Stream is sometimes written as *Waikele Stream* on more recent USGS maps and as *Waieli*, meaning "dug water" (Pukui et al. 1974:221), on a late 19th century Oʻahu Island map (Hawaiian Government Survey 1881). *Wahiawā* means "place of noise" (Pukui et al. 1974:71), referring possibly to the drums kept at Hoʻolonopahu Heiau that resonated across the plains to announce the birth of a high chief.

The majority of the transmission line is in the lower elevations of Waiʻanae Uka Ahupuaʻa. The names and borders of any smaller traditional divisions once in this area are unknown. One of Oʻahu's largest *ahupuaʻa*, Waiʻanae Uka Ahupuaʻa, is landlocked and extends from the tablelands across the crests of the Waiʻanae and Koʻolau mountain ranges. Hawaiian deities guarded the boundary between Waiʻanae Uka and the *ahupuaʻa* to the west (Lualualei and Waiʻanae Uka). Mount Kaʻala is the home of the kind goddess Kaiona who harmed no one. The mountain goddess Kolekole protected the mountain pass (Sterling and Summers 1978:133–135). A likely ancient pass through the saddle is afforded at Kolekole (ʻĪʻī 1959:99) by Mount Kaʻala, the highest point on the island.

Handy et al. (1972:465) refer to a famous traditional place named Kukui-o-Lono, where the high chief Kūkaniloko is said to have made the first *loʻi*. Kukui-o-Lono might correspond to one of the cultivated watersheds in western Waiʻanae Uka (such as Kalena, Mohiākea, or Haleʻauʻau streams) because the location is described as "above and west" of the present town of Wahiawā north and northeast of the project area.

Another traditional place name near the APE is Kokoloea, the location of a benchmark in the late 1800s Crown Lands surveys and a USGS benchmark (271 meters, or 888 feet, above sea level) (Figure 4). Located on the south side of what is now Lake Wilson, near Wilikina Drive, the 1876 Boundary Commission testimonies describe an ancient *ʻulu maika* field or *kahua maika*

named Kapalauauai (ʻĪʻī 1959:99) as being at Kokoloea. Kokoloea was the name of a chief of the *Lo* class and the site of the "old Dowsett ranch house" (Tomonari-Tuggle 1997:13).

The SBMR oral history study (Social Research Pacific, Inc. 2004) reports that Mr. Lenchanko told of:

> a navigational chart was created on land that helped train people to use the ocean. But after 900 A.D. there was no need to sail since the land provided for the people, and sailing became an art form. The *Kaʻa Naniao*, located within the SBMR vicinities, is part of the traditional navigational chart. It is a grid that links sites together that are located on military properties throughout Oahu. The location of the *Kaʻa Naniao* was not revealed. [Social Research Pacific, Inc. 2004:23]

4.3 Early Settlement

Traditionally, Honouliuli Ahupuaʻa contained a large permanent settlement around what is now the West Loch, scattered fishing encampments elsewhere on the coast, and small permanent settlements and associated agricultural plots (Tuggle 1995:100). Initial settlement on the eastern slopes of the Waiʻanae Mountains and the central plains was likely mainly temporary and might have been related to bird hunting and the collection of other forest and inland resources.

Permanent Hawaiian settlement of Waiʻanae Uka might have started as early as AD 1250, as populations expanded into central Oʻahu (Roberts et al. 2004:6). Habitation sites are identified as primarily temporary, suggesting recurring occupation perhaps associated with cultivation seasons. The limited number of permanent occupation sites led Carson and Yeomans (2000:68) to propose intensive habitation began shortly before the area was abandoned because a long period of habitation would result in a more intensive archaeological landscape. However, the extensive historic and modern landscape alterations have effectively erased the archaeological remains of the traditional inhabitants so that the extent and type of traditional habitation in the plateau lands might never be known.

Two charcoal samples derived from pondfield contexts in an irrigated agricultural complex (State Inventory of Historic Places [SIHP] No. 5394) in upland Līhuʻe produced calibrated date ranges of AD 1120–1430 and AD 1280–1420 (Carson and Yeomans 2000:18). A similar calibrated date range of AD 1290–1470 was returned from agricultural deposits at nearby SIHP No. 5392 (Robins and Spear 2002: Appendix C-2).

These dates suggest that by about the 13th century, irrigated pondfields were developed along Waiʻeli Stream (and in other similar stream valleys) (Robins and Spear 1997a:7). Although a variety of ceremonial, habitation, burial, and agricultural sites have been identified in the uplands west of the APE, the distribution of sites suggest that intensive agriculture in the stream valleys was a focus of Hawaiian activity. Despite the lack of direct archaeological evidence resulting from extensive historic land disturbances, traditional Hawaiian land use in the neighboring tablelands of Honouliuli, Waiʻanae Uka, and Waikele are presumed to have followed the same pattern of cultivation and associated permanent habitation.

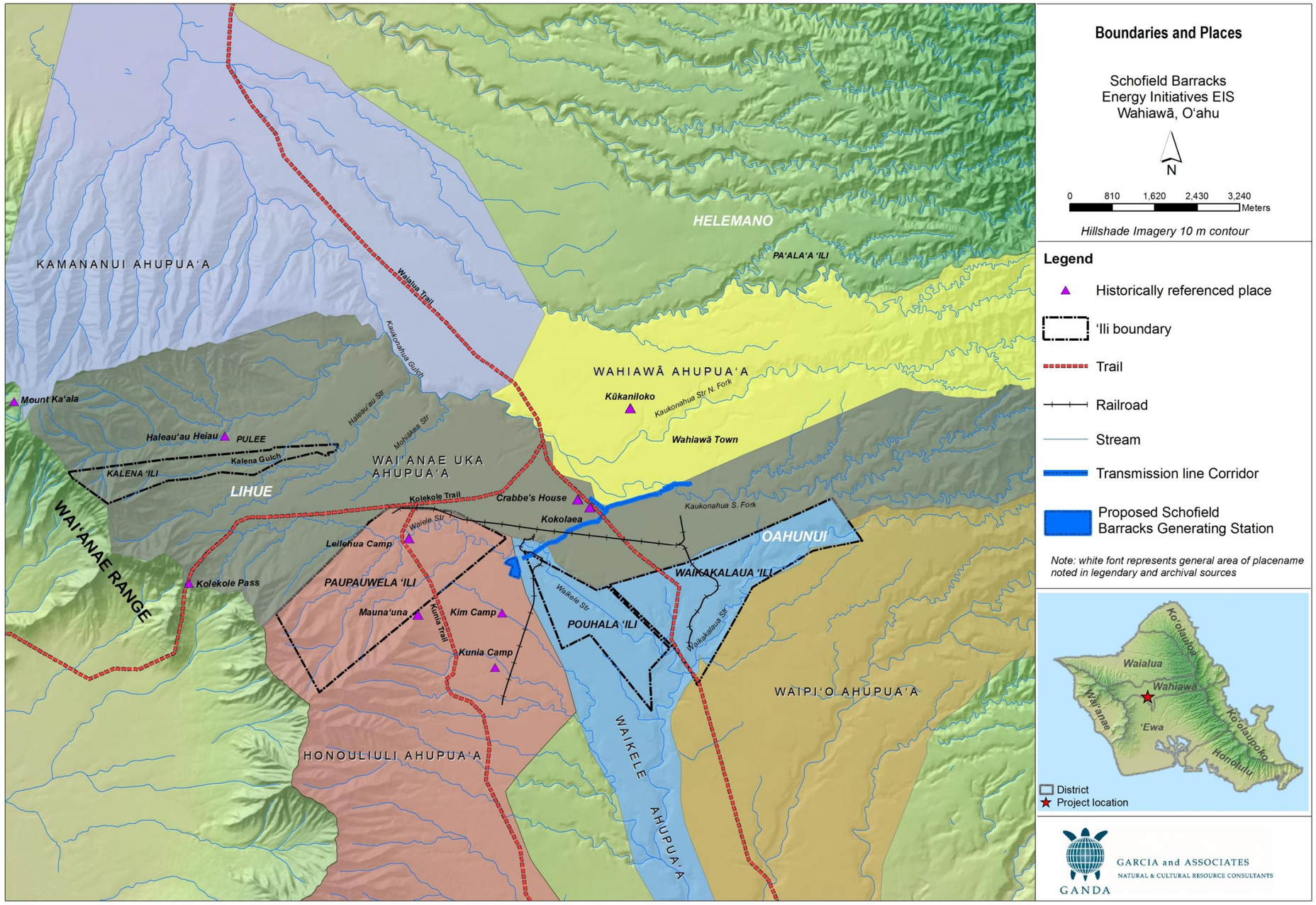

Figure 4. Traditional and historic boundaries and place names near the Schofield Generating Station Project.

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The large number of agricultural sites documented in the uplands above the SBMR suggests the areas' significance in traditional cultivation regimes. Mr. Kane agrees with this interpretation since the traditional inhabitants were living off the land and sea. Although little archaeological evidence remains, the lack of abundant water sources in the plateau lands suggests there was a reliance on dryland cultivation with wetland fields near the few streams and intermittently flowing gulches. It is possible that Waiʻeli Gulch held wetland cultivation plots and that the dryer reaches contained sweet potato or other dryland crops. However, the traditional stories and myths do not impart a sense of ancient types and methods of the APE's subsistence regimes.

Mr. Shirai suggests that because of the occasional presence of water in the gulch formed by Waiʻeli Stream, this would be an area that community members might be concerned with as potentially containing traditional cultural resources.

4.4 Trails

A network of trails provided access to settlement and ceremonial areas in central Oʻahu and connected these places with other parts of the island. The three main travel routes recorded by mid-18th century Hawaiian scholar John Papa ʻĪʻī (1959) provided transportation across the island (Figure 4). Mr. Kane stressed the importance of the tablelands in supplying transportation routes.

One trail extended in a northerly direction from the rich estuaries of Waikele along the south coast of the island to the north shore at Waialua (Waialua Trail). On its way to Kūkaniloko, the Waialua Trail passes under the transmission line just west of the intersection of Kunia Road and Wilikina Drive. Another route, the Kolekole Trail, passed through Waiʻanae Kai, crossed the Waiʻanae Mountains at Kolekole Pass and descended into western Waiʻanae Uka to meet with the Waialua Trail. The third trail, Kunia Trail, came from the south across Honouliuli Ahupuaʻa to meet the Kolekole Trail.

The following extended excerpt explains the trail system and references a number of important cultural sites and place names. Some of the place names are found in the 1881 Hawaiian Government (Figure 5) and 1902 Hawaiʻi Territory Survey (Figure 6) maps.

> They went down to the water and up, going above the group of taro patches of Waiau, to the stream of Kukehi, up to the two maika fields, Puehulunui and Haupuu. Puehulu lies at the crossroads, where one [trail] leads to Waialua and the other branches off to Honouliuli, and to Waianae. . . . There were three roads there at Puuokapolei, Pohakea, and **Kolekole**, from Kunia, the plain of Keahumoa, up to **Maunauna** and by Paupauwela where they join with the road from **Wahiawā** and the one from Waialua**,** on the west side of Mahu to Malamanui, to which spot one can look down from **Kolekole**, to Pokiʻi and Waianae-uka. There was a long cliff road, Eloui, from **Kalena** and **Haleʻauʻau**, on the east side of **Kaʻala**, coming down here to Waianae. There was also a trail going up and then down Makaha-uka, called Kumaipo. Below that trail was a fortress in the olden days, named Kawiwi. At the time of battle a boy was set as a guard every night [with no food--which led to turning over to rebels] . . . From the stream of Anahulu and from Kamani, above the homes, and taro patches a trail lies in front of Kuokoa's houselot and the church, which goes on to meet the creeks of Opaeula and **Halemano**, the sources of the stream of **Paalaa**, on down to the

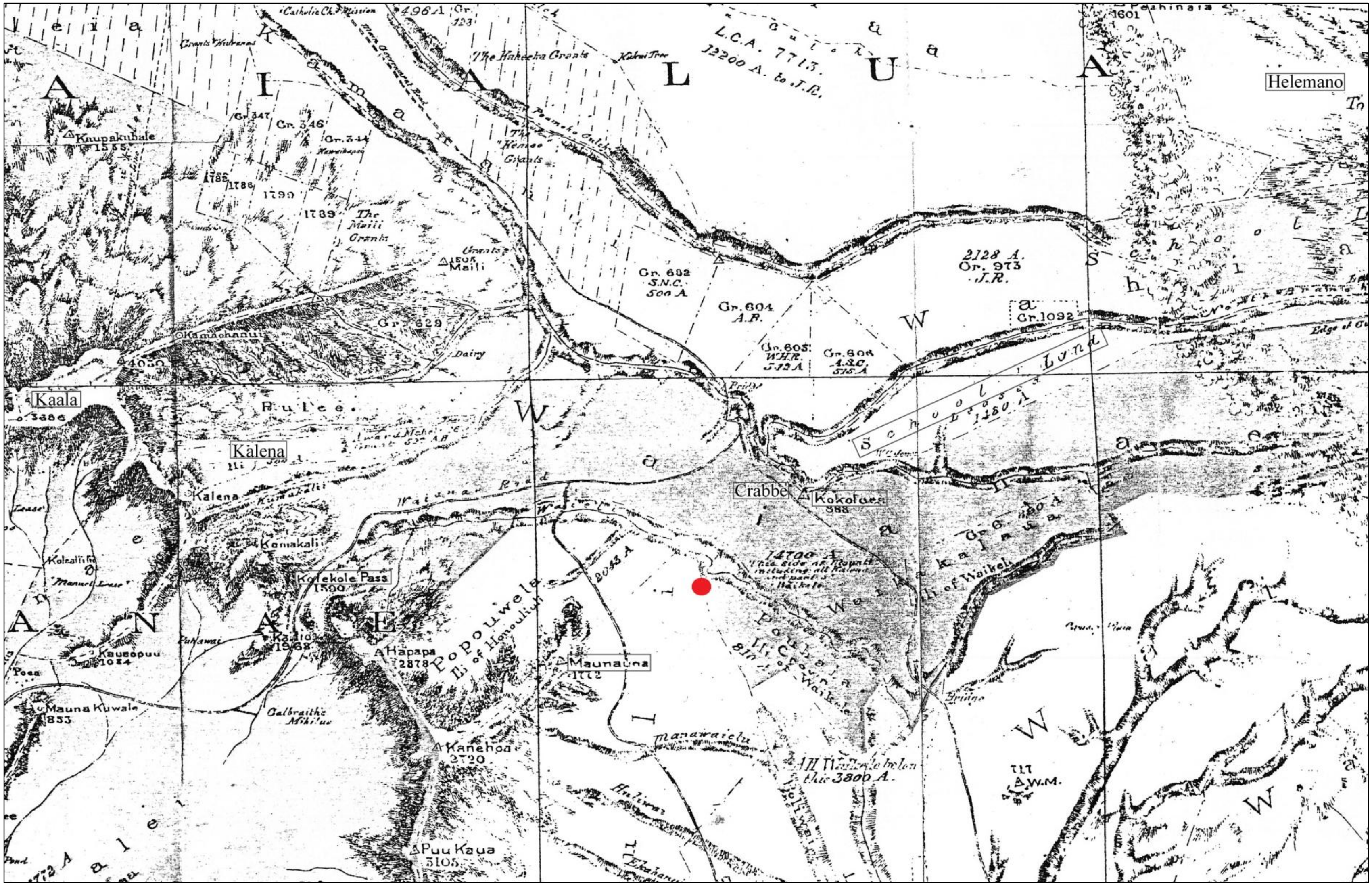

Figure 5. Enlarged detail of an 1881 O'ahu Island map with proposed Schofield Generating Station marked in red and boxes around place names mentioned in text (Hawaiian Government Survey, W.D. Alexander – General Surveyor).

Figure 6. Enlarged detail of 1902 O‘ahu Island map with proposed Schofield Generating Station marked in red and boxes around place names mentioned in text (Hawai‘i Territory Survey, Walter E. Wall – Surveyor).

> stream of Pooamoho, and go to the crossroad which branches from Mokuleia to Kamananui and Kewaaihe, The kukui grove of Kahewahewa lies below the trail to **Kūkaniloko** where visitors gathered. It goes to the stream of Paka, and the maika playing field of Kapalauauai which lies above the pond belonging to the village. There the trail meets with the one from **Kolekole** and goes on to the stream of Waikakalaua, Piliamoo, the plain of Punaluu to a rise, then down to Kïpapa to Kehaulele, A trail runs off from this long trail to Kalakoa, **Oahunui** and other places much visited, like **Kūkaniloko**, and from there to the digging place of Kahalo. [ʻĪʻī 1959:99; emphasis added]

4.5 The Lō Aliʻi and Kūkaniloko

Oʻahu's central plateau has long been an important Hawaiian religious center with the establishment of an *aliʻi* birthplace at Kūkaniloko, *heiau*, such as Hoʻolonopahu, and Haleʻauʻau and Kalena in western Waiʻanae Uka, and the Maunauna site in Waikele Ahupuaʻa east of the project parcel (Figure 4).

The *lō aliʻi*, in conjunction with Kūkaniloko, are central to the traditional Hawaiian lore of the Līhuʻe-Wahiawā region of the central plateau and its mountainous periphery. The *lō aliʻi* were a specific class of *aliʻi* tied by birth and practice of strict *kapu* to the Līhuʻe-Wahiawā-Helemano region of Oʻahu's central plateau. Kamakau (1964) provides the following description of the *lō aliʻi* class:

> The chiefs of Līhuʻe, Wahiawā, and Halemano on Oʻahu were called *lō aliʻi*. Because the chiefs at these places lived there continually and guarded their *kapu*, they were called *lō aliʻi* [from whom a "guaranteed" chief might be obtained, *loaʻa*]. They were like gods, unseen, resembling men. [Kamakau 1964:40]

> The chiefs of Lihue, Wahiawa, and Halemano on Oahu were called *Lo* chiefs, *Poʻe Lo Aliʻi* {"people from whom to obtain a chief"}, because they preserved their chiefly kapus. The men had kapus, and the women had kapus, and when they joined their kapus and children were born, the children preserved their 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 (*aliʻi nui*) for the kingdom. Or if a chief was without a wife, there one could be found—one from chiefly ancestors. Kauakahiʻailani, Maʻilikukahi, Kalona, Piliwale, Kukaniloko, Paʻakakanilea {Paʻakanilea}, Kaʻakauualani, Kaʻau, Lale, Paoakalani, Pakapakakuaua, Nononui, Kokoloea, and a great many others were *Lo* chiefs. [Kamakau 1964:5][2]

The emergence of the *lō aliʻi* in central Oʻahu probably has its origin in the sacred birthing site of Kūkaniloko (SIHP No. 50-80-04-218), on the Waialua side of Kaukonahua Gulch. Tomonari-Tuggle and Bouthillier (1994:75) suggest that Kūkaniloko might have extended as far south as Waikalalaua and would therefore encompass some of the project area. Listed on the NRHP (Register No. 73000674), the Kūkaniloko birthstones was one of two sacred places in the

[2] An almost identical passage is found in the Appendix of *Kepelino's Traditions of Hawaii* (Beckwith 2007:196).

Hawaiian Islands where *kapu* chiefesses went to give birth (Handy et al. 1972:465; McAllister 1933:134–135; see also Cordy 1996:596; Fornander 1996:20; Kamakau 1991:136).

Around the 13th and 14th centuries, Kūkaniloko was established by Nanakāoko and his wife Kahihiokalani for the birth of their son, Kapawa. In a chant commemorating Kapawa, Līhuʻe and nearby lands, that are now within the project area, are referenced as metaphors for his birth at Kūkaniloko (Kamakau 1991:136):

> Kapawa, the chief of Waiʻalua
> Was born at Kukaniloko
> Wahiawa the site;
> At Lihue the placenta
> At Kaʻala the naval cord,
> At Kapukapuakea [heiau] the caul

Kūkaniloko can be translated as "an inland area from which great events are heralded" and "to anchor the cry within." According to Kamakau (1991:53), "Chiefs born at Kūkaniloko were the *akua* [gods, spirits] of the land and were *aliʻi kapu* as well."

Associated with Kūkaniloko is the nearby *heiau* of Hoʻolonopahu (SIHP No. 50-80-04-219). By 1933 pineapple cultivation had obliterated the *heiau* (McAllister 1933:137). Remnants of the *heiau* are said to be in the gulch to the south of the birth site (Au 1993, personal communication), although McAllister (1933:57) places the *heiau* to the north of Kūkaniloko, and hence, north of the project area.

The sacred drums of Opuku and Hawea were stored in Hoʻolonopahu, which translates to "sounding the *pahu* drum." The drums were sounded to announce the birth of an *aliʻi* and the cutting of the naval cord (Sterling and Summers 1976:140). Hawaiian traditions tell of:

> thunderous waves at Wai-a-lua being carried as far inland as Wahi-a-wa. Such passages sometimes refer not merely to the ocean's roar, but may also connote the sound of ceremonial drums signaling the birth of a royal chief. [Pukui and Korn 1973:33]

During the long period of island-wide rule by Līhuʻe chiefs, and continuing into the succeeding years, birth at Kūkaniloko remained a powerful status symbol. In 1797 Kamehameha arranged to have his son Liholiho born at Kūkaniloko, but the plan was foiled by the sickness of Queen Keopuolani. It is notable that by this date, the site had already "fallen into decay" (Sterling and Summers 1978:140).

Kūkaniloko also served as a *puʻuhonua*, or place of refuge. According to ʻĪʻī (1959:138), ". . . Kūkaniloko in Wahiawa, Oahu; and Holoholoku in Wailua, Kauai, were places to which one who had killed could run swiftly and be saved." The story of Lāʻieikawai provides additional evidence. Early in this story we learn that, "Now, Kapukaihaoa took Laielohelohe to the uplands of Wahiawa, to the place called Kukaniloko" (Haleole 2006). Kapukaihaoa, a priest, took Laielohelohe to Kūkaniloko because the baby girl would have been killed by her father (or his executioner) if he discovered she had been born.

Another story of the central plateau's traditional importance is set at O‘ahunui (east of the project area), said to have been a residence of high chiefs. However, it was abandoned during the reign of chief O‘ahunui, who was turned to stone when he became a cannibal and ate the two sons of his brother-in-law, Lehuanui (Nakuina 1897:90).

> Lo-Aikanaka is the name given to a family of South Sea chiefs who are driven from the plains of Mokuleia into the hills to a place called Hele-mano, where they are received by the chief Oahu-nui east of that locality and the two chiefs exchange courtesies. Oahu-nui develops a passion for human flesh and finally the two chubby sons of his sister Kilikiliula, wife of Lehua-nui, are sacrificed to his appetite during the absence of their father. Warned by a vision, the father returns, puts to death the chief and his sister, and abandons the place with his men. A curse hangs over the place...None has ever dared to live there since (T.Thrum quoted in Beckwith 1970:342).

Desilets et al. (2011:13) describe the sociopolitical and cultural importance of O‘ahu's central plateau:

> Around AD 1300, district (*moku*) level organization appears to have arisen on O‘ahu. By about AD 1320 to 1340, the *moku* of ‘Ewa, Kona, and Ko‘olaupoko were ruled by the sons of Maweke (Cordy 2002:22). ‘Ewa, including not only ‘Ewa proper, but Wai‘anae and Wai‘alua as well, was ruled by the Maweke-Kumuhonua line. It is possible that Maweke's grandson, Kumuhonua, ruled the entirety of O‘ahu between AD 1340 and 1360 from his seat of power in Līhu‘e on the central plateau. Kumuhonua's ‘Ewa lands would have included the sacred birthing place Kūkaniloko and it is likely that Līhu‘e was the primary ruling center for all of O‘ahu. Although most chiefly classes were not regionally based, Līhu‘e was exceptional and was home to chiefs with the specific designation of *lō ali‘i* during this time. This class of chiefs populated the Central Plateau between the Ko‘olau and Wai‘anae ranges, including all of what is today referred to as Wai‘anae Uka Ahupua‘a. The high status of the *lō ali‘i* chiefs was likely derived from birthing at Kūkaniloko, interbreeding, and strict *kapu* observance.

4.6 Warfare

The chiefly residents of Līhu‘e were recognized for their skills in spear throwing and were known as excellent teachers of the skill (Kamakau 1991:50). Mr. Kane states that the central plateau is noted for its association with practices used to prepare for traditional warfare and wars. Mr. Lenchanko states that "longhouses were situated throughout the area and that this was the ‘training grounds for the warriors'" (Social Research Pacific, Inc. 2004:23).

Lua, a battle method of dislocating joints of opponents, was practiced on unsuspecting travelers crossing over the western boundary of Wai‘anae Uka at Kolekole Pass (Sterling and Summers 1978:134–135).

Paupauwela, Kalena, Pulee, and Malamanui were noted battlefields between the island chief Kuali‘i and rival island chiefs from the ‘Ewa and Waialua districts (Fornander 1996:280–281). Fornander (1996:393) provides a translation of *Ka inoa o Kuali‘i*, or Chant of Kuali‘i, recounting the famous battle at Kalena:

Where, where was the field
[on which] the warriors fought?
Lo! The field is at Kalena;
Scattered about, overflowing
Poured out is the godly fluid

In the cultural monitor report for the cultural resource management associated with the Stryker Brigade Combat Team, Mr. Eric Burch discusses the battle of Kalena:

The Mele of Kalena
Ihea, ihea la ke kahua
Where, where is the field?
Paia ao O ke koa-a
On which the warriors fought
I kahua I Kalena
There the field is Kalena
I manini, I hanini
Scattered about, overflowing bodies
I ninia I ka wai Akua
Poured out is the godly fluid, blood
I kou hana I Malamanui
By your work (battle) at Malamanui

The Mele of Kalena talks about one chief whose name is Ku‘ali‘i and how he was trying to end the division between many Ahupua‘a. This story talks about the people of old who fought for what they believed in. Just like the Kupuna today, how they try to fight for what they believe in. As you read about the story of “The Battle of Kalena,” imagine and think about “What would you do?” to conquer twelve thousand men on one side and the other side had just four men.

Ku‘ali‘i was born at Waihole; he trained at Kualoa Valley that was a place where the Ali‘i trained. As he trained, he mastered the art of sling and spear throwing. He was a very disciplined person. He sounds like a person who was very dedicated in mastering some skills. It must have taken some time to put everything into perfection.

As he became a man, he noticed how all the districts on the island of Oahu became independent. He realized that each district was growing their food and the island was not unified under one rule. After analyzing what was going on in the island he decided that he wanted to become the Mo‘i of the island. Mo‘i means being the one to conquer, or a person who becomes successful. He started to come up with a plan to conquer the island of Oahu.

He decided to travel to the island of Kauai in search for the finest woods to make spears for his men. Ku‘ali‘i wanted to make sure he had the right type of weapon to become successful. He searched for the finest of weapon makers so they could make all the spears and other weapons he needed to fight in a war. After getting all his weapons together he returned back to Oahu. Upon returning back to Oahu, he saw people gathered at Kamaile. Ku‘ali‘i said, “If they want to fight, we will meet them at Kalena.” As he got closer he noticed they were the chiefs of Ewa and Waialua.

> So Ku‘ali‘i started to get ready for battle by gathering up as many men to fight with him.
>
> Ku‘ali‘i, Maheleana, and Malanihaehae were the only ones to fight on Ku‘ali‘i’s side.
>
> They took a nights rest before battle. The next morning the fighting began at Kalena on the plains of Haleauau (near Lihue). On one side there were twelve thousand men, while Ku‘ali‘i had only three men on his side. Ku‘ali‘i defeated all twelve thousand men with just having three men all together.
>
> The battle of Kalena happened at Schofield Barracks and seeing the sites, artifacts, and writing on rocks really explained what happened in the past. The story really made me feel the mana that the training area has until today. Working out at the BAX really makes me feel that history was once: they’re walking around and planting plants and making food to survive. This story really made me think about how the Hawaiians were very smart when it came to war. [Toney and Desilets 2013:87–89]

At Mauna‘una, the Wai‘anae chief Kuiaia avoided a battle with Kuali‘i, as well as impending slaughter, by heeding a warning from his advisor and performing a chant to the god Kū:

> Mauna-una…Kuiaia, the chief of Wai-anae, came with his forces to meet Kualii on the battleground here mentioned. His kahu, forewarned, told him when coming to battle should he find a knotted ti leaf on the road he would know he was in danger and surrounded by an ambush which would cut off his whole force. On finding this knotted ti leaf, he began and chanted this mele from the beginning to end, to the honor of Ku. All on both sides laid down in reverence. Ku gave the signal of reconciliation, and the slaughter was averted. [Fornander 1969, cited in Sterling and Summers 1978:38]

According to the Legend of Kuali‘i (Beckwith 1970:395), it was after the battles in Malamanui, Pulee, and Paupauwela that Kuali‘i “subdues the whole island” and reestablishes paramount rule between around AD 1720 and 1740 (Cordy 2002:32). Beckwith (1970:396–398) suggests the Kuali‘i tradition might represent a political movement led in the name of Kū, rather than signifying the efforts of a single chief.

5.0 POST-CONTACT HISTORY

This section presents the post-contact history of the project area. Desilets et al. (2011), Tomonari-Tuggle (1997), and Tomonari-Tuggle and Bouthillier (1994) all provide a more detailed description of the historic context of O‘ahu’s central plateau.

5.1 Initial Post-Contact Impacts

By western contact, when history started being recorded, the central O‘ahu plateau was dotted with villages. The location of schools provides insight into the size of central plateau settlements soon after contact.

> Kamakau (1992:424) writes that during the reign of Kamehameha III (1825-1854), “schools were built in the mountains and in the crowded settlements...At Kahalepo‘ai, Hauone, Kalakoa, Wahiawa, Halemano, and

> Kanewai, there were large villages with teachers and schoolhouses; so at Lihuʻe, Kalena, Maunauna, Kake, and Puʻukuʻu." This probably occurred sometime after 1840 when a law establishing government schools was passed. This law required "that a school should be maintained in every community where there were fifteen or more children of suitable age" (Kuykendall 1968:347). Given that rural areas throughout the islands were being abandoned in the early 1800s as a result of factors such as population collapse or out-migration to Honolulu, the fact that these settlements could support government schools at mid-century suggests that they had been of substantial size and/or stability at contact. [Tomonari-Tuggle 1997:15]

School land, leased to W.C. Jones, is shown in the 1881 Oʻahu map drafted as part of the Hawaiian Government Survey by W.D. Alexander, General Surveyor, in the area of what would become the town of Wahiawā (Figure 5). The map also displays much of the plateau as undeveloped and devoid of forest land.

Like elsewhere in the Hawaiian Islands, the native population of central Oʻahu experienced a major decline due to the spread of foreign diseases and movement away from remote localities to the shipping ports and business centers, such as Honolulu. Reverend Artemis Bishop recounts the quick and devastating effects of a measles epidemic he observed from 1848 to 1849 in the Waiʻanae and ʻEwa residents:

> The past has been a year of trials and sorrows among my people in passing through scenes of sickness and death, beyond what I had ever witnessed…how strikingly their former athletic frames and warlike habits contrast with their enfeebled and effeminate corpses.
>
> Middle of October the measles broke out like wildfire…burning the dead was the great work, all other occupations were suspended and people staggered about like walking corpses. [Bishop 1849 and 1851: Mission letters]

Not long after western contact (ca. 1815–1826), *ʻiliahi* or sandalwood was extensively harvested from the Hawaiian Islands, resulting in the decimation of much of the native forests, particularly in the lower, more accessible elevations. Central Oʻahu was undoubtedly affected by the over-harvesting of sandalwood because Wahiawā was famous for its large sandalwood trees (Kamakau 1992:251–252). In pursuit of the riches gained in the sandalwood trade, chiefs ordered the *makaʻāinana* (commoners) to devote all their time to cutting sandalwood. As a consequence, subsistence practices were abandoned, such as farming and fishing, and famine was experienced throughout the islands (McGrath et al. 1973:18). Foreign contact also led to the over-harvesting of other forest trees used as fuel on whaling ships to render whale blubber into oil (Cuddihy and Stone 1990:38).

The establishment of Christian mission stations in Waialua, Waiʻanae, and ʻEwa resulted in transportation route improvements for easier travel between settlements in the vicinity of the project area. In 1837 Reverend Emerson reported improvements to the Kolekole Trail:

> During the year past, a number of patches of road have been made, which considerably facilitate our access to some remote parts of the station and to Waianae. The pali between Waialua and Waianae, which formerly rendered the latter place inaccessible from Waialua except on foot, has been so

> improved that a horse can be rode up and down without difficulty (Emerson 1837: Mission letters).

Historical documents and archival data for the central Oʻahu region indicate that Native Hawaiians continued to live and cultivate crops during the mid- to late-1800s, particularly along Mohiākea and Kalena ʻIli, and along Waiʻeli Stream which runs through the study area (Robins and Spear 2002:23, 24, 31, and 32). An 1886 photograph with Kolekole pass in the background shows the location of a homestead and active pondfields (likely *loʻi kalo*) along a portion of Waiʻeli Stream to the west of the project area (Figure 7). It is presumed that the rectangular features represent fenced boundaries of traditional features, such as dwellings and active or recently active croplands.

5.2 Historic Land Tenure

In the mid-1800s Māhele, all of Waiʻanae Uka Ahupuaʻa, with the exclusion of Kalena ʻIli, was designated as Crown Land. Honouliuli Ahupuaʻa was awarded to Kekauʻohoni, grandchild of Kamehameha I. Upon her death in 1851, her husband Levi Haʻalelea inherited the majority of the land, and later (1864) passed it on to his wife at the time, Amoe Haʻalelea. Haʻalelea sold it to her brother-in-law John Harvey Coney. The land has since been acquired by private owners and the state and federal government for ranching, cultivation practices, and U.S. military activities as detailed in the following sections.

5.3 Ranching

Honoluliuli

In 1877 James Campbell purchased the portion of Honouliuli retained by John Harvey Coney (about 43,640 acres) and established a cattle ranch under the namesake of Honouliuli Ranch. Before the purchase, John Meek and James Dowsett leased portions of Honouliuli for cattle grazing and stock running. Meek and Dowsett "introduced grazing in areas too high or dry for agriculture" (Burgett and Rosendahl 1992:E-7). Meek was known to have leased more than 3,000 acres in the ʻEwa District, including Waikakalaua Gulch, and had 4,000–5,000 head of cattle (Tomonari-Tuggle and Bouthillier 1994:19). By 1881 Honouliuli Ranch was a successful ranch with 10,000 acres devoted to agriculture. Some of the cultivated land may have encompassed the project area.

Waiʻanae Uka

Meek was the first individual to ranch cattle at Waiʻanae Uka. In 1851 Kalena ʻIli was conveyed to Meek by Reverend Bishop (Bureau of Conveyances, Book 17:148), who described the parcel as having "taro patches for 4 or 5 families" (Department of the Interior, n.d.). By 1875 his heirs leased the entire *ahupuaʻa* of Waiʻanae Uka.

Meek's affluence in Oʻahu society is remembered by Taylor (1922:223):

> The days are recalled, also, when Captain Meek controlled Lihue and Wahiawa on Oahu under lease from the government. He raised thoroughbred horses, and his daughters rode the finest in the islands…

Figure 7. 1886 photograph showing homestead and active crops in Wai‘eli Stream (Bishop Museum Archives, Neg. CP117, 503), from Robins and Spear (2002:31).

A ranch house once likely occupied by Meek’s daughter Elizabeth Meek Crabbe and husband Horation Crabbe is shown on a late 19th century map as “Crabbe” (Hawaiian Government Survey 1881) (Figure 4, Figure 5). Between 1875 and 1889, Wai‘anae Uka was leased to various westerners for cattle ranching, including a shared lease between Meek (and his heirs) and Dowsett.

In 1882 King Kalākaua and C.H. Judd purchased two-thirds of Wai‘anae Uka, under whom the lands were named Leilehua Ranch (Tomonari-Tuggle and Bouthillier 1994:22; Figure 4, Figure 6). Kalākaua and Judd built a hunting lodge, Malamanui, to use as a retreat and place to entertain influential people (Nedbalek 1984:13). In 1889 Dowsett purchased the lease and Leilehua Ranch assets, which consisted of more than 20,000 acres and 3,000 head of cattle and other stock (Tomonari-Tuggle and Bouthillier 1994:24). Wai‘anae Uka remained under Dowsett Ranch until the U.S. military took over in the early 1900s.

Tomonari-Tuggle (1997:24) describes the significant effect of more than 20 years of cattle ranching on the central plateau as follows:

> the probable final demise of native plants as the dominant vegetation of the area. Cattle are known to have opened up native forests through foraging, trampling of the forest understory, and spreading of alien grasses. In addition, associated human activities exacerbated the actions of the cattle. Logging often preceded ranch operations or was used to expand existing pastures. Timber was cut for fencing or ranch buildings. Some native plants

> were considered "noxious" and removed to encourage pasture growth and facilitate the movement of cattle (Cuddihy and Stone 1990:62).

5.4 Commercial Agriculture

In 1897 the Oahu Sugar Company was established on the ʻEwa Plains by the predecessor of Amfac, H. Hackfield & Co. (Wilcox 1996:98). In 1898 a group of homesteaders began settling the Wahiawā Colony Tract, which the Land Act of 1895 designated as a homestead land (Nedbalek 1984:18). Clearly shown in the 1902 survey map, W.C. Jones' leased land has been split into 17 homesteads roughly bounded by the north and south forks of Kaukonahua Stream (Figure 6).

James B. Dole began growing pineapple in the Wahiawā Tract in 1900 for his canning operation, the Hawaiian Pineapple Company. The east part of the military reservation, and the school land leased to W.C. Jones, is shown as pineapple land in the 1902 map (Figure 6).

The Wahiawā Colony organized the Wahiawa Water Company, which by 1902 built a network of flumes, ditches, and tunnels to provide water to the homesteads and cultivated fields (Nedbalek 1984:28). The water company completed a dam across Kaukonahua Gulch in 1906 to form the reservoir now known as Lake Wilson (Haile 1976). By the 1920s more than 71 artesian wells had been dug in Honouliuli, which produced more than 100 million gallons of water per day (Burgett and Rosendahl 1992: Appendix E). Within a decade, thousands of acres of pineapple fields were being cultivated in central Oʻahu.

In 1906 the Oahu Rail and Land Company (OR&L) extended their railway from Waipahu to Wahiawā, through what would become WAAF, so that pineapples could be transported from the fields to the new Dole cannery constructed at Iwilei in Honolulu. These rail lines expanded over the decades to keep up with the commercial growth of the central plateau (Figure 4).

Between 1910 and 1920 a number of smaller plantations were established in central Oʻahu, mostly by Japanese immigrants. Masanari Saito was one of the independent growers who, in 1913, first planted pineapple on leased fields near Kunia using pineapple tops discarded by another grower (Nedbalek 1984:56). Saito decided to move his plantation from Kunia to "Leilehua…in the valley west of Schofield," which proved to be a difficult undertaking:

> He and his friend Tamotsu Ono traveled by horse and began clearing a path as they moved along. At Leilehua first he built something that looked like a chicken coop and slept there. Then he built a kitchen and slept there and finally he made the main rooms. After the land had been cleared, plowed and planted he bought passage on a ship and returned to Japan for the woman who would be his bride. [Nedbalek 1984:56]

North of the project area, a plantation camp labeled as "Leilehua" might correspond to Saito's early plantation that Nedbalek (1984) also refers to as Leilehua (Figure 6).

Large corporations, including Dole and Hawaiian Islands Packing Company, established labor camps near the fields, including the Kunia and Robinson I camps southeast of the present study area. Small stores and itinerant peddlers served these outlying communities and isolated plantations.

By the 1920s mechanized pineapple farming and military occupation of the central plateau at SBMR and WAAF contributed to economic expansion centered in Wahiawā that gradually promoted infilling development and an even greater expansion of pineapple farming throughout the central plateau. USGS maps from the 1920s to 1953 indicate that all of the upper plateau lands and broad ridge tops were cultivated in pineapple, and a network of roads were also established for access between the fields (Figure 8, Figure 9).

An aerial photo of SBMR cantonment dated to 1926 shows the Schofield Generating Station area, in the left foreground below Wai‘eli Stream, planted in pineapple (Figure 10). A photo of anti-aircraft training amidst pineapple fields in O‘ahu’s central plateau during World War II also shows the extent of commercial cultivation (Figure 11). Pineapple cultivation continued in and around KUNTA under various companies (Roberts et al. 2004:6) until Del Monte Pineapple Company abruptly shut down operations in November 2006.

5.5 U.S. Military

Following annexation of the Hawaiian Islands by the United States in 1898, former Crown Lands, including Wai‘anae Uka, became the property of the federal government. In 1899 Wai‘anae Uka (excluding Kalena ‘Ili) was set aside as a military reservation. In the 1902 Hawai‘i Territory Survey map by Walter E. Wall, Surveyor, much of the central plateau, with the exception of Kalena, is shown as U.S. Military Reservation (Figure 6). The military reservation was not occupied until 1909 when it was mandated to be the base for O‘ahu’s mobile defense troops because of its strategic central location.

The landscape of the project area is described in a report on the adequacy of the central plateau for a military post:

> The main road across the island runs across the tract, cutting it into two pieces of 8,000 and 6,000 acres respectively. The west section is cultivated with pineapples and is the smaller of the two and in my opinion the other tract is amply large for all purposes and not having been broken up, is covered with sod which is a very great advantage as the red dirt here is beastly dusty in dry weather and equally vile in wet. The site is an ideal one for a post being a level or practically level place, but there is not a tree on the tract. [Foster 1908, cited in Tomonari-Tuggle 1997:25]

Initially called either Leilehua Barracks or Castner Village, the latter named for the construction supervisor Captain Castner, SBMR was first occupied by 473 soldiers from the 5th Cavalry Regiment (Alvarez 1982:16). In April 1909 the military base was formally named Schofield Barracks in honor of Lt. General John M. Schofield, a former Civil War hero and Commander of the Army’s Pacific Division. Although World War I halted construction, most major construction for SBMR (General Officers housing, new barracks for artillery troops, new infantry barracks, and additional Officers Quarters for the infantry and cavalry sections) was finished in the early 1920s (Robins and Spear 1997b:39–42). A 1909–1919 military survey map suggests initial development of SBMR was centered immediately north of the study area at a place called Leilehua along the north boundary. An OR&L railroad track terminating at several structures in Leilehua might be the original track that was extended into the military reservation in 1906 (U.S. Army Military Survey 1909).

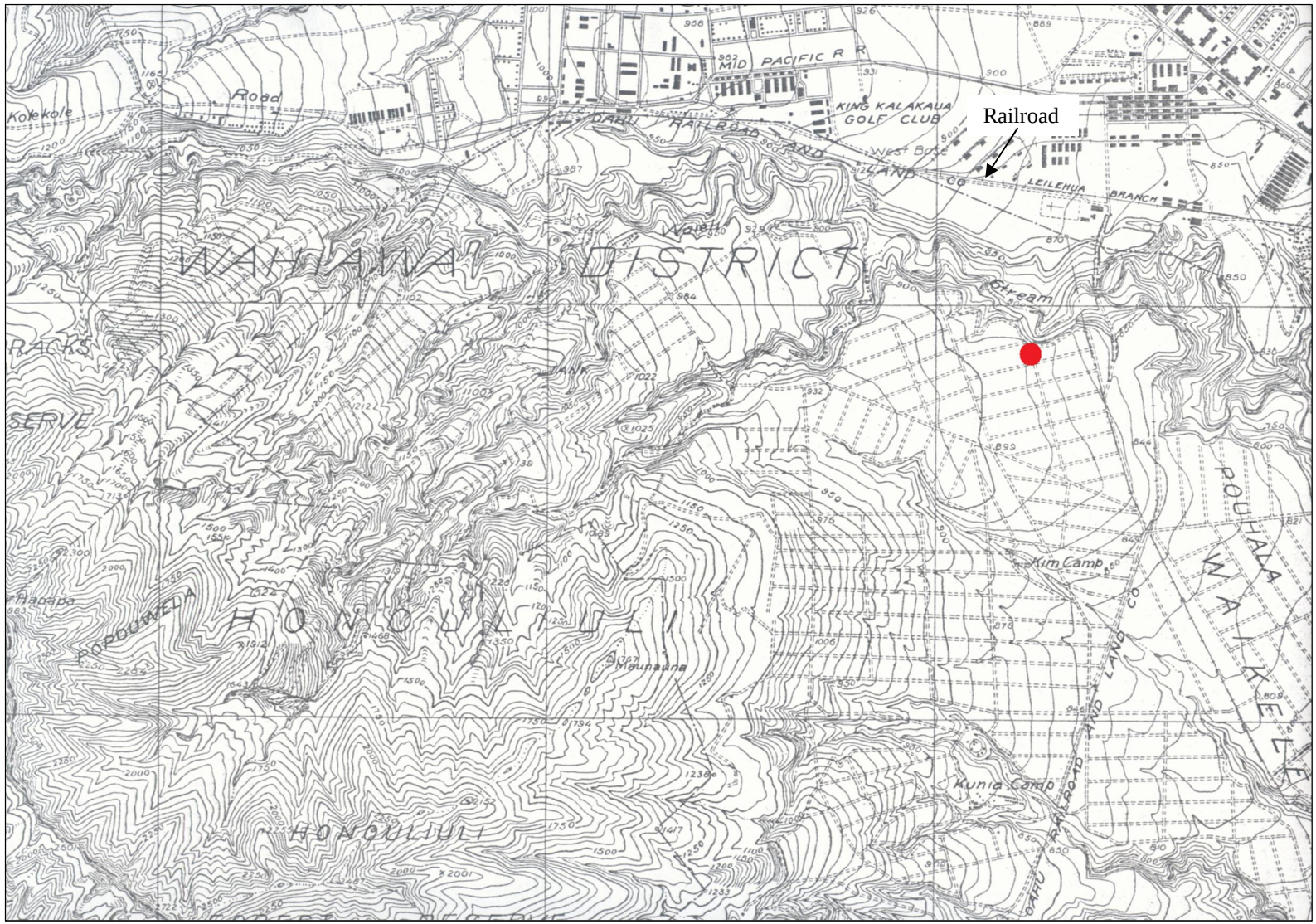

Figure 8. Enlarged detail of the 1927–1930 USGS Schofield Quadrangle with proposed Schofield Generating Station marked. Dashed lines around marked area indicate one-lane roads through cultivated fields.

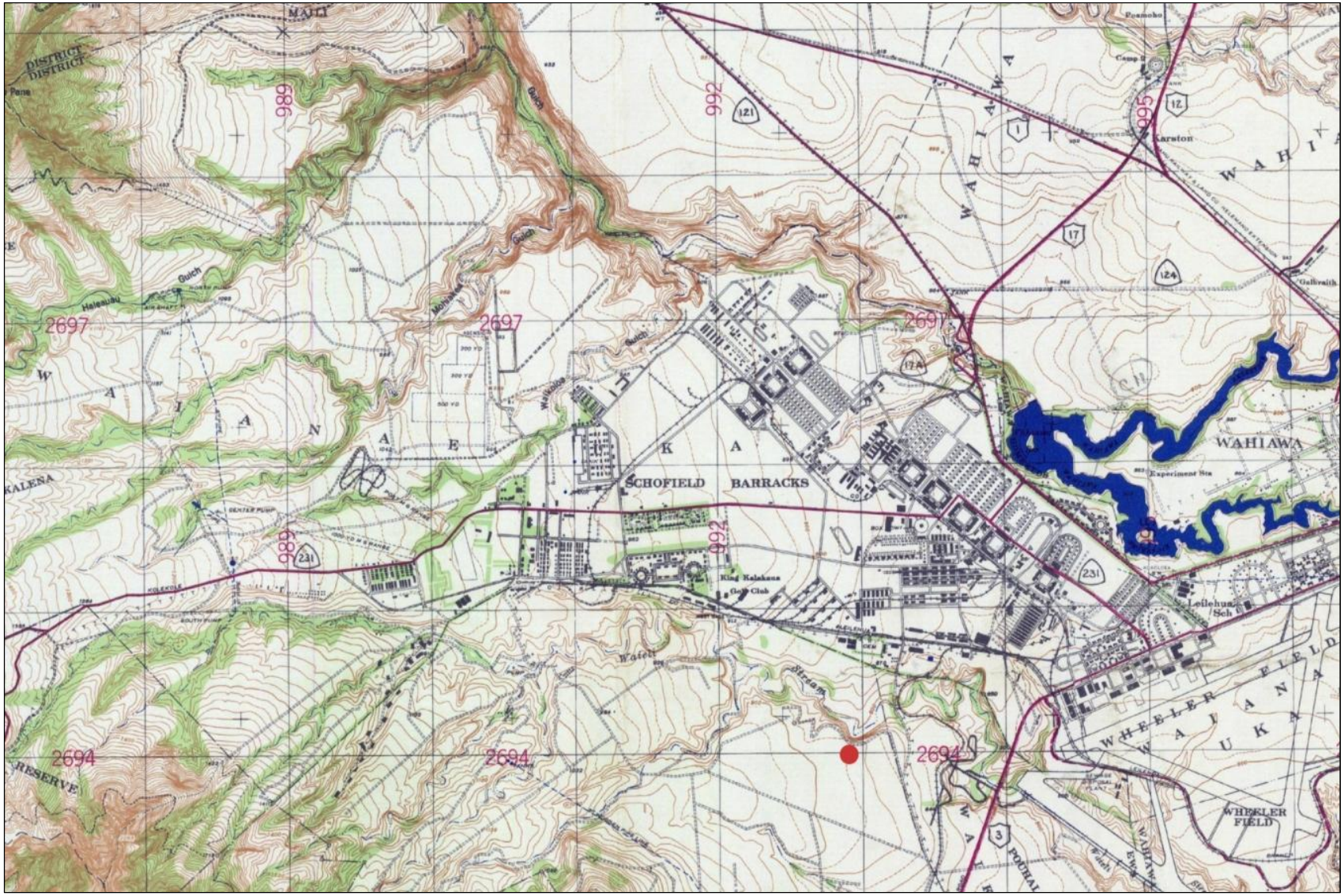

Figure 9. Enlarged detail of the 1943 USGS Schofield Quadrangle with proposed Schofield Generating Station marked.

Provided by Tropic Lighting Museum Aerial of Schofield 23 Jan. 1936 P.306

Figure 10. 1936 aerial photograph of Schofield Barracks showing surrounding pineapple fields (Tropic Lighting Museum).

Figure 11. Anti-aircraft training amidst pineapple fields in central O‘ahu during World War II (From Paradise of the Pacific 1944:49).

During early development of SBMR, water was scarce and was apparently derived from one primary source at a "spring on the slopes of the Waianae Mountains Range" (Nedbalek 1984:59). Photographs taken in 1909 show water tanks and a water supply camp in western Wai‘anae Uka that might correlate with the location of a probable pump house identified as SIHP Site No. 6557 in Hale‘au‘au Stream (Robins et al. 2005:16). A water shortage continued at SBMR until 1925 when Ku Tree Reservoir was constructed in eastern Wai‘anae Uka (Nedbalek 1984:60) and a deep well was excavated in 1938 (Addleman 1940, cited in Spencer Mason Architects 1997).

A northwestern extension of the OR&L line connected the lower post with the artillery area in the 1920s and 1930s. The USGS Schofield Barracks Quadrangle map of 1927–1930 displays two rail companies extending through the plateau; the OR&L and the Mid Pacific Railroad (Figure 8). Both companies have rails leading to the cantonment area. The same shows the Leilehua Ranch house is now identified as the King Kalākaua Golf Club.

WAAF was established as a military installation in 1922 on land included in the 1909 Executive Order establishing SBMR. Initially used for mounted cavalry training, WAAF was constructed in the 1920s by a detachment from the Army Air Service based at Luke Field on Ford Island. During the 1930s the field was upgraded and new buildings were constructed, including houses, hangars, and a fire station. At the same time, the OR&L relocated their railroad tracks to avoid the aviation field that was under construction.

During the 7 December 1941 Japanese attack on Pearl Harbor, SBMR was subject to Japanese air fire. Troops returned fire from the quadrangle roofs, shooting down two Japanese planes and one U.S. plane (Alvarez 1982:64). No significant damage was incurred at SBMR during the attack; however, nearby WAAF was hit hard. SBMR was used as a major training camp during the Pacific campaign of World War II. The Ranger Combat Training School at SBMR was established in 1942 and intended to train the troops for jungle warfare (Alvarez 1982:68). In 1947 WAAF was moved to U.S. Air Force control and then put in caretaker status from 1948 until 1951, when the Korean War began.

While the number of troops and level of activity at SBMR has varied considerably since the close of World War II, the reservation has continued in its importance as a training center and post for the U.S. Army's 25th Infantry Division. WAAF remained in U.S. Air Force control until 1993, when it was returned to the U.S. Army. The 1943 USGS map displays few changes from the 1930 USGS map (Figure 9). There are a few more permanent structures. Mid Pacific Railroad is no longer displayed; and WAAF is established.

In 2005 the U.S. Army purchased 1,402 acres south of the SBMR cantonment and east of the South Range from the Campbell Estate. The northernmost of the three parcels, composing the South Range Acquisition Area, would become KUNTA. At the time of purchase, the lands, including broad ridges and stream floors, were still under pineapple cultivation as they had been for almost a century.

6.0 CULTURAL IMPACT ASSESSMENT RESULTS

Native Hawaiian use of the lands encompassed by the APE ended more than a century ago as U.S. military, ranching, and commercial agricultural endeavors encroached upon the traditional

landscape. These developments transformed the landscape into extensive farmlands, military installations, and an urban development. Lack of public access to the portions of the APE within SBMR likely had a deleterious effect on traditional use of those areas. As previous oral history and ethnographic studies of SBMR and WAAF (e.g., Desilets et al. 2011; Social Research Pacific, Inc. 2004) have found, there are very few, if any, Hawaiian oral historians, *kapuna*, and community members with knowledge of traditional cultural practices and land use associated with this region.

According to the cultural consultants in this CIA, most knowledge about cultural practices and cultural sites on Oʻahu's central plains is only available from archival documents and archaeological research rather than first-hand experience. The cultural consultants knew of no traditional Hawaiian resources, sites, or practices within the APE and saw no adverse effects from the project.

6.1 Cultural Resources, Practices, and Beliefs Identified—Location and Significance

All archival ethnohistoric research and ethnographic consultations conducted during this study indicate that the lower elevations of Oʻahu's central plateau contained important traditional transportation routes, centers for training in warfare, and battlefields. Most significantly the Līhuʻe-Wahiawā-Helemano region is associated with a specific class of high chiefs, the *lō aliʻi*, tied by birth and practice of strict *kapu* to the uplands. The only remnants of this cultural complex are the Kūkaniloko birthing stones, located well outside of the project area, and a large number of archaeological sites in the upland reaches of SBMR, also quite distant from the project area. More than a century of commercial agriculture, military development, and urban growth appear to have eliminated most, if not all, evidence of traditional cultural activity within the APE.

Data analyzed during this assessment indicate that the long period of historic development, particularly that related to the vast expanses of pineapple fields and military installations, has resulted in the termination of any traditional cultural practices that might have once occurred in or adjacent to the project area. There is no tangible or intangible evidence of any former or ongoing cultural practices (including resource procurement through hunting or gathering, transportation routes, burials, or other ceremonial activities) occurring in the APE.

6.2 Effects of the Proposed Project

Based on the above findings, this study concludes that there will be no adverse impact to cultural resources, cultural practices, and traditional beliefs by the SGSP. Traditional Hawaiian land use in the APE terminated more than a century ago with any potential tangible remains long lost to commercial agricultural endeavors, military activities, and urban development. Along with this loss of cultural properties in the project area, the *moʻolelo* once held by traditional community members were forgotten.

6.3 Confidential Information Withheld

During the course of conducting the ethnographic survey for the SGSP, no sensitive or confidential information was discovered in the background literature or communicated by consultants. All results of this effort are therefore presented in an unrestricted manner and no data was withheld.

6.4 Conflicting Information

No conflicting information was identified in the consultation process or in the archival research. A number of themes were consistently repeated in interviews and background literature (i.e., transportation routes, warfare) demonstrating independent confirmation and verification of findings.

6.5 Proposed/Potential Physical Alterations and Isolation/Alteration of Resources

With no known tangible or intangible cultural resources or practices in the project area, the SGSP presents very little potential to physically alter or isolate any cultural resources.

6.6 Recommendations

It is recommended that the proposed design for constructing the generating station and installing the electric poles and overhead lines be followed as planned. The proposed design will not impact any known cultural sites or practices and avoids impact to Wai‘eli Stream gulch, which which a cultural consultant noted might raise concerns of community members. Should the planned development substantially change, it is recommended that this CIA be revisited.

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APPENDIX A: AGREEMENT TO PARTICIPATE

Agreement to Participate in the Cultural Impact Assessment for the Schofield Generating Station EIS
Jolie Liston, Garcia and Associates

You are invited to participate in the Cultural Impact Assessment of the Schofield Generating Station Environmental Impact Assessment (EIS) on O'ahu (herein referred to as "Project"). The Project is being conducted by Garcia & Associates, a cultural resource management firm, on behalf of TetraTech, who is conducting the EIS on behalf of the Hawaiian Electric Company. The ethnographer will explain the purpose of the Project, the procedures that will be followed, and the potential benefits and risks of participating. A brief description of the Project is written below. Feel free to ask the ethnographer questions if the Project or procedures need further clarification. If you decide to participate in the Project, please sign the attached Consent Form. A copy of this form will be provided for you to keep.

Description of the Project

This ethno-historic study is being conducted to collect information about the long-term land use in and around the project area through interviews with individuals who are knowledgeable about this area, and/or about information including cultural practices, legends, songs, or chants. The goal of this Project is to identify and understand the importance of any traditional Hawaiian and/or historic cultural resources, places, or traditional cultural practices in these properties.

Procedures

After agreeing to participate in the Project and signing the Consent Form, the ethnographer will record your interview on audio tape and have it transcribed. The transcript will be sent to you for editing and final approval. Data from the interview will be used as part of the Cultural Impact Assessment for this EIS and transcripts may be included in part or in full as an appendix to the report. The ethnographer may take notes and photographs and ask you to spell out names or unfamiliar words.

Discomforts and Risks

Possible risks and/or discomforts resulting from participation in this Project may include, but are not limited to the following: being interviewed and recorded; having to speak loudly for the recorder; providing information for reports which may be used in the future as a public reference; your uncompensated dedication of time; possible misunderstanding in the transcribing of information; loss of privacy; and worry that your comments may not be understood in the same way you understand them. It is not possible to identify all potential risks, although reasonable safeguards have been taken to minimize them.

Benefits

This Project will give you the opportunity to express your thoughts and opinions and share your knowledge, which will be considered, shared, and documented for future generations. Your sharing of knowledge may be instrumental in the preservation of cultural resources, practices, and information.

Confidentiality

Your rights of privacy, confidentiality and/or anonymity will be protected upon request. You may request, for example, that your name and/or sex not be mentioned in Project material, such as in written notes, on tape, and in reports; or you may request that some of the information you provide remain off-the-record and not be recorded in any way. To ensure protection of your privacy, confidentiality and/or anonymity,

you should immediately inform the ethnographer of your requests. The ethnographer will ask you to specify the method of protection, and note it on the attached Consent Form.

Refusal/Withdrawal

At any time during the interview process, you may choose to not participate any further and ask the ethnographer for the tape and/or notes. Please note that you will be given an opportunity to review your transcript, and to revise or delete any part of the interview.

Consent Form

I, _____, am a participant in the Cultural Impact Assessment for the Schofield Generating Station Project Environmental Impact Assessment (herein referred to as "Project"). I understand that the purpose of the Project is to conduct oral history interviews with individuals knowledgeable about the lands the project will impact. I understand that Garcia and Associates and/or TetraTech will retain the product of my participation (audio tapes, transcripts of interviews, etc.) as part of their permanent collection and that the materials may be used for scholarly, educational, land management, and other purposes.

_____ I hereby grant to Garcia and Associates and TetraTech ownership of the physical property delivered to the institution and the right to use the property that is the product of my participation (e.g., my interview, photographs, and written materials) as stated above. By giving permission, I understand that I do not give up any copyright or performance rights that I may hold.

_____ I also grant to Garcia and Associates and TetraTech my consent for any photographs provided by me or taken of me in the course of my participation in the Project to be used, published, and copied by Garcia and Associates and TetraTech and its assignees in any medium for purposes of the Project.

_____ I agree that Garcia and Associates and TetraTech may use my name, photographic image, biographical information, statements, and voice reproduction for this Project without further approval on my part.

_____ I understand that I will have the opportunity to review my transcripts to ensure that they accurately depict what I meant to convey. I also understand that if I do not return the revised transcripts after one week from the date of receipt, my signature below will indicate my release of information for the draft report, although I will still have the opportunity to make revisions during the draft review process.

By signing this permission form, I am acknowledging that I have been informed about the purpose of this Project, the procedure, how the data will be gathered, and how the data will be analyzed. I understand that my participation is strictly voluntary, and that I may withdraw from participation at any time without consequence.

_____

Consultant Signature **Date**

_____

Print Name **Phone**

_____

Address

Thank you for participating in this valuable study.