Environmental Assessment for the Distributed Common Ground Station Pacific Hub at Joint Base Pearl Harbor-Hickam, Wahiawa Annex, Oahu, Hawaii

Prepared For:

United States Air Force, 480th Intelligence, Surveillance, and Reconnaissance Wing

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Cover Sheet

Environmental Assessment

Distributed Common Ground Station Pacific Hub at Joint Base Pearl Harbor-Hickam, Wahiawa Annex, Oahu, Hawaii

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Comments must be received by:	June 23, 2021
Abstract:	The United States Air Force has prepared this Environmental Assessment to assess the potential environmental impacts that may result from construction and operation of a Distributed Common Ground Station Pacific Hub (DCGS Pacific Hub) facility on Wahiawa Annex. To achieve its mission, the 480th Intelligence, Surveillance, and Reconnaissance (ISR) Wing needs a DCGS Pacific Hub to provide secure communications support for Pacific region ISR operations and support infrastructure and equipment requirements for ISR missions. Currently, no regional DCGS Pacific Hub exists to provide global operational capabilities in the event that global ISR communications are disrupted. A DCGS Pacific Hub would provide secure communications support for Pacific region ISR operations. One Action Alternative and a No Action Alternative were considered in this Environmental Assessment.

Executive Summary

The United States (U.S.) Air Force (USAF) has prepared this Environmental Assessment (EA) to evaluate the potential environmental effects of the Proposed Action: constructing and operating a permanent Distributed Common Ground Station Pacific Hub (DCGS Pacific Hub) facility located at Joint Base Pearl Harbor-Hickam (JBPHH), Wahiawa Annex, Oahu Hawaii.

The environmental assessment (EA) has been prepared in accordance with the National Environmental Policy Act of 1969 (NEPA) (42 United States Code Section 4321 et seq.), the Council on Environmental Quality's (CEQ's) NEPA-implementing regulations[1] (Title 40 of the Code of Federal Regulations [CFR] Parts 1500 through 1508), USAF NEPA-implementing regulations (32 CFR 989), and U.S. Department of Defense Instruction 4715.9, *Environmental Planning and Analysis*. The proposed project site is located within the JBPHH Wahiawa Annex, a U.S. Navy (Navy) installation; therefore, the USAF has also prepared this EA in accordance with the Navy NEPA-implementing regulation (32 CFR 775) and the Office of the Chief of Naval Operations M-5090.1, *Environmental Readiness Program Manual*. This EA also analyzes the potential impacts of the Proposed Action and supports a determination of whether to prepare an Environmental Impact Statement or a Finding of No Significant Impact.

This project is a USAF 480th Intelligence, Surveillance, and Reconnaissance (ISR) Wing project. The 692nd ISR Group (692nd ISRG), a subordinate unit of the 480th ISR Wing, is headquartered at JBPHH. The DCGS Pacific Hub project at Wahiawa Annex would support 692nd ISRG operations by providing secure and resilient communications supporting Pacific region ISR operations. The project also would consolidate squadron leadership, training, and administration functions for units on JBPHH currently supporting USAF-delegated missions at the National Security Agency/Central Security Service Hawaii.

The JBPHH Wahiawa Annex is a Navy installation comprising approximately 700 acres within the Wahiawa District on the island of Oahu, Hawaii. The Wahiawa Annex lies north of the town of Wahiawa and east of Whitmore Village. The proposed project site is centrally located along Midway Drive, within the Wahiawa Annex.

Purpose and Need

The purpose of the Proposed Action is to provide the necessary facility for the 480th ISR Wing and 692nd ISRG to provide secure communications support for Pacific region ISR operations. The Proposed Action is needed because current facilities at JBPHH used by the 692nd ISRG were not designed or constructed to support technology-intensive systems equipment or enable modernization efforts needed by the 692nd ISRG.

The existing facilities on JBPHH are World War II-era buildings currently at capacity on occupancy, power, cooling, and data center capability. These facilities, designed as aircraft hangars and administrative offices, have been modified numerous times to support operations of past generations. The facilities now struggle to adequately meet current mission loads and cannot support an increase in steady-state missions, wartime and surge operations tempo, or evolving ISR data architecture.

Proposed Action

The Proposed Action would construct and operate a DCGS Pacific Hub on the Wahiawa Annex. The Proposed Action project site, including the DCGS Pacific Hub and associated infrastructure, areas to accommodate construction staging and laydown, and utility connections, comprises approximately 811,640 square feet

[1] The USAF made the decision to prepare the EA in July 2020 prior to the CEQ update to the NEPA-implementing regulations effective date of September 14, 2020; therefore, the original NEPA implementing regulations were used for this EA.

(18.6 acres). Activities under the Proposed Action include demolishing existing warehouse structures, their concrete pads, and access roads; constructing the two-story (partially below grade) DCGS Pacific Hub, with approximately 100,000 square feet of floor space; constructing approximately 189,000 square feet (4.3 acres) of new paved areas to include sidewalks, two parking areas, and access roads; constructing utility connections to include a sanitary sewer system and electrical system; and constructing stormwater management systems to comply with low-impact development requirements. Stormwater management would include vegetated filter strips, bioretention basins, and bioswales.

The 480th ISR Wing would provide the military personnel, contractors, and civilians to operate and maintain the DCGS Pacific Hub. Approximately 180 to 200 personnel are expected to work at the hub, and most of those personnel currently live or work near the project. The remaining approximately 50 contractors and civilians needed to work at the hub are anticipated to come from the local workforce. No increase in military personnel would be assigned to the 480th ISR Wing as part of this Proposed Action. No additional housing on Oahu would be required under the Proposed Action.

Typical operation activities would include vehicle traffic for personnel and visitors traveling to and from the DCGS Pacific Hub and truck traffic for deliveries. Operations also would include routine maintenance of the hub and outside facilities, including parking lots, access roads, stormwater management infrastructure, and landscaping. Section 2.2 of this EA provides a detailed discussion of the Proposed Action.

Project Schedule

The Proposed Action is estimated to require approximately 39 months to construct, with construction anticipated to begin in 2024 at the earliest. Fit out (making interior spaces suitable for occupation) of network equipment would occur after construction is completed; therefore, the building may not be fully operational until the following year.

Alternatives

Alternatives carried forward for analysis in this EA include the Proposed Action, as described above, and No Action Alternative. Under the No Action Alternative, a new DCGS Pacific Hub would not be constructed, and the existing facilities occupied at JBPHH would continue to lack the flexibility to support the infrastructure and equipment required for evolving ISR missions. The lack of a hub also would prevent dissemination of ISR information and data. Further, under the No Action Alternative, the lack of a purpose-built hub for the Pacific region would prevent mission-system upgrades and impair operations, during periods of degraded communications. The No Action Alternative would not achieve the project purpose and need, but it was carried through the analysis as a benchmark to compare the Proposed Action’s magnitude of environmental effects.

Alternatives Considered but Eliminated from Detailed Study

This EA analyzes the Proposed Action and the No Action Alternative. An action alternative to renovate existing facilities on JBPHH was considered; however, no existing facilities could support the comprehensive mission requirements; therefore, this alternative was eliminated from consideration. This action alternative also was dismissed due to its lack of sufficient space and its very low elevation being vulnerable to storm surge or tsunami hazards.

In addition, two sites within the Wahiawa Annex were considered but then eliminated from detailed study, because they are not located near existing utilities (for example, water, electric power, sewer, and communications) and have no emergency or large vehicle accessibility. These two sites also had missions and security considerations. These alternative sites on Wahiawa Annex also did not meet the selection standards presented in Section 2.1 of this EA and, therefore, were eliminated from further consideration.

Environmental Consequences

In accordance with the CEQ and with USAF directives to focus analyses on environmental resource areas where significant impact could occur and where analyses are expected to provide useful information to the decision-maker in choosing between alternatives, some resource areas have been eliminated from further study. Preliminary evaluation concluded that no impact would occur to the following resources, which were therefore eliminated from detailed study: land use, visual resources, floodplains, environmental justice, protection of children, or coastal zones.

The EA indicates that the Proposed Action would not result in significant impacts on air quality, noise, biological resources, cultural resources, water resources and water quality, geology and soils, utilities and infrastructure, hazards and hazardous wastes, socioeconomics, or traffic.

Impact Summary

Table ES-1 compares the impacts of the Proposed Action and the No Action Alternative. Neither would result in significant impacts on any of the resources analyzed in this EA.

Table ES-1. Summary of Potential Environmental and Socioeconomic Consequences

Resource	Proposed Action [a, b]	No Action Alternative [b, c]
Air quality	Construction: short-term minor impact Operation: long-term minor impact	No impact
Noise	Construction: short term minor impact Operation: long-term minor impact	No impact
Biological resources	Construction: short-term minor impact Operation: negligible impact	No impact
Cultural resources	Construction: negligible impact Operation: no impact	No impact
Water resources and water quality	Construction: short-term minor impact Operation: negligible impact	No impact
Geology and soils	Construction: short-term minor impact Operation: no impact	No impact
Utilities and infrastructure	Construction: short-term minor impact Operation: long-term minor impact	No impact
Hazardous materials and wastes	Construction: short-term minor impact Operation: negligible impact	No impact
Socioeconomics	Construction: short-term minor, beneficial impact Operation: no impact	No impact
Traffic	Construction: short-term minor impact Operation: long-term minor impact	No impact
Cumulative impact	No significant cumulative impact	No impact

[a] Effects are compared with the No Action Alternative.

[b] **No impact** applies where a project does not create an impact in that environmental resource category; a **negligible impact** is an environmental impact that is so small it would be difficult to observe and trivial enough to be disregarded; and a **minor impact** is an environmental impact that is observable yet unlikely to noticeably affect human health, cultural resources, or the environment. **Short-term** impacts are those that would result from activities associated with a project's construction and demolition. **Long-term** impacts are generally those resulting from the Proposed Action's operation.

[c] The No Action Alternative would involve no construction; therefore, no effects would result from construction or operation.

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Acronyms and Abbreviations

—	not applicable
μg/m^3	microgram(s) per cubic meter
A.M.	ante meridiem
ABA	Architectural Barriers Act
ACAM	U.S. Air Force Air Conformity Applicability Model
ACM	asbestos-containing material(s)
AF	U.S. Air Force
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AFI	Air Force Instruction
AFMAN	Air Force Manual
AFPD	Air Force Policy Directive
ASM	Affiliates, Inc.
BA	Bachelor of Arts
BEA	U.S. Bureau of Economic Analysis
BLS	U.S. Bureau of Labor Statistics
BMP	best management practice
BS	Bachelor of Science
CAA	Clean Air Act
CCH	City and County of Honolulu
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2e	carbon dioxide equivalent
CSF	conforming storage facility
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
dB	decibel(s)
dBA	A-weighted decibel(s)
DCGS	Distributed Common Ground Station
DCGS Pacific Hub	Distributed Common Ground Station Pacific Hub
DLNR	State of Hawaii Department of Land and Natural Resources
DoD	U.S. Department of Defense
EA	Environmental Assessment
ECC	estimated construction cost
EIAP	Environmental Impact Analysis Process
EISA	Energy Independence and Security Act of 2007
EO	executive order
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
et al.	and others
et seq.	and what follows

FE	federal endangered protection status
FEMA	Federal Emergency Management Agency
FHAT	Flood Hazard Assessment Tool
FHWA	Federal Highway Administration
FIRE	finance, insurance, real estate, rental, and leasing
FT	federal threatened protection status
FTA	Federal Transit Administration
FTE	full-time equivalent
FY	fiscal year
GHG	greenhouse gas(es)
GIS	geographic information system
gpd	gallon(s) per day
H_2S	hydrogen sulfide
HAR	Hawaii Administrative Rule
HAZMAT	hazardous material(s)
HCM	Highway Capacity Manual
HDOH	State of Hawaii Department of Health
HDOT	State of Hawaii Department of Transportation
HEER	Hazard Evaluation and Emergency Response
HI	Hawaii
HRS	Hawaii Revised Statute
HSIP	Highway Safety Improvement Program
HWMP	Hazardous Waste Management Plan
HWY	highway
ICRMP	Integrated Cultural Resources Management Plan
IR	introduced, resident year-round
ISR	Intelligence, Surveillance, and Reconnaissance
ISRG	Intelligence, Surveillance, and Reconnaissance Group
Jacobs	Jacobs Engineering Group Inc.
JBPHH	Joint Base Pearl Harbor-Hickam
kV	kilovolt
kVA	kilovolt ampere
LBP	lead-based paint
L_{eq}	equivalent noise level
LID	low-impact development
LLC	limited liability corporation
LOS	level of service
MA	Master of Arts
MBA	Master of Business Administration
MBTA	Migratory Bird Treaty Act
MS	Master of Science
MTSC	Master of Technical and Scientific Communication
MUP	Master of Urban Planning

n.d.	no date
NAAQS	National Ambient Air Quality Standards
NAVFAC HI	Naval Facilities Engineering Command Hawaii
NAVFAC	Naval Facilities Engineering Command
Navy	U.S. Department of the Navy
NEPA	National Environmental Policy Act
NH_3	ammonia
NHPA	National Historic Preservation Act
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
O_3	ozone
OSHA	Occupational Safety and Health Administration
P.M.	post meridiem
Pb	lead
PDF	portable document file
PIS	pesticide-impacted soil(s)
PM_{10}	particulate matter less than 10 micrometers in aerodynamic diameter
$PM_{2.5}$	particulate matter less than 2.5 micrometers in aerodynamic diameter
ppm	parts per million
PA	Programmatic Agreement
PVC	polyvinyl chloride
R	resident year-round
ROI	region of influence
sec/veh	second(s) per vehicle
SO_2	sulfur dioxide
SPCC	spill prevention, control, and countermeasure
TBD	to be determined
TMDL	total maximum daily load
TRB	Transportation Research Board
U.S.	United States
U.S.C.	United States Code
USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
VOC	volatile organic compound
W	present during nonbreeding season

SECTION 1

Purpose and Need for Action

The United States (U.S.) Air Force (USAF) has prepared this Environmental Assessment (EA) to evaluate the potential environmental impacts of the Proposed Action: constructing and operating a permanent Distributed Common Ground Station (DCGS) Pacific Hub (DCGS Pacific Hub) facility located at Joint Base Pearl Harbor-Hickam (JBPHH), Wahiawa Annex, Oahu, Hawaii.

The EA has been prepared in accordance with the National Environmental Policy Act of 1969 (NEPA) (United States Code [U.S.C.] Title 42, Section 4321 et seq.), the Council on Environmental Quality's (CEQ's) NEPA-implementing regulations[1] (Code of Federal Regulations [CFR], Title 40, Parts 1500 through 1508), USAF NEPA-implementing regulations (32 CFR 989), and U.S. Department of Defense (DoD) Instruction 4715.9, *Environmental Planning and Analysis*. The proposed project site is located within the JBPHH Wahiawa Annex, a U.S. Department of the Navy (Navy) installation; therefore, the USAF has also prepared this EA in accordance with the Navy NEPA-implementing regulation (32 CFR 775) and the Office of the Chief of Naval Operations M-5090.1, *Environmental Readiness Program Manual* (September 3, 2019). This section describes the purpose of and need for the Proposed Action, summarizes the scope of the EA, and explains applicable regulatory requirements.

1.1 Introduction

The project is a USAF 480th Intelligence, Surveillance, and Reconnaissance (ISR) Wing project; the USAF leader in globally networked ISR operations. The 480th ISR Wing is the lead for the USAF DCGS, which is the USAF primary ISR planning and direction, collection, processing, exploitation, analysis, and dissemination weapon system. The 692nd ISR Group (ISRG), a subordinate unit of the 480th ISR Wing, is headquartered at JBPHH. The 692nd ISRG is the USAF component of the National Security Agency-Central Security Service – Hawaii and provides USAF National Tactical Integration to the 613th Air and Space Operations Center, also located at JBPHH. The DCGS Pacific Hub project at the Wahiawa Annex would support 692nd ISRG operations by providing secure and resilient communications supporting Pacific region ISR operations. The project also would consolidate squadron leadership, training, and administration functions for units on JBPHH currently supporting USAF-delegated missions at National Security Agency-Central Security Service – Hawaii.

The proposed project site is located within the JBPHH Wahiawa Annex, a Navy installation comprising approximately 700 acres within the Wahiawa District on the island of Oahu, Hawaii (Figure 1-1). Other military presence in the region includes Schofield Barracks, Wheeler Army Airfield, and Helemano Military Reservation, all located within 10 miles of Wahiawa Annex. The Wahiawa Annex lies north of the town of Wahiawa and east of Whitmore Village. The project site is centrally located along Midway Drive within the Wahiawa Annex (Figure 1-2).

1.2 Purpose and Need

The purpose of the Proposed Action is to provide the necessary facility for the 480th ISR Wing and 692nd ISRG to provide secure communications support for Pacific region ISR operations. The Proposed Action is needed because current facilities at JBPHH used by the 692nd ISRG were not designed or constructed to support technology-intensive systems equipment or enable modernization efforts needed by the 692nd ISRG.

[1] The USAF made the decision to prepare the EA in July 2020 prior to the CEQ update to the NEPA-implementing regulations effective date of September 14, 2020; therefore, the original NEPA implementing regulations were used for this EA.

Figure 1-1
Regional Vicinity Map
JBPHH Wahiawa Annex, Oahu, Hawaii

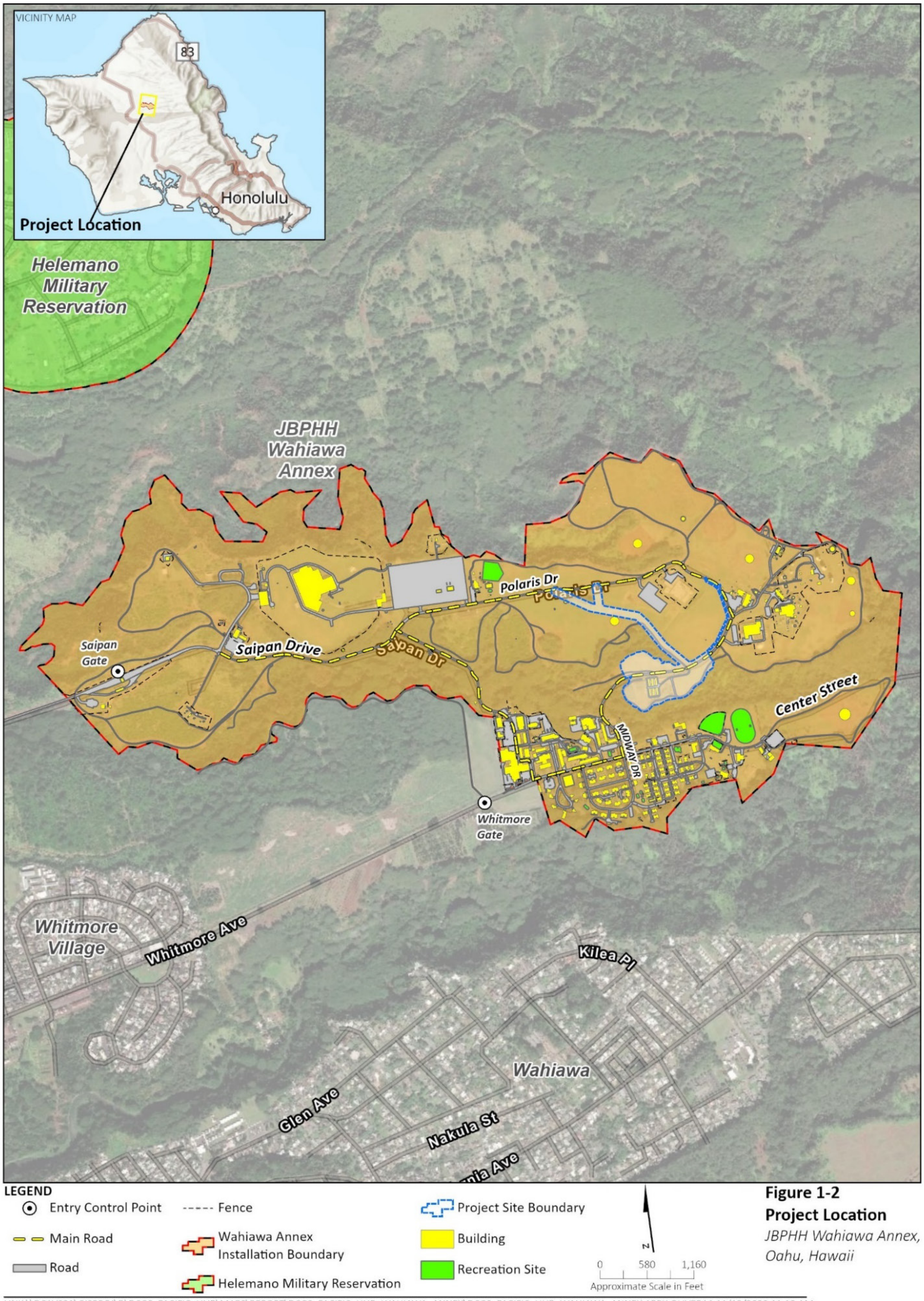

Figure 1-2
Project Location
JBPHH Wahiawa Annex, Oahu, Hawaii

The existing facilities on JBPHH are World War II-era buildings currently at capacity on occupancy, power, cooling, and data center capability. These facilities, designed as aircraft hangars and administrative offices, have been modified numerous times to support operations of past generations. The facilities now struggle to adequately meet current mission loads and cannot support an increase in steady-state missions, wartime and surge operations tempo, or evolving ISR data architecture.

The proposed project needs to comply with the following principles and guidelines:

- 2018 National Defense Strategy (DoD, 2018a)
- 2018 Under Secretary of Defense for Intelligence ISR Guiding Principles
- *AF ISR 2023: Delivering Decision Advantage, A Strategic Vision for the AF ISR Enterprise* (USAF, 2013)
- *2018-2028 AF Next Generation ISR Dominance Flight Plan* (USAF, 2018a)
- Air Combat Command ISR Innovation and Data Strategy
- U.S.C. Title 10 Armed Forces

U.S.C. Title 10 outlines the role of the armed forces and provides the legal basis for the roles, missions, and organization of each armed service, as well as the DoD. U.S.C. Title 10, Subtitle D outlines the role of USAF missions and organizations, which includes effectively supervising and controlling the USAF intelligence activities.

The Proposed Action also would fulfill the following objectives:

- Connect significant, local communications pipelines and infrastructure support elements;
- Provide critical infrastructure for surveilling and protecting the DCGS-wide area network and virtual distributed networks for supported users and customers;
- Support ancillary Signal Intelligence Element mission leadership, administration, and training functions;
- Address quality-of-life support elements otherwise not currently available;
- Provide space for the Airmen Resiliency Team when working at Wahiawa Annex;
- Enhance resiliency to extreme weather events; and
- Provide Information Assurance forces with ready access to the sensitive networks and systems they monitor and protect.

1.3 Regulatory Overview

1.3.1 Integration of Environmental Statutes and Regulations and Required Consultations

Table 1-1 summarizes the permits, approvals, and required consultations that may be required prior to construction. Compliance with applicable executive orders (EOs) is discussed within applicable resource areas of the EA.

Table 1-1. Potential Environmental Regulations and Consultation Requirements

Permit, Approval, or Consultation	Description	Statute, Regulation, Order(s)	Administrative Authority
National Historic Preservation Act (NHPA) Section 106 Consultation	Section 106 of the NHPA requires federal agencies to consider the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on such undertakings (36 CFR 800.1[a]).	NHPA (54 U.S.C. 306108); 36 CFR Part 800	State of Hawaii Department of Land and Natural Resources (DLNR) State Historic Preservation Division and Native Hawaiian Organizations
Endangered Species Act (ESA) Section 7 Consultations and Migratory Bird Treaty Act (MBTA) Consultation and Coordination	Section 7(a)(2) of the ESA requires for actions authorized, funded, or carried out by a federal agency, the agency shall, in consultation with the U.S. Fish and Wildlife Service (USFWS) ensure that the action is not likely to jeopardize any endangered or threatened species or result in the destruction or adverse modification of their critical habitat. Federal agencies must also avoid adverse impacts species protected by the MBTA.	ESA (16 U.S.C. 1531) MBTA (16 U.S.C. 703 through 712) 50 CFR 21.27	USFWS
Clean Water Act (CWA) Section 401 State Water Quality Certification; Section 402 National Pollutant Discharge Elimination System (NPDES) Permit(s)	Section 401 of the CWA requires a State Water Quality Certification to show that the Proposed Action will comply with state water quality standards for any activity that results in a discharge to a water body. An NPDES Construction General Permit is required to authorize stormwater discharges associated with construction activities greater than 1 acre. An NPDES General Permit Authorizing Discharges of Hydrotesting Waters and/or an NPDES General Permit Authorizing Discharges Associated with Construction Activity Dewatering could be required if the project involves discharging any non-stormwater to a drainage system or waterbody.	CWA Sections 401 (33 U.S.C. 1341) and 402 (33 U.S.C. 1251 et seq.)	State of Hawaii Department of Health (HDOH) Clean Water Branch
CWA Section 404 Verification	Section 404 of the CWA requires that a permit be obtained from the U.S. Army Corps of Engineers (USACE) when discharge of dredged or fill material is proposed within Waters of the United States.	CWA Section 404 (33 U.S.C. 328.3[a])	USACE
Clean Air Act (CAA)	CAA requires new source review permits and for certain facilities to obtain a facility-wide Title V operating permit for stationary sources of air emissions. General Conformity rule established under CAA requires that federal actions do not cause or contribute to new violations of the National Ambient Air Quality Standards (NAAQS), worsen existing NAAQS violations, or delay attaining NAAQS.	HAR 11-60.1 Air Pollution Control Regulations 40 CFR Parts 93 Determining Conformity of General Federal Actions to State or Federal Implementation Plans	HDOH Clean Air Branch USACE
Coastal Zone Management Act (CZMA) Federal Consistency Determination	All federally proposed or permitted actions within the State of Hawaii must be evaluated for consistency with the Hawaii CZMA Program.	CZMA (16 U.S.C. 1451 et seq.) 15 CFR 930	State of Hawaii, Office of Planning

1.3.2 Decision to be Made

Based on the analysis in this EA, the USAF will make one of three decisions regarding the Proposed Action:

- Choose to move forward with the Proposed Action and sign a Finding of No Significant Impact, allowing the selected alternative to be implemented;
- Initiate preparation of an Environmental Impact Statement, if significant impacts would likely occur from implementing the Proposed Action; or
- Select the No Action Alternative, where the Proposed Action would not be implemented.

1.4 Public Outreach and Involvement

The USAF is soliciting public and agency comments on the EA and draft Finding of No Significant Impact. The EA is available online at https://www.afcec.af.mil/Home/Environment/. A Notice of Availability of the EA was published in the *Honolulu Star Advertiser*, a newspaper with statewide distribution, and in *Environmental Notice*, the bimonthly publication of the State of Hawaii, Office of Environmental Quality Control. USAF will fully consider all comments received during the Draft EA comment period before rendering its decision on the Proposed Action.

1.5 Environmental Assessment Outline

The following is a brief outline of each EA section:

- **Section 1.0 Purpose and Need for Action** provides background information about the Proposed Action, the Proposed Action's purpose and need, and applicable regulatory requirements and briefly describes how the EA is organized.
- **Section 2.0 Description of the Proposed Action and Alternatives** presents the considered alternatives, describes in detail the Proposed Action and No Action Alternative, and discusses resources eliminated from further analysis.
- **Section 3.0 Affected Environment** describes the existing conditions of the environmental resources potentially affected by the Proposed Action and No Action Alternative.
- **Section 4.0 Environmental Consequences** analyzes potential direct, indirect, and cumulative impacts on environmental resources resulting from the Proposed Action and No Action Alternative.
- **Section 5.0 List of Preparers** lists the individuals who helped prepare this EA.
- **Section 6.0 References** lists references used in preparing this EA.

Description of the Proposed Action and No Action Alternative

This section discusses the criteria for selecting the alternatives considered in this EA and describes the Proposed Action and No Action Alternative carried forward for detailed analysis. This section also describes alternatives considered but eliminated from detailed study and lists resource areas analyzed or eliminated from further analysis.

2.1 Selection Standards for Alternatives

Per 32 CFR 989.8(c), the USAF may develop written selection standards to narrow the range of alternatives analyzed to those that meet operational, technical, or environmental standards applicable to this Proposed Action. Reasonable alternatives for providing secure communications support for Pacific region ISR operations must accomplish the following in a cost-efficient and cost-effective manner, with minimal impact on human health and the environment:

- Be located in an area that is not vulnerable to storm surge or tsunami hazards,
- Be located in an area with large vehicle access and accessible to utilities,
- Provide sufficient capacity to adequately meet current mission loads, support an increase in steady-state missions, support wartime and surge operations tempo, and support evolving ISR data architecture,
- Be near national mission partners for operational support for Pacific region ISR operations, and
- Support technology-intensive systems equipment or enable modernization efforts needed by the 692nd ISRG.

Alternatives were analyzed and existing facilities on JBPHH were reviewed for renovation, however, no alternatives could support the comprehensive requirement. Due to the lack of sufficient space, very low elevation, and vulnerability to storm surges and/or tsunamis at JBPHH, other installations were considered. The most appropriate location for the action alternative proved to be Wahiawa Annex due to its landing point for long-haul communication transport bandwidth necessary for global operability, elevation (1,000 feet above mean sea level), central location on Oahu (more than 20 miles from the ocean), proximity to national mission partners, and robust infrastructure. Section 2.4 describes alternatives considered but eliminated from detailed analysis.

2.2 Proposed Action

The Proposed Action would construct a new DCGS Pacific Hub on the Wahiawa Annex. The project site is located in the southeastern portion of the Wahiawa Annex and bisected by Midway Drive. Existing structures on the site include six warehouses, concrete pads, and an access road, all of which would be demolished as part of the Proposed Action.

Proposed Action construction and operation discussed in the following subsections are based largely on information in the *Distributed Common Ground Station Pacific Hub User Requirements Document* (Jacobs, 2019). The following subsections provide further details regarding activities that would occur with implementing the Proposed Action.

2.2.1 Demolition

Under the Proposed Action, six existing warehouses, concrete pads, and access roads would be demolished. The warehouses were constructed in 1987, and each measure approximately 100 feet by 10 feet, with a height of 12 feet. The six warehouses together span a compact rectangular space measuring approximately 110 feet by 220 feet (24,200 square feet). These warehouses and paved areas are shown on Figure 2-1. Approximately 46,650 square feet (1.1 acres) of paved surfaces would be removed during demolition activities.

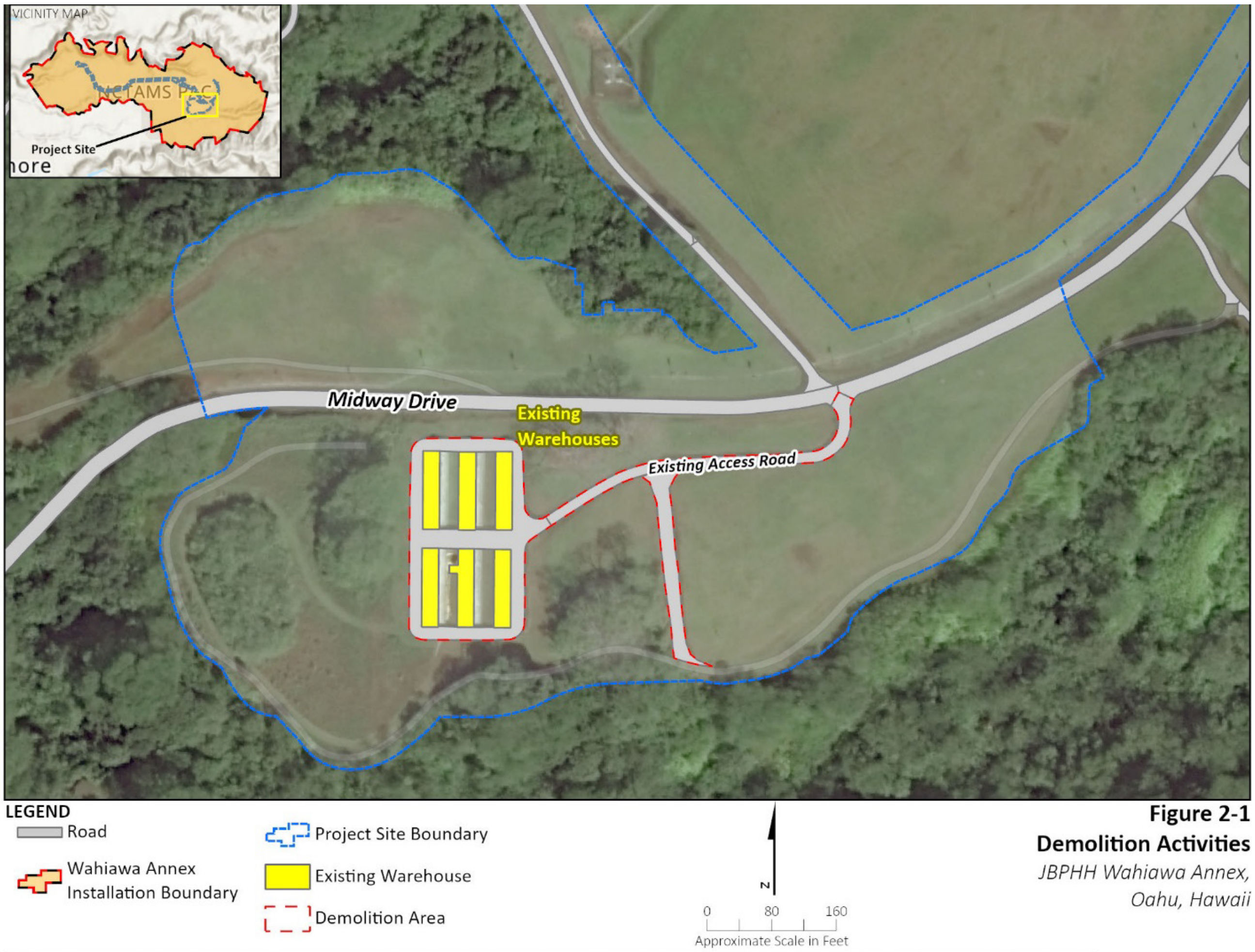

Figure 2-1
Demolition Activities
JBPHH Wahiawa Annex, Oahu, Hawaii

UNK \\DC1VS01\GISPROJ\D\DCGS_PACIFIC_HUB\MAPS\REPORT\DCGS_PACIFIC_HUB_WAHIAWA_ANNEX\DCGS_PACIFIC_HUB_WAHIAWA_ANNEX.APRX OLIVERA1 12/15/2020 6:41 PM

2.2.2 Construction

The Proposed Action project site, including the DCGS Pacific Hub and associated infrastructure, areas to accommodate construction staging and laydown, and utility connections, comprises approximately 811,640 square feet (18.6 acres). The Proposed Action would construct the DCGS Pacific Hub, paved areas for sidewalks, parking and delivery access, utility connections, and stormwater management infrastructure. The proposed DCGS Pacific Hub site layout and project site boundary are shown on Figure 2-2.

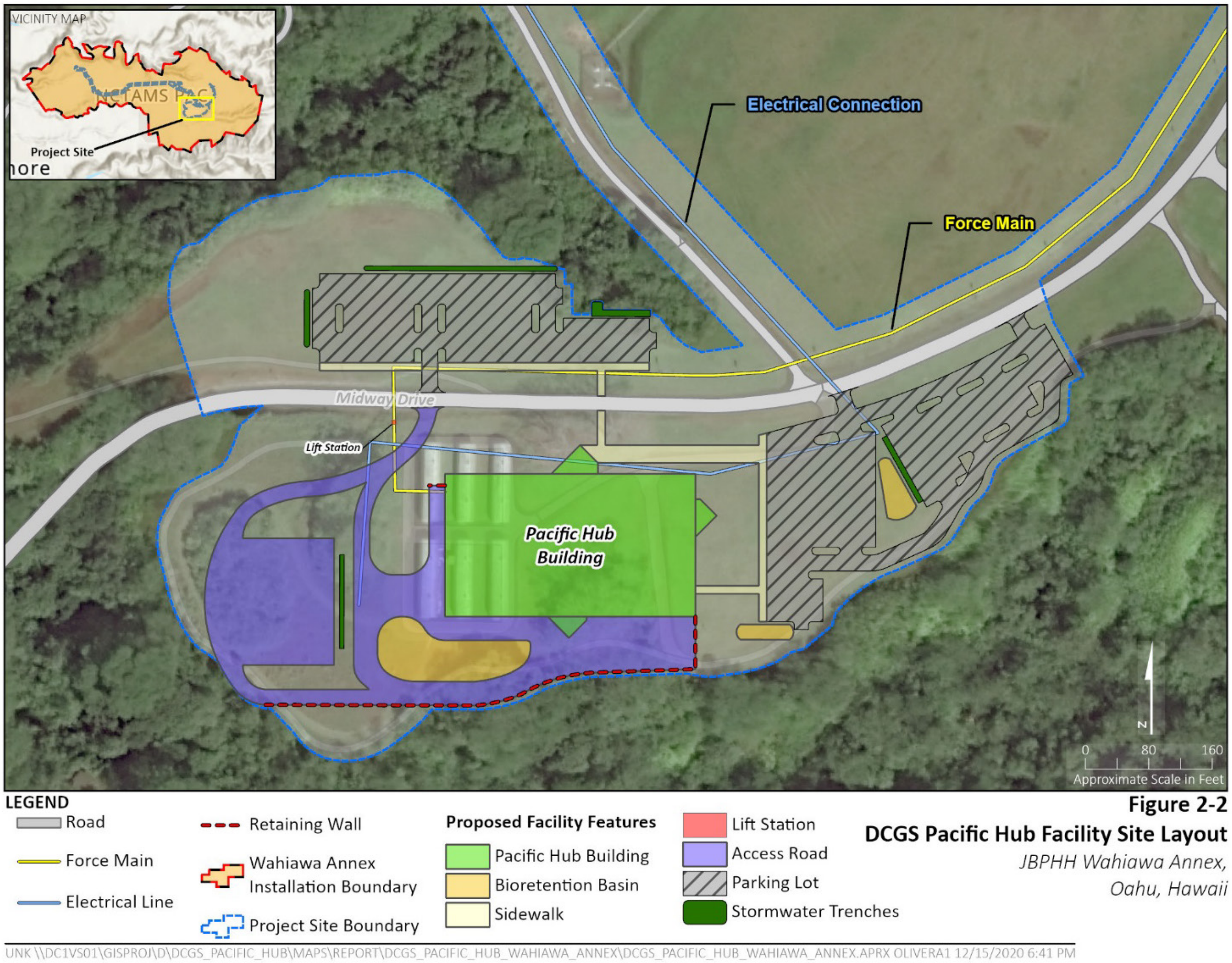

Figure 2-2
DCGS Pacific Hub Facility Site Layout
JBPHH Wahiawa Annex, Oahu, Hawaii

2.2.2.1 Distributed Common Ground Station Pacific Hub

The DCGS Pacific Hub would comprise a two-story facility with approximately 100,000 square feet of floor space. The hub would include a server room, operations floor, systems administration, administrative office space, mission and crew briefing rooms, medical and fitness rooms, training areas, and storage. Personnel to occupy the DCGS Pacific Hub would support the 692nd ISRG mission. Approximately 180 to 200 military and civilian personnel would be expected to occupy the hub, and expected hub activities would include administration, training, mission planning, and crew briefings.

The DCGS Pacific Hub would occupy approximately 60,000-square-feet (1.4-acre) on the project site. Due to the site's natural topography, the hub's first story would be located partially below grade, with only the upper story visible from Midway Drive. Conceptual site layouts to the southwest and northeast of the proposed DCGS Pacific Hub site, as presented in the *Distributed Common Ground Station Pacific Hub User Requirements Document* (Jacobs, 2019), are shown on Figures 2-3 and 2-4, respectively.

Figure 2-3. Conceptual Site Layout - View to the Southwest
Source: Jacobs (2019)

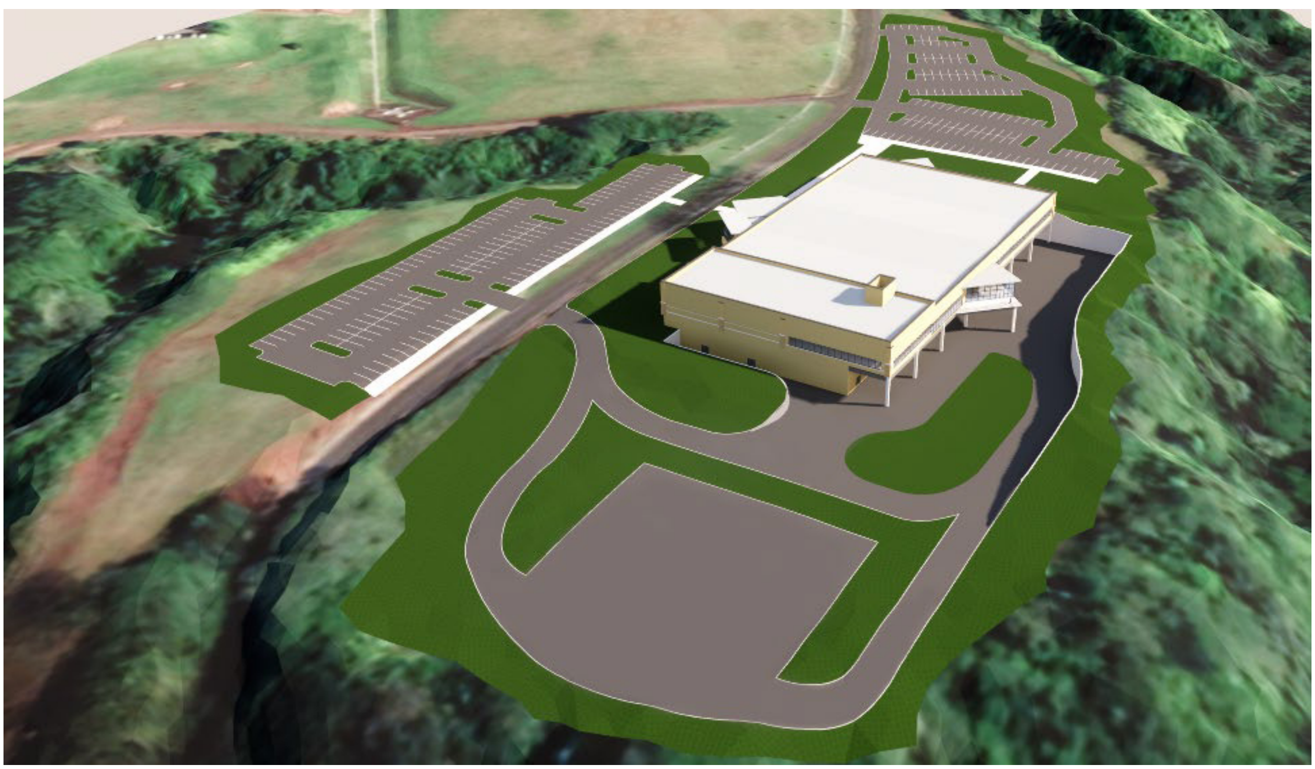

Figure 2-4. Conceptual Site Layout – View to the Northeast
Source: Jacobs (2019)

2.2.2.2 Paved Areas

The Proposed Action would construct approximately 189,000 square feet (4.3 acres) of new paved areas, to include sidewalks, two parking areas, and an access road for deliveries. Access to the parking areas would be from Midway Drive.

The two parking areas would include 120 spaces for assigned personnel, 25 for visitors, and 5 for government, for a total of 150 parking spaces; 5 percent of available parking spaces, which would comprise eight spaces, would be Architectural Barriers Act (ABA) accessible. The ABA addresses disabled-access concerns for federal buildings. The hub would operate 24 hours a day, 7 days a week with approximately 180 to 200 personnel assigned to work there. The two parking areas would provide adequate parking space for personnel, because not all would be working at the hub at the same time. Stairs or ramps and sidewalks would be constructed from the parking areas for pedestrian access to the DCGS Pacific Hub.

Paved areas would include a pull-off loading and visitor drop-off space at the front of the building near the main sidewalk. The loading space would be marked with pavement paint and signage in accordance with the *Manual on Uniform Traffic Control Devices* (FHWA, 2009), to prevent unattended vehicles or parking.

2.2.2.3 Utilities

Wastewater

The DCGS Pacific Hub would require constructing a sanitary sewer system from the proposed facility to an existing sanitary sewer gravity line. Sanitary sewer design would conform with Unified Facilities Criteria 3-240-01, *Wastewater Collection* (DoD, 2020). Due to area topography, a sewage lift station would be required on site to discharge future building sewage to the existing sanitary sewer gravity lines. The lift station would be located along the force main route with a possible location for the sewage lift station south of Midway Drive to the west of the hub (Figure 2-5). The lift station would have an area of approximately 36 square feet, with most of the lift station being underground with minimal aboveground components. A gravity sewer lateral would be constructed to connect the facility to the proposed lift station along Midway Drive.

The force main route would traverse approximately 2,000 to 2,150 feet northeast from the project site to a sewer connection point. The connection point on Midway Drive would be at one of two possible connection points (Options A and B on Figure 2-5). The force main would lie adjacent to the existing sidewalk off the northern shoulder of Midway Drive along a moderate slope (5- to 8-percent slope) in an open field. The elevation change along the force main route is approximately 70 feet. The force main would comprise a 4-inch polyvinyl chloride (PVC) pipe and be constructed by open trenching along the force main route. The force main would be constructed within the 50-foot-wide corridor shown on Figure 2-5.

Electrical System

Under the Proposed Action, the electrical system for the DCGS Pacific Hub would involve constructing two pad-mounted switches, a concrete-encased ductbank with 5-inch PVC conduits, manholes, and a main-tie-main sectionalizing switch, or switches, and a generator plant. Power to the DCGS Pacific Hub would be supplied by a 12-kilovolt (kV) 501 switching station located on the north side of the Wahiawa Annex.

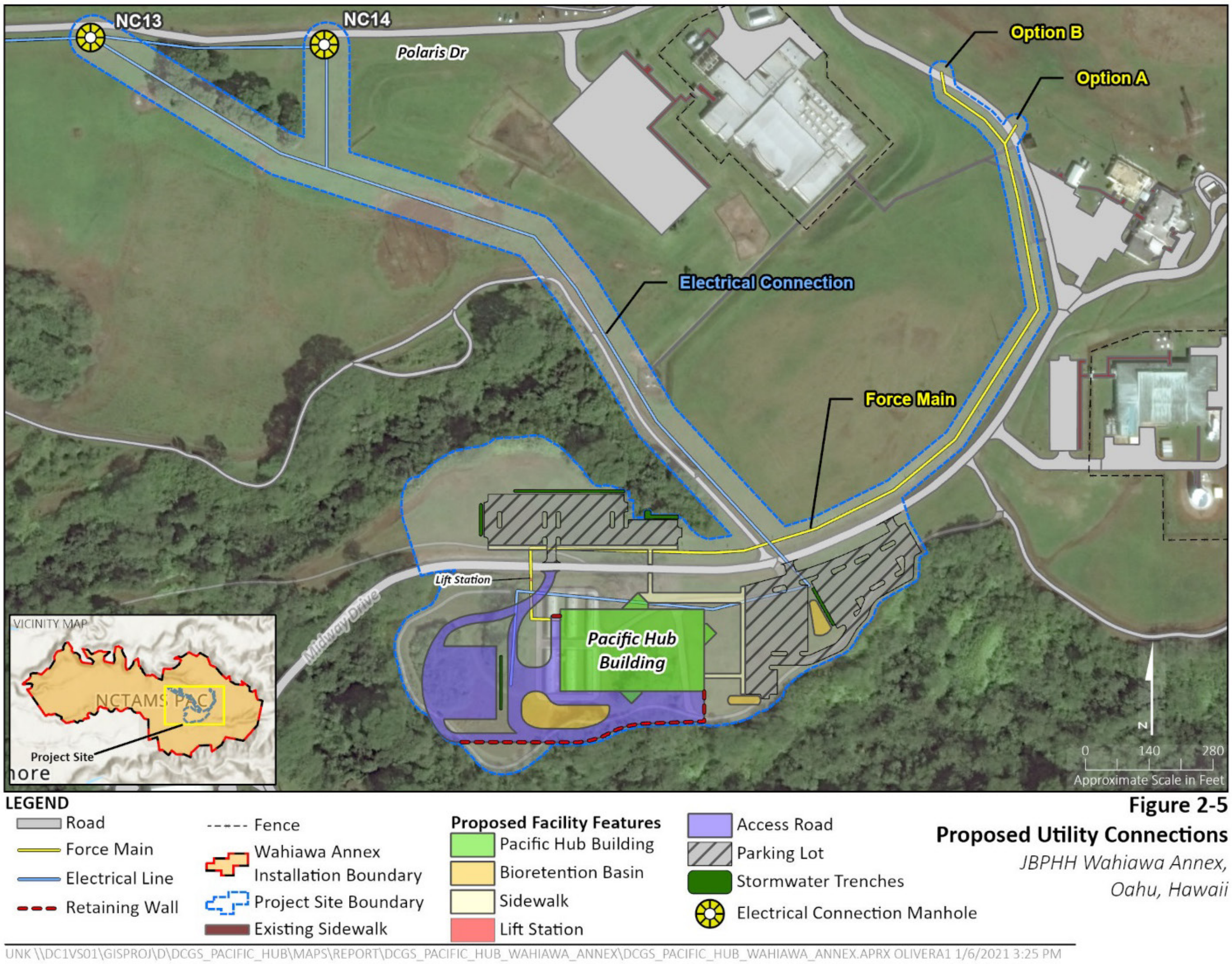

Figure 2-5
Proposed Utility Connections
JBPHH Wahiawa Annex, Oahu, Hawaii

New electrical subcircuits would be constructed underground from the DCGS Pacific Hub to either existing manhole locations—NC13 or NC14 (Figure 2-5). The two subcircuits (electrical connections) would be constructed 3 feet below ground in a concrete-encased ductbank with 5-inch PVC conduits. Aboveground manholes spaced at a maximum of every 400 feet (350 feet at bends) would be constructed along the concrete encased ductbank. The electrical connection would be constructed within the 100-foot-wide corridor shown on Figure 2-5.

Power to the DCGS Pacific Hub would be supplied by an existing 12-kV 501 switching station located on the north side of Wahiawa Annex. The new electrical subcircuits would be connected to the 501 switching station either through existing circuits/ductbanks (P10 and P11) located along Polaris Drive or by new circuits that may be constructed under a separate Navy project. If either option is not available, then the USAF would consider constructing additional circuits along Polaris Drive from manhole NC13 or NC14 to the 501 switching station under an addendum to this EA.

A mechanical utility yard to include a generator plant and cooling towers would be constructed to the southwest of the hub on paved surfaces. The generator plant would supply back-up power and comprise three 2,500-kilowatt/3,125-kilovolt ampere (kVA), prime-rated, 480/277-volt, 3-phase, 4-wire generators, and two diesel fuel storage tanks (16,000-gallon capacity each).

Pole-mounted light fixtures would be constructed in the parking lots and along the site access roads to provide exterior lighting. The exterior lighting levels would be designed for 1-foot candle average. Emergency lighting would be required at all egress points to permit safe exit from the hub to the "public way." Exterior lighting would comply with Hawaii's "Dark Sky" requirements (DLNR, 2016) for zero up-light components for site lighting.

Water and Fire Protection

The primary water main distribution loop for the Wahiawa Annex runs in Midway Drive. The primary water source for Wahiawa Annex is from Water Pump Building No. 440, which includes booster pumps that operate in parallel with backup fire pumps. The backup fire pumps initiate when demand exceeds booster pumps capacity to maintain pressure and flow in the water distribution system.

Water distribution system design would conform with Unified Facilities Criteria 3-230-01, *Water Storage, Distribution, and Transmission* (DoD, 2018b). The existing 14-inch water main in Midway Drive currently provides fire protection to the existing warehouses at the project site via an 8-inch waterline that tees off the 14-inch main, encircling the warehouses with fire hydrants. This existing 8-inch connection could be used for service to the new facilities. A new secondary connection to the 14-inch water main could be constructed for hydrant coverage in the front of the facility from Midway Drive within the project site, if needed. Federal Fire Department Hawaii is headquartered at JBPHH; a federal fire department station is located on Wahiawa Annex at Building 466 on Center Street. The nearest civilian fire station to the project site is Honolulu Fire Department Station 16, located in the town of Wahiawa.

Telecommunication Lines

Existing telecommunication lines and manholes are located along Midway Drive within the project site boundary. Under the Proposed Action, telecommunication lines from the DCGS Pacific Hub would be installed and connected to this existing utility within the project site.

2.2.2.4 Grading and Retaining Walls

The project site is located on terrain with slopes of 3 to 5 percent, with some steeper areas. The project site is bound by steep gulches to the north, west, and south, with more than 20-percent grade changes and steep areas located along Midway Drive. The grade is from north to south, with the project site draining to Poamoho Stream to the south. Site preparation would involve grading extensively and constructing retaining walls on the southern edge of the project site.

Project site grading would direct runoff from impervious pavement surfaces onto vegetated surfaces. Where feasible, grading would use a minimum 5-percent slope away from the DCGS Pacific Hub for the first 10 feet on grass surfaces. Impervious cover (for example, concrete, asphalt) and gravel surfaces would generally have a slope of 2 percent away from the building. Parking lots would be no more than 5-percent sloped, and accessible spaces and paths to the building would follow ABA guidelines (generally, no greater than 2-percent slope in any direction).

During construction, topsoil would be stripped from the site's disturbance limits and stockpiled separately from subsoil. Respreading the topsoil would aid in successfully reestablishing healthy vegetation to inhibit erosion and possibly avoid the need for soil amendments or irrigation.

Under the Proposed Action, an approximately 615-foot-long retaining wall with an average height of 12 to 18 feet would be constructed along the southern edge of the project site. The retaining wall would create the building's walkout condition from the hub's ground floor and keep steep slopes directly south of the project site from being disturbed. A shorter 20-foot-long retaining wall, with a maximum height of 6 feet tapering to ground level, would be constructed on the hub's west side.

2.2.2.5 Stormwater Management

Project site design would include low-impact development (LID) that complies with Section 438 of the Energy Independence and Security Act of 2007 (EISA). All stormwater management facilities proposed to meet EISA requirements would adhere to the *Storm Water Permanent Best Management Practices Manual* (HDOT, 2007), *Storm Water BMP Guide For New and Redevelopment for the City and County of Honolulu*

(CCH, 2017), and CWA regulations for stormwater management. Proposed stormwater management and best management practices (BMPs) include vegetated filter strips, bioretention basins, and bioswales. A bioretention basin is anticipated on the lower service area, southwest of the building, to manage some or all of the roof and surrounding surface drainage (Figure 2-2).

Stormwater conveyance would include broad, grass-lined ditches and culverts to stormwater and BMP facilities, as needed to meet EISA requirements. Drainage not retained on site would ultimately drain to the gulches to the north, south, and west. Storm drain inlets and closed-conduit storm runs would be provided as needed to drain areas that cannot be directed to vegetated areas as surface flow.

The Proposed Action could involve constructing permeable pavement and permeable sidewalks based on a site-specific soil analysis. Permeable surfaces would contain the 95-percentile storm event volume. Infiltration under the permeable surface's stone layer could also be used, if possible, to retain the design storm volume. The volume exceeding the 95-percentile storm event that reaches a downstream stormwater management facility would be considered bypass flow and would not need to be further detained or treated.

2.2.2.6 Access Staging and Equipment

Construction vehicles would enter and exit Wahiawa Annex through the Saipan Gate (Figure 1-2 in Section 1). The proposed site for laydown and storage during construction would be within the project site boundary north of Midway Drive where the parking area would be constructed (Figure 2-2). Contractor personnel and equipment would work within the designated construction limits of the project site boundary. Typical construction equipment that could be used includes the following:

- Excavators
- Tractors, loaders, or backhoes
- Trucks
- Cement and mortar mixers
- Paving equipment
- Boring equipment
- Rollers
- Graders
- Cranes
- Rubber-tired dozers
- Water trucks

2.2.2.7 Project Schedule

The Proposed Action is estimated to take approximately 39 months to construct, with construction anticipated to begin in 2024 at the earliest. Fit out (making interior spaces suitable for occupation) of network equipment would occur after construction is completed; therefore, the building may not be fully operational until the following year.

2.2.3 Operation

The 480th ISR Wing would provide the military personnel, contractors, and civilians to operate and maintain the DCGS Pacific Hub. Approximately 180 to 200 personnel are expected to work at the hub. Most personnel that would work at the facility (approximately 158) currently live or work in the project vicinity. The remaining approximately 50 contractors and civilians needed to work at the hub are anticipated to come from the local workforce on Oahu. Military personnel that would work at the facility are currently housed at nearby Helemano Military Reservation or Schofield Barracks, in the Wahiawa area or at JBPHH, Navy housing near JBPHH, or Aliamanu Military Reservation, near Honolulu. No increase in military personnel would be assigned to the 480th ISR Wing as part of this Proposed Action, and additional personnel hired to work at the hub would be from the local workforce. No additional housing on Oahu would be required for hub operations, which would occur 24 hours a day, 7 days a week.

Typical operations activities would include vehicle traffic for personnel and visitors traveling to and from the DCGS Pacific Hub and truck traffic from deliveries. Operations also would include routine maintenance of the building and outside facilities (including parking lots, access roads, stormwater management infrastructure, and landscaping).

2.3 Description of the No Action Alternative

Under the No Action Alternative, a new DCGS Pacific Hub would not be constructed. The existing facilities occupied at JBPHH lack the flexibility to support the infrastructure and equipment required for evolving ISR missions, and the lack of a hub would prevent dissemination of ISR information and data. Also, under the No Action Alternative, the lack of a purpose-built hub for the Pacific region would prevent mission-system upgrades and impair operations during periods of degraded communications. The No Action Alternative would not achieve the project purpose and need, but it was carried through the analysis as a benchmark to compare the Proposed Action's magnitude of environmental effects.

2.4 Alternatives Considered but Eliminated from Detailed Study

This EA analyzes the Proposed Action and the No Action Alternative. An alternative to renovate existing facilities on JBPHH was considered; however, no existing facilities could support the comprehensive mission requirements; therefore, this alternative was eliminated from consideration. This alternative was also dismissed due to its lack of sufficient space and its very low elevation being vulnerable to storm surge or tsunami hazards. Further, this alternative did not meet the selection standards presented in Section 2.1 and, therefore, was eliminated from further detailed study.

In addition, two sites within Wahiawa Annex were considered then eliminated from detailed study, because they are not located near existing utilities (for example, water, electric power, sewer, and communications) and have no emergency or large vehicle accessibility. These sites also had missions and security considerations. These alternative locations on Wahiawa Annex also did not meet the selection standards presented in Section 2.1 and, therefore, were eliminated from further consideration.

2.5 Resources Analyzed

This EA identifies the potential impacts on all relevant resource areas that would be required to implement the Proposed Action and alternatives. 40 CFR 1508.27 specifies that a determination of significance requires considering context and intensity.

2.5.1 Resource Areas Analyzed

This EA evaluates the potential impacts on the following environmental resources:

- Air quality
- Noise
- Biological resources
- Cultural resources
- Water resources and water quality
- Geology and soils
- Utilities and Infrastructure
- Hazardous materials (HAZMAT) and hazardous wastes

- Socioeconomics
- Traffic

2.5.2 Resource Areas Eliminated from Further Analysis

In accordance with the CEQ and USAF directives to focus analyses on environmental resource areas where significant impact could occur and where analyses are expected to provide useful information to the decision-maker in choosing among alternatives, some resource areas have been eliminated from further study. The resource areas are identified and rationale for their elimination are summarized in the following subsections.

2.5.2.1 Land Use

The Proposed Action is located within an area designated for "operations” within the Wahiawa Annex (Pond & Company et al., 2016). No change in land use designation would be required with implementing the Proposed Action; therefore, no impact on existing land use would occur.

2.5.2.2 Visual Resources

The DCGS Pacific Hub and associated infrastructure has been designed to comply with the applicable standards for architectural and site development per the *Commander Navy Region Hawaii Installation Appearance Plan* (NAVFAC HI, 2013). The Proposed Action would be centrally located within the Wahiawa Annex and not anticipated to be visible from surrounding communities or roadways outside of the annex. The project site is not located within a scenic viewshed or located adjacent to a designated scenic highway or scenic byway; therefore, the Proposed Action would have no impacts on visual resources.

2.5.2.3 Floodplains

EO 11988, *Floodplain Management,* requires federal agencies to take actions to reduce the risk of flood loss and avoid environmental impacts on floodplains. According to the Federal Emergency Management Agency (FEMA) Digital Flood Insurance Rate Maps (FEMA, 2020), the Proposed Action area is in an area designated as Flood Zone D, which is an area of possible, but undetermined, flood hazard where no flood hazard analysis has been conducted.

The State of Hawaii provides a Natural Resources Flood Hazard Assessment Tool (FHAT), which is an interactive informational map that displays flood zones. According to the FHAT, the Proposed Action area is not shown to be within a flood zone (DLNR, 2020).

City and County of Honolulu (CCH), through the Hawaii Statewide GIS [Geographic Information System] Program, provides potential flood area reference maps that identify areas on Oahu as having a history of flood risk. The Proposed Action area is not located in an area having had a history of flood risk (CCH, 2018).

The Proposed Action area is located at an elevation of more than 1,100 feet above mean sea level. The project site has an average slope of approximately 3 to 5 percent, falling from northeast to southwest toward a steep gulch that drains to Poamoho Stream, south of the site. Poamoho Stream is located approximately 50 to 70 feet lower in elevation than the project site, and the stream’s 100-year water surface elevation is expected to be contained within its banks.

Due to the project site’s elevation, the lower elevation of nearby Poamoho Stream, and lack of known flooding within the Proposed Action area, and because no floodplains or areas with a history of flood risk have been identified near the project site by FEMA, the State of Hawaii, or CCH, no impact on floodplains is anticipated to occur with implementation of the Proposed Action.

2.5.2.4 Environmental Justice

EO 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*, requires federal agencies to consider disproportionate risks to minority and low-income communities.

Wahiawa and Whitmore Village, the communities nearest to Wahiawa Annex, have a large concentration of native Hawaiians (USCB, 2020a), which constitutes a minority community in the United States. However, impacts from the Proposed Action would primarily remain within the boundaries of Wahiawa Annex, and no disproportionate environmental impacts on minority and low-income communities would be expected with implementing the Proposed Action based on the analysis provided in Section 4, *Environmental Consequences*.

2.5.2.5 Protection of Children

EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, requires federal agencies to address disproportionate risks to children. The Proposed Action would be located within Wahiawa Annex. Although residences, family recreation areas, and a child-care facility are located within Wahiawa Annex, none have nearby accessibility to the project site; therefore, no disproportionate impacts would be expected to occur on children, based on the analysis provided in Section 4, *Environmental Consequences*.

2.5.2.6 Coastal Zones

The Proposed Action would be located within the coastal zone of Hawaii. Based on the Federal Consistency Assessment Form and this EA, USAF has determined the Proposed Action would have no significant effects on the coastal zone and is consistent with the Hawaii Coastal Zone Management Program policies and objectives. The rationale for this determination can be explained in the Federal Consistency Assessment Form provided in Appendix A. A request for concurrence determination, with supporting documentation, will be submitted to Hawaii Coastal Zone Management Program. Draft documents can be found in Appendix A. The impact on Hawaii coastal zones is anticipated to be negligible.

Affected Environment

This section presents specific information about the environment that could be adversely affected as a result of implementing the Proposed Action. Potential impacts resulting from the Proposed Action are detailed in Section 4, Environmental Consequences.

3.1 Air Quality

3.1.1 Definition

3.1.1.1 Air Quality and National Ambient Air Quality Standards

Air quality for a given location is defined by ambient air concentrations of specific pollutants determined by U.S. Environmental Protection Agency (EPA) to be of concern to public health and welfare and the environment. Pollutant emissions typically refer to the amount of pollutants or pollutant precursors introduced into the atmosphere by a source or group of sources. Pollutant concentrations in the ambient air are attributed to the pollutant directly emitted from the sources, and/or formed by precursor pollutants interacting in the atmosphere. Air quality is influenced by many factors, including the type and amount of pollutants emitted into the atmosphere, an area's size and topography, and local and regional meteorological conditions.

The significance of air pollutant concentrations in a region or geographical area is determined by comparing the concentrations to applicable federal and/or state ambient air quality standards. Federal air quality policies are regulated through the federal Clean Air Act (CAA). Pursuant to the CAA, EPA has the National Ambient Air Quality Standards (NAAQS) for ozone, nitrogen dioxide, carbon monoxide, particulate matter less than 10 micrometers in aerodynamic diameter, particulate matter less than 2.5 micrometers in aerodynamic diameter, sulfur dioxide, and lead. The NAAQS include primary standards that protect public health and secondary standards that protect public welfare. The State of Hawaii Department of Health (HDOH) has also established its own air quality standards. Table 3-1 summarizes the NAAQS and Hawaii State Standards.

EPA designates the attainment status of geographic areas depending on whether or not the area meets the NAAQS. A region consistently meeting an air quality standard for a given pollutant is designated as being in "attainment" for that pollutant. If the area does not meet an air quality standard, then it is designated as being in "nonattainment." Areas with insufficient data or designations that have yet to be made are "unclassified." Maintenance areas are former nonattainment areas that are now consistently meeting the NAAQS and have been reclassified by EPA from nonattainment to attainment with a maintenance plan.

3.1.1.2 Greenhouse Gases

Greenhouse gases (GHGs) include both naturally occurring and anthropogenic gases that trap heat in the earth's atmosphere. GHGs include carbon dioxide, methane, nitrous oxide, hydrochlorofluorocarbons, perfluorocarbons, and sulfur hexafluoride. These gases trap the energy from the sun and help maintain the temperature of the earth's surface, creating a process known as the greenhouse effect. GHG emissions occur from natural processes and human activities. GHG accumulation in the atmosphere influences the long-term range of average atmospheric temperatures. EPA's authority to regulate GHG emissions stems from the U.S. Supreme Court decision in Massachusetts v. EPA (U.S. Supreme Court, 2007). The Supreme Court ruled that GHGs meet the definition of air pollutants under the existing CAA and must be regulated if these gases could be reasonably anticipated to endanger public health or welfare. Responding to the Court's ruling, EPA finalized the endangerment finding in December 2009.

Table 3-1. National and State Ambient Air Quality Standards

Pollutant	Averaging Periods	NAAQS		Hawaii State Standards	Standard Form (NAAQS)
		Primary	Secondary		
O_3	8 hours	0.070 ppm	0.070 ppm	0.08 ppm	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
PM_{10}	Annual arithmetic mean	—	—	50 µg/m^3	Annual mean, averaged over 3 years
	24 hours	150 µg/m^3	150 µg/m^3	150 µg/m^3	Not to be exceeded more than once per year, averaged over 3 years
$PM_{2.5}$	Annual arithmetic mean	12 µg/m^3	15 µg/m^3	—	Annual mean, averaged over 3 years
	24 hours	35 µg/m^3	35 µg/m^3	—	98th percentile, averaged over 3 years
CO	8 hours 1 hour	9 ppm 35 ppm	— —	4.4 ppm 9 ppm	Not to be exceeded more than once per year
NO_2	Annual arithmetic mean	0.053 ppm	0.053 ppm	0.04 ppm	Annual mean
	1 hour	0.100 ppm	—	—	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
SO_2	Annual arithmetic mean	—	—	0.03 ppm	Annual mean
	24 hours	—	—	0.14 ppm	Not to be exceeded more than once per year
	3 hours	—	0.5 ppm	0.5 ppm	Not to be exceeded more than once per year
	1 hour	0.075 ppm	—	—	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
Lead	Rolling 3-month average calendar quarter	0.15 µg/m^3	—	1.5 µg/m^3	Not to be exceeded
H_2S	1 hour	0.025 ppm	—	—	Not to be exceeded

Sources: EPA (2016) and HDOH (2020).

— = not applicable

µg/m^3 = micrograms per cubic meter
CO = carbon monoxide
H_2S = hydrogen sulfide
NAAQS National Ambient Air Quality Standards
NO_2 = nitrogen dioxide
O_3 = ozone
PM_{10} = particulate matter less than 10 micrometers in aerodynamic diameter
$PM_{2.5}$ = particulate matter less than 2.5 micrometers in aerodynamic diameter
ppm = parts per million
SO_2 = sulfur dioxide

3.1.2 Existing Environment

Air quality is affected by the quantity, timing, and location of pollutant emissions and by meteorological conditions that influence pollutant movement and dispersal in the atmosphere. The project site is located on the island of Oahu near the town of Wahiawa on a plateau or "central valley" between the two volcanic mountain ranges which comprise the island. Wahiawa is located on a broad ridge that receives moderate rainfall throughout the year. The mean annual temperature near the project site is approximately 69 degrees Fahrenheit and mean annual rainfall is approximately 67 inches, with most of the rainfall occurring between October and March (Giambelluca et al., 2014). The predominant wind direction in Wahiawa is from the east throughout the year.

HDOH operates a network of air quality-monitoring stations around the state to monitor criteria pollutant levels; four are located on Oahu. The State of Hawaii, including the island of Oahu where the project is located, is in attainment for all criteria pollutants under the NAAQS (HDOH, 2020).

3.2 Noise

3.2.1 Definition

Noise, often defined as unwanted sound, is one of the most common environmental issues associated with human activities. Public annoyance is the most common impact associated with exposure to elevated noise levels. The actual impact of noise is not a function of loudness alone. The frequency, content, time of day during which noise occurs, and the noise duration also are important factors in assessing impacts. The effects of noise on people can be listed in three general categories:

- Subjective effects of annoyance, nuisance, or dissatisfaction
- Interference with activities, such as speech, sleep, or learning
- Physiological effects, such as startling and hearing loss

Noise-sensitive receptors can be defined as lands on which serenity and quiet are of extraordinary significance and serve an important public need and where preserving those qualities is essential if the area is to continue to serve its intended purpose. Noise-sensitive receptors may include residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

Acoustics is the study of sound, and noise is defined as unwanted sound. Airborne sound is a rapid fluctuation or oscillation of air pressure above and below atmospheric pressure creating a sound wave. Table 3-2 summarizes the acoustical terms used in this EA.

Table 3-2. Definitions of Acoustical Terms

Term	Definition
Ambient noise level	This is the composite of noise from all sources near and far, the normal or existing level of environmental noise or sound at a given location.
Sound pressure (noise) level decibel (dB)	This is a unit describing the amplitude of sound.
A-weighted sound pressure (noise) level (dBA)	This is the sound level in decibels as measured on a sound level meter using the A-weighted filter network. The A-weighted filter deemphasizes the sound’s very low and very high frequency components in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. All sound (noise) levels in this EA are A-weighted.
Equivalent Noise Level (L_{eq})	The average A-weighted noise level, on an equal energy basis, during a measurement period.

The most common noise benchmark referred to is a day-night average sound level of 65 decibels (dB) that are A-weighted decibels (dBA). A weighting emphasizes sounds in the range of human hearing (EPA, 1974). The region of influence (ROI) for impacts on noise resources considered in this EA includes noise-sensitive receptors within Wahiawa Annex.

3.2.2 Existing Conditions

Currently, the project site comprises six storage warehouses and open space areas around the Wahiawa Annex. Substantial noise sources have not been identified in the project vicinity, and no noise-sensitive uses (for example, residences, schools, or hospitals) are immediately adjacent to the project site. Land uses in the nearby project vicinity are typically associated with military operational areas and consist of administrative buildings, roadways, and antenna complexes. Military housing closest to the project site is approximately 600 feet away, and a childcare facility is located approximately 1,000 feet away from the project site. No medical facilities or hotels are within 2,500 feet of the project site.

3.3 Biological Resources

3.3.1 Definition

Biological resources consist of plants and animals and their habitats. These resources provide aesthetic, recreational, and socioeconomic benefits to society. A Biological Assessment (AECOS, 2021a) was prepared for the Proposed Action for potential impacts on federally listed species. Wetlands are identified and evaluated by three parameters: vegetation, soils, and hydrology. Wetlands generally include marshes, bogs, and similar areas (33 CFR 328.3[b]).

3.3.2 Regulatory Setting

Following are laws that apply to the analysis of biological resources for the project:

- The **Endangered Species Act (ESA) of 1973** requires the government to protect threatened and endangered plants and animals (listed species) and the habitats upon which they depend. The ESA requires federal agencies to ensure that any action it authorizes, funds, or conducts does not “adversely impact” listed species or “destroy or adversely modify” critical habitat for that species. Critical habitat is defined as a specific geographic area that contains features for the conservation of an endangered species and that may require special management and protection.
- The **Migratory Bird Treaty Act (MBTA) of 1918**, as amended, implements various treaties and conventions between the United States and Canada, Japan, Mexico, and Russia to protect migratory birds. Under the MBTA, taking, killing, or possessing listed birds is unlawful, unless permitted by regulation.
- **EO 11990, *Protection of Wetlands*, and the Clean Water Act (CWA)** require federal agencies to minimize the destruction of, loss of, or degradation to wetlands and preserve and enhance the natural and beneficial values of wetlands.
- **Air Force Manual 32-7003** provides guidance and procedures for natural resource programs at Air Force installations.

The ROI for impacts on biological resources considered in this EA includes Wahiawa Annex.

3.3.3 Existing Environment

The Wahiawa Annex is on the leeward slope of the Koolau Range, between two branches of Kiikii Stream in the Kiikii Watershed. The proposed DCGS Pacific Hub site is along Midway Drive on low-sloping ground at an elevation between 1,185 and 1,225 feet. The site slopes south-southwest toward an unnamed gulch that runs westward through the middle of Wahiawa Annex to eventually join Poamoho Stream. This steep-sided gulch and a small branch bound the site on the north, west, and south. (AECOS, 2021b).

Most of the adjacent gulch is covered in forest that extends up the marginal slopes to the rim and onto the interfluve only in a few areas. This forested ground contrasts with most of the Wahiawa Annex, which has been developed with various facilities and infrastructure, maintained as a lawn with minimal shrub and tree cover. Vegetation in the project area (the project area consists of Wahiawa Annex within and adjacent to the project site) consists primarily of maintained lawn with several stands of trees and shrubs. Vegetation types near the Proposed Action site are shown on Figure 3-1.

Climate at Wahiawa Annex is moderately wet. The project site receives an average annual rainfall of approximately 1720 millimeters (67.7 inches). Prior site surveys did not reveal physical indicators of flow or evidence of streams (AECOS, 2021a). No floodplains or areas with a history of flood risk have been identified near the project site.

Federally designated critical habitat is not present in the project area. Conservation zoning in Hawaii is promulgated at the state level by state conservation districts. No conservation districts are located near the proposed project site (AECOS, 2021b).

3.3.3.1 Vegetation

Field reconnaissance surveys of the project site were conducted on November 5 and 9, 2020. During the plant survey, 88 plant species were observed (listed in Appendix B). Most plant species observed (approximately 90 percent) are common, naturalized (nonnative) species. The remaining plants observed are native to the Hawaiian Islands.

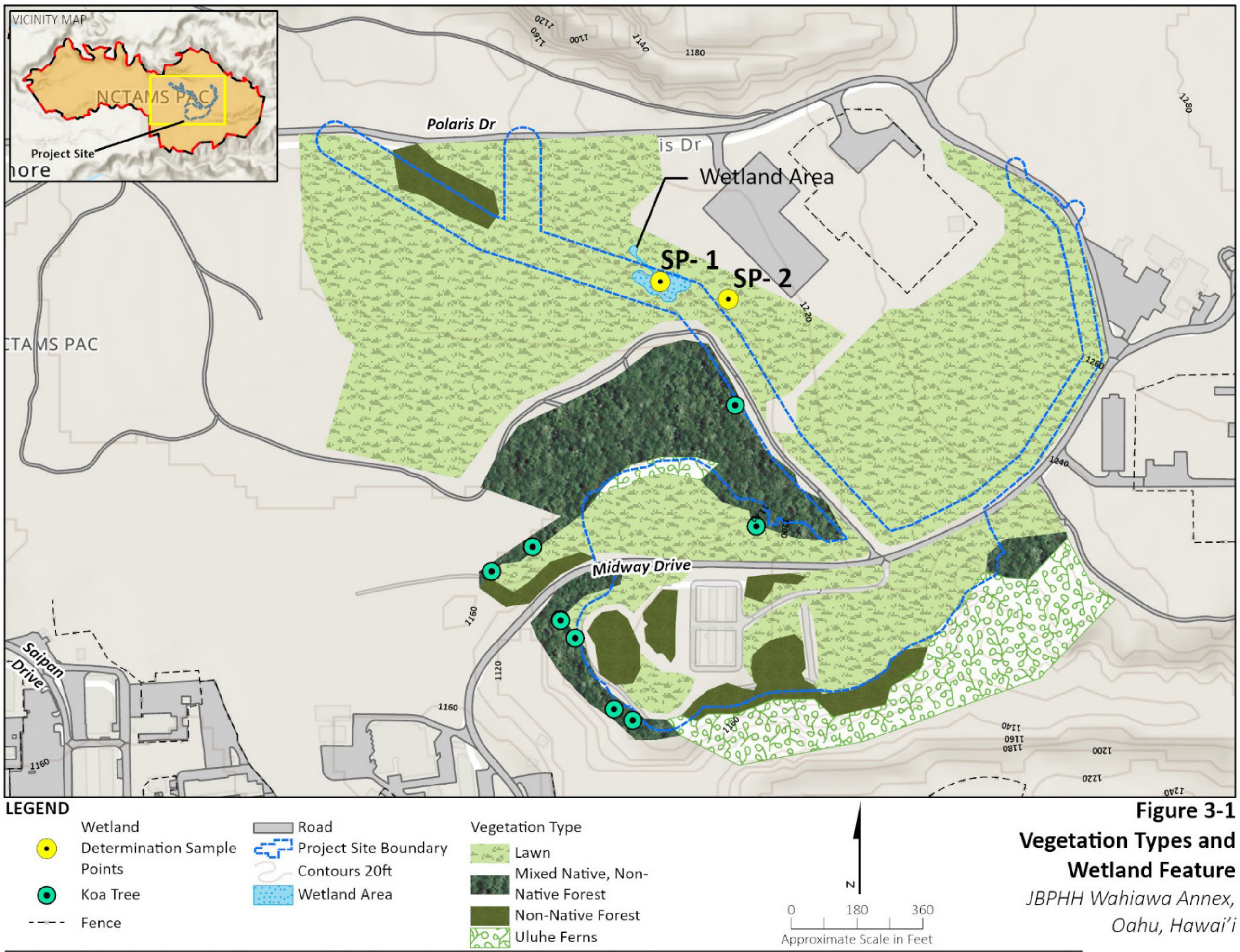

Figure 3-1
Vegetation Types and Wetland Feature
JBPHH Wahiawa Annex, Oahu, Hawai'i

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Six indigenous (native to Hawaii and elsewhere) species present include *ʻuluhe* (*Dicranopteris linearis*), *palaʻa* (*Sphenomeris chinesis*), *ʻuhaloa* (*Waltheria indica*), *ʻaeʻae* (*Bacopa monnieri*), and two sedges (*Fimbristylis dichotoma* and *Cyperus polystachyos*). Two endemic (only found in Hawaii) species present include *koa* (*Acacia koa*) and *naupaka kuahiwi* (*Scaevola gaudichaudiana*). One species that are Polynesian or likely Polynesian introductions ("canoe plants") include the yellow wood sorrel or *ʻihiʻai* (*Oxalis corniculata*). (AECOS, 2021b)

The vegetative environment observed during the survey was not pristine or unique. No native species of conservation concern were present. No plant species proposed for listing or listed as endangered or threatened under either federal or state endangered species statutes were found during the survey (AECOS, 2021b).

3.3.3.2 Birds

A total of 157 individual birds of 16 species were recorded from three stations during point-count avian surveys conducted on November 9, 2020. In addition, four species were recorded outside of the timed survey counts (incidental species). Of the 20 birds identified during the survey, only the Pacific golden plover or *kōlea* (*Pluvialis fulva*) is an indigenous migratory species. The remaining 19 species are common, nonnative species established (naturalized) in the Hawaiian Islands. No endemic Hawaiian birds were observed (AECOS, 2021a).

None of the 20 bird species recorded during the survey are listed as threatened or endangered under federal or state endangered species statutes (Table 3-3). However, 19 of the 20 birds, including the Pacific golden plover, which was observed during the survey are bird species federally protected under the MBTA (16 U.S.C. 703 through 712), as amended. Table 3-4 lists special-status bird species potentially occurring at Wahiawa Annex (AECOS, 2021b).

3.3.3.3 Mammals

The mammalian survey conducted November 5, 2020 was limited to visual observations, such as scat, tracks, and other animal signs, and auditory detection. Small Indian mongoose (*Herpestes javanicus*) and wild boar (*Sus scrofa)* were the only mammalian species detected during the survey. In addition, some invasive (alien) Muridae, such as roof rat (*Rattus rattus*), brown rat (*Rattus norvegicus*), and Polynesian rat (*Rattus exulans hawaiiensis*), likely use various resources within the general project area. With the exception of the federally endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), all land mammals found in the Hawaiian Islands are nonnative, introduced species. No mammalian species currently protected or proposed for protection under either the federal or state endangered species programs were detected during the survey; however, Hawaiian hoary bats were detected in the area during acoustic surveys conducted during 2012-2013 and 2017-2018 (West, 2019; Carnes pers. comm., 2021). The only special-status mammalian species with the potential to occur in the project area is the Hawaiian hoary bat or *ʻōpeʻapeʻa* (AECOS, 2021b).

3.3.4 Federal- and State-Listed Species

3.3.4.1 Seabirds

Although no seabirds were detected during the avian survey, endangered Hawaiian petrel (*Pterodroma sandwichesis*) and the threatened Newell's shearwater (*Puffinus newelli)* could nest in upland mountainous habitat, and these species have been recently detected on Oahu. Nocturnal seabirds, such as the band-rumped storm petrel (*Hydrobates castro*) may enter the project area during nesting and fledgling season, which is generally between April and the middle of December (AECOS, 2021a).

Table 3-3. Bird Species Observed During Surveys at Wahiawa Annex

Species Scientific Name	Species Common Name	Status[1]
Francolinus pondicerianus	Gray francolin	IR
Gallus	Domestic chicken	—
Pavo cristatus	Indian peafowl	IR
Streptopelia chinensis	Spotted dove	IR
Geopelia striata	Zebra dove	IR
Pluvialuis fulva	Pacific golden-plover	W
Bubuculus ibis	Cattle egret	R
Psittacula krameria	Rose-ringed parakeet	IR
Aluda arvensis	Eurasian skylark	IR
Pycnonotus cafer	Red-vented bulbul	IR
Pycnonotus jocosus	Red-whiskered bulbul	IR
Horonis diphone	Japanese bush warbler	IR
Zosterops japonicus	Warbling white-eye	IR
Leiothrix lutea	Red-billed leiothrix	IR
Copsychus malabaricus	White-rumped shama	IR
Acridotheres tristis	Common myna	IR
Paroaoria coronate	Red-crested cardinal	IR
Haemorhous mexicanus	House finch	IR
Estrilda astrild	Common waxbill	IR
Lonchura punctulata	Scaly-breasted munia	IR

Source: AECOS (2021b)

[1] IR = introduced, resident year-round; R = resident year-round; and W = present during nonbreeding season

— = not applicable

Table 3-4. Special-status Bird Species Potentially Occurring at Wahiawa Annex

Species Scientific Name	Species Common Name	Protection Status[1]	Presence
Pterodroma sandwichensis	Hawaiian petrel	FE	Potential
Hydrobates castro	Band-rumped storm petrel	FE	Potential
Puffinus newelli	Newell’s shearwater	FT	Potential
Drepanis coccinea	\`i\`iwi	FT	None; no suitable habitat
Anas wyvilliana	Hawaiian duck	FE	None; no suitable habitat
Gallinula galeata sandvicensis	Hawaiian common Gallinule	FE	None; no suitable habitat
Fulica americana alai	Hawaiian coot	FE	None; no suitable habitat

Table 3-4. Special-status Bird Species Potentially Occurring at Wahiawa Annex

Species Scientific Name	Species Common Name	Protection Status[1]	Presence
Himantopus mexicanus knudseni	Hawaiian stilt	FE	None; no suitable habitat
Paroreomyza maculate	Oahu creeper	FE	None; no suitable habitat and species likely extinct
Chasiempis ibidis	Oahu `elepaio	FE	None; no suitable habitat and species likely extinct
Phoebastria albatrus	Short-tailed alabatross	FE	None; no suitable habitat and species likely extinct

Source: AECOS (2021a); USFWS (2021)

[1] FE = federal endangered, FT = federal threatened

White tern (*Gygis alba*), or *manu o Kū*, is an indigenous seabird listed as threatened under the state endangered species statute, Hawaii Revised State (HRS) 195D. In the main Hawaiian Islands, most white tern population is found in central urban and suburban Honolulu, with a known breeding range extending from Niu Valley to JBPHH. White terns were not observed during the survey and are unlikely to use the project area. (AECOS, 2021b)

3.3.4.2 Short-Eared Owl

The Hawaiian endemic subspecies of short-eared owl or *pueo* (*Asio flammeus sandwichenis*) is state-listed as endangered on Oahu only and protected by the MBTA. Although no evidence of *pueo* was found during the survey, the project site could be a resource area for this species. The open grassland habitat is abundant within Wahiawa Annex, where close-cropped grasses are maintained to reduce wildfire hazards. *Pueo* may use these grasslands to hunt for prey; however, the frequency of maintenance and high human traffic through the area would impede nesting behavior (AECOS, 2021b).

3.3.4.3 Hawaiian Hoary Bats

The Hawaiian hoary bat, or *ʻōpeʻapeʻa* (*Lasiurus cinereus semotus*), which is a federal- and state-listed endangered species, is the only native terrestrial mammal species that still exists within the Hawaiian Islands. The bats forage in open, wooded, and linear habitats with a wide range of vegetation types. These animals are insectivores and regularly observed foraging over streams, reservoirs, and wetlands up to 300 feet offshore. Hawaiian hoary bats typically roost in dense canopy foliage or in the subcanopy when canopy is sparse, with open access for launching into flight. Hawaiian hoary bats could overfly or use tree species near the proposed project site for foraging and roosting seasonally. A survey specifically for Hawaiian hoary bats was not conducted; however, suitable habitat for roosting and foraging was noted during field reconnaissance surveys of the project site, and these species have been detected by state consultants (West, 2019) and the U.S. Geological Survey (Carnes pers. comm., 2021). Several potential bat roost trees (that is, trees over 15-feet tall) exist within the project site, and many more tall trees are located just beyond the project site boundary. Although the population of this bat is sparse on Oahu, bat presence is assumed to be possible (AECOS, 2021a).

Hawaiian hoary bats are known to use multiple roosts within a home territory (AECOS, 2021a). However, bats are vulnerable during the pupping season, where a female bat carrying a pup may be unable to rapidly vacate a roost tree that is being felled, or an unattended pup may be unable to flee a tree that is being felled. Several tall albizia (*Falcateria moluccana*) are trees located within the project site near Midway Drive but are dead and devoid of foliage and unlikely to be used for bat roosting (AECOS, 2021a).

3.3.4.4 Tree Snails (*Achatinella*)

A survey of Hawaiian endemic tree snails, or *kahuli,* was conducted in the early morning hours of December 10, 2020. No Hawaiian endemic tree snails or shells were observed during the field survey. The *Recovery Plan for Oahu Tree Snails of the Genus Achatinella* (USFWS, 1993) depicts the project site within the known range of at least seven federal- and state-listed endangered tree snail species of the genus *Achatinella*. Hawaiian endemic tree snails are found in montane wet forests, usually dominated by *ōhia* (*Metrosideros polymorpha)*. Snails feed on fungi and algae that grow on tree leaves. Tree snails may occur on a variety of plant species, predominately native, but nonnative plants as well. (AECOS, 2021a)

All species of terrestrial snails in the genus *Achatinella* are endemic to Oahu and are listed as endangered under state and federal endangered species statutes, along with several other endemic snail in the family *Achatinellidae*. No endangered tree snails or shells were observed during the survey. The short-cropped lawn and isolated pockets of nonnative disturbed forest habitat are proposed for demolition and grubbing at the project site are not optimal for tree snails. Native tree and shrubs, as well as nonnative disturbed forest on the project site's perimeter may afford some habitat but are not anticipated to be grubbed or otherwise disturbed by project construction. The elevation of the proposed hub is around 365 meters (1,200 feet) above sea level, which is at the lower range of the *Achatinella* species. The project site's interfluve appears relatively dry with a long history of vegetation disturbance. However, because the proposed project would occur within the mapped ranges of the endangered Hawaiian endemic tree snails (*Achatinella spp*.; USFWS, 1993), further consultation with U.S. Fish and Wildlife Service (USFWS)– Pacific Island Fish and Wildlife Office may be required, especially if disturbance affects any native trees or shrubs. (AECOS, 2021a)

Existing vegetation to be removed within the project site are lawn grasses and nonnative disturbed forest, dominated by albizia, shoebutton ardisia (*Ardisia elliptica*), *koa haole* (*Leucaena leucocephala*), and fiddlewood (*Citharexylum caudatum*), with an understory of wedelia (*Sphagneticola trilobata*) and Guinea grass (*Megathyrsus maximus*). This vegetation is not optimal habitat for Hawaiian endemic tree snails. In addition, few lichen or moss species were observed in the forest vegetation during the survey. *Ōhia* were not observed in the project area, however, a few *ōhia* trees were observed beside an outlet of a retention basin near Polaris Drive. (AECOS, 2021b)

The proposed project site perimeter is predominantly disturbed forest of shoebutton ardisia, fiddlewood, satin leaf (*Chrysophyllum oliviforme*), and strawberry guava (*Psidium cattleianum*). Native plants are interspersed along the proposed project site perimeter and gulch walls. Native plants here include *koa* (*Acacia koa*), thickets of *'uluhe* (*Dicranopteris linearis*) fern, and native herbs. No snails were found around the proposed site's perimeter, including areas of native vegetation. Anticipated project activities would not require removing forest beyond the project perimeter. (AECOS, 2021b)

3.3.5 Wetlands

During the site survey, an approximately 0.2-acre (0.08-hectare or 813-square-meter) wetland feature below an outlet of an existing retention basin was observed within the corridor of the proposed electric connection between the project site and Polaris Drive (Figure 3-1). No evidence of connectivity to jurisdictional waters in relation to the wetland feature was found during the survey. A wetland is not considered jurisdictional and regulated under the CWA if no jurisdictional waters are adjacent, and the wetland feature does not contribute flow to a jurisdictional tributary. (AECOS, 2021b)

3.4 Cultural Resources

3.4.1 Definition

Cultural resources are defined as prehistorical or historic districts, sites, buildings, structures, or objects considered important to a culture, subculture, or community for scientific, traditional, religious, or other purposes. They include archaeological resources, historical architectural or engineering resources, Native American resources, and other similar resources.

Archaeological resources are places where past peoples left physical evidence of their occupation or uses and may include structural ruins or deposits of prehistorical or historical-era occupation debris, such as artifacts, debris, or food remains (for example, seed, shells, and bones). Historical architectural or engineering resources are defined here as structures and buildings relating to the historical era.

A historic properties study (ASM, 2021) was prepared for the Proposed Action and includes a literature review and documents a field inspection of the project area. The cultural resource evaluation included the project area comprising approximately 18.7 acres on a portion of Tax Map Key: (1) 7-1-002:007 in Kamananui Ahupuaa, Wahiawa District, Island of Oahu.

3.4.2 Regulatory Setting

The USAF is required under federal law to ensure that cultural resources are considered in all undertakings and that significant resources are protected to the extent possible. The most relevant federal laws pertaining to cultural resources for the Proposed Action are the National Historic Preservation Act of 1966 (NHPA), and the Archeological Resources Protection Act of 1979.

A Programmatic Agreement (PA) (Navy, 2003) between the Navy and the Advisory Council on Historic Preservation states under Stipulation IX.A.1 that, where Navy personnel meeting the Secretary of the Interior's Historic Preservation Professional Qualification Standards determined that an undertaking does not have the potential to cause effects, then no further review under the PA or the NHPA is required.

3.4.3 Existing Environment

3.4.3.1 Cultural and Historical Context

The project area is located within the District of Wahiawa, and prior to 1913, it was part of the traditional *moku* (district) or *kalana* (land division smaller than a district) of Waialua, one of six in which the Island of Oahu was divided. The traditional *moku* of Waialua contained 14 distinct ahupuaa (traditional land division marking residential and resource territory) that comprised a significant portion of the north shore and the south/southeast portion of the Central Oahu Plain. Wahiawa is the name for the general area of the central plateau of Oahu and the inland portion of Kamananui Ahupuaa (including the Wahiawa Annex area). The modern district of Wahiawa was created in 1913, when the Territorial Government combined the upper portion of Kamananui Ahupuaa with Waianae Uka Ahupuaa. (ASM, 2021)

Kamananui Ahupuaa is situated in the southernmost portion of the *moku* of Waialua, and it extends from the western side of the Koolau Mountains to the coast near Kaiaka Bay on the north shore of the island. Kamananui Ahupuaa is bounded on the north by Paalaa Ahupuaa and to the south by the traditional *ahupuaa* of Waianae Uka. (ASM, 2021)

3.4.3.2 World War II

The Navy began developing Wahiawa Annex in 1940 in agricultural area less than 2 miles north of the village of Wahiawa. The site was created from three land parcels acquired from the Waialua Agricultural Company and minority owners. The Wahiawa site was initially intended to function as a temporary Naval radio transmitting station and Naval radio direction finder station. In anticipation of World War II, the newly purchased Wahiawa site would become a Naval radio station (ASM, 2021).

After the December 7, 1941 attack on Pearl Harbor, several Naval facilities were moved inland to Wahiawa. On December 21, 1941, the site was officially commissioned as Naval Radio Station Wahiawa. Once established, Naval Radio Station Wahiawa became the main link in the Naval communications chain between Washington and the Pacific combat area (ASM, 2021).

Following the attack on Pearl Harbor, construction work at the Naval facility sped up significantly and war-time designs were employed, such as temporary barracks and bombproof structures. One building constructed was a wood-frame direction-finder building (that is, Facility 17, which has been demolished). This building was located within the project area just south of Polaris Drive, near an existing utility conduit. Radio direction finders were devices used for finding the direction to a radio source and as a navigation system for ships and aircraft. Facility 17 housed the receiver in a small wood-frame structure flanked by two antennas on wood bases (ASM, 2021).

Following World War II, the Naval radio station had been downgraded to a receiver site when the central radio station was returned to Pearl Harbor, however, it was moved back to Wahiawa in 1956. Wahiawa also served as an important sending and receiving station of the fleet satellite communication system, which was developed in 1971 (ASM, 2021).

3.4.4 Cultural Resources

Cultural resource surveys were conducted at the project site on December 10 and December 17, 2020. The surveys included pedestrian archaeological survey of the project site (100-percent surface survey). One previously identified archaeological resource—the foundation remnant of Facility 17—was identified in the project area near the proposed electrical corridor. No other archaeological resources were identified within the project area (ASM, 2021). No known subsurface cultural deposits are located at Wahiawa Annex (JBPHH, n.d.).

The JBPHH *Integrated Cultural Resources Management Plan* (ICRMP; JBPHH, n.d.) states that five previous archaeological studies have been prepared for Wahiawa Annex. Based on the results of these studies, archaeological site management areas have been delineated for Wahiawa Annex. The Proposed Action project site is located entirely within the “No” and/or “Low” potential delineated area.[1] The plateau terrain at the annex is considered to have low to no potential for archaeological sites due to recurring ground disturbances associated with former intensive pineapple cultivation, as well as military construction of buildings, roads, utilities, and communication structures (ASM, 2021).

3.4.5 Historical Cultural Landscape

The ICRMP (JBPHH, n.d.) states that Wahiawa Annex is a historic cultural landscape of military lands and uses containing installation wide, character-defining features, including spatial organization and land patterns, views and vantage points, topography and drainage, vegetation, circulation networks, and objects, in addition to buildings and structures.

[1] “No” and/or “Low” potential areas have little or no possibility of site preservation due to intensive ground disturbance or modern development. At the Wahiawa Annex, these areas also include those that have been archaeologically surveyed and tested and found to not contain sites or buried cultural deposits (JBPHH, n.d).

3.5 Water Resources and Water Quality

3.5.1 Definition

Water resources include surface water and groundwater. Surface water resources include lakes, rivers, streams, and wetlands and can be important to economic, ecological, recreational, and human health resources. The U.S. Army Corps of Engineers (USACE) and EPA define wetlands as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

Groundwater includes the subsurface hydrologic resources of the physical environment and is an essential resource. Groundwater properties are often described in terms of depth to aquifer or water table, water quality, and surrounding geologic composition.

3.5.2 Regulatory Setting

The USACE has jurisdiction over all Waters of the United States, which include navigable waters and traditionally navigable waters as defined in 33 CFR 328.3(a). Under CWA Section 404, the USACE regulates the discharge of dredged or fill materials (including from construction activities) into Waters of the United States.

CWA Section 401 establishes a program to protect the quality of Waters of the United States through a water quality certification program administered by the individual states. CWA Section 401 certification program ensures that actions do not exacerbate or contribute to water quality impairment. CWA Section 401 certification program is administered at the state level by the HDOH Clean Water Branch.

Through delegated jurisdiction under CWA Section 402 (National Pollutant Discharge Elimination System [NPDES]), the HDOH-Clean Water Branch regulates point-source discharges to Waters of the United States and Waters of the State of Hawaii under the NPDES. Regulated discharges also include diffused discharge sources caused by general construction activities covering an area of disturbance greater than 1 acre and stormwater discharges. The project is expected to require a NPDES General Permit Authorizing Discharges of Stormwater Associated with Construction Activities. The project could also require an NPDES General Permit Authorizing Discharges of Hydrotesting Waters and/or an NPDES General Permit Authorizing Discharges Associated with Construction Activity Dewatering if the project would discharge any non-stormwater (including hydrotesting[1] waters or dewatering effluent) to a drainage system or waterbody.

3.5.3 Existing Environment

3.5.3.1 Surface Water

Wahiawa Annex is located on the upper reaches of a sloping plateau adjacent to the Ewa Forest Reserve on the leeward slope of the Koolau Mountain Range. Surface water resources near Wahiawa Annex include streams that drain the upland forest reserve areas. Poamoho Stream follows the northern boundary of Wahiawa Annex, and Kaukonahua Stream runs south of the annex. A branch of Kiikii Stream is located north of the project site. The project site slopes south-southwest toward an unnamed gulch that runs westward through the middle of Wahiawa Annex to eventually join Poamoho Stream (Figure 3-2).

[1] Hydrotesting waters are waters used to test the integrity of a tank or pipeline, pipeline disinfection, and/or pipeline flushing.

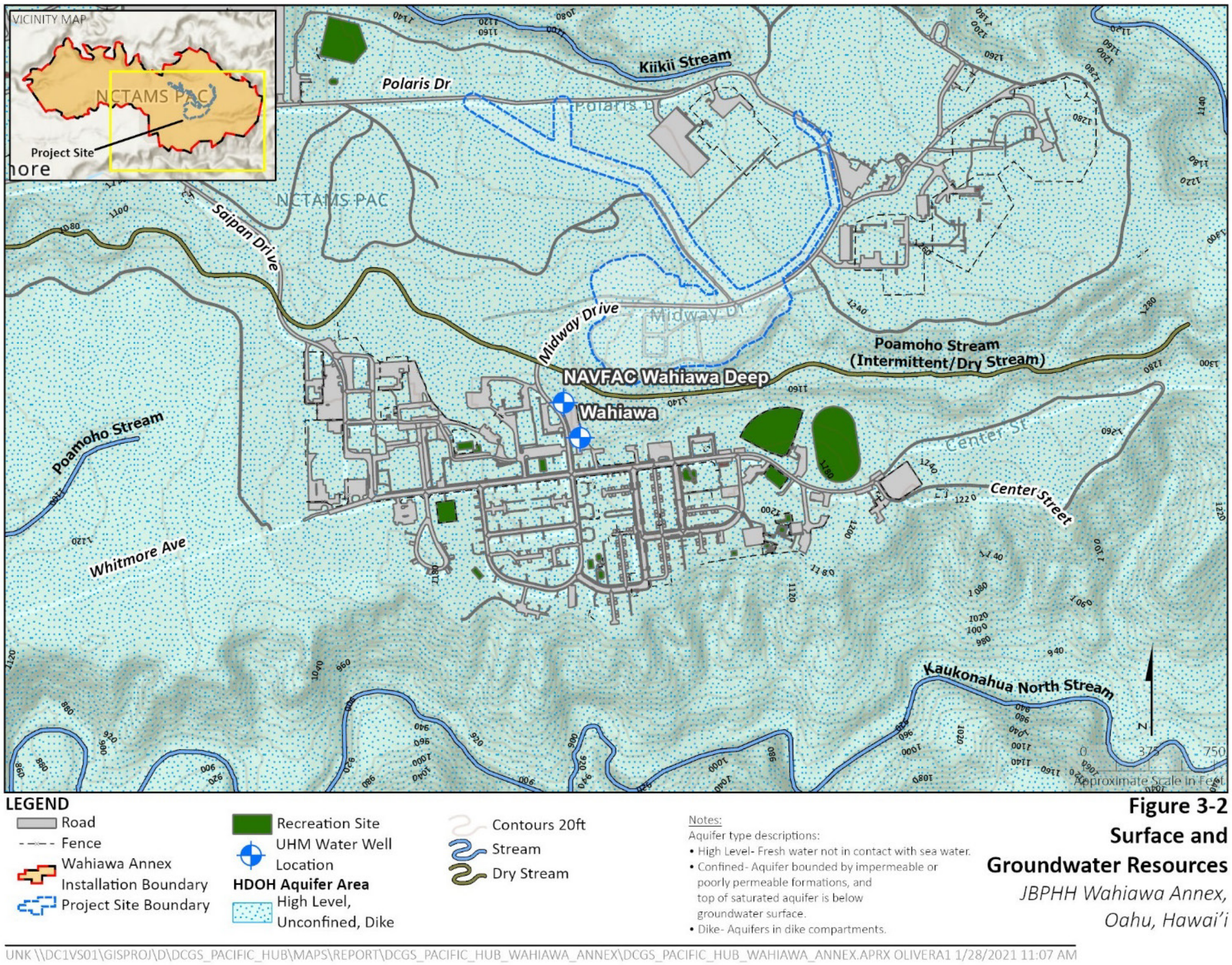

Figure 3-2
Surface and Groundwater Resources
JBPHH Wahiawa Annex, Oahu, Hawai'i

Poamoho Stream comprises two branches: the main branch follows the northern boundary of Wahiawa Annex, and the southern branch is located within an unnamed gulch south of the project site (Figure 3-2). Receiving waters south of the project site include the unnamed stream that flows within a shallow, forested gulch (approximately 50 feet [15 meters] deep) that is dry for most of the year (JBPHH, 2011). The stream flows in an east-to-west direction, running north of Whitmore village, eventually joining the main tributary of Poamoho Stream and Kiikii Stream. The Poamoho Stream system ultimately drains into the ocean at Kaiaka Bay in Haleiwa approximately 9 miles (14.5 kilometers) downstream. No USACE jurisdictional wetlands are located at the annex (JBPHH, 2011).

Pursuant to CWA Section 303(d), HDOH developed a list of waters that do not attain applicable water quality standards and a priority ranking of impaired waters for total maximum daily loads (TMDLs) development based on pollution severity and water uses. The Final 2018 303(d) List of Impaired Waters in Hawaii identifies Kaiaka Bay and Poamoho Stream as Category 3 waterbodies, indicating that available data are insufficient or that water is impaired or threatened and TMDL development is needed. The primary objectives of the proposed TMDLs are to stimulate and guide action that control sources of excessive nutrients and sediment to improve water quality (HDOH, 2009).

3.5.3.2 Groundwater

The Wahiawa Annex is located over the high-level, unconfined, dike-impounded Wahiawa (Schofield) aquifer system (Navy, 2005), Aquifer Sector Code 30501212 and Status Code 11111. The Wahiawa Aquifer is a high-level freshwater aquifer where freshwater does not come into contact with ocean water. The aquifer surface is approximately 800 to 900 feet below ground surface (Navy, 2015). The aquifer is used for drinking water.

Dike-impounded systems of the Koolau rift zone are to the east, and the Waianae rift zone on the west bound the Wahiawa Aquifer. Groundwater dams separate the Wahiawa Aquifer from adjacent freshwater lens systems to the north and south of the annex. The Wahiawa Aquifer receives recharge from the adjacent Koolau and Waianae rift zones.

3.6 Geology and Soils

3.6.1 Definition

Geologic resources consist of the earth's surface and subsurface materials. Soils are the unconsolidated surface materials that form from underlying bedrock or other parent material. Topography refers to an area's surface features, including its shape, height, and depth. The ROI for impacts on geologic resources includes Wahiawa Annex.

3.6.2 Existing Environment

3.6.2.1 Topography

The project site elevation ranges between 1,225 feet above mean sea level on the eastern side to 1,185 feet above mean sea level on the western side; this equates to a slope of approximately 3- to 5-percent with some narrow steeper areas. Beyond this general area, the slopes increase, with the general project site area bounded by steep gulches to the north, west, and south, with more than 20-percent grade changes. Midway Drive winds around the project site along this steep grade and contributes to some steeper features along the edge of the roadway. Poamoho Stream runs east-west at the bottom of a steep gulch on the south side of the project site.

3.6.2.2 Soils

The predominant soil type within the DCGS Pacific Hub site is Paaloa silty clay (PaC), with 3- to 12-percent slopes (NRCS, 2020; USDA, 1972). The Paaloa series is a dark, reddish-brown clay silt consisting of well-drained soils developed in old alluvium and residuum from basic igneous rock. Permeability is moderately rapid, runoff is slow to medium, and erosion hazard is slight to moderate. The soil has a low shrink-swell potential and is strongly acidic and highly corrosive to uncoated steel and moderately corrosive to concrete. Figure 3-3 shows the distribution of soil types within the project vicinity.

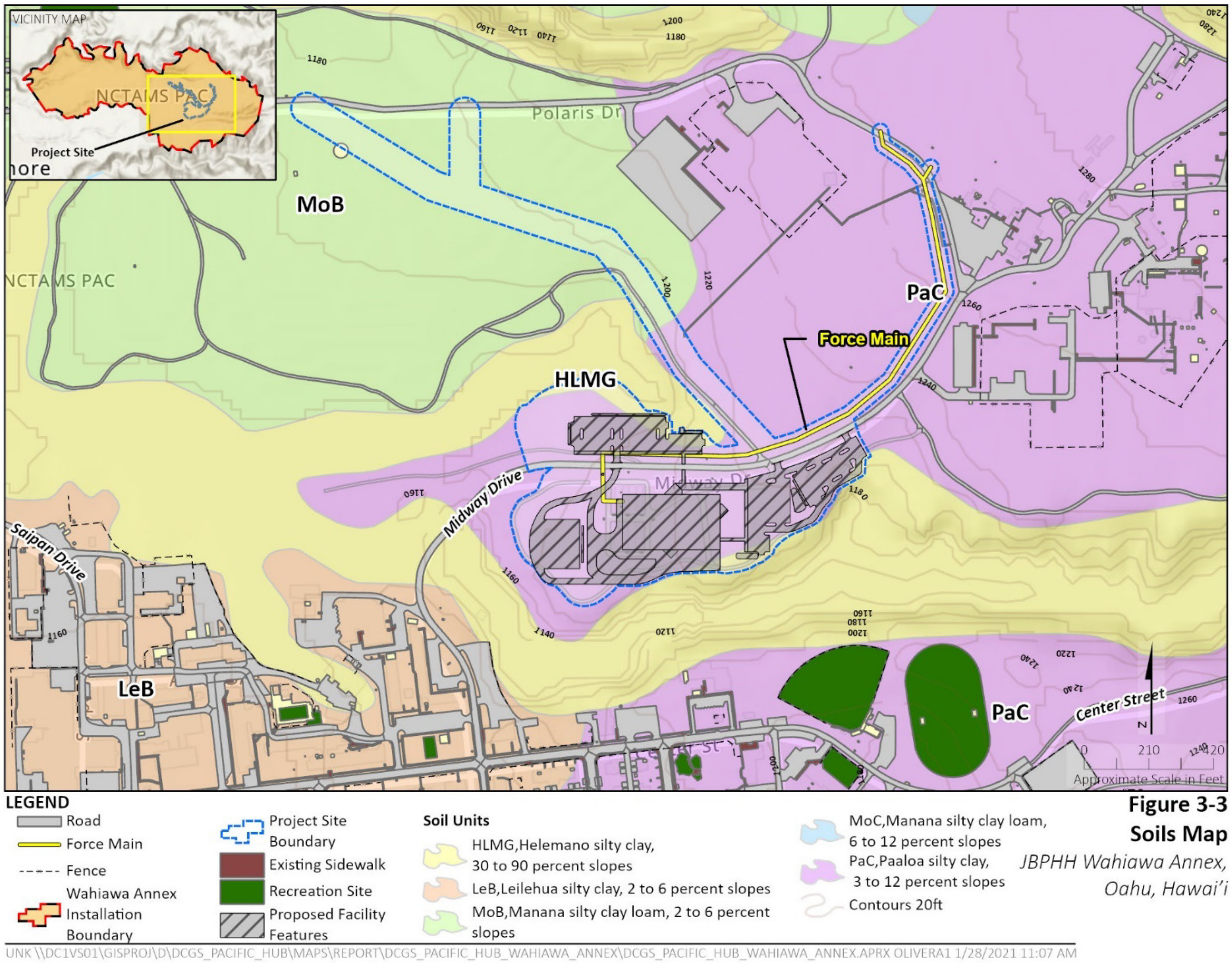

Figure 3-3
Soils Map
JBPHH Wahiawa Annex, Oahu, Hawai'i

The northern portion of the project site, in the location of the electrical connection route, contains Manana silty clay loam (MoB), with 2- to 6-percent slopes (NRCS, 2020; USDA, 1972). The Manana series consists of well-drained soils on uplands that developed in material weathered from basic igneous rock. These areas are gently sloping to steep, runoff is slow, and the erosion hazard is slight.

Small areas on the project site's northern, western, and southern perimeters contain Helemano silty clay (HLMG), with 30- to 90-percent slopes (NRCS, 2020; USDA, 1972). Helemano series soils consist of well-drained soils on alluvial fans and colluvial slopes on the sides of gulches, and they developed on alluvium and colluvium derived from basic igneous rock. These areas are located on steep to extremely steep slopes on the sides of gulches. No soils located at the project site are listed on the U.S. Department of Agriculture Soil Data Access, Hydric Soils List (NRCS, 2020).

3.7 Utilities and Infrastructure

3.7.1 Definition

Utility infrastructure refers to the system of public works that provides the underlying community framework and includes stormwater, water, wastewater, electrical, gas, and telecommunications. The ROI for impacts on utilities includes Wahiawa Annex. Utilities were evaluated to determine whether upgrades or extensions to current systems are required and whether the Proposed Action would increase maintenance to required operational resources.

3.7.2 Existing Environment

3.7.2.1 Stormwater Drainage

Existing drainage structures were identified between the existing warehouse buildings within the vegetated planter strips; these structures appear to be abandoned and are in disrepair. The drainage structures discharge to a swale that parallels Midway Drive. Additional stormwater runoff from the project area collects in gullies as surface flow to the surrounding vegetated areas.

3.7.2.2 Water

Fire protection for the existing warehouses is provided by a water line that tees off of a 14-inch water main located along Midway Drive; this is the primary water main distribution system that serves Wahiawa Annex from two directions and sources (Helemano Military Reservation and the Town of Wahiawa). The water system is fed from Water Pump Building No. 440 located northeast of the project site. The booster pumps operate in parallel with backup fire pumps that initiate when demand exceeds the capacity of the booster pumps to maintain pressure in the water distribution system.

A potable water production well is located at the Wahiawa Annex. Water that is not withdrawn from wells flows to the north or south across the northern and southern Schofield groundwater barriers. Withdrawals from the aquifer are regulated by the state to ensure they are within sustainable levels. The freshwater lens system in the northern and southern Oahu groundwater areas is recharged with the excess flow.

3.7.2.3 Wastewater

The Naval Facilities Engineering Command (NAVFAC) – Hawaii (NAVFAC HI) Utilities and Energy Management Group maintains the wastewater collection system at Wahiawa Annex. The collection system consists of a network of gravity mains, lift stations, and force mains that discharge to a single gravity main in Whitmore Avenue where it connects to the CCH wastewater collection system. No existing wastewater lines are in the vicinity of the project site. The wastewater lines closest to the project site are located approximately 900 feet to the south and 1,400 feet to the northeast.

The Navy has an existing wastewater discharge agreement with CCH that limits Wahiawa Annex flows to 191,560 gallons per day (gpd) average daily flow and 720,000 gpd peak wet-weather flow. As of 2017 the Wahiawa Annex had an average daily wastewater flow of approximately 149,420 gpd. (Brown and Caldwell, 2017).

3.7.2.4 Electrical

Existing electrical distribution near the Proposed Action area along Midway Drive consists of a legacy 4160-volt system with a mixture of modern insulated conductors with older cloth- and lead-covered conductors. A newer 12-kV 501 switching station is located on the northwest side of the annex. Two existing electrical circuits, P10 and P11, run north of the proposed project site along Polaris Drive. A future project on Wahiawa Annex could potentially replace the 4160-volt distribution along the south part of the annex and upgrade to 12 kV to align with the newer system to the north. The existing warehouses at the annex are currently being powered by a 25-kVA pad-mounted transformer. No electrical circuits adjacent to the project site on Midway Drive have the capacity to support the Proposed Action’s electrical requirements.

3.8 Hazardous Materials and Wastes

3.8.1 Definition

The Comprehensive Environmental Response, Compensation, and Liability Act defines HAZMAT as any substance with physical properties of ignitability, corrosivity, reactivity, or toxicity that could cause an increase in mortality, serious irreversible illness, and incapacitating reversible illness or pose a substantial threat to human health or the environment.

The Resource Conservation and Recovery Act defines hazardous wastes as any solid, liquid, contained gaseous, or semisolid waste or any combination of wastes that pose a substantial present or potential hazard to human health or the environment. In general, both HAZMAT and hazardous wastes include substances that, because of their quantity, concentration, physical, chemical, or infectious characteristics, might present substantial danger to public health and welfare or the environment when released or otherwise improperly managed.

Occupational health and safety is the field of public health that proposes and implements strategies and regulations to prevent illnesses and injuries in the worker population. Implementing occupational health and safety practices and regulations ensures work environments have safety precautions in place to prevent work-related injuries.

3.8.2 Regulatory Setting

Air Force Policy Directive (AFPD) 32-70, *Environmental Considerations in Air Force Programs and Activities* (USAF, 2018b), establishes the following USAF HAZMAT and hazardous waste policy requirements:

- Cleaning up environmental damage resulting from its past activities
- Meeting all environmental standards applicable to its present operations
- Planning its future activities to minimize environmental impacts
- Responsibly managing the irreplaceable natural and cultural resources it holds in public trust
- Eliminating pollution from its activities wherever possible

Air Force Instruction (AFI) 32-7086, *Hazardous Materials Management* (USAF, 2004), establishes procedures and standards that govern HAZMAT management throughout the USAF. The AFI applies to all USAF personnel who authorize, procure, issue, use, or dispose of HAZMAT and those who manage, monitor, or track those activities. AFI 32-7042, *Waste Management* (USAF, 2010), sets forth procedures for management of hazardous waste and is the driver for the development of the *Navy Region Hawaii Hazardous Waste Management Plan* (HWMP; NAVFAC HI, 2014).

The following regulations would apply to the Proposed Action as applicable:

- **Resource Conservation and Recovery Act—**Under this act, EPA regulations 40 CFR 260 through 272, control identifying, treating, storing, transporting, handling, labeling, and disposing of hazardous waste. 40 CFR 273 regulates managing universal waste, and 40 CFR 279 regulates used oil storage, transportation, and disposal.

- **Hazardous Materials Transportation Act—**Under the act, U.S. Department of Transportation regulations 49 CFR 100 through 199 regulate transporting HAZMAT and hazardous waste. Occupational Safety and Health Administration regulation 29 CFR 1910.120 regulates hazardous waste operations and emergency response.

- **Comprehensive Environmental Response, Compensation and Liability Act—**Under this act, EPA regulations 40 CFR 300, 302, 355, 370, 372 and 373 control identifying, notifying, reporting, and responding to oils of oil and releases of hazardous substances, pollutants and contaminants. They also require coordination, notification, and reporting to local community and state planning committees.

- **Federal Facility Compliance Act—**This act subjects federal facilities to all provisions of federal, state, and local hazardous waste laws and regulations. The full range of available enforcement tools, including civil fines and penalties, are available to the federal, state, and local agencies in enforcing these laws and regulations. These agencies can issue notices of violations to the Commander or Commanding Officer of Navy Region Hawaii for any deficiencies or deviations from these regulations.

- **Oil Pollution Prevention Rules (40 CFR 112)—**The goal of this regulation is to prevent oil from reaching navigable waters and adjoining shorelines and contain oil discharges. The regulation requires these facilities to develop and implement spill prevention, control, and countermeasure (SPCC) plans and establishes procedures, methods, and equipment requirements.
- **Hawaii Administrative Rule (HAR) Title 11—**This rule provides the regulations governing hazardous waste in Hawaii. Most HARs regulating hazardous waste mirrors EPA regulations; HAR Sections 11-260 through 272 control identifying, treating, storing, transporting, handling, labeling, and disposing of hazardous waste. HAR Section 11-273 regulates managing universal waste, and HAR Section 11-279 regulates used oil storage, transportation, and disposal (NAVFAC HI, 2014). Hazardous waste on Hawaii is regulated by the Hazard Evaluation and Emergency Response (HEER) Office of the HDOH.

The Occupational Safety and Health Administration (OSHA) regulations 29 CFR 1910.120 and 29 CFR 1910.106 govern hazardous waste operations and emergency response and requirements for flammable and combustible liquids. Activities occurring on JBPHH comply with applicable OSHA regulations, as well as with Navy and USAF safety regulations. Following are applicable regulations:

- Air Force Manual (AFMAN) 91-203, *Air Force Occupational Safety, Fire, and Health Standards* (USAF, 2020a)
- AFI 91-204, *Safety Investigations and Hazard Reporting* (USAF, 2020b)
- *NAVFAC Safety and Health Handbook* (NAVFAC, 2012)

3.8.3 Existing Environment

Hazardous and toxic materials at JBPHH and Wahiawa Annex are approved and tracked by the NAVFAC HI Hawaii Environmental Services Hazardous Waste Disposal Branch, which has overall management responsibility of the Installation Environmental Program. The branch also supports and monitors environmental permits, HAZMAT and hazardous waste storage, spill prevention and response, and HWMP maintenance (NAVFAC HI, 2014). The HWMP prescribes the roles and responsibilities with respect to waste stream inventory, waste analysis plan, hazardous waste management procedures, training, emergency response, and pollution prevention. The HWMP also establishes procedures to comply with applicable federal, state, and local standards for solid waste and hazardous waste management. The HWMP outlines procedures for transporting, storing, and disposing of hazardous wastes.

HAZMAT at JBPHH are managed by the Naval Supply Systems Command Fleet Logistics Center Pearl Harbor Hazardous Materials Information Network Center. HAZMAT and petroleum products such as fuels, flammable solvents, paints, corrosives, pesticides, deicing fluid, refrigerants, and cleaners are used throughout JBPHH for various functions, including aircraft, aircraft ground equipment, and ground vehicle maintenance; communications infrastructure; and facilities maintenance (NAVFAC HI, 2014).

The Navy Region Hawaii owns a permitted treatment, storage, and disposal facility, referred to as the conforming storage facility (CSF), at JBPHH. The CSF is used as a central facility for receiving and temporarily storing hazardous waste. Hazardous waste is treated or reused, and if reuse or treatment is not feasible, then the hazardous waste is temporarily stored at the CSF pending transfer to the Defense Logistics Agency Disposition Services Pearl Harbor or shipment to an EPA-approved disposal site in the continental U.S.

Asbestos Program Management (NAVFAC, 2017) for JBPHH includes program administration, organizational roles and responsibilities, standard work practices, and documentation. Buildings constructed before 2005 are assumed to contain asbestos-containing materials (ACM) unless proven by sampling that materials are not ACM. Comprehensive information or records on the presence or absence of asbestos or lead-based paint (LBP) in the existing JBPHH Wahiawa Annex warehouse buildings are not available but could be assumed to be present.

Environmental Restoration Program sites are located on Wahiawa Annex. One abandoned firing range is located at Wahiawa Annex and is identified as Site 21 in the 2015 Wahiawa Annex Site 21 Draft Record of Decision (Navy, 2015). Site 21 is located approximately 0.25 mile west-northwest of the project site and was developed in 1942 for annex security personnel for small-arms qualification training. Active use of the range ceased in the early 1980s, and it is currently closed.

Investigations at Site 21 documented munitions constituents in soil that exceeded risk-based screening levels for metals, thus a nontime-critical removal action was undertaken in 2014 to remove an estimated 148 tons of munitions constituents-impacted soil. No Further Action was identified as the final selected remedy for Site 21. Based on the information contained in the 2015 Record of Decision, Site 21 is also unlikely to have ordnance contamination at the Wahiawa Annex (Navy, 2015).

Buildings constructed on Wahiawa Annex prior to 1990 are assumed to have been ground-treated for termite protection using chemicals such as chlordane, dieldrin, and other pesticides that were later banned by the EPA due to their persistence and toxicity. The Navy refers to these historically termite-treated soils as pesticide-impacted soils (PIS). Although Wahiawa Annex has no historical records for ground treatment of its soils, PIS is assumed to be present under the existing warehouse footprints, extending horizontally 30 inches from the perimeter at depths of 0 to 2 feet below ground surface.

3.9 Socioeconomics

3.9.1 Definition

This section describes the socioeconomic conditions of the study area or ROI, including population, employment and unemployment, and employment by industry. The ROI for this study is defined as the geographic area within which any social and economic impacts associated with project implementation are likely to occur. Although predominant socioeconomic impacts of the proposed DCGS Pacific Hub are likely to be centered in the area surrounding the Wahiawa Annex, for economic modeling analysis, the affected environment is defined as the entire county of Honolulu, which includes the city of Honolulu.

Data from the U.S. Census Bureau (USCB) website were used to identify the historical and current population in the study area while data from the U.S. Bureau of Labor Statistics (BLS) were used to describe the study area's historical and current employment and unemployment characteristics. The employment by industry and income by industry data came from the U.S. Bureau of Economic Analysis, as did the implicit gross domestic product price deflators that were used to convert the incomes from nominal (current) dollar values to constant (real) dollars values to facilitate income comparisons across different years.

The IMPLAN model, a regional input-output economic model, was used to estimate the regional economic impacts resulting from changes in project construction expenditures. The regional economic impact analysis considered both initial or direct impact on the primary affected industries and the secondary impacts resulting from those industries that provide inputs to the directly affected primary industries. This analysis also included the changes in economic activity stemming from household spending of income earned by those employed in the economy sectors affected either directly or indirectly. These secondary impacts are often referred to as multiplier effects.

3.9.2 Existing Environment

3.9.2.1 Population

The estimated population and the changes in the population in Honolulu County, the state of Hawaii, and the United States are presented in Table 3-5. The population growth rate between 2010 and 2018 for the county and state are almost the same as that for the United States. Honolulu County population grew by about 0.7 percent, while Hawaii and the United States grew by about 0.8 percent each.

Table 3-5. Population

Area	Population 2010	Population 2015	Population 2018	2010 through 2018 Average Annual Growth Rate (percent)
Honolulu	936,984	984,178	987,638	0.7
Hawaii	1,333,591	1,406,299	1,422,029	0.8
United States	303,965,272	316,515,021	322,903,030	0.8

Source: USCB (2020b, 2020c, and 2020d)

3.9.2.2 Employment and Unemployment

Table 3-6 summarizes the annual average civilian labor force and employment data for Honolulu, Hawaii, and the United States in 2019, the latest year for which annual estimates are available. The annual average unemployment rates in Honolulu and Hawaii were both about a percentage point below the national annual average in 2019.

Table 3-6. 2019 Employment Data

Area	Labor Force	Employment	Unemployment	Unemployment Rate (percent)
Honolulu	450,562	438,936	11,626	2.6
Hawaii	664,992	646,973	18,019	2.7
United States	259,175,000	157,538,000	6,001,000	3.7

Source: BLS (2020)

Unemployment rates peaked in 2009 during the Great Recession (Figure 3-4), before slowly starting to decline. However, unemployment rates increased significantly at the beginning of the Coronavirus-19 pandemic when the stay-at-home order were in effect across most of the country; Hawaii's unemployment rate peaked in April 2020 at 23.8 percent, while Honolulu's peak unemployment rate of 20.8 percent occurred one month later. Unemployment rates declined after the restrictions were eased during the summer, although they have not rebounded to where they were at the beginning of 2020. The unemployment rate in November 2020—the latest month for which the unemployment data are available—were 8.8 percent for Honolulu and 10.1 percent for Hawaii (BLS, 2021).

3.9.2.3 Employment by Industry

Table 3-7 and Figure 3-5 summarize the average annual employment by industry for Honolulu County, which is concentrated in the services, government, and retail sectors. These three sectors account for about 75 percent of all jobs in the county for each of the 3 years shown in Table 3-7 and on Figure 3-5. Between 2010 and 2018, annual industry employment increased by approximately 68,200 jobs (11 percent) and grew by an average annual rate of 1.1 percent. The highest growth during the 2010 to 2018 period was in the transportation, warehousing, and utilities sector, which had an annual growth rate of 2.7 percent. The construction sector had the second-highest annual growth rate (2.3 percent) during the same period.

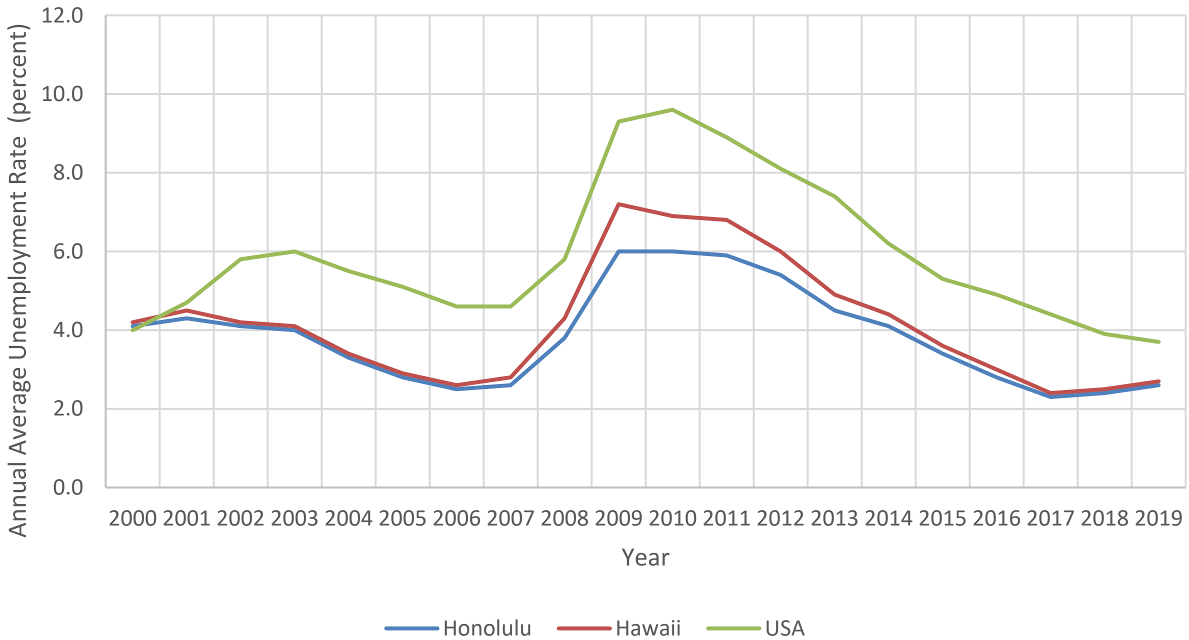

Figure 3-4. Trend in Annual Unemployment Rates
Source: BLS (2020)

Table 3-7. Employment by Industry, Honolulu County

Industry Sector	2010	2015	2018	2010 through 2018 Average Annual Growth Rates (percent)
Agriculture[1]	3,347	3,902	3,992	1.9
Mining, quarrying, and oil and gas extraction	690	603	449	-1.7
Construction	26,712	31,972	33,356	2.3
Manufacturing	12,377	13,582	13,812	1.2
Wholesale trade	16,561	18,167	16,237	1.2
Retail trade	55,797	60,827	61,168	1.1
Transportation, warehousing, and utilities	22,411	27,696	35,152	2.7
Information	9,458	8,631	9,111	-1.1
FIRE[2]	48,300	49,923	53,600	0.4
Services	248,145	278,101	285,251	1.4
Government	151,988	154,631	151,866	0.2
Total industry employment	595,786	648,035	663,994	1.1

Source: BEA (2020a)

[1] Employment in forestry, fishing, and related activities is included.
[2] FIRE is a combination of the finance, insurance, real estate, rental, and leasing sectors.

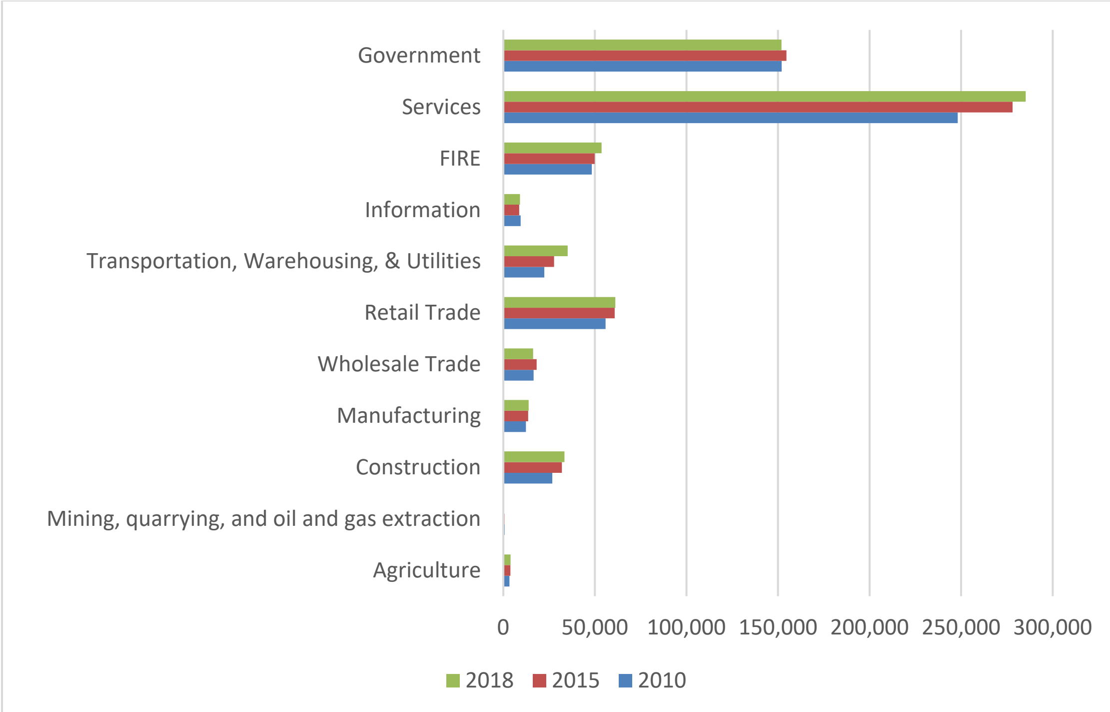

Figure 3-5. Total Employment by Major Industry in Honolulu County

3.9.2.4 Personal Income

Table 3-8 summarizes the personal income and the per capita income (2020 dollars) in the study area for 2010, 2015, and 2018.

Table 3-8. Income (2020 dollars)

Type	2010	2015	2018	2010 through 2018 Average Annual Growth Rates (percent)
Personal incomes (millions)	51,332	57,224	60,123	2.2
Per capita income	53,678	57,724	61,344	1.5

Source: (BEA, 2020b)

3.9.2.5 Income by Industry

Table 3-9 and Figure 3-6 summarize the real annual income by industry (in 2020 dollars) for Honolulu County. Similar to the annual employment by industry, the real annual industry incomes are concentrated in the services, government, and retail sectors. These three sectors account for about 75 percent of all jobs in the county for each of the three years shown in Table 3-9 and on Figure 3-6. Between 2010 and 2018, real annual industry income increased by approximately $5.8 billion (15 percent) and grew by an average annual rate of 1.3 percent. The highest growth during the 2010 through 2018 period was in the transportation, warehousing, and utilities sector, which had an annual growth rate of 3.4 percent. The construction sector had the second-highest annual growth rate (2.6 percent) during the same period.

Table 3-9. Real Income by Industry, Honolulu County (2020 million dollars)

Industry Sector	2010	2015	2018	2010 through 2018 Average Annual Growth Rates (percent)
Agriculture[1]	215	142	138	-5.1
Mining, Quarrying, and Oil and Gas Extraction	33	30	27	-0.9
Construction	2,638	3,252	3,357	2.6
Manufacturing	707	797	836	1.5
Wholesale Trade	1,062	1,167	1,206	1.2
Retail Trade	2,121	2,299	2,319	1.0
Transportation, Warehousing, and Utilities	1,646	2,158	2,363	3.4
Information	725	694	723	-0.6
FIRE[2]	2,520	2,653	2,965	0.6
Services	12,859	14,999	15,911	1.9
Government	13,395	13,900	13,896	0.5
Total Industry Earnings	37,921	42,091	43,741	1.3

Source: BEA (2020b and 2020c)

[1] Employment in forestry, fishing, and related activities is included.
[2] FIRE is a combination of the finance, insurance, real estate, rental, and leasing sectors.

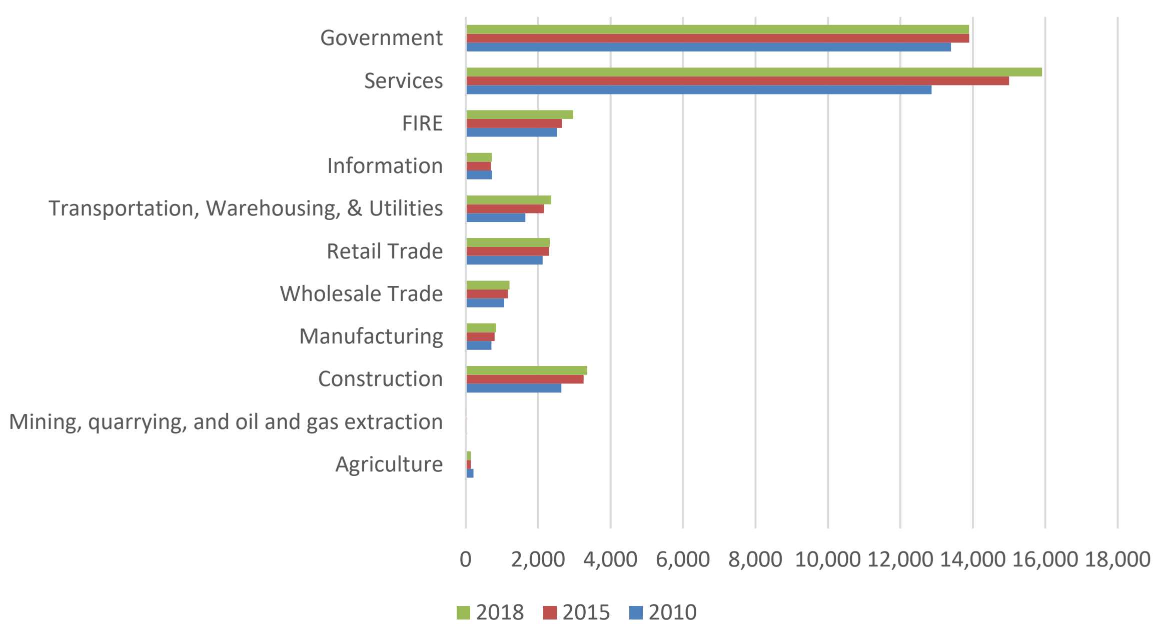

Figure 3-6. Total Real Income by Major Industry in Honolulu (2020 dollars)

3.10 Traffic

3.10.1 Definition

Transportation and traffic resources generally include the internal and external street systems near the Proposed Action. The ROI for impacts on to transportation-related resources considered in this EA includes Wahiawa Annex and the major roads in the vicinity of the installation.

A traffic study was conducted for the Proposed Action and includes detailed information regarding the affected environment near the project site. This section summarizes the traffic study findings; the study is included as Appendix C of this EA.

3.10.2 Existing Environment

Public roadways within the study area (shown on Figure 1-2 in Appendix C) include Kamehameha Highway and Whitmore Avenue. Both roadways carry general-purpose traffic and would be used by project-related construction traffic. Private military roadways within the study area include Saipan Drive, Polaris Drive, Center Street, and Midway Drive. These private roadways are not open the public, but they also would carry project-related construction traffic.

Whitmore Avenue (also known as State Route 7012) is a public road providing local access to the Wahiawa Annex, classified as an Urban Minor Collector by the Hawaii Department of Transportation (HDOT), and intended to serve as a connection between local or residential land uses and the regional arterial system. Whitmore Avenue also provides the sole regional access to the Whitmore Village residential community. Through Whitmore Village within the residential area, the roadway provides direct access to business and residential driveways, parks and recreational activities, and community resources.

Saipan Drive is a two-lane undivided roadway that meets Whitmore Avenue as a stop-controlled intersection west of Whitmore Village and provides access to the Saipan Gate of Wahiawa Annex. Saipan Drive also provides an alternative route for traffic accessing Wahiawa Annex, thus reducing traffic flow through Whitmore Village.

Within Wahiawa Annex, roadways providing access to Midway Drive and the project site include Saipan and Polaris Drives to the north and Center Street to the south. These roadways provide traffic circulation around and within the annex and are generally two-lane undivided streets with posted speed limits of 25 miles per hour or less.

The traffic study (Appendix C) evaluated traffic operations at four study intersections, listed below, outside of Wahiawa Annex; the location of each intersection is shown in Appendix C on Figure 1-2:

- Intersection 1 – Kamehameha Highway at Whitmore Avenue – *signalized*
- Intersection 2 – Kamananui Road at Kaukonahua Road – signalized
- Intersection 3 – Kamehameha Highway at California Avenue – *signalized*
- Intersection 4 – Whitmore Avenue at Saipan Drive – *stop-controlled*

Traffic operations can generally be described by six level of service (LOS) grades, which categorize operating conditions at an intersection based on the average vehicle delay time in seconds. LOS classifications are given a letter designation from A to F. LOS A generally represents ideal operating conditions with little to no delay and where movements are not influenced by other vehicles on the roadway. LOS F typically represents poor operating conditions, including high delays and extreme congestion. Table 3-10 shows the LOS categories in reference to average delay time criteria for signalized and stop-controlled intersections.

Table 3-10. Intersection Level of Service Criteria

LOS	Average Signalized-Control Delay [1] (sec/veh)	Average Stop-Controlled Delay [1] (sec/veh)	General Description
A	Less than or equal to 10	0 to 10	Generally free flow
B	More than 10 to 20	More than 10 to 15	Stable flow (slight delays)
C	More than 20 to 35	More than 15 to 25	Stable flow (acceptable delays)
D	More than 35 to 55	More than 25 to 35	Approaching unstable flow with vehicles occasionally waiting through more than one signal cycle before proceeding
E	More than 55 to 80	More than 35 to 50	Unstable flow (intolerable delay)
F	More than 80	More than 50	High delays and extreme congestion

Source: TRB (2010)

[1] Delay includes delay on the stop-controlled approach.

LOS = level of service
sec/veh = seconds per vehicle

Within the city and county of Honolulu, LOS D is generally considered the acceptable level of mobility. Traffic that operates at LOS E or LOS F is considered to be less than desirable and should be examined for potential improvements to maintain acceptable operations. Table 3-11 summarizes the existing operational results by approach movement at the study intersections. At signalized locations, the overall intersection, vehicle delay, and LOS are also reported.

Under existing conditions, the four study intersections operate at LOS D or better during the morning and afternoon peak hours. Westbound and southbound left-turn movements at Intersection 1 (Kamehameha Highway and Whitmore Avenue) operate at LOS E during the A.M. peak hour. Relatively high vehicle volumes leaving Whitmore Village, likely headed to Honolulu during the morning commute, conflict with southbound left-turns and contribute to delays at the traffic signal. In the P.M. peak hour, southbound left-turn movements at Intersection 1 operate at LOS E; this movement likely experiences relatively high delay times, because the traffic signal accommodates the heavy vehicle movement leaving the Wahiawa Annex (westbound left-turns) during the afternoon. At Intersection 3, (Kamehameha Highway at California Avenue), the overall intersection operates at LOS C during the morning and afternoon peaks.

Table 3-11. Existing (2020) Weekday Peak-Hour Intersection Analysis

	A.M. Peak Hour		P.M. Peak Hour	
Intersection and Movement	**Delay[1]**	**LOS**	**Delay[1]**	**LOS**
1. Kamehameha Highway at Whitmore Avenue	***38.4***	***D***	***41.1***	***D***
Westbound left	57.5	E	49.2	D
Westbound right	0.0	A	0.0	A
Northbound through	29.9	C	43.6	D
Northbound right	0.0	A	0.0	A
Southbound left	62.2	E	59.8	E
Southbound through	13.3	B	25.3	C
2. Kamananui Road at Kaukonahua Road	***8.9***	***A***	***13.6***	***B***
Eastbound left/through/right	25.3	C	20.1	C
Westbound left/through/right	27.5	C	25.4	C
Northbound left/through/right	3.7	A	10.3	B
Southbound left/through/right	2.9	A	9.0	A
3. Kamehameha Highway at California Avenue	***27.3***	***C***	***34.0***	***C***
Eastbound left/through	47.5	D	46.4	D
Eastbound through/right	50.7	D	51.0	D
Westbound left/through	41.3	D	44.1	D
Westbound right	31.8	C	34.3	C
Northbound left	16.4	B	21.1	C
Northbound through	20.9	C	27.9	C
Northbound right	21.8	C	37.8	D
Southbound left	16.4	B	21.4	C
Southbound through	22.0	C	28.4	C
Southbound right	16.3	B	20.5	C
4. Saipan Drive at Whitmore Avenue				
Eastbound left	12.3	B	9.8	A
Southbound left	32.2	D	20.6	C
Southbound right	11.1	B	14.4	B

Source: Jacobs (2021); included as Appendix C.

[1] Delay is the average measured in seconds per vehicle.

A.M. = ante meridiem
LOS = level of service
P.M. = post meridiem

SECTION 4

Environmental Consequences

This section identifies potential impacts on all relevant resource areas that would be required to implement the Proposed Action. 40 CFR 1508.27 specifies that a determination of significance requires considering context and intensity. Impacts described in this section are evaluated in terms of type (beneficial or negative), context (setting or location), intensity (none, negligible, minor, moderate, or significant), and duration (short-term/temporary or long-term/permanent). The type, context, and intensity of an impact on a resource are explained under each resource area. Unless otherwise noted, short-term impacts are those that would result from the activities associated with a project's construction and demolition and end when those phases are complete. Long-term impacts are generally those resulting from the Proposed Action's operation. Impact intensities are further defined as follows:

- A **negligible** impact is defined as an environmental impact that is so small that it would be difficult to observe and is trivial enough to be disregarded.
- A **minor** impact is defined as an environmental impact that is observable yet unlikely to noticeably affect human health, cultural resources, or the environment.
- A **moderate** impact is an environmental impact that is observable and may affect human health, cultural resources, or the environment.
- A **significant** impact is observable and could cause a major impact on human health, cultural resources, or the environment.

4.1 Air Quality

4.1.1 Proposed Action

4.1.1.1 General Conformity Applicability

The General Conformity Rule was established under the CAA Section 176(c)(4) to ensure that actions taken by federal agencies in nonattainment and maintenance areas do not interfere with a state's plans for bringing these areas back into attainment with the NAAQS. Under the CAA's conformity provisions, no federal agency can approve or undertake a federal action or project in a nonattainment or maintenance area unless it has been demonstrated to conform to the applicable state implementation plans. The purpose of the rule is to ensure that federal actions do not cause or contribute to new violations of the NAAQS, worsen existing NAAQS violations, or delay attaining NAAQS.

The Proposed Action would be in an area that is in attainment for all criteria pollutants under the NAAQS. Because conformity requirements only apply in areas that are designated by EPA as NAAQS nonattainment or maintenance NAAQS, the Proposed Action is not subject to General Conformity Rule requirements. Therefore, a general conformity applicability analysis and further conformity demonstration for the Proposed Action are not required.

4.1.1.2 Construction

Air quality impacts of the Proposed Action were evaluated following the *Air Force Air Quality Environmental Impact Analysis Process (EIAP) Guide – Fundamentals, Volume 1 of 2* (AFCEC, 2019). The Proposed Action would cause temporary emission increases due to the use of off-road construction equipment and on-road vehicles for construction activities. Emissions associated with these activities are primarily from mobile sources and fuel combustion in off-road and on-road engines. In addition, earth-moving activities and vehicle travel would result in fugitive dust emissions.

Although the Proposed Action is not subject to general conformity requirements, air pollutant emissions associated with the Proposed Action were quantified using USAF's Air Conformity Applicability Model (ACAM) following the EIAP methodologies.[1] The estimated emissions from the Proposed Action were compared with the ACAM-defined air quality threshold for attainment areas. The Proposed Action would potentially have substantial adverse impacts if the emission increases would exceed the ACAM air quality thresholds. Construction emissions from the following activities were included in the ACAM analysis:

- Demolishing six warehouses
- Demolishing concrete pads and paved areas
- Grading and building the retaining walls
- Constructing the DCGS Pacific Hub, coating associated architecture, and paving access roads, parking lots, and sidewalks
- Trenching utility installations and constructing associated utility structures

Constructing the Proposed Action is anticipated to take approximately 39 months. Construction emission calculations conservatively assumed that all construction activities would occur in a single year. Emissions from the construction activities associated with the Proposed Action are summarized in Table 4-1 and compared with the ACAM air-quality thresholds for attainment areas. Appendix D provides a summary of project data and assumptions used for estimating emissions from the Proposed Action. Appendix D also includes the Air Conformity Applicability Model Report Record of Air Analysis and the Detailed Air Conformity Applicability Model Report.

Table 4-1. Construction Emissions from Proposed Action – Criteria Pollutants

Pollutants	**Construction (tons per year)**	**Air Quality Thresholds (tons per year)**
VOC	1.677	250
NO_x	2.968	250
CO	3.779	250
SO_x	0.009	250
PM_{10}	0.321	250
$PM_{2.5}$	0.114	250
Pb	0.000	25
NH_3	0.003	250

CO = carbon monoxide
NH_3 = ammonia
NO_x = nitrogen oxides
Pb = lead
PM_{10} = particulate matter less than 10 micrometers in aerodynamic diameter
$PM_{2.5}$ = particulate matter less than 2.5 micrometers in aerodynamic diameter
SO_2 = sulfur dioxide
VOC = volatile organic compound

[1] ACAM is an air emissions estimating model that performs an analysis to assess the potential air quality impacts associated with a USAF action in accordance with AFI 32-7040 (USAF, 2017), CAA Section 176[c]), EIAP (32 CFR 989); and General Conformity Rule (40 CFR 93 Subpart B).

As shown in Table 4-1, emission increases of all pollutants analyzed would be below the corresponding ACAM air quality thresholds. In addition, BMPs would be implemented during construction of the Proposed Action to reduce emissions. BMPs could include the following or similar measures:

- Covering stockpiles with appropriate material; dispose of debris properly
- Using water, dust fences, and disturbance area limitations and revegetating to minimize dust emissions, as appropriate
- Keeping adjacent paved roads clean from construction debris
- Covering open-bodied trucks whenever hauling material that can be blown away
- Limiting the amount of disturbed areas at any given time and/or stabilizing inactive areas that have been exposed
- Revegetating disturbed areas as soon as practical after construction
- Stabilizing construction entrances to avoid tracking sediment off site
- Using vehicles that are properly maintained

Air quality impacts from the Proposed Action construction phase are expected to be **short-term and minor,** because the construction period is of limited duration and the emissions would be below the ACAM thresholds. The impacts would be further minimized by implementing BMPs for dust control and exhaust emissions.

4.1.1.3 Operation

DCGS Pacific Hub operations primarily include communications and administrative-related activities. Operational air emissions associated with the Proposed Action could result from the new stationary sources, including three diesel-fired back-up generators, diesel-fired pumps, and diesel storage tanks and from vehicle emissions due to additional employee commute trips. The back-up generators would meet all applicable federal and state air quality regulations.

Emissions increases associated with operation of the Proposed Action were estimated using the ACAM model, including the following sources:

- Additional commute trips for 150 employees
- Three emergency generators, 2,500 kilowatts each
- One fire pump engine, 150 horsepower
- Two diesel fuel storage tanks, 16,000-gallon capacity each

Criteria pollutant emissions from project operations are summarized in Table 4-2 and compared with the ACAM air quality thresholds. Detailed information used in ACAM modeling is available in Appendix D. As shown in Table 4-2, operational emissions from the project would be below the air quality thresholds for all pollutants analyzed. Therefore, operation of the project would have **long-term minor impacts** on air quality.

EPA delegates the CAA permitting programs to the state of Hawaii. HDOH is the state authority that regulates air emissions from stationary sources in Hawaii to prevent violations of NAAQS and to ensure that emission controls are in place when necessary. HDOH would require an air quality permit to construct and operate stationary sources of air emissions unless those sources meet permit exemption requirements (HAR Section 11-60.1). If not exempt, DCGS will obtain required air permits and comply with the HDOH permitting and air emissions requirements.

Table 4-2. Operation Emissions from Proposed Action – Criteria Pollutants

Pollutants	Construction (tons per year)	Air Quality Thresholds (tons per year)
VOC	1.104	250
NO_x	26.483	250
CO	10.961	250
SO_x	0.05	250
PM_{10}	0.857	250
$PM_{2.5}$	0.856	250
Pb	0.000	25
NH_3	0.021	250

CO = carbon monoxide
NH_3 = ammonia
NO_x = nitrogen oxides
Pb = lead
PM_{10} = particulate matter less than 10 micrometers in aerodynamic diameter
$PM_{2.5}$ = particulate matter less than 2.5 micrometers in aerodynamic diameter
SO_2 = sulfur dioxide
VOC = volatile organic compound

4.1.1.4 Greenhouse Gases

GHG emissions and climate change are cumulative impacts at global scale; therefore, an individual project is not expected to generate enough GHG emissions to significantly influence global climate change. Currently, no federal agency has adopted a quantitative threshold to evaluate the significance of an individual project's contribution to GHG emissions in the context of NEPA. GHG emissions were estimated using ACAM for the Proposed Action's construction and operation activities using the same methodology and assumptions as for the criteria pollutant emission calculation. Emissions of GHGs are evaluated in terms of carbon dioxide equivalent and summarized in Table 4-3. GHG emissions from the project would only result from temporary project construction activities and the operation of the emergency engines and the fire pump engine. GHG emissions associated with the Proposed Action are anticipated to be **long-term** and **minor**, as shown in Table 4-3.

Table 4-3. Greenhouse Gas Emissions from Proposed Action

Activity	CO_2e (tons per year)
Construction (2024)	924.0
Operation	1693.4

CO_2e = carbon dioxide equivalent

4.1.2 No Action Alternative

The No Action Alternative would not generate any new emissions and would have no impact on air quality.

4.2 Noise

4.2.1 Proposed Action

4.2.1.1 Construction

The Proposed Action would result in short-term increases in noise from construction activities. Noise-generating sources during demolition and construction would be associated primarily with standard construction equipment and construction equipment transportation. Construction activities generate noise by their very nature and are highly variable, depending on the type, number, and operating schedules of equipment. Construction projects are usually executed in stages, with each stage having its own combination of equipment and noise characteristics and magnitudes. Construction activities are expected to be typical of other similar construction projects.

Noise levels from construction activities were estimated based on data and methods derived from the Federal Highway Administration's *Roadway Construction Noise Model* (FHWA, 2006) and the Federal Transit Administration's *Transit Noise and Vibration Impact Assessment Manual* (FTA, 2018). The data represent the most recent and comprehensive tabulation of noise from common pieces of construction equipment. Typical construction equipment noise levels are presented in Table 4-4. Pile driving, typically one of the loudest construction activities, would not occur under the Proposed Action.

Table 4-4. Construction Equipment Noise Levels

Equipment Description	Sound Level at 50 feet (dBA)	Sound Level at 100 feet (dBA)	Sound Level at 200 feet (dBA)	Sound Level at 400 feet (dBA)
Backhoe	80	74	68	62
Boring jack power unit	80	74	68	62
Compactor (ground)	80	74	68	62
Concrete mixer truck	85	79	73	67
Concrete pump truck	82	76	70	64
Crane	85	79	73	67
Dozer	85	79	73	67
Dump truck	84	78	72	66
Excavator	85	79	73	67
Flat-bed truck	84	78	72	66
Front-end loader	80	74	68	62
Generator	82	76	70	64
Grader	85	79	73	67
Paver	85	79	73	67
Pickup truck	55	49	43	37
Tractor	84	78	72	66

Source: FHWA (2006)

dBA = A-weighted decibel(s)

Reviewing the construction equipment noise levels presented in Table 4-4 indicates the loudest equipment generally emits noise in the range of 80 to 85 dBA at 50 feet from the noise source. Noise at any specific receptor is dominated by the closest and loudest equipment. The equipment types, numbers, and duration anticipated to be used during construction near any specific receptor location would vary over time.

A general construction noise estimate was developed based on the general assumption of multiple pieces of loud equipment operating near each other. Specifically, the following analysis uses five pieces of general construction equipment working near each other:

- One piece of equipment generating a reference noise level of 85 dBA at 50 feet at the edge of the construction area,
- Two pieces of equipment generating reference 85 dBA noise levels located 50 feet farther away from the edge of construction, and
- Two more pieces of equipment generating reference 85 dBA noise levels located 100 feet farther away the edge of construction.

Expected average construction equipment noise levels at various distances, based on this scenario, are presented in Table 4-5 and Figure 4-1.

Table 4-5. Average Construction Equipment Noise Levels Versus Distance

Distance from Construction Activity (feet)	Average Construction Noise Level (dBA)
50	87
100	83
200	78
400	73
800	67

dBA = A-weighted decibel(s)

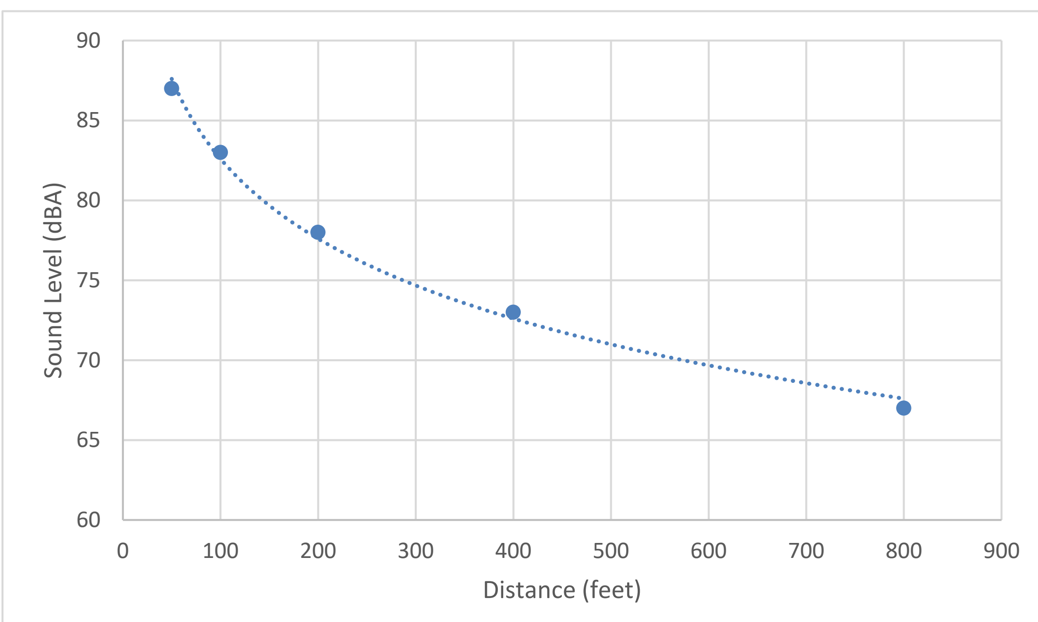

Figure 4-1. Plot of Sound Level versus Distance

Areas expected to experience the highest levels of construction noise would be those closest to the construction activities. Construction is a dynamic activity, and as such, sound levels would vary, and equipment would not be stationary or located at the closet location to any particular receptor throughout the construction period.

To reduce noise exposure, construction activities would be limited to daytime hours, and indoor noise levels with windows closed would be expected to be 15 dB lower than the outdoor levels identified above. Standard construction noise minimization measures include properly maintaining all equipment and using mufflers. Therefore, construction activities associated with the Proposed Action would have a **minor, short-term** effect on sensitive receptors due to an increase in noise levels, their distance from the project site, and use of measures to minimize noise.

4.2.1.2 Operation

Operational noise associated with the Proposed Action would be associated with mechanical equipment located outside of the DCGS Pacific Hub. Building mechanical equipment is expected to be similar to other similar office-type buildings and include heating, ventilation, and air conditioning systems, as well as stand-by generators. Outdoor mechanical equipment that could contribute to sound levels beyond the project site is primarily limited to the air-cooled chillers and stand-by generators that would be located in an outdoor mechanical yard that would be located within the access road adjacent to the hub depicted on Figure 2-2 in Section 2.

While acoustical specification of mechanical equipment would be finalized during detailed design, the expected sound level from the air-cooled chillers is expected to vary with loads between 66 to 77 dBA at 30 feet, and the stand-by generator is anticipated to be specified with an acoustical enclosure and silencer that achieves 70 dBA at 7 meters (23 feet). Typical generator operations would be limited to routine maintenance, monthly testing (approximately 1-hour in duration), and operation in response to a utility outage or other periods where stand-by power is anticipated. Thus, when operating at the expected maximum sound level of 77 dBA at 30 feet, the sound dissipates to approximately 53 dBA at 600 feet due to distance. If generators are operated simultaneously, then these sound levels are predicted to increase by 1 dBA. These estimates do not consider additional attenuation afforded when the line of sight between the noise source and receiver is blocked by obstructions such as terrain or structures. Impacts on nearby sensitive receptors resulting from noise generated from operation of the Proposed Action are expected to be **long-term** and **minor**.

4.2.2 No Action Alternative

Under the No Action Alternative construction or operation would not occur; therefore, **no impact** on sensitive noise resources would occur.

4.3 Biological Resources

4.3.1 Proposed Action

4.3.1.1 Construction

Vegetation and Wildlife

The Proposed Action would be located in an area primarily comprising maintained lawns, with a small portion of the project site consisting of warehouses and paved access roads and sparse areas of shrubs and trees. The prominent vegetation at the project site is nonnative landscaped grass. During construction, several stands of trees and shrubs present in the project area would be removed. Although the Proposed Action construction activities would permanently affect nonnative vegetation, the disturbed areas would be revegetated using a native seed mix following construction; therefore, the Proposed Action would result **short-term minor impacts** on vegetation as a result of construction activities.

Wildlife may be disturbed by noise during construction activities. However, because the project site is located in an area that is disturbed and does not represent high habitat value, wildlife disturbance would be **short-term** and **minor**.

Threatened and Endangered Species

Vegetation

No plants federally listed as threatened or endangered were observed in the project site area during surveys and, because of the highly disturbed nature of the project site, would not be expected to occur. The Proposed Action would require removing several trees adjacent to the existing warehouses; however, these trees do not warrant protection because they are not federally listed species. Because no federally protected plant species are located within the project site, **no impact** would occur with implementing the Proposed Action.

Birds

The bird community at the project site is predominantly common, nonnative (alien) species naturalized in the Hawaiian Islands. None of these species observed during the site survey warrant protection under federal endangered species statutes.

Sea Birds

Although not detected during site surveys, the federally endangered Hawaiian petrel (*Pterodroma sandwichesis*) and federally threatened Newell's shearwater (*Puffinus newelli*) could over-fly the project site area between April and the middle of December each year. Newell's shearwater is not known to breed on the island of Oahu, although recent acoustical surveys have recorded low numbers of this species calling over the higher reaches of the island (AECOS, 2021a). Nocturnally flying seabirds, such as the band-rumped storm petrel (*Hydrobates castro*), especially fledglings on their way to sea during the summer and fall, could become disoriented by exterior lighting. Disoriented seabirds may collide with built structures and, if not killed outright, could become easy targets of opportunity for feral mammals. As proposed, night-time construction is not anticipated to occur under the Proposed Action. Exterior lighting would comply with Hawaii's "Dark Sky" requirements (DLNR, 2016) for zero up-light components for site lighting; therefore, impacts on nocturnally flying seabirds are expected to be **short-term** and **minor**. USAF initiated Informal consultation with the USFWS for the Proposed Action on April 12, 2021 to address potential impacts on seabirds as a result of hub construction (Appendix E). USFWS concurrence regarding potential effects would need to be completed and permits obtained as needed before proceeding with the Proposed Action construction.

The white tern (*Gygis alba*), or *manu o Kū*, is an indigenous seabird protected by the MBTA and listed as threatened under Hawaii endangered species statute HRS 195D. No individuals of white tern were observed during the survey. In the main Hawaiian Islands, most white tern population is found in central urban and suburban Honolulu, with a known breeding range extending from Niu Valley to JBPHH (AECOS, 2021a). White tern using the project site area is unlikely; therefore, impacts on this species as a result of the Proposed Action is anticipated to be **negligible**. Should any endangered waterbird or seabird appear on the project site during construction, work in that area must cease until the animal leaves voluntarily.

Owls

The Hawaiian endemic subspecies of short-eared owl or *pueo* (*Asio flammeus sandwichensis*) is state-listed as endangered on Oahu only. Short-eared owl nest on the ground and are, thus, susceptible to mammalian predation. The species is increasingly scarce on Oahu, and although no evidence of short-eared owl was found during the site survey, the project site has some potential as a resource area for this bird. The open grassland habitat is very common at Wahiawa Annex, where close-cropped grasses are maintained to reduce wildfire hazard. Owls may use these grasslands to hunt for prey. Owl nests were not observed at the project site during survey and the maintenance frequency and high human traffic through the area are anticipated to impede nesting behavior; therefore, the impact on this species as a result of the Proposed Action is anticipated to be **negligible**.

Migratory Birds

The bird species observed during the December 2020 survey at the Wahiawa Annex (with the exception of the Pacific golden-plover) are introduced, nonnative species. Active nests (containing eggs or young) may be disturbed or destroyed as a result of the Proposed Action. Although the temporary displacement of these individuals at the project site is not expected to affect their survival or the overall species' populations, measures to avoid disturbance will be implemented when feasible. These measures include conducting a preconstruction survey prior to site disturbance to identify nesting birds within the project site area. If nesting birds are found, then a buffer distance between the active nest and construction activity will be created until the nest is no longer deemed active (that is, chicks have fledged, abandoned, or predated). Therefore, construction activities associated with the Proposed Action would have a **short-term minor** effect on migratory birds due to disturbance to surrounding habitat and use of measures to minimize disturbance of active bird nests.

Mammals

No mammalian species currently protected or proposed for protection under either federal or state endangered species programs were detected during site surveys. The federally listed as endangered Hawaiian hoary bat could potentially use resources within the project vicinity. This species is solitary; however, it has a potentially widespread distribution on Oahu. Several potential bat roost trees (trees over 15 feet tall) exist within the Proposed Action project site and would be cleared during construction. In addition, tall trees are present adjacent to the project site boundary. Hawaiian hoary bats use multiple roosts within a home territory, so the disturbance associated with removing any particular tree would be minimal. However, bats are vulnerable during the pupping season, where a female bat carrying a pup may be unable to rapidly vacate a roost tree that is being felled, or an unattended pup may be unable to flee a tree that is being felled. Potential adverse impacts on Hawaiian hoary bat would be avoided or minimized by not clearing woody vegetation taller than 4.6 meters (15 feet) between June 1 and September 15, the bat pupping season. With avoidance of tree-clearing activities during the pupping season the potential for adverse impacts on the Hawaii hoary bat would be **short-term** and **minor**. USAF will initiate Informal consultation with the USFWS for the Proposed Action to address potential impacts on Hawaiian hoary bat, as a result of hub construction (Appendix E). USAF concurrence regarding potential effects would need to be completed and permits obtained as needed before proceeding with the Proposed Action construction.

Tree Snails

No Hawaiian endemic tree snails or shells were observed during site surveys and surveys of the perimeter of the project site. The short-cropped lawn and isolated pockets of nonnative disturbed forest habitat are proposed for demolition, and grubbing at the project site does not provide optimal habitat for tree snails. Native trees and shrubs, as well as nonnative disturbed forest on the perimeter of the project may afford some habitat but are not anticipated to be grubbed or otherwise disturbed by implementing the Proposed Action. Impacts on Hawaiian endemic tree snails are, therefore, anticipated to be **negligible**.

Wetlands

An approximately 0.2-acre (0.08-hectare or 813-square-meter) wetland feature below an outlet of an existing retention basin is located within the corridor of the proposed electric connection between the project site and Polaris Drive (Figure 3-1). Installing the electrical conduit would involve constructing a trench to underground the utility, which would result in temporary impacts on approximately 6,750 square feet (0.15 acre) of the wetland. This wetland feature lacks a surface water connectivity (nexus) or adjacency to any jurisdictional tributary and, therefore, is not considered a federally jurisdictional water regulated by the USACE. No federal jurisdictional Waters of the United States were found on the project site during the site surveys. Because installation of the electrical conduit at the location of the wetland feature would be temporary in nature, and the area would be returned to original contours after construction, impacts on the wetland are, therefore, anticipated to be **negligible**.

4.3.1.2 Operation

No long-term biological impacts would be expected from operational activities associated with the Proposed Action. Pole-mounted light fixtures would be installed at the DCGS Pacific Hub along the site access roads and parking lots to provide exterior lighting. The exterior lighting levels would be designed for 1-foot candle average. Exterior lighting would comply with Hawaii's "Dark Sky" requirements for zero up-light components for site lighting and would follow appropriate lighting guidelines (DLNR, 2016). **Long-term** impacts during Proposed Action operations are expected to be **negligible**.

4.3.2 No Action Alternative

Under the No Action Alternative, a new DCGS Pacific Hub would not be constructed. The No Action Alternative would have **no impact** on biological resources.

4.4 Cultural Resources

4.4.1 Proposed Action

4.4.1.1 Construction

One archaeological resource (foundation remnant of Facility 17) was previously identified in the project site area near the electrical connection route. In this portion of the project site, the Proposed Action would involve installing underground electrical utilities. Although ground disturbance (trenching) would occur within the vicinity of the archaeological resource, ground-disturbing activities would avoid the foundation remnant of Facility 17. A historical map of the Wahiawa Annex prepared in 1946 depicts an antenna array in what is now an open field within the eastern portion of the proposed project area, south of Midway Drive. The foundation remnant of Facility 17 would not be disturbed during construction, and the antenna array is no longer present; therefore, the Proposed Action would have **no impact** on these resources.

The project site area is in an area of Wahiawa Annex considered to have low to no potential for archaeological sites due to recurring ground disturbance (JBPHH, n.d.); therefore, the potential for the Proposed Action to encounter previously undiscovered archaeological site or buried cultural deposits is considered **negligible**. However, in the event that previously undiscovered surface or subsurface archaeological or cultural sites were discovered during construction, ICRMP guidelines (JBPHH, n.d.) would be implemented to reduce impacts on **short-term** and **minor**.

The Proposed Action would have **no impact** on the historical cultural landscape of military lands and uses on Wahiawa Annex, because the proposed DCGS Pacific Hub design incorporates planning guidelines found in the JBPHH *Integrated Cultural Resources Management Plan* (JBPHH, n.d.); therefore, the Proposed Action would not affect the character-defining qualities of the landscape.

As discussed in Section 3.4.2, the PA (Navy, 2003) between the Navy and the Advisory Council on Historic Preservation states under Stipulation IX.A.1 that, where Navy personnel meeting the Secretary of the Interior's Historic Preservation Professional Qualification Standards determined that an undertaking does not have the potential to cause impacts, then no further review under the PA or NHPA is required. The NAVFAC HI Cultural Resource Manager has confirmed that the NHPA Section 106 requirements for the Proposed Action have been satisfied per the existing PA (Pantaleo pers. comm., 2021).

4.4.1.2 Operation

No long-term impacts on cultural resources would occur from operational activities associated with the Proposed Action, because no ground-disturbing activities would occur during Proposed Action operation.

4.4.2 No Action Alternative

Under the No Action Alternative, **no impact** on cultural resources would occur because the Proposed Action would not be constructed, and existing site conditions would be maintained.

4.5 Water Resources and Water Quality

4.5.1 Proposed Action

4.5.1.1 Construction

Earth-moving activities during Proposed Action construction could result in sediment reaching surface-water bodies and potentially cause short-term impacts on drainages. BMPs, including drainage and erosion-control measures, would be implemented during construction to manage surface runoff and pollutants. BMPs to control runoff and sedimentation would include conducting regular and documented site inspections, using silt fences, minimizing earth-moving activities during wet weather, and revegetating appropriate plant materials in disturbed areas. The project would comply with applicable federal, state, and local regulations, including the CWA (Section 402 NPDES Permit), Chapter 11-54, HAR (*Water Quality Standards*), and Chapter 11-55 (*Water Pollution Control*). An NPDES Construction General Permit or applicable state-level permit would be obtained before construction begins. The project could also require an NPDES General Permit Authorizing Discharges of Hydrotesting Waters and/or an NPDES General Permit Authorizing Discharges Associated with Construction Activity Dewatering.

The Proposed Action would comply with all applicable federal, state, and local regulations, which would reduce potential impacts on water quality resulting from construction to **short-term minor** levels.

4.5.1.2 Operation

The project site is covered primarily with vegetation with the exception of the paved areas, where the warehouses and access roads (approximately 46,650 square feet [1.1 acres] of impervious surfaces) are currently located. The Proposed Action would include approximately 249,000 square feet (5.7 acres) of paved surfaces. Considering existing paved surfaces, approximately 202,300 square feet (4.6 acres) of new impervious surfaces would be constructed at the site.

The site design would include LID in compliance with Section 438 of EISA. EISA requires the 95-percentile rainfall event to be kept on site by infiltration, evapotranspiration, or harvesting for beneficial reuse on site. As discussed in Section 2.2.2.4, Grading and Retaining Walls, and Section 2.2.2.5, Stormwater Management, drainage and grading would be integrated with LID stormwater management where grading would direct runoff from impervious pavement surfaces onto vegetated surfaces. Storm drain inlets would be provided as needed to drain the areas that cannot be directed to vegetated swales. LID stormwater designs (for example, bioretention basins, bioswales, vegetated strips) encourage percolation and minimize the impact of runoff discharged into the nearby area streams and would be incorporated into the project design (Figure 2-2 in Section 2). In addition, permeable pavement and sidewalk would be considered as options for final design, based on site-specific soil analysis.

The Proposed Action would not likely generate or result in any adverse long-term impacts on groundwater or surface water resources, nor would they increase the potential for resource infiltration due to runoff or pollutants. The project would implement measures to capture and retain stormwater on site and allow it to infiltrate into the soil or to be discharged at a rate that would not exceed the predevelopment hydrology to adjacent surface waters. Low-impact development stormwater management systems associated are designed to manage the increase in runoff volume from new impervious surfaces and reduce the potential for total suspended solids and other pollutants from leaving the project site. Therefore, impacts on surface and groundwater resources would be **negligible**.

4.5.2 No Action Alternative

Under the No Action Alternative, a new DCGS Pacific Hub would not be constructed. The No Action Alternative would have **no impact** on ground or surface water resources.

4.6 Geology and Soils

4.6.1 Proposed Action

4.6.1.1 Construction

Preparing the DCGS Pacific Hub site would involve extensive grading in areas where the building, parking areas, and access roads would be located. Soil removed during grading likely would be reused on site to optimize the balance of cuts and fills. Soils would be tested for PIS (refer to Section 3.8, Hazardous Materials and Waste) prior to reuse on site. Soils found to be PIS could be reused on site provided that 2 feet of clean soil cover the PIS or the PIS are covered by a hard surface, such as concrete or asphalt, per JBPHH guidance.

Vegetation removal is expected to be minimal because the project site is mostly clear of vegetation, with the exception of maintained lawn and a stand of large trees south of Midway Drive adjacent to the existing warehouses. Soil disturbance for construction of the underground force main and electrical circuits is expected to be minimal.

A geotechnical investigation has not been conducted at the project site; however, an investigation conducted at a nearby site found silty clay and clayey silt in the top 10 to 20 feet of soil. Neither unsuitable soils for bearing nor rock were encountered during the investigation (Jacobs, 2019). Deep foundations would not be required for the DCGS Pacific Hub, and the foundation is expected to comprise either isolated spread footings supporting columns and continuous strip footings supporting walls or a mat foundation for the building. A site-specific geotechnical investigation would be conducted during detailed design of the hub to verify site geotechnical conditions.

After soils are disturbed and exposed, the potential for soil erosion would increase; however, ground-altering construction activities would comply with all applicable regulatory requirements. An NPDES permit would be obtained from the HDOH for stormwater discharge associated with construction activities. BMPs for soil erosion include using soil binders in areas exposed for an extended period and erosion-control devices, such as silt fences around construction sites. All bare soils would be revegetated using native plant seed mix or native vegetation upon construction completion. The construction contractor would be responsible for implementing BMPs to control soil erosion and sedimentation during construction activities. Compliance with applicable permit requirements and implementation of BMPs to control fugitive dust and sedimentation would occur during construction; therefore, impacts on soils would be **short-term** and **minor**.

4.6.1.2 Operation

During Proposed Action operations, no ground disturbance would occur; therefore, **no impacts** are anticipated.

4.6.2 No Action Alternative

No change to geology, soils, or topography would occur under the No Action Alternative; therefore, **no impact** would occur.

4.7 Utilities and Infrastructure

4.7.1 Proposed Action

4.7.1.1 Construction

Existing underground utilities are present within in the project site boundary and could be encountered during construction of the Proposed Action. A subsurface utility survey, and coordination with the Hawaii One Call Center, would be conducted prior to construction to confirm location of existing utilities and the existence of any other undocumented utilities or features (for example, abandoned structures, piping, or refuse) to reduce the risk of unforeseen issues arising during construction that affect the site design, constructability, budget, or schedule due to existing utilities; therefore, potential impacts on undocumented utilities within the project site would be **negligible**.

Constructing the electrical subcircuits would require trenching to bury underground electrical ducts and installing manholes. Connection of the new sub-circuits has the potential to temporarily impact electrical services to existing Wahiawa Annex customers. If an outage is required to connect electrical sub-circuits, adequate advanced notice would be provided to affected customers regarding required outage dates and times; therefore, impacts on existing electrical services would be **short-term** and **minor**.

4.7.1.2 Operation

Stormwater Drainage

The Proposed Action would involve grading that would affect existing land contours and drainage patterns. Grading would be integrated with the LID stormwater management paradigm, where grading would direct runoff from impervious pavement surfaces onto vegetated surfaces. Storm drain inlets would be provided as needed to drain areas that cannot be directed to the vegetated swales. The site design would include LID in compliance with Section 438 of EISA. The EISA requires the 95-percentile rainfall event to be kept on site by infiltration, evapotranspiration, or harvesting for beneficial reuse on site.

The site design emphasizes slow flow across vegetation instead of piped high-velocity runoff flow away from the site. Stormwater management and BMPs proposed for the site include vegetated filter strips, bioretention basins, and bioswales. Drainage not retained on site would ultimately drain to the gulches to the north, south and west. The addition of vegetated BMPs and drainage structures would require maintenance during operation; however, impacts are expected to be **long-term** and **minor**.

Water

The Proposed Action would not impact the delivery of water services to existing customers. Water connections would be required for the DCGS Pacific Hub mechanical and chiller rooms for domestic water, cooling, and sprinkler service. Additionally, two fire hydrants may be required to provide complete coverage of the building and mechanical yard. The existing 8-inch connection would potentially be utilized for service to the new facilities, while a new secondary connection to the existing 14-inch water main along Midway Drive would be used to ensure necessary hydrant coverage to the front of the building.

The Proposed Action would not significantly impact the Helemano Military Reservation and the Town of Wahiawa water source; therefore, impacts are expected to be **negligible**.

Wastewater

Treating and disposing of wastewater generated from the DCGS Pacific Hub would be via the existing CCH wastewater collection system. Under the CCH wastewater collection system, wastewater would potentially be treated at the Wahiawa Wastewater Treatment Plant, and the tertiary-treated effluent would be discharged into the Wahiawa Reservoir.

The new wastewater systems would increase the amount of wastewater infrastructure and wastewater discharge on Wahiawa Annex. As stated in Section 3.7.2, the existing wastewater discharge agreement with CCH limits the Wahiawa Annex flows to 191,560 gpd average daily flow and 720,000 gpd peak wet-weather flow. The 2017 *Utility Technical Study of Wastewater Collection System JBPHH Wahiawa Annex* (Brown and Caldwell, 2017) indicated that Wahiawa Annex had an average daily wastewater flow of 149,420 gpd. Under the Proposed Action, for each increase of 50 people, average daily flow likely would increase by 1,500 gpd, which is within the limits of the wastewater agreement for personnel anticipated to occupy the facility. Because wastewater generated by the Proposed Action would be within the existing limits of the wastewater agreement with CCH, no significant impact would occur to wastewater capacity under the CCH wastewater discharge agreement. Increased operation and maintenance requirements for the new wastewater infrastructure is anticipated to be **long-term** and **minor**.

Electrical

Under the Proposed Action, the existing electrical transformer that supplies power to the warehouses would be demolished before construction, and new electrical subcircuits would be constructed underground from the DCGS Pacific Hub to either manhole NC13 or NC14 located at Polaris Drive (Figure 2-5 in Section 2). The 501 switching station located in the western portion of Wahiawa Annex has the capacity to supply electricity for operation of the Proposed Action. The new electrical circuits would be connected to the 501 switching station either through existing circuits (P10 and P11) or ductbanks located along Polaris Drive or by new circuits that may be constructed under a separate Navy project. If either option is not available, then the USAF would consider constructing additional circuits along Polaris Drive from manhole NC13 or NC14 to the 501 switching station under an addendum to this EA. The availability and use of electrical circuits or spare underground electrical ducts would be coordinated and verified with the Navy Base Utility at Wahiawa Annex. After the electrical connection to the 501 switching station is established, the Proposed Action would have a **long-term minor** impact on the environment during operation resulting from routine maintenance of the electrical circuits.

4.7.2 No Action Alternative

Under the No Action Alternative, a new DCGS Pacific Hub would not be constructed; therefore, no changes to utilities would occur and there would be **no impact**.

4.8 Hazardous Materials and Wastes

4.8.1 Proposed Action

4.8.1.1 Construction

Under the Proposed Action, the existing Wahiawa Annex warehouses would be demolished, and demolition materials would be characterized for disposal or recycle. Warehouse demolition could result in generating HAZMAT and hazardous waste to include ACM and LBP. If ACM is determined to be present in the existing JBPHH Wahiawa Annex warehouses, then the ACM would be properly removed and disposed of during deconstruction and demolition according to NAVFAC's *Asbestos Program Management* (NAVFAC, 2017). LBP could be present in the existing JBPHH Wahiawa Annex warehouses. During demolition, any potential LBP would be properly handled and disposed of in accordance with federal, state, and local laws; therefore, the impact from ACM and LBP would be **short-term** and **minor**.

PIS could be present at the JBPHH Wahiawa Annex warehouses. Grading the soils from under the warehouses could spread PIS throughout the project site and expose personnel to them during construction. Current JBPHH guidance allows PIS to be reused on site provided 2 feet of clean soil cover the PIS or the PIS is covered by a hard surface, such as concrete or asphalt, resulting in no exposure pathways for personnel. Soils would be tested to determine presence and levels of PIS. Any potential PIS would be properly handled and reused on site according to JBPHH guidance or disposed of in accordance with federal, state, and local laws regarding hazardous waste; therefore, the impact would be **short-term** and **minor**.

Soil excavated at the project site is anticipated to be reused on site; however, excess or surplus soil could potentially be reused on Wahiawa Annex property for erosion issues or as fill for antenna fields provided that the soil is clean (free of debris) and does not contain hazardous waste (such as polychlorinated biphenyl waste). Prior to reuse, soils would be tested, and contaminant concentrations would be less than or equal to current Tier 1 Unrestricted Land Use Environmental Action Levels established by the HEER of the HDOH.

If unexpended small arms ammunition or munitions and explosives of concern/material potentially presenting an explosive hazard are encountered during construction, then the appropriate explosive ordnance disposal unit would be contacted to assess the situation and recover and/or dispose of any dangerous materials that are found. Further construction activities would be assessed to minimize unintentional contact with undocumented munitions and explosives of concern/material potentially presenting an explosive hazard and unexploded ordnance construction support should be considered during intrusive trenching or excavation activities; therefore, the impact from potential ordnance would be **short-term** and **minor**.

Due to the localized nature of construction activities and in-place safety precautions, impacts from construction would be **short-term** and **minor**.

Construction workers and equipment operators would comply with OSHA regulations for worker safety, including wearing appropriate personal protective equipment and being properly trained for the work being performed. The HWMP (NAVFAC HI, 2014) provides instructions for properly managing hazardous waste to minimize potential adverse effects on human health and the environment during project construction. To protect public health and the environment, all solid or hazardous waste would be properly identified, handled, accumulated, managed, and disposed of at a permitted facility or designated collection point and in accordance with all applicable laws and regulations.

A Health and Safety Plan would be completed prior to construction to address worker safety. All work areas would be clearly marked with appropriate signage. Construction managers would be required to comply with OSHA, as well as other applicable federal, state, USAF, and Navy regulations. Compliance with the HWMP and OSHA and other applicable regulations would increase safety for construction workers; therefore, the Proposed Action would have a **negligible** impact on occupational health.

4.8.1.2 Operation

The quantity of HAZMAT such oil, hydraulic fluid, solvents, and sealants related to DCGS Pacific Hub operations would increase on Wahiawa Annex with implementation of the Proposed Action. HAZMAT produced and required by personnel would be procured, controlled, and tracked through the Environmental Services Hazardous Waste Disposal Branch, following established NAVFAC HI procedures; this would allow all HAZMAT used to be properly tracked.

Three emergency generators and two diesel fuel storage tanks would operate at the project site. The diesel fuel storage tanks are expected to use Convault concrete and steel tanks that include integral secondary containment. The fuel storage tanks would be monitored for leaks, and additional supplemental secondary containment would not be required. Subbase fuel storage tanks, which have a secondary tank integral to the assembly, would be used under the emergency generators for secondary containment. The engine crankcase of each generator may require secondary containment, which will be determined during design.

The project would require an SPCC plan that would describe how design and operation of the emergency generators and diesel fuel storage tanks would comply with SPCC rules and requirements to prevent oil pollution. A copy of the final version of the SPCC plan would be submitted to the Navy Host Command's SPCC Program Manager, NAVFAC HI EV13. The tenant command must follow the requirements set forth by the SPCC plan for maintaining their fuel system to ensure no fuel is discharged into the installation's stormwater system, waterways, or tributaries. The SPCC plan would be made available for review upon request by the Navy Host Command.

Examples of operational practices and BMPs to reduce long-term impacts from operating the emergency generators and diesel fuel storage tanks include providing an emergency action plan; training personnel; testing associated alarms, interlocks, and controls; and posting the SPCC plan. In addition, inspecting and maintaining the area around the tanks; properly maintaining and inspecting fire prevention equipment; employing maintenance and operational practices that control leakage and prevent spillage; and keeping the area free of weeds, trash, and other combustible materials would be implemented to reduce impacts from potential leaks and failures due to operation of these facilities.

The emergency generators and diesel fuel storage tanks would meet all applicable SPCC plan requirements, and the project would implement operational practices and BMPs to contain potential leaks and failures; therefore, the Proposed Action would result in a **negligible** impact from operating these facilities.

The quantity of hazardous and/or solid waste generated would increase as a result of operations at the DCGS Pacific Hub and associated infrastructure at JBPHH; however, all hazardous waste generated as a result of this work would be properly handled, stored, and disposed of following the HWMP (NAVFAC HI, 2014), ensuring that hazardous waste is managed according to federal, state, and local laws and regulations. As such, impacts would be **negligible** from the procurement and use of HAZMAT or the storage and disposal of hazardous waste under the Proposed Action.

Operating the DCGS Pacific Hub facility would comply with OSHA principles, as well as other applicable federal, state, USAF, and Navy health and safety regulations; therefore, impacts on occupational health and safety during operation would be **negligible**.

4.8.2 No Action Alternative

Under the No Action Alternative, construction and operation would not occur; therefore, there would be **no impacts** on any HAZMAT, hazardous or special wastes, or occupational health and safety.

4.9 Socioeconomics

4.9.1 Proposed Action

4.9.1.1 Construction

Changes in the socioeconomic resources resulting from changes during construction were evaluated in terms of their direct impact on population, employment, and income. The changes in the socioeconomic resources would be a direct result of the changes in employment (number of workers during project construction) and income (measured as expenditures during project construction) in the study area.

In addition to these direct economic effects, the Proposed Action would also result in secondary (indirect and induced) economic effects. These economic effects include changes in characteristics such as regional employment and income. Secondary employment effects would include indirect employment resulting from purchasing goods and services by firms involved with construction and induced employment because of construction workers spending their income within the project area.

In addition to these secondary employment impacts, construction activity would also result in indirect and induced incomes. The magnitudes of these economic effects depend on the initial changes in economic activity within the region (such as construction expenditures), the interactions within the regional economy, and the linkages of economic activity from this regional economy to the larger, surrounding economy. Economic linkages create multiplier effects in a regional economy as money is circulated by trade. Economic linkages reduce the multiplier effects in a regional economy.

The IMPLAN model—an economic input-output model commonly used by federal agencies for these types of analyses—was used to estimate the regional economic effects of construction-related expenditures for the action alternatives. The IMPLAN model package includes county-level data to describe the local economy in a given year and an online platform that allows users to input more refined and/or accurate input data reflecting the regional economy.

Indirect and induced economic effects during construction were evaluated using an IMPLAN model of Honolulu County and the 2018 IMPLAN county data. The project's construction costs were refined using assumptions on construction duration, construction cost split (between materials/equipment and labor), labor force origin and size, and origin of construction materials. Because the IMPLAN model is an annual model that evaluates the regional economic effects of changes in local expenditures, identifying which of the Proposed Action's costs were on locally sourced material and labor inputs. As with any model, the accuracy of the results depends on the accuracy of the inputs. Cost estimates are preliminary and may change as engineering design is refined. Cost estimates are in 2020 dollars and were run in the IMPLAN model as such. The labor income results out of the IMPLAN model are reported in 2020 dollars to facilitate comparisons to existing income levels in the study area.

Table 4-6 shows the total construction costs associated with the Proposed Action. The project's total design and construction cost is estimated to be between $78 million and $134 million (in 2020 dollars). Of this estimated construction cost, 27 percent is assumed to be construction payroll while the remaining 73 percent is assumed to be cost of materials. The project anticipates that between 80 and 90 percent of the construction workforce would come from within the County of Honolulu and about 10 to 30 percent of the material cost would be from locally sourced materials. Table 4-7 summarizes these cost assumptions split between labor and materials and local (within Honolulu county) and nonlocal (outside Honolulu county).

Table 4-6. Project Construction Costs

Low Range (-15 percent)	Estimated Costs	High Range (+30 percent)
$78,504,439	$98,503,108 ECC	$120,065,613
$87,787,589	$110,151,101 Project Cost	$134,263,372

Source: Jacobs (2019) Table 5-2

ECC = estimated construction cost

Table 4-7. Assumptions on Construction Costs Split

		Regional	
Construction Expenditure	Total (percent)	Local (percent)	Nonlocal (percent)
Labor	27	80 - 90	10 - 20
Materials	73	10 - 30	70 - 90

The construction duration for the project is estimated to be 39 months. This construction schedule was used to develop the corresponding annual estimates for input into the IMPLAN model. Table 4-8 summarizes these annual local construction cost inputs when the local labor is assumed to be 85 percent (that is, midpoint of the 80 percent and 90 percent range shown in Table 4-7) and expenditures on locally sourced materials are assumed to be 20 percent (that is, the midpoint of the 10 percent and 30 percent range shown in Table 4-7).

Table 4-8. Total Annual Local Construction Cost Estimates

Low Range (-15 percent)	Estimated Costs	High Range (+30 percent)
$14,258,229	$16,774,388	$21,806,704
$17,370,088	$20,435,398	$26,566,017

To estimate the regional economic impacts associated with Proposed Action, only the highest and lowest values in Table 4-8 were used as input into the IMPLAN model. Table 4-9 summarizes the regional economic impacts associated with the Proposed Action in terms of employment and labor income. Total annual employment is estimated to be between 197 and 367 full-time equivalents (FTEs). This estimate includes both the direct annual FTEs and the secondary (indirect and induced) annual FTEs created by the project. The total annual increase in FTEs in Honolulu county represents about 0.1 percent of the 2018 total employment and 1.1 percent of the 2018 construction employment (Table 4-8).

The increase in regional employment would be accompanied by increased labor incomes within the study area. Construction of the proposed project is expected to result in an increase of about $16.3 million to $30.2 million (in 2020 dollars) in total annual labor income. This estimate includes both the direct and secondary (indirect and induced) annual labor incomes. The increase in total annual regional labor income represents less than 0.1 percent of the 2018 total personal income (Table 4-9) in Honolulu County of $60 billion (in 2020 dollars). Construction of the Proposed Action result in **a minor, short-term economic benefit**.

Table 4-9. Regional Employment and Income Impacts Associated with Construction

Impact	Employment (FTEs)	Labor Income (2020 million dollars)
Direct	126 to 235	$11.7 to $21.8
Indirect	17 to 32	$1.3 to $2.3
Induced	54 to 100	$3.3 to $6.1
Total	197 to 367	$16.3 to $30.2

FTE = Full-time equivalent

4.9.1.2 Operation

The impacts associated with the construction phase are temporary and, as such, different from the long-term effects associated with the operational phase of the project. Operation of the DCGS Pacific Hub is expected to require additional personnel; however, because most of these personnel currently live or work in the project vicinity, **no impacts** would be associated with operational payroll on the socioeconomic resources in Oahu.

4.9.2 No Action Alternative

Under the No Action Alternative, a new DCGS Pacific Hub would not be constructed; therefore, no changes to the socioeconomic resources of the project site would occur and there would be **no impact**.

4.10 Traffic

4.10.1 Proposed Action

A traffic study (Appendix C) was prepared for the Proposed Action to evaluate the Proposed Action's effects on traffic during construction and operation (Jacobs, 2021). This section summarizes that study's findings.

4.10.1.1 Construction

Large trucks and other vehicles would be necessary to transport construction materials and equipment to the project site from various locations on Oahu. In addition, construction personnel would be required on site throughout all construction activities. Construction activities are anticipated to occur on weekdays only during daylight hours. Depending on delivery schedules and availability of materials, trucks may be required to enter or exit the site throughout a typical day.

During project construction, travelers at the study intersections would likely experience temporary increases in average vehicle delay and longer queue lengths when large, heavy, slow-moving trucks are traveling along the project area roadways between the Wahiawa Annex and Honolulu. While these impacts may be noticeable, they would be temporary and could be minimized by providing advanced warning of construction activities, implementing a traffic management plan, coordinating with state and local transportation authorities, and obtaining required permits. Therefore, impacts on traffic during Proposed Action construction are anticipated to be **short-term** and **minor**.

4.10.1.2 Operation

Trip Generation and Distribution

When DCGS Pacific Hub operations begin, staff would be on site 24 hours per day, 7 days a week to maintain operations. Of the 200 personnel expected to occupy the DCGS Pacific Hub, approximately 50 personnel are anticipated to be already currently working at the Wahiawa Annex and then reassigned to the DCGS Pacific Hub. Assuming the remaining 150 personnel would travel to the hub alone (no carpooling assumed), 150 new-vehicle round-trips (one inbound trip and one outbound trip) would be generated each day and added to the transportation network. These 150 personnel vehicle trips to and from the DCGS Pacific Hub are not anticipated to affect regional traffic patterns or contribute to commute peak congestion on the H-1 or H-2 freeways.

Staff commuting to and from the Wahiawa Annex would likely travel in the opposite direction of commuter traffic for employment based in downtown Honolulu or Kapolei, the island’s primary business centers. Also, because of the hub’s unique staffing and operations requirements, personnel arrivals and departures at the hub during operations would occur throughout the day as necessary and would not be concentrated around the typical morning or afternoon commute peaks. Personnel are expected to travel to Wahiawa Annex throughout the day and would often travel in the opposite direction as commuter traffic on the H-1 or H-2 freeways; therefore, impacts on traffic during commute peak hours is expected to be **long-term** and **minor**.

Intersection Operations

Operating the Proposed Action would not require changes to lane configurations at any study intersection. Most intersection movements would operate within the acceptable LOS D threshold during DCGS Pacific Hub operations.

Tables 4-10 and 4-11 summarize the intersection operational results, compared with the No Action Alternative. With operations trips, the minor increases to average vehicle delay for individual turning movements are **negligible**, and most movements are expected to operate within the acceptable LOS D threshold.

Intersection movements expected to operate at LOS E when DCGS Pacific Hub operations begin would do so with or without the project, not as a result of project-generated operations trips on the transportation network. Therefore, impacts on traffic during operation of the Proposed Action are anticipated to be **negligible.**

Table 4-10. No Action Alternative and Proposed Action (2027) A.M. Peak-Hour Intersection Analysis

	No Action Alternative (2027) A.M. Peak Hour		Proposed Action (2027) A.M. Peak Hour	
Intersection and Movement	**Delay [1]**	**LOS**	**Delay [1]**	**LOS**
1. Kamehameha Highway at Whitmore Avenue	***41.1***	***D***	***43.2***	***D***
Westbound left	59.7	E	61.4	E
Westbound right	0.0	A	0.0	A
Northbound through	33.8	C	36.1	D
Northbound right	0.0	A	0.0	A
Southbound left	66.0	E	68.6	E
Southbound through	14.4	B	15.0	B
2. Kamananui Road at Kaukonahua Road	***9.1***	***A***	***9.3***	***A***
Eastbound left/through/right	25.1	C	25.0	C
Westbound left/through/right	27.5	C	27.5	C
Northbound left/through/right	4.1	A	4.2	A
Southbound left/through/right	3.1	A	3.2	A
3. Kamehameha Highway at California Avenue	***29.4***	***C***	***29.4***	***C***
Eastbound left/through	49.2	D	49.2	D
Eastbound through/right	52.7	D	52.7	D
Westbound left/through	43.7	D	43.7	D
Westbound right	32.8	C	32.8	C
Northbound left	17.9	B	18.0	B
Northbound through	22.9	C	23.1	C
Northbound right	23.9	C	23.9	C
Southbound left	17.8	B	17.9	B
Southbound through	24.0	C	24.2	C
Southbound right	17.6	B	17.6	B
4. Saipan Drive at Whitmore Avenue				
Eastbound left	12.9	B	13.4	B
Southbound left	36.3	E	38.3	E
Southbound right	11.4	B	11.6	B

Note: Results reported are consistent with the 2010 methodology in *HCM2010: Highway Capacity Manual 2010* (TRB, 2010).

[1] Delay is the average measured in seconds per vehicle.

A.M. = ante meridiem
LOS = level of service

Table 4-11. No Action and Proposed Action (2027) P.M. Peak-Hour Intersection Analysis

Intersection and Movement	No Action Alternative (2027) P.M. Peak Hour		Proposed Action (2027) P.M. Peak Hour	
	Delay [1]	LOS	Delay [1]	LOS
1. Kamehameha Highway at Whitmore Avenue	***46.5***	***D***	***49.4***	***D***
Westbound left	52.0	D	53.6	D
Westbound right	0.0	A	0.0	A
Northbound through	55.5	E	62.5	E
Northbound right	0.0	A	0.0	A
Southbound left	60.9	E	61.2	E
Southbound through	***28.4***	***C***	***29.5***	***C***
2. Kamananui Road at Kaukonahua Road	***14.9***	***B***	***15.2***	***B***
Eastbound left/through/right	19.7	B	19.6	B
Westbound left/through/right	25.9	C	26.1	C
Northbound left/through/right	12.1	B	12.5	B
Southbound left/through/right	10.2	B	10.5	B
3. Kamehameha Highway at California Avenue	***36.9***	***D***	***37.0***	***D***
Eastbound left/through	48.4	D	48.4	D
Eastbound through/right	53.0	D	53.0	D
Westbound left/through	47.3	D	47.3	D
Westbound right	35.4	D	35.4	D
Northbound left	23.1	C	23.4	C
Northbound through	30.3	C	30.6	C
Northbound right	43.0	D	43.0	D
Southbound left	23.6	C	23.8	C
Southbound through	31.1	C	31.4	C
Southbound right	22.1	C	22.1	C
4. Saipan Drive at Whitmore Avenue				
Eastbound left	10.1	B	10.3	B
Southbound left	22.4	C	23.4	C
Southbound right	15.3	C	15.9	C

Note: Results reported are consistent with the 2010 methodology in *HCM2010: Highway Capacity Manual 2010* (TRB 2010).

[1] Delay is the average measured in seconds per vehicle.

LOS = level of service
P.M. = post meridiem

4.10.2 No Action Alternative

Under the No Action Alternative, DCGS Hub construction and operation would not occur; therefore, there would be **no impacts** on traffic.

4.11 Cumulative Impacts

On July 15, 2020, the CEQ announced its final rule: *Update to the Regulations Implementing the Procedural Provisions of the National Environmental Policy Act*. The CEQ recognizes that analyzing indirect and cumulative impacts is, by its nature, speculative in most cases; therefore, an indirect or cumulative analysis is no longer required to be evaluated during the NEPA process under the final rule. The revised regulation applies to actions begun after the effective date of September 14, 2020; however, agencies have discretion to apply to ongoing reviews. A cumulative impact analysis is included in the EA as the analysis began prior to the effective date of the final rule.

Cumulative impacts are defined by the CEQ as “the impact on the environment which results from the incremental impact of the action when added to other past, present or reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertake such other actions” (40 CFR 1508.7). Cumulative impacts can result from individually minor but collectively substantial actions undertaken over a period by various agencies or individuals. Cumulative impacts must occur to the same resources, in the same geographic area, and within the same period as the Proposed Action.

Actions to consider in the cumulative impact assessment include past, present, and reasonably foreseeable future actions that have the potential to combine with incremental effects of the Proposed Action. Projects considered for the cumulative impact assessment have been recently completed, are ongoing, or are planned to begin within the next 2 years. The following subsections describe foreseeable future military and private actions of similar character that could affect similar environmental resources or actions that are located in proximity to the Proposed Action:

Following are existing or planned projects on **Wahiawa Annex**:

- **Current to fiscal year (FY) 2021—**P013 Renovation of Building 261, Communication Center, is currently under construction; it is located near the Whitmore Gate.
- **FY2021/FY2022—**Various small projects for antennas and a small building located in the northern portion of Wahiawa Annex are planned.
- **FY2021—**A water well and pump system is planned for construction in the eastern portion of Wahiawa Annex.

Following are **planned future HDOT projects** (HDOT, 2020):

- **Wahiawa Pedestrian Bridge, Whitmore Village to Wahiawa (HDOT Project Number HWY-O-07-18)—** The project, currently in the environmental review/design phase, involves constructing a pedestrian bridge spanning from Whitmore Village to Wahiawa. The estimated construction date is not available.
- **Kamehameha Highway, Kamananui Road, and Wilikina Drive Rehabilitation, Vicinity of Weed Circle to Interstate Route H-2 (HDOT Project Number NH-099-1(031)–**This project involves making roadway pavement and infrastructure improvements. The estimated construction date is not available.

Following are **current HDOT projects** (HDOT, 2020):

- **Slope Improvements For Erosion Control at Various Sites On Oahu, Phase 8 (HDOT Project Number HWY-O-01-18, Mileposts 7.63 to 7.79 [Kamananui Road/Wilikina Drive)—**Improvements include clearing vegetation; grading the site; demolishing and removing the existing concrete ditch; installing new drainage culverts, concrete baffle box and grouted rip rap; installing and maintaining permanent

BMPs; applying hydromulch; installing and maintaining temporary erosion control BMPs; and providing traffic control. The project is currently 95-percent complete.

- **Interstate Route H-2 and Moanalua Freeway, Guardrail and Shoulder Improvements (HDOT Project Number IM-STP-0300 (106)—**Improvements include installing and upgrading all guardrails and constructing guardrail-to-bridge connections, bridge railings, guardrail end terminals, crash attenuators, shoulder improvements, miscellaneous drainage, and other appurtenant improvements. The project is currently 95 percent complete.
- **Interstate Route H-2 Installation of Enhanced Pavement Marking and New Milled Rumble Strip at Various Locations, Island of Oahu (HDOT Project Number HSIP-0300(155) WO 1)—**The construction date is not available.

A discussion about how these activities could affect the same resource areas of the Proposed Action is provided below.

4.11.1 Air Quality

The Proposed Action would result in negligible overall effects to air quality due to the temporary, localized, and minor nature of criteria pollutant emissions resulting from Proposed Action construction activities and the negligible, intermittent nature of air emissions resulting from Proposed Action operational activities. No other large construction projects are scheduled to occur at the Wahiawa Annex concurrently with the Proposed Action, and no other significant stationary sources of emissions are located near the project; therefore, effects to air quality would not be cumulatively significant.

4.11.2 Noise

Cumulative noise effects could occur if noise from other construction activities were to interact with noise from the Proposed Action. Construction-related noise from the Proposed Action would be short-term and minor, and no other large construction projects are scheduled at Wahiawa Annex concurrently with the Proposed Action; therefore, no cumulative noise impacts during construction would occur. Outdoor mechanical equipment would be a long-term source of noise at the project site that could interact with other noise sources in the project area.

Sound levels at any receiver are dominated by the loudest source, and sound levels do not add arithmetically given the logarithmic nature of decibels and decibel addition. That is, 50 dBA plus 50 dBA does not equal 100 dBA, but 53 dBA. When comparing similar sources (traffic with traffic), 3 dBA is considered the threshold of a perceivable difference. When one source is louder than another by 10 dBA, the combined sound level is the same as the loudest source (60 dBA plus 50 dBA equals 60 dBA). Thus, cumulative impacts for noise are typically limited to a just perceivable amount or similar to those of the Proposed Action; therefore, impacts from noise would not be cumulatively significant.

4.11.3 Biological Resources

The Proposed Action would not result in permanent impacts on protected biological resources. The identified cumulative projects near the Proposed Action would also comply with consultation and permit requirements for impacts on protected biological resources as needed; therefore, impacts would not be cumulatively significant.

4.11.4 Cultural Resources

The Proposed Action would not affect known historical or cultural resources on Wahiawa Annex; therefore, no cumulative impacts on cultural resources would occur. In the event that previously undiscovered surface or subsurface archaeological or cultural sites were discovered during construction of the Proposed Action or other construction projects occurring on Wahiawa Annex, ICRMP guidelines (JBPHH, n.d.) would be implemented, and no cumulative impacts on cultural resources would occur. The Proposed Action, when combined with other future projects on the annex, would not be cumulatively significant.

4.11.5 Water Resources and Water Quality

The Proposed Action could result in short-term minor impacts on water resources during construction. Earth-moving activities associated with multiple construction projects occurring simultaneously could affect water resources by decreasing the quality of surface water runoff during storm events. Impacts from multiple actions would be reduced by adhering to the basewide permits and programs that are currently in place or would be implemented under the Proposed Action. Individual projects could have NPDES and stormwater pollution prevention plan requirements, further minimizing impacts on water quality. No significant cumulative impacts are expected.

4.11.6 Geology and Soils

The effects of the Proposed Action, when combined with impacts of the identified cumulative activities, would not have significant cumulative impacts on geology or soil resources in the area due to the distance between projects.

4.11.7 Utilities

The Proposed Action would construct new electrical and wastewater systems on Wahiawa Annex and would result in an increase in use of electricity and water and an increase in wastewater discharge. The identified cumulative projects near the Proposed Action would include renovating a facility and other various small projects on Wahiawa Annex and local transportation projects outside of the annex, none of which would require a long-term increase in electric or water consumption or an increase in wastewater discharge. Discharge of wastewater associated with the Proposed Action would be within the limits of the wastewater discharge agreement with CCH. Therefore, the effects of the Proposed Action, when combined with impacts of other past present or reasonably foreseeable projects, would not have significant cumulative impacts on utilities.

4.11.8 Hazardous Materials and Wastes

HAZMAT or wastes encountered or generated during the Proposed Action would be managed in accordance with AFI 32-7086, *Hazardous Materials Management* (USAF, 2004); AFPD 32-7042*, Waste Management* (USAF, 2010); and the HWMP (NAVFAC HI, 2014). Any future actions at Wahiawa Annex would also comply with these guidelines. Therefore, the Proposed Action, in conjunction with other future proposed projects at the annex, would not be cumulatively significant.

4.11.9 Socioeconomics

The Proposed Action would temporarily increase the demand for labor during the project construction; however, the increase in demand for labor would constitute a very small proportion of the total employment, as well the construction sector employment, in the county. Although a number of projects are currently under development near the Proposed Action that could potentially have an adverse cumulative socioeconomic effect, most of these projects have not advanced to the point where enough is known about them in terms of construction workforce requirements or construction schedule.

4.11.10 Traffic

The Proposed Action would temporarily affect the local roadway network during project construction because of minor, short-term increases in truck traffic and traffic from construction workers in personal vehicles. The other cumulative projects constructed concurrently with the Proposed Action could also temporarily affect the local roadway network. However, traffic volumes during construction are expected to be within the capacity of local and regional roadways, and a long-term increase in traffic volume is anticipated to be minor. Given the minor increases in traffic, the contribution of the Proposed Action to cumulative traffic impacts would not be significant.

4.12 Irreversible and Irretrievable Commitments of Resources

An irreversible or irretrievable commitment of resources refers to impacts on or losses to resources that cannot be recovered or reversed if the Proposed Action is implemented. Implementing the Proposed Action would commit natural and built resources to the DCGS Pacific Hub construction and operation.

The Proposed Action would irreversibly and irretrievably commit the following types of resources: (1) general development costs, including labor, fuels, energy, and construction equipment and materials; (2) project-specific resources, such as natural resources and land use at the project site; and (3) operational resources, such as materials, electricity, and water. No irreversible or irretrievable resources would be committed for the No Action Alternative.

SECTION 5

List of Preparers

Table 5-1 lists individuals who contributed to the preparation of this EA.

Table 5-1. Environmental Assessment Preparers

Name	Role	Education	Years of Experience
Chris Manz	Program Manager	BS, Mechanical Engineering	30
Richard Manz	Project Manager	BA, General Science; MS, Geology	36
Julie Petersen	Senior Planner	BS, Biology	16
Michelle Rau	Senior Technical Consultant	BS, Ecology and Evolutionary Biology MBA, Business Administration	24
Julie Hong	Project Quality Control Manager	BA, Environmental Science MS, Environmental Science and Policy	26
Nancy Nishikawa	Senior Technical Consultant	MUP, Urban and Regional Planning MS, Natural Resource Policy and Management	33
Marjorie Eisert	Senior Biology Consultant	B.S., Wildlife and Fisheries Biology	32
Kristine Hargreaves	Senior Technical Consultant	MA, Architecture	39
John Cardenas	Senior Utility Consultant	BS, Civil and Infrastructure Engineering	16
Roger Collette	Senior Electrical System Consultant	BS, Electrical Engineering	31
Miya Akiba	Planner	BS, Global Environmental Science	13
Jeff Onaga	Water Resource Engineer	BS, Civil Engineering	5
George DeMetropolis	Hazardous Waste and Ordnance Senior Technical Consultant	BS, Political Science/French MBA, Business Administration (Management) PhD, Business Administration	43
Mark Bastasch	Acoustical Engineer	BS, Environmental Engineering MS, Environmental Engineering	22
Jeremy Hollins	Cultural Resources Senior Consultant	BA, History (Environmental) MA, Public History	18
Jonathan Straley	Electrical and Telecommunications Engineer	BS, Electrical Engineering	7.5
Carlos Kelton	Planner	BA, Environmental Geography MA, Urban and Regional Planning	6
Fatuma Yusuf	Economist	BS, Range Management; MA, Agricultural Economics MS, Statistics PhD, Agricultural Economics	23
Elizabeth Schwing	Air Quality Specialist	BS, Chemical Engineering	11
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Table 5-1. Environmental Assessment Preparers

Name	Role	Education	Years of Experience
Shane Tom	Biologist	BS, Biology; MS, Ecology and Evolutionary Biology	3.5
Ken Greene	Hazardous Waste and Ordnance Specialist	BS, Natural Resources Management	20
Terry Yuen	Traffic Engineer	BS, Civil Engineering	20
Alexander Oliver	GIS Professional	BS, Geology and Geophysics	4
Sharon Mirikitani	Project Assistant	BA, Japanese	25
Jennifer Moore	Technical Editor	BS, English and Journalism MTSC, Technical and Scientific Communication	25
Manomi Fernando	Document Processor	BA, Communication Studies	15

References

AECOS Inc. 2021a. *Biological Assessment Distributed Common Ground Facility at the Wahiawa Annex of Joint Base Pearl Harbor Hickam (JBPHH).* March.

AECOS Inc. 2021b. *Natural Resources Assessment for a Distributed Common Ground Facility JBPHH Wahiawa Annex, O'ahu*. January.

Air Force Civil Engineer Center (AFCEC). 2019. *Air Force Air Quality Environmental Impact Analysis Process (EIAP) Guide – Fundamentals*. Volume 1 of 2. Prepared by Solutio Environmental, Inc. Prepared for U.S. Department of the Air Force, Air Force Civil Engineer Center, Compliance Technical Support Branch. May.

ASM Affiliates, Inc. (ASM). 2021. *Historic Properties Study in Support of a National Environmental Policy Act Environmental Assessment for the Construction of a Distributed Common Ground Station Pacific Hub at Joint Base Pearl Harbor-Hickam, Wahiawa Annex, Oahu, Hawaii*. January.

Brown and Caldwell. 2017. *Utility Technical Study of Wastewater Collection System JBPHH Wahiawa Annex*. Prepared for Naval Facilities Engineering Command, Pacific Joint Base Pearl Harbor-Hickam. February.

Bureau of Economic Analysis (BEA). 2020a. *Regional Data – Local Area Personal Income and Employment – CAEMP25N Total full-time and Part-time Employment by NAICS Industry*. Accessed at http://www.bea.gov/regional/index.htm. Accessed September 30, 2020. U.S. Department of Commerce, Bureau of Economic Analysis.

Bureau of Economic Analysis (BEA). 2020b. *Regional Data – GDP and Personal Income – CAINC5N Personal Income By Major Component and Earnings by NAICS Industry*. Accessed at http://www.bea.gov/regional/index.htm. Accessed September 30, 2020. U.S. Department of Commerce, Bureau of Economic Analysis.

Bureau of Economic Analysis (BEA). 2020c. *GDP and Personal Income, National Data*. Table 1.1.9. Implicit Price Deflators for Gross Domestic Product. Accessed at https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=2#reqid=19&step=2&isuri=1&1921=survey. Accessed September 25, 2019 and September 30, 2020. U.S. Department of Commerce, Bureau of Economic Analysis.

Bureau of Labor Statistics (BLS). 2020. *Local Area Unemployment Statistics*. Accessed at https://www.bls.gov/lau/#tables. Accessed October 1, 2020. U.S. Department of Commerce, Bureau of Labor Statistics.

Bureau of Labor Statistics (BLS). 2021. *Metropolitan Area Employment and Unemployment – November 2020*. News Release USDL-21-0001. Accessed at https://www.bls.gov/news.release/archives/metro_01052021.pdf. Accessed January 20, 2021. U.S. Department of Commerce, Bureau of Labor Statistics. January 5.

Carnes, Corrina. 2021. Personal communication via email from Corrina Carnes/Naval Facilities Engineering System Commend to Marjorie Eisert/Jacobs Engineering Group Inc. March 17.

City and County of Honolulu (CCH). 2017. *Storm Water BMP Guide for New and Redevelopment for the City and County of Honolulu*. Permit No. HI S000002. Prepared by City and County of Honolulu, Department of Planning and Permitting. Accessed at https://www.honolulu.gov/rep/site/dfmswq/dfmswq_docs/SW_BMP_Guide_REVISED_July_2017.pdf. July.

City and County of Honolulu (CCH). 2018. *Potential Flood Area Reference Map*. Prepared by City and County of Honolulu, Department of Planning and Permitting. January.

Federal Emergency Management Agency (FEMA). 2020. Digital flood data Honolulu, City and County of Unincorporated Areas – Flood Map 15003C0140F. FEMA Flood Map Service Center. Accessed at https://msc.fema.gov/portal/search?AddressQuery=Wahiawa%2C%20Hawaii#searchresultsanchor. Accessed November 2020.

Federal Highway Administration (FHWA). 2006. *Construction Noise Handbook.* Final Report. FHWA-HEP-06-015, DOT-VNTSC-FHWA-06-02, NTIS No. PB2006-109102. Chapter 9 Construction Equipment Noise Levels and Ranges. Accessed at http://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/handbook09.cfm. U.S. Department of Transportation, Federal Highway Administration, Office of Planning, Environment, and Realty. August.

Federal Highway Administration (FHWA). 2009. *Manual on Uniform Traffic Control Devices for Streets and Highways*. 2009 Edition, including Revision 1, dated May 2012, and Revision 2, dated May 2012. U.S. Department of Transportation, Federal Highway Administration. Accessed at https://mutcd.fhwa.dot.gov/. December.

Federal Transit Administration (FTA). 2018. *Transit Noise and Vibration Impact Assessment Manual*. FTA Report No. 0123. Prepared by U.S. Department of Transportation, Federal Transit Administration, John A. Volpe National Transportation Systems Center. Accessed at https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/118131/transit-noise-and-vibration-impact-assessment-manual-fta-report-no-0123_0.pdf. September.

Giambelluca, T.W., X. Shuai, M.L. Barnes, R.J. Alliss, R.J. Longman, T. Miura, Q. Chen, A.G. Frazier, R.G. Mudd, L. Cuo, and A.D. Businger. 2014. *Evapotranspiration of Hawaii*. Final report submitted to the U.S. Army Corps of Engineers—Honolulu District, and the Commission on Water Resource Management, State of Hawaii. Accessed at http://climate.geography.hawaii.edu/interactivemap.html.

Jacobs Engineering Group Inc. (Jacobs). 2019. *Distributed Common Ground Station Pacific Hub User Requirements Document* (Unclassified/For Official Use Only). Prepared for the U.S. Army Corps of Engineers, Honolulu District, Hawaii. October 25.

Jacobs Engineering Group Inc. (Jacobs). 2021. *Distributed Common Ground Station Pacific Region Hub Joint Base Pearl Harbor-Hickam, Wahiawa Annex Traffic Study*. Prepared for U.S. Army Corps of Engineers – Honolulu District. January 6, 2021.

Joint Base Pearl Harbor-Hickam (JBPHH). 2011. *Integrated Natural Resources Management Plan*. Chapter 11 NCTAMSPAC Wahiawa. September.

Joint Base Pearl Harbor-Hickam (JBPHH). n.d. *Integrated Cultural Resources Management Plan*. Chapter 4.2, Non-Military Context and Naval Computers and Telecommunications Area Master Station, Pacific Wahiawa; and Chapter 5.2 Naval Computer and Telecommunications Area Pacific Wahiawa.

Natural Resources Conservation Service (NRCS). 2020. *Web Soil Survey*. Accessed at https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx. U.S. Department of Agriculture, Natural Resources Conservation Service. Accessed December 2020.

Naval Facilities Engineering Command (NAVFAC). 2012. *NAVFAC Safety and Health Handbook*. P-1300. December.

Naval Facilities Engineering Command (NAVFAC). 2017. *Asbestos Program Management*. NAVAC P-502. Naval Facilities Engineering Command Public Works Business Line. Accessed at https://www.wbdg.org/ffc/navy-navfac/p-publications/p-502.

Naval Facilities Engineering Command – Hawaii (NAVFAC HI). 2013. *Commander, Navy Region Hawaii Installation Appearance Plan*. Prepared by Group 70 International, Inc. and Walters, Kimura, Motoda, Inc., Honolulu, Hawaii. Prepared for Naval Facilities Engineering Command, Hawaii Pearl Harbor, Hawaii. March.

Naval Facilities Engineering Command – Hawaii (NAVFAC HI). 2014. *Navy Region Hawaii Hazardous Waste Management Plan*. February 2014.

Pantaleo, Jeff. 2021. Personal communication via email between Jeff Pantaleo/NAVFAC HI Cultural Resource Manager and Michael Desilets/USACE. March 26.

Pond & Company and The Urban Collaborative, LLC. 2016. *Wahiawa Annex Area Development Plan*. Prepared for United States Army Corps of Engineers, Fort Worth District. October.

State of Hawaii Department of Health (HDOH). 2009. *Total Maximum Daily Loads (TMDLs) for the North and South Forks of Kaukonahua Stream, Oahu, Hawaii*. Prepared by the State of Hawaii Department of Health Environmental, Health Administration Environmental Planning Office, with Tetra Tech, Inc. Accessed at https://health.hawaii.gov/cwb/files/2013/05/Integrated_UpperKaukonahua.pdf. September.

State of Hawaii Department of Health (HDOH). 2020. *2018 Annual Summary – Hawaii Air Quality Data*. Accessed at https://health.hawaii.gov/cab/hawaii-air-quality-data-books/. March.

State of Hawaii Department of Land and Natural Resources (DLNR). 2016. *Wildlife Lighting*. DLNR Division of Forestry and Wildlife. Accessed at http://dlnr.hawaii.gov/wildlife/files/2016/03/DOC439.pdf; last retrieved January 20, 2021.

State of Hawaii Department of Land and Natural Resources (DLNR). 2020. *Flood Hazard Assessment Tool - Flood Hazard Assessment Report for Wahiawa Annex*. Kaukonahu; Poamoho Watershed. Accessed at http://gis.hawaiinfip.org/FHAT/. Accessed December 2020.

State of Hawaii Department of Transportation (HDOT). 2007. *Storm Water Permanent Best Management Practices Manual*. Prepared by the State of Hawaii Department of Transportation, Highways Division. Accessed at https://hidot.hawaii.gov/wp-content/uploads/2015/05/Appx-E.1-Permanent-BMP-Manual-Feb-2007.pdf. February.

State of Hawaii Department of Transportation (HDOT). 2020. Project Status for Hawaii DOT Projects. Accessed November 2020. Accessed at https://histategis.maps.arcgis.com/apps/MapSeries/index.html?appid=39e4d804242740a89d3fd0bc76d8d7de.

U.S. Census Bureau (USCB). 2020a. *Quick Facts Wahiawa Census Designated Place, Hawaii*. Accessed at https://www.census.gov/quickfacts/fact/table/wahiawacdphawaii,HI/PST045219. Accessed November 2020.

U.S. Census Bureau (USCB). 2020b. *2010 American Community Survey 5-Year Estimates – Demographic and Housing Estimates (DP05)*. Accessed at https://data.census.gov/. Accessed September 30, 2020.

U.S. Census Bureau (USCB). 2020c. *2015 American Community Survey 5-Year Estimates – Demographic and Housing Estimates (DP05)*. Accessed at https://data.census.gov/. Accessed September 30, 2020.

U.S. Census Bureau (USCB). 2020d. *2018 American Community Survey 5-Year Estimates – Demographic and Housing Estimates (DP05)*. Accessed at https://data.census.gov/. Accessed September 30, 2020.

U.S. Department of Agriculture (USDA). 1972. *Soil survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii.* Accessed at https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/hawaii/islandsHI1972/Five_islands_SS.pdf.

USDA Soil Conservation Service in cooperation with the University of Hawaii, Agricultural Experiment Station. August.

U.S. Department of Defense (DoD). 2018a. *Summary of the 2018 National Defense Strategy*. Accessed at https://www.defense.gov/Explore/Spotlight/National-Defense-Strategy/. Accessed November 2020.

U.S. Department of Defense (DoD). 2018b. *Water Storage, Distribution, and Transmission.* Unified Facilities Criteria 3-230-01. Unified Facilities Criteria 3-230-01. Change 2, 1 May 2020. Accessed at https://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc/ufc-3-230-01. September 1.

U.S. Department of Defense (DoD). 2020. *Wastewater Collection.* Unified Facilities Criteria 3-240-01. Change 2, 1 January 2021. Accessed at https://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc/ufc-3-240-01. May 1.

U.S. Department of the Air Force (USAF). 2004. *Hazardous Materials Management.* Air Force Instruction 32-7086. Accessed at https://www.hsdl.org/?abstract&did=776082.

U.S. Department of the Air Force (USAF). 2010. *Air Force Instruction 32-7042 Waste Management*. Incorporating Change 1, March 31, 2010.

U.S. Department of the Air Force (USAF). 2013. *AF ISR 2023: Delivering Decision Advantage, A Strategic Vision for the AF ISR Enterprise*. Accessed at https://www.airuniversity.af.edu/Portals/10/ISR/documents/slideshow/AF-ISR_2023.pdf.

U.S. Department of the Air Force (USAF). 2017. *Air Quality Compliance and Resource Management*. Air Force Instruction 32-7040. Accessed at https://static.e-publishing.af.mil/production/1/eglinafb/publication/afi32-7040_eglinafbsup/afi32-7040_eglinafbsup.pdf. Supplement December 19.

U.S. Department of the Air Force (USAF). 2018a. *2018-2028 AF Next Generation ISR Dominance Flight Plan – Summary*. Accessed at https://www.af.mil/Portals/1/documents/5/isrflightplan.pdf. Accessed November 2020.

U.S. Department of the Air Force (USAF). 2018b. *Environmental Considerations in Air Force Programs and Activities*. Air Force Policy Directive 32-70. Accessed at https://static.e-publishing.af.mil/production/1/saf_ie/publication/afpd32-70/afpd32-70.pdf.

U.S. Department of the Air Force (USAF). 2020a. Air Force Manual 91-203, *Air Force Occupational Safety, Fire, and Health Standards*. Accessed at https://static.e-publishing.af.mil/production/1/af_se/publication/afman91-203/afman91-203.pdf. September 8.

U.S. Department of the Air Force (USAF). 2020b. Air Force Instruction 91-204, *Safety Investigation and Hazard Reporting*. Accessed at https://static.e-publishing.af.mil/production/1/af_se/publication/afi91-204/afi91-204.pdf. July 7.

U.S. Department of the Navy (Navy). 2003. *Programmatic Agreement among The Commander Navy Region Hawaii, the Advisory Council on Historic Preservation and the Hawaii State Historic Preservation Officer Regarding Navy undertakings in Hawaii*. Commander Navy Region Hawaii. June 2003.

U.S. Department of the Navy (Navy). 2015. *Draft Record of Decision, Site 21, Abandoned Firing Range Joint Base Pearl Harbor-Hickam, Wahiawa Annex, Oahu, Hawaii – Naval Computer and Telecommunications Area Pacific National Priorities List Site*. December.

U.S. Environmental Protection Agency (EPA). 1974. *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*. Accessed at https://nepis.epa.gov/Exe/ZyPDF.cgi/2000L3LN.PDF?Dockey=2000L3LN.PDF. March 1974.

U.S. Environmental Protection Agency (EPA). 2016. NAAQS Table. Accessed at https://www.epa.gov/criteria-air-pollutants/naaqs-table.

U.S. Fish and Wildlife Service (USFWS). 1993. *Recovery Plan for the O'ahu Tree Snails of the Genus Achatinella*. U.S. Department of the Interior Fish and Wildlife Service, Region One, Portland, Oregon Accessed at https://ecos.fws.gov/docs/recovery_plan/920630.pdf. April.

U.S. Fish and Wildlife Service (USFWS). 2021. *Information for Planning and Consultation*. Accessed at https://ecos.fws.gov/ipac/. Accessed January 21, 2021.

U.S. Supreme Court. 2007. Massachusetts et al. v. Environmental Protection Agency et al. Accessed at https://supreme.justia.com/cases/federal/us/549/05-1120/index.pdf. Decided April 2, 2007.

West Environmental and Statistical Consultants, Inc. (West). 2019. *Hawaiian Hoary Bat Occupancy and Distribution on Oahu – Project Status Update*. Accessed at https://dlnr.hawaii.gov/wildlife/files/2019/03/ESRC_March2019_StatusUpdate_Final.pdf. March 6.

Appendix A
Coastal Zone Management Act Federal Consistency Assessment Form

HAWAII CZM PROGRAM
FEDERAL CONSISTENCY ASSESSMENT FORM

RECREATIONAL RESOURCES

Objective: Provide coastal recreational opportunities accessible to the public.

Policies:

1) Improve coordination and funding of coastal recreational planning and management.
2) Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:
    a) Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas.
    b) Requiring replacement of coastal resources having significant recreational value including, but not limited to surfing sites, fishponds, and sand beaches, when such resources will be unavoidably damaged by development; or requiring reasonable monetary compensation to the State for recreation when replacement is not feasible or desirable.
    c) Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value.
    d) Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation.
    e) Ensuring public recreational uses of county, state, and federally owned or controlled shoreline lands and waters having recreational value consistent with public safety standards and conservation of natural resources.
    f) Adopting water quality standards and regulating point and non-point sources of pollution to protect, and where feasible, restore the recreational value of coastal waters.
    g) Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, and artificial reefs for surfing and fishing.
    h) Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission, board of land and natural resources, and county authorities; and crediting such dedication against the requirements of Hawaii Revised Statutes, section 46-6.

RECREATIONAL RESOURCES (continued)

Check either Yes or No for each of the following questions, and provide an explanation or information for Yes responses in the Discussion section:

	Yes	No
1. Will the proposed action occur in or adjacent to a dedicated public right-of-way, e.g., public beach access, hiking trail, shared-use path?	☐	☑
2. Will the proposed action affect public access to and along the shoreline?	☐	☑
3. Does the project site abut the shoreline?	☐	☑
4. Is the project site on or adjacent to a sandy beach?	☐	☑
5. Is the project site in or adjacent to a state or county park?	☐	☑
6. Is the project site in or adjacent to a water body such as a stream, river, pond, lake, or ocean?	☑	☐
7. Will the proposed action occur in or affect an ocean recreation area, swimming area, surf site, fishing area, or boating area?	☐	☑

Discussion: (If more space is needed, attach a separate sheet.)

6. The project site is near Poamoho Stream, which flows within a forested gulch located downslope and south of the project site. The stream is dry during most of the year, and the Proposed Action would not have any impacts to existing uses of the stream.

HISTORIC RESOURCES

Objective: Protect, preserve, and, where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture.

Policies:

1) Identify and analyze significant archaeological resources.
2) Maximize information retention through preservation of remains and artifacts or salvage operations.
3) Support state goals for protection, restoration, interpretation, and display of historic resources.

Check either Yes or No for each of the following questions, and provide an explanation or information for Yes responses in the Discussion section:

	Yes	No
1. Is the project site within a designated historic or cultural district?	☐	☑
2. Is the project site listed on or nominated to the Hawaii or National Register of Historic Places?	☐	☑
3. Has the project site been surveyed for historic or archaeological resources?	☑	☐
4. Does the project parcel include undeveloped land which has not been surveyed by an archaeologist?	☐	☑
5. Is the project site within or adjacent to a Hawaiian fishpond or historic settlement area?	☐	☑

Discussion: (If more space is needed, attach a separate sheet.)

3. Archaeological surveys were conducted at the project site on December 10 and December 17, 2020. No historical or archaeological resources were identified that would be adversely affected by the project. The project area is located in an area of Wahiawa Annex considered to have low to no potential for archaeological sites due to recurring ground disturbance.

SCENIC AND OPEN SPACE RESOURCES

Objective: Protect, preserve, and, where desirable, restore or improve the quality of coastal scenic and open space resources.

Policies:

1) Identify valued scenic resources in the coastal zone management area.
2) Ensure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline.
3) Preserve, maintain, and, where desirable, improve and restore shoreline open space and scenic resources.
4) Encourage those developments that are not coastal dependent to locate in inland areas.

Check either Yes or No for each of the following questions, and provide an explanation or information for Yes responses in the Discussion section:

	Yes	No
1. Will the proposed action alter any natural landforms or existing public views to and along the shoreline?	☐	☑
2. Does the proposed action involve the construction of a multi-story structure?	☑	☐
3. Is the project site located on or adjacent to an undeveloped parcel, including a beach or oceanfront land?	☐	☑
4. Does the proposed action involve the construction of a structure visible between the nearest coastal roadway and the shoreline?	☐	☑
5. Will the proposed action involve constructing or placing a structure in waters seaward of the shoreline?	☐	☑

Discussion: (If more space is needed, attach a separate sheet.)

2. The DCGS Pacific Hub would consist of a two-story building. Due to the steep sloped topography of the project site, the first story of the building would be located partially below grade with only the upper story visible from the adjacent roadway, Midway Drive, on the Wahiawa Annex. The project area is centrally located within the Wahiawa Annex, and is not anticipated to be visible from surrounding communities or roadways outside of the installation.

COASTAL ECOSYSTEMS

Objective: Protect valuable coastal ecosystems, including reefs, from disruption and minimize adverse impacts on all coastal ecosystems.

Policies:

1) Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources.
2) Improve the technical basis for natural resource management.
3) Preserve valuable coastal ecosystems, including reefs, of significant biological or economic importance.
4) Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land water uses, recognizing competing water needs.
5) Promote water quantity and quality planning and management practices that reflect the tolerance of fresh water and marine ecosystems and maintain and enhance water quality through the development and implementation of point and nonpoint source water pollution control measures.

Check either Yes or No for each of the following questions, and provide an explanation or information for Yes responses in the Discussion section:

	Yes	No
1. Does the proposed action involve dredge or fill activities?	☐	☑
2. Is the project site within the Special Management Area (SMA) or the Shoreline Setback Area?	☐	☑
3. Is the project site within the State Conservation District?	☐	☑
4. Will the proposed action involve some form of discharge or placement of material into a body of water or wetland?	☐	☑
5. Will the proposed action require earthwork, grading, clearing, or grubbing?	☑	☐
6. Will the proposed action include the construction of waste treatment facilities, such as injection wells, discharge pipes, or septic systems?	☑	☐
7. Is an intermittent or perennial stream located on or adjacent to the project parcel?	☑	☐
8. Does the project site provide habitat for endangered species of plants, birds, or mammals?	☐	☑
9. Is any such habitat located in close proximity to the project site?	☐	☑

	Yes	No
10. Is a wetland located on the project site or parcel?	☑	☐
11. Is the project site situated in or abutting a Natural Area Reserve, a Marine Life Conservation District, or an estuary?	☐	☑
12. Will the proposed action occur on or in close proximity to a reef or coral colonies?	☐	☑

Discussion: (If more space is needed, attach a separate sheet.)

5. The project would involve grading, clearing and grubbing at the location of the building site and parking areas. Project site grading would direct runoff from impervious pavement surfaces onto vegetated surfaces. Where feasible, grading would use a minimum 5-percent slope away from the DCGS Pacific Hub facility. Best management practices (BMP) including drainage and erosion-control measures would be implemented during construction to manage surface runoff and pollutants. BMPs to control runoff and sedimentation would include regular and documented site inspections, the use of silt fences, minimization of earth-moving activities during wet weather, and revegetation with appropriate plant materials in disturbed areas. A National Pollutant Discharge Elimination System Construction General Permit will be obtained for related construction or demolition activities, including clearing, grading, grubbing, or excavation, or any other activity that results in greater than 1 acre of land disturbance.

6. The project would require constructing a sanitary sewer system (lift station and force main) from the proposed facility to an existing sanitary sewer gravity line. The sanitary sewer system would be constructed to connect to the existing sanitary sewer system; as such, no discharge of wastewater to coastal waters would occur.

7. The project site is near Poamoho Stream, which flows within a forested gulch located downslope and south of the project site. The stream is dry during most of the year, and the Proposed Action would not have any impacts to existing uses of the stream.

10. An approximately 0.2 acre (0.08 hectare or 813 square meter) wetland feature below an outlet of an existing retention basin is located within the corridor of the proposed electric connection between the project site and Polaris Drive. Installing the electrical conduit would involve constructing a trench to underground the utility, which would result in temporary impacts on approximately 6,750 square feet (0.15 acre) of the wetland feature. This wetland feature lacks a surface water connectivity (nexus) or adjacency to any jurisdictional tributary and, therefore, is not considered a federally jurisdictional water regulated by the USACE. No federal jurisdictional Waters of the United States were found on the project site during the site surveys. Because installation of the electrical conduit at the location of the wetland feature would be temporary in nature, and the area would be returned to original contours after construction, impacts on the wetland feature are, therefore, anticipated to be negligible.

ECONOMIC USES

Objective: Provide public or private facilities and improvements important to the State's economy in suitable locations.

Policies:

1) Concentrate coastal development in appropriate areas.
2) Ensure that coastal dependent development such as harbors and ports, and coastal related development such as visitor industry facilities and energy generating facilities, are located, designed, and constructed to minimize adverse social, visual, and environmental impacts in the coastal zone management area.
3) Direct the location and expansion of coastal dependent developments to areas presently designated and used for such development and permit reasonable long-term growth at such areas, and permit coastal dependent development outside of presently designated areas when:
   a) Use of presently designated locations is not feasible;
   b) Adverse environmental effects are minimized; and
   c) The development is important to the State's economy.

Check either Yes or No for each of the following questions, and provide an explanation or information for Yes responses in the Discussion section:

	Yes	No
1. Does the proposed action involve a harbor or port?	☐	☑
2. Is the proposed action a visitor industry facility or a visitor industry related activity?	☐	☑
3. Does the project site include agricultural lands or lands designated for such use?	☐	☑
4. Does the proposed action relate to commercial fishing or seafood production?	☐	☑
5. Is the proposed action related to energy production or transmission?	☐	☑
6. Is the proposed action related to seabed mining?	☐	☑

Discussion: (If more space is needed, attach a separate sheet.)

COASTAL HAZARDS

Objective: Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence, and pollution.

Policies:

1) Develop and communicate adequate information about storm wave, tsunami, flood, erosion, subsidence, and point and nonpoint source pollution hazards.
2) Control development in areas subject to storm wave, tsunami, flood, erosion, hurricane, wind, subsidence, and point and nonpoint source pollution hazards.
3) Ensure that developments comply with requirements of the Federal Flood Insurance Program.
4) Prevent coastal flooding from inland projects.

Check either Yes or No for each of the following questions, and provide an explanation or information for Yes responses in the Discussion section:

	Yes	No
1. Is the project site on or abutting a sandy beach?	☐	☑
2. If "Yes" to question no. 1, has the project parcel or adjoining shoreline areas experienced erosion?	☐	☐
3. Is the project site within a potential tsunami inundation area? Refer to tsunami evacuation maps at http://www.scd.hawaii.gov	☐	☑
4. Is the project site within a flood hazard area according to a FEMA Flood Insurance Rate Map (https://msc.fema.gov)?	☐	☑
5. Is the project site within a subsidence hazard area?	☐	☑

Discussion: (If more space is needed, attach a separate sheet.)

MANAGING DEVELOPMENT

Objective: Improve the development review process, communication, and public participation in the management of coastal resources and hazards.

Policies:

1) Use, implement, and enforce existing law effectively to the maximum extent possible in managing present and future coastal zone development.
2) Facilitate timely processing of applications for development permits and resolve overlapping or conflicting permit requirements.
3) Communicate the potential short and long-term impacts of proposed significant coastal developments early in their life cycle and in terms understandable to the public to facilitate public participation in the planning and review process.

Check either Yes or No for each of the following questions, and provide an explanation or information for Yes responses in the Discussion section:

	Yes	No
1. List the permits or approvals required for the proposed action and provide the status of each in the Discussion section below.		
2. Does the proposed action conform with state and county land use designations for the site?	✔	☐
3. Has the public been notified of the proposed action?	✔	☐
4. Has an environmental impact statement or environmental assessment been prepared for the proposed action?	✔	☐

Discussion: (If more space is needed, attach a separate sheet.)

1. Endangered Species Act (ESA) Section 7 Consultations and Migratory Bird Treaty Act (MBTA) Consultation and Coordination; USFWS, approval pending.

CWA Section 404 Verification; USACE, application pending.

Clean Water Act (CWA) Section 401 State Water Quality Certification; Section 402 National Pollutant Discharge Elimination System (NPDES) Permit(s); HDOH Clean Water Branch, application pending (to be submitted by contractor)

2. The project is located on Joint Base Pearl Harbor-Hickam Wahiawa Annex, and conforms with federal land use designations for the site.

3. In accordance with U.S. Department of Defense and U.S. Air Force (USAF) policies and instructions for implementing the National Environmental Policy Act, the USAF will solicit public comments for this Environmental Assessment (EA) and provide copies of the EA on the Internet.

4. An EA and draft Finding of No Significant Impact (FONSI) with Finding of No Practicable Alternative (FONPA) has been prepared for the Proposed Action.

PUBLIC PARTICIPATION

Objective: Stimulate public awareness, education, and participation in coastal management.

Policies:

1) Promote public involvement in coastal zone management processes.
2) Disseminate information on coastal management issues by means of educational materials, published reports, staff contact, and public workshops for persons and organizations concerned with coastal issues, developments, and government activities.
3) Organize workshops, policy dialogues, and site-specific mediations to respond to coastal issues and conflicts.

Check either Yes or No for each of the following questions, and provide an explanation or information for Yes responses in the Discussion section:

	Yes	No
1. Has information about the proposed action been disseminated to the public?	✔	
2. Has the public been provided an opportunity to comment on the proposed action?	✔	
3. Has or will a public hearing or public informational meeting be held?		✔

Discussion: (If more space is needed, attach a separate sheet.)

1. Public comments on the Proposed Action will be solicited through providing copies of the EA and draft FONSI with FONPA, on the Internet. A Notice of Availability of these documents will be published in the Honolulu Star Advertiser, a newspaper with statewide distribution, and in The Environmental Notice, the bimonthly publication of the State of Hawaii, Office of Environmental Quality Control.

2. All comments received during the public comment period will be fully considered before rendering a decision on the Proposed Action.

BEACH PROTECTION

Objective: Protect beaches for public use and recreation.

Policies:

1) Locate new structures inland from the shoreline setback to conserve open space, minimize interference with natural shoreline processes, and minimize loss of improvements due to erosion.
2) Prohibit construction of private erosion-protection structures seaward of the shoreline, except when they result in improved aesthetic and engineering solutions to erosion at the sites and do not interfere with existing recreational and waterline activities.
3) Minimize the construction of public erosion-protection structures seaward of the shoreline.
4) Prohibit private property owners from creating a public nuisance by inducing or cultivating the private property owner's vegetation in a beach transit corridor.
5) Prohibit private property owners from creating a public nuisance by allowing the private property owner's unmaintained vegetation to interfere or encroach upon a beach transit corridor.

Check either Yes or No for each of the following questions, and provide an explanation or information for Yes responses in the Discussion section:

	Yes	No
1. Will the proposed action occur on or adjacent to a beach?	☐	☑
2. Is the proposed action located within the shoreline setback area?	☐	☑
3. Will the proposed action affect natural shoreline processes?	☐	☑
4. Will the proposed action affect recreational activities?	☐	☑
5. Will the proposed action affect public access to and along the shoreline?	☐	☑

Discussion: (If more space is needed, attach a separate sheet.)

MARINE RESOURCES

Objective: Promote the protection, use, and development of marine and coastal resources to assure their sustainability.

Policies:

1) Ensure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial.
2) Coordinate the management of marine and coastal resources and activities to improve effectiveness and efficiency.
4) Assert and articulate the interests of the State as a partner with federal agencies in the sound management of ocean resources within the United States exclusive economic zone.
5) Promote research, study, and understanding of ocean processes, marine life, and other ocean resources to acquire and inventory information necessary to understand how ocean development activities relate to and impact upon ocean and coastal resources.
6) Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.

Check either Yes or No for each of the following questions, and provide an explanation or information for Yes responses in the Discussion section:

	Yes	No
1. Will the proposed action involve the use or development of marine or coastal resources?	☐	☑
2. Will the proposed action affect the use or development of marine or coastal resources?	☐	☑
3. Does the proposed action involve research of ocean processes or resources?	☐	☑

Discussion: (If more space is needed, attach a separate sheet.)

Appendix B
Plant and Wildlife Species List

Scientific Name	Common Name
Plants	
Dicranopteris linearis	*`uluhe*
Sphenomeris chinesis	*Pala`a*
Nephrolepis multiflora	swordfern
Christella parasitica	wood-fern
Juniperus chinensis	Chinese juniper
Schinus terebinthefolius	Christmas berry
Centella asiatica	Asiatic pennywort
Ciclospermum leptophyllum	fir-leaved celery
Schefflera actinophylla	octopus tree
Ageratum conyzoides	maile hohono
Bidens alba	beggarticks
Calyptocarpus vialis	horseherb
Conyza bonariensis	hairy horseweed
Crassocephalum crepidioides	redflower ragleaf
Cyanthillium cinereum	little ironweed
Emilia fosbergii	Flora's paintbrush
Gammochaeta purpureaum	purple cudweed
Pluchea carolinensis	sourbush
Sphagneticola triloba	wedelia
Synedrella nodiflora	node weed
Youngia japonica	Oriental hawksbeard
Tabebuia heterophylla	pink tecoma
Heliotropum procumbans	fourspike heliotrope
Buddleia asiatica	dog tail
Petrorhagia velutina	childing pink
Cecropia obtusifolia	guarumo
Clusea rosea	autograph tree
Ipomoea obscura	obscure morning-glory
Euphorbia hirta	garden spurge

Scientific Name	Common Name
Euphorbia hypericifolia	graceful spurge
Euphorbia hyssopifolia	hyssop-leaf sandmat
Euphorbia prostrata	prostrate spurge
Phyllanthus debilis	niruri
Acacia koa	koa
Chamaecrista nictitans	partridge pea
Desmanthus pernambucanus	virgate mimosa
Desmodium incanum	Spanish clover
Falcateria moluccana	albizia
Indigofera hendicaphyla	creeping indigo
Leucaena leucocephala	hoale koa
Macroptilium atropurpureum	purple bushbeam
Macroptilium lathyroides	cow pea
Trifolium arvense	rabbitfoot clover
Scaevola gaudichaudiana	*naupaka kuahiwi*
Cuphea hyssopifolia	false heather
Waltheria indica	*`uhaloa*
Miconia crenata	Koster's curse
Ficus macrocarpa	Chinese banyan
Ardisia elliptica	shoebutton ardisia
Psidium cattleianum	strawberry guava
Syzygium cumini	Java plum
Oxalis corniculata	yellow wood sorrel
Passiflora edulis	passion fruit
Plantago lanceolata	English plantain
Plantago major	common plantain
Bacopa monnieri	*`ae`ae*
Polygala paniculate	bubblegum plant
Grevillea robusta	silk oak
Spermacoce assurgens	buttonweed

Scientific Name	Common Name
Chrysophyllum oliviforme	satin leaf
Pilea microphylla	artillery plant
Citharexylum caudatum	fiddlewood
Stachytarpheta jamaicensis	Jamaican vervain
Cordyline fruticose	*ki,* ti
Fimbristylis dichotoma	forked fimbry
Kyllinga brevifolia	*kiliʻoʻopu*
Cyperus polystachyos	sedge *sp.*
Arundina graminifolia	bamboo orchid
Spathoglottis plicata	Philippine ground orchid
Andropogon sp.	broomsedge
Axonopus fissifolius	narrow-leaved carpetgrass
Bothriochloa bladhii	beardgrass
Cenchrus echinatus	sand bur
Cynodon dactylon	Bermuda grass
Eleusine indica	wiregrass
Eragrostis sp.	
Megathyrsus maximus	Guinea grass
Melinus repens	natal redtop
Paspalum conjugatum	Hilo grass
Paspalum fimbriatum	Panama grass
Paspalum urvillei	Vasey grass
Poa annua	annual bluegrass
Sacciolepis indica	Glenwood grass
Setaria parviflora	yellow foxtail
Sporobolus indicus	rattail grass
Urochloa mutica	California grass
Ravenala madagascariensis	traveler's tree
Mammals	
Herpestes javanicus	Small Indian mongoose

Scientific Name	Common Name
Sus scrofa	wild boar
Birds	
Francolinus pondicerianus	Gray francolin
Gallus	Domestic chicken
Pavo cristatus	Indian peafowl
Streptopelia chinensis	Spotted dove
Geopelia striata	Zebra dove
Pluvialuis fulva	Pacific golden-plover
Bubuculus ibis	Cattle egret
Psittacula krameria	Rose-ringed parakeet
Aluda arvensis	Eurasian skylark
Pycnonotus cafer	Red-vented bulbul
Pycnonotus jocosus	Red-whiskered bulbul
Horonis diphone	Japanese bush warbler
Zosterops japonicus	Warbling white-eye
Leiothrix lutea	Red-billed leiothrix
Copsychus malabaricus	White-rumped shama
Acridotheres tristis	Common myna
Paroaoria coronate	Red-crested cardinal
Haemorhous mexicanus	House finch
Estrilda astrild	Common waxbill
Lonchura punctulata	Scaly-breasted munia

Appendix C
Traffic Study

Distributed Common Ground Station Pacific Region Hub Joint Base Pearl Harbor-Hickam, Wahiawa Annex

Traffic Study

January 6, 2021

U.S. Army Corps of Engineers – Honolulu District

Distributed Common Ground Station Pacific Region Hub Joint Base Pearl Harbor-Hickam, Wahiawa Annex

Project No:	D3414600.A.PN.OE.03-FI
Document Title:	Traffic Study
Document No.:	FES1203201921HNL
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Client Name:	U.S. Army Corps of Engineers – Honolulu District
Project Manager:	Richard Manz
Author:	Terry Yuen
File Name:	DCGS_Wahiawa_TrafficStudy_010621.docx

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Acronyms and Abbreviations

DCGS	Distributed Common Ground Station
H-2	U.S. Interstate Highway 2
HDOT	Hawaii Department of Transportation
LOS	level of service
mph	mile(s) per hour
sec/veh	second(s) per vehicle
Traffic Study Report	*Traffic Study Report for MILCON P-013 NIOC Hawaii Communications/Cryptologic Facilities at JBPHH Wahiawa Annex, Wahiawa, Oahu, Hawaii*
TRB	Transportation Research Board
U.S.	United States
USAF	U.S. Air Force
v/c	volume-to-capacity ratio

1. Introduction

The United States (U.S.) Air Force (USAF) is planning to construct and operate a permanent Distributed Common Ground Station (DCGS) Pacific Hub located at Joint Base Pearl Harbor-Hickam, Wahiawa Annex, Oahu, Hawaii. The DCGS Pacific Hub project at the Wahiawa Annex would support operations for the 692nd Intelligence, Surveillance, and Reconnaissance Group (ISR) Group by providing secure and resilient communications supporting Pacific Region ISR operations.

1.1 Project Site Location and Access

The proposed project site is located within the Joint Base Pearl Harbor-Hickam Wahiawa Annex, a U.S. Navy installation comprising approximately 700 acres within the Wahiawa District on the island of Oahu, Hawaii. Nearby military presence in the region includes Schofield Barracks, Wheeler Army Airfield, and Helemano Military Reservation, located within 10 miles of Wahiawa Annex. The Wahiawa Annex lies north of the town of Wahiawa and east of Whitmore Village. The project site is centrally located along Midway Drive within the Wahiawa Annex (Figure 1-1).

All vehicular access to the Wahiawa Annex is controlled by JBPHH security staff and is limited to the Whitmore and Saipan Gates. The Whitmore Gate is located at the east terminus of Whitmore Avenue, a public local access road that bisects the residential community of Whitmore Village. The public portion of Whitmore Avenue provides direct access to residential driveways and passes through crosswalks and stop-controlled intersections. The Saipan Gate is located at the northwest boundary of the Wahiawa Annex along Saipan Drive. Saipan Drive bypasses Whitmore Village to the north and allows access to the annex without potential conflicts between residential traffic (Figure 1-1).

1.2 Project Construction Access and Schedule

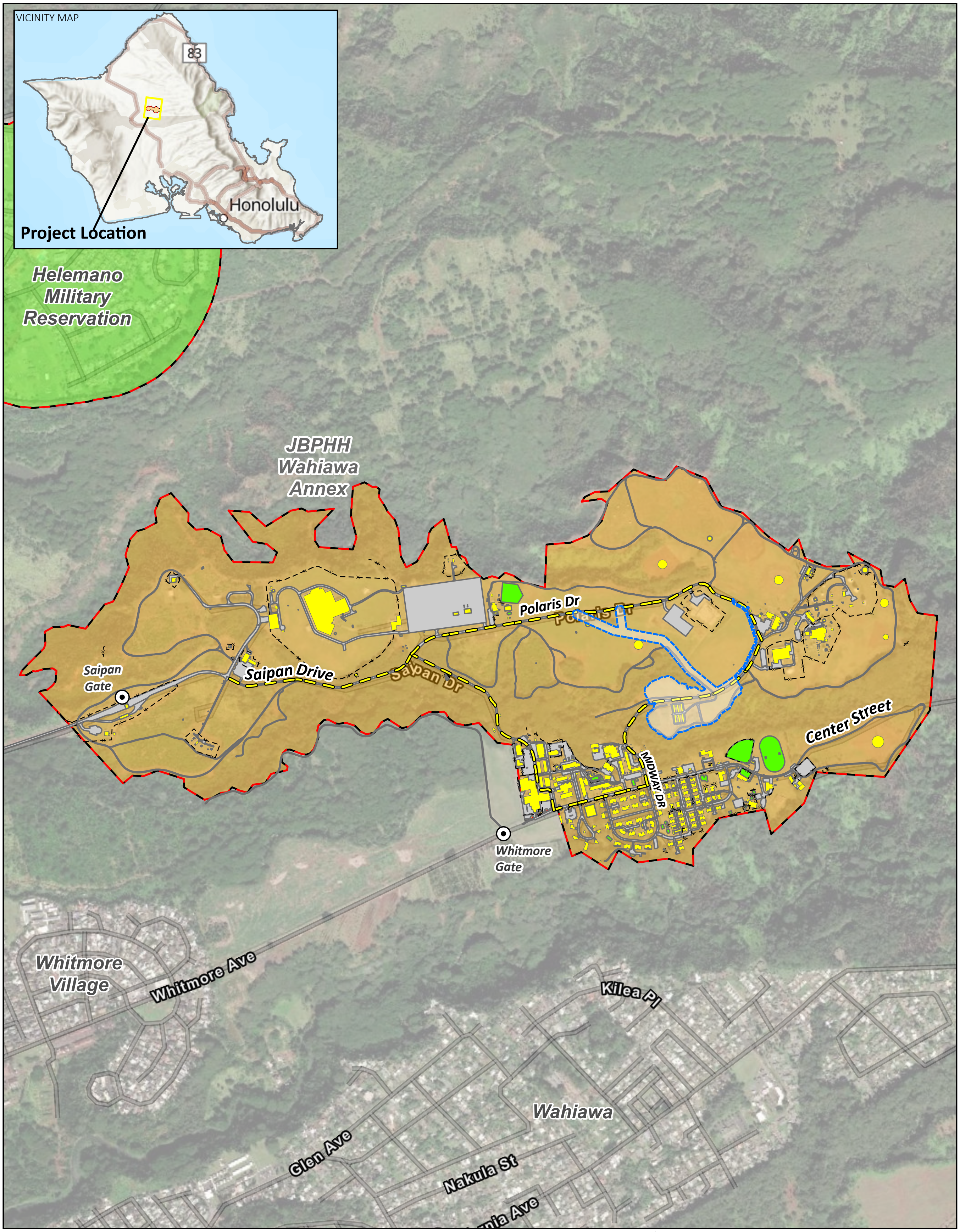
Traffic related to project construction will arrive at the site via Kamehameha Highway from the north or the south. Vehicles travelling from Kamehameha Highway will travel east on Whitmore Avenue for approximately 0.30 mile to Saipan Drive. From Saipan Drive, this traffic will enter the Wahiawa Annex at the Saipan Gate and continue east towards Midway Drive to the project site. Figure 1-2 depicts the transportation access network surrounding the Wahiawa Annex.

Project construction is expected to begin in 2024 at the earliest, with peak construction activity occurring approximately 12 to 18 months after construction's initial start. Access to the project site during construction will be via the Saipan Gate only. The project will take approximately 39 months to construct.

1.3 Project Operations

When operations begin, up to 200 staff will occupy the DCGS Pacific Hub each day. The Hub will be operational 24 hours per day, every day, and staff are expected to arrive and depart the site throughout a typical day. During operations, both the Saipan and Whitmore Gates may be used for access.

This traffic study describes the existing and future year peak-hour conditions at four study intersections that are expected to experience traffic generated by the proposed project. Traffic conditions are assessed for scenarios with and without construction, as well as with and without the operation of the DCGS Pacific Hub. Figure 1-2 shows the study intersections and their relative location to the project site.



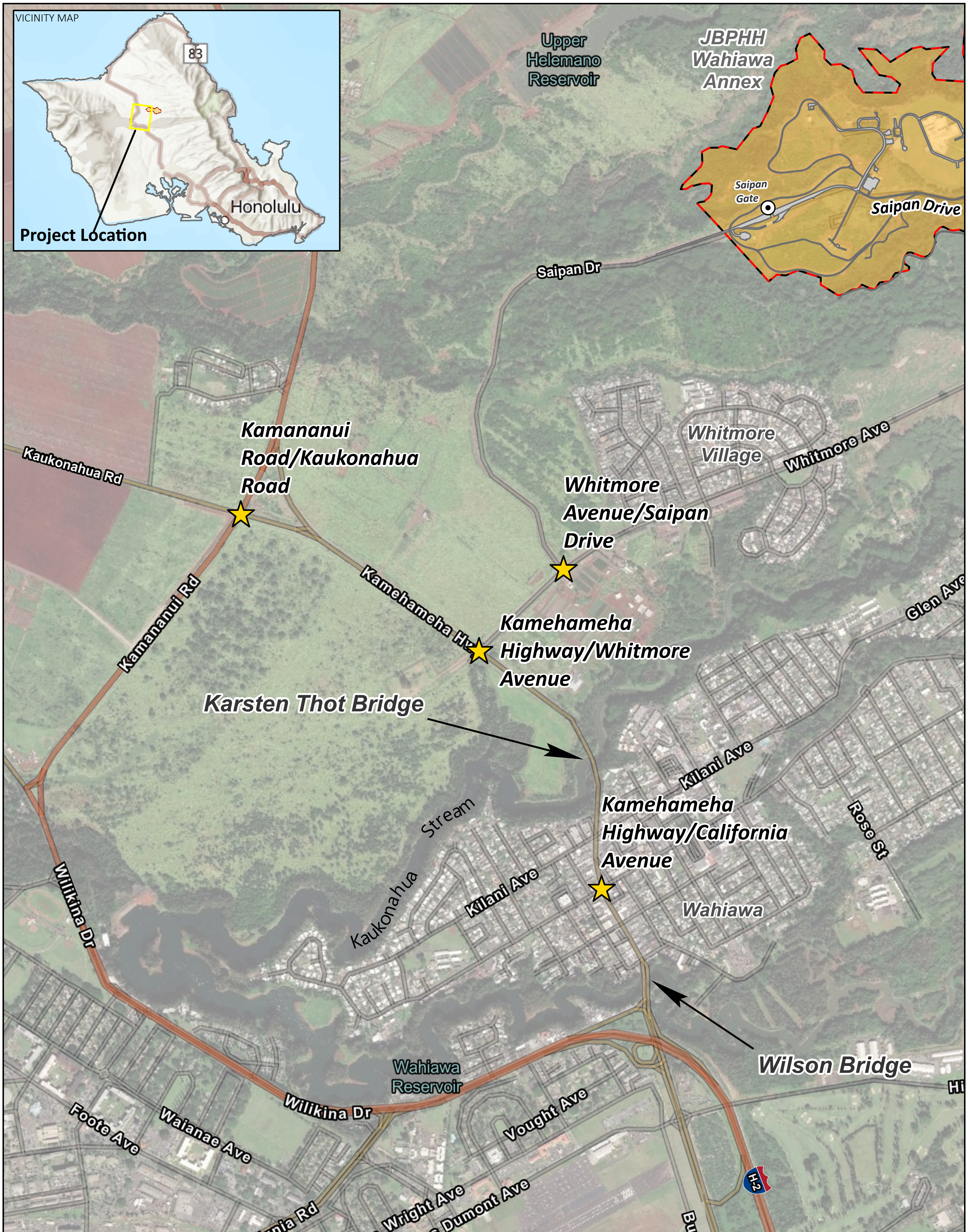
LEGEND

- Entry Control Point
- Main Road
- Road
- Fence
- Wahiawa Annex Installation Boundary
- Helemano Military Reservation
- Project Site Boundary
- Building
- Recreation Site

0 580 1,160
Approximate Scale in Feet

Figure 1-1
Traffic Study Project Location
JBPHH Wahiawa Annex, Oahu, Hawaii

UNK \\DC1VS01\GISPROJ\D\DCGS_PACIFIC_HUB\MAPS\REPORT\DCGS_PACIFIC_HUB_WAHIAWA_ANNEX\DCGS_PACIFIC_HUB_WAHIAWA_ANNEX.APRX OLIVERA1 12/15/2020 6:41 PM



LEGEND

- Entry Control Point
- Traffic Study Intersections
- Wahiawa Annex Installation Boundary

N

0 690 1,380
Approximate Scale in Feet

Figure 1-2
Traffic Study Analysis Area
JBPHH Wahiawa Annex, Oahu, Hawaii

2. Existing Conditions (2020)

This section describes the existing transportation conditions (2020) within the study area. The study area for this analysis is shown on Figure 1-2, in Section 1.

2.1 Study Area Roadways

Public roadways within the study area include Kamehameha Highway and Whitmore Avenue. Both roadways carry general purpose traffic and will be used by project-related construction traffic. Private military roadways within the study area include Saipan Drive, Polaris Drive, Center Street, and Midway Drive. These private roadways are not open the public, but they will carry this project-related construction traffic.

Kamehameha Highway (also known as State Route 80) is the primary public regional access road to the proposed project site. This roadway is classified as an Urban Principal Arterial (Other) by the Hawaii Department of Transportation (HDOT), indicating that it can carry relatively high volumes of traffic for longer distances, also while providing access to major land uses and activity centers. Within the study area, Kamehameha Highway generally runs in a north-south direction providing regional access between U.S. Interstate Highway 2 (H-2) and the north shore of Oahu.

From the H-2 interchange, Kamehameha Highway crosses Wahiawa Reservoir at the Wilson Bridge. This bridge has three vehicular travel lanes in each direction divided by a median, as well as a sidewalk on the west side of the bridge. No truck restrictions are posted, and the bridge is anticipated to accommodate all legal loads within the state of Hawaii. Kamehameha Highway extends north through the town of Wahiawa as a four-lane roadway with dedicated turn lanes at intersections, multiple driveway accesses, and on-street parallel parking. Directional traffic is separated by a center two-way left-turn lane. Sidewalks are provided on both sides of the street, and although there are no marked bicycle lanes, Kamehameha Highway is shared by bicyclists and motorists. The posted speed limit through Wahiawa is 25 miles per hour (mph).

North of Wahiawa, Kamehameha Highway narrows to a two-lane undivided highway with narrow paved shoulders. The highway crosses the north fork of Kaukonahua Stream at the Karsten Thot Bridge. This bridge carries one lane of traffic in each direction and provides a separate, nonmotorized path on either side of the bridge. Posted restrictions limit vehicle heights to 14 feet 4 inches and vehicle weight to 22 tons. The posted speed limit across the bridge is 25 mph.

Near Whitmore Avenue, the undivided highway continues with one travel lane in each direction, narrow paved shoulders, and street lighting. The highway has no sidewalks or bicycle lanes in this area. North of Whitmore Avenue, the posted speed limit on Kamehameha Highway is 35 mph.

Whitmore Avenue (also known as State Route 7012) is a public road providing local access to the Wahiawa Annex, classified as an Urban Minor Collector by the HDOT, and intended to serve as a connection between local or residential land uses and the regional arterial system. This roadway generally runs in an east-west direction between Kamehameha Highway and the Whitmore Gate. From Kamehameha Highway, Whitmore Avenue narrows from a four-lane to two-lane undivided roadway with narrow shoulders up to approximately 3 feet wide in some locations. This roadway is a signed, shared roadway bicycle route, and its posted speed limit is 25 mph.

Whitmore Avenue also provides the sole regional access to the Whitmore Village residential community. Through Whitmore Village within the residential area, the roadway provides direct access to business and residential driveways, parks and recreational activities, and community resources. Traffic on Whitmore Avenue is generally given the right-of-way (cross traffic must stop before proceeding), however, several all-way stop-controlled intersections and marked crosswalks are provided at nearly every intersection within Whitmore Village.

Saipan Drive is a two-lane undivided roadway that meets Whitmore Avenue as a stop-controlled intersection west of Whitmore Village and provides access to the Saipan Gate of Wahiawa Annex. Saipan Drive also provides an alternative route for traffic accessing Wahiawa Annex, thus reducing traffic flow through Whitmore Village. Saipan Drive is aligned to the west and north of Whitmore Village and has a posted speed limit of 35 mph.

Within Wahiawa Annex, roadways providing access to Midway Drive and the project site include Saipan Drive and Polaris Drive to the north and Center Street to the south. These roadways provide traffic circulation around and within the installation and are generally two-lane undivided streets with posted speed limits of 25 mph or less (Figure 1-1, in Section 1).

2.2 Study Intersection Volumes

Traffic generated by the project was analyzed at four study intersections. The location of each intersection is shown on Figure 1-2 and include the following:

- Intersection 1 – Kamehameha Highway at Whitmore Avenue – *signalized*
- Intersection 2 – Kamananui Road at Kaukonahua Road – *signalized*
- Intersection 3 – Kamehameha Highway at California Avenue – *signalized*
- Intersection 4 – Whitmore Avenue at Saipan Drive – *stop-controlled*

Morning and afternoon peak-period turning movement volumes were collected on a typical weekday at Intersections 1, 2, and 3 on the week beginning November 2, 2020. Morning traffic counts were collected between 7:00 a.m. and 9:00 a.m., while afternoon traffic counts were collected between 3:00 p.m. and 5:00 p.m. These timeframes are consistent with the peak traffic time periods analyzed in the *Traffic Study Report for MILCON P-013 NIOC Hawaii Communications/Cryptologic Facilities at JBPHH Wahiawa Annex, Wahiawa, Oahu, Hawaii* (Traffic Study Report; Helber Hastert & Fee Planners and Julian Ng, Inc. 2019). Traffic volumes at Intersection 4 were estimated based on peak-period volumes collected at Intersection 1 and turning-movement proportions shown in the Traffic Study Report. The A.M. peak and P.M. peak-hour analyses in this study should represent the worst-case traffic conditions during a typical day, which are often associated with the height of commuter or school-related traffic.

Intersection traffic volumes were collected during the COVID-19 public health pandemic and may not represent historical traffic trends nor future traffic volume forecasts. Therefore, the field-collected traffic volumes at the four study intersections have been adjusted in an attempt to represent typical conditions. HDOT provides current traffic volume data collected on select major routes compared with annual average daily traffic volumes that were collected during 2019 during pre-COVID conditions at the same location. HDOT displays the current average daily traffic volumes as a percentage change from the 2019 pre-COVID traffic volumes on their website.[1]

The nearest HDOT count location to Wahiawa is located on H-2, south of Mililani. It is assumed that this HDOT count location reasonably represents the change in traffic volume, from pre-COVID to current conditions, within the project traffic study area. Traffic counts on H-2 collected during the week of November 2, 2020 were approximately 16 percent lower than 2019 annual average traffic volumes at the

[1] https://hidot.hawaii.gov/highways/covid-19-traffic-volume-comparison/.

same location. The field-collected traffic volumes for this study were adjusted accordingly. HDOT traffic data trends and count locations are included in Appendix A.

For this traffic study, only weekday traffic volumes are used to analyze operations because they represent the worst-case scenario for DCGS Pacific Hub construction activities and operations. Peak-hour turning movement analysis volumes for the A.M. and P.M. peaks and the existing lane channelization at the study intersections are presented on Figure 2-1.

2.3 Transit Service

Public transit services on Oahu are provided by the City and County of Honolulu Department of Transportation Services (DTS). The DTS operates TheBus, which offers fixed-route transit service island wide, and The Handi-Van, a public service for persons who are unable to use TheBus.

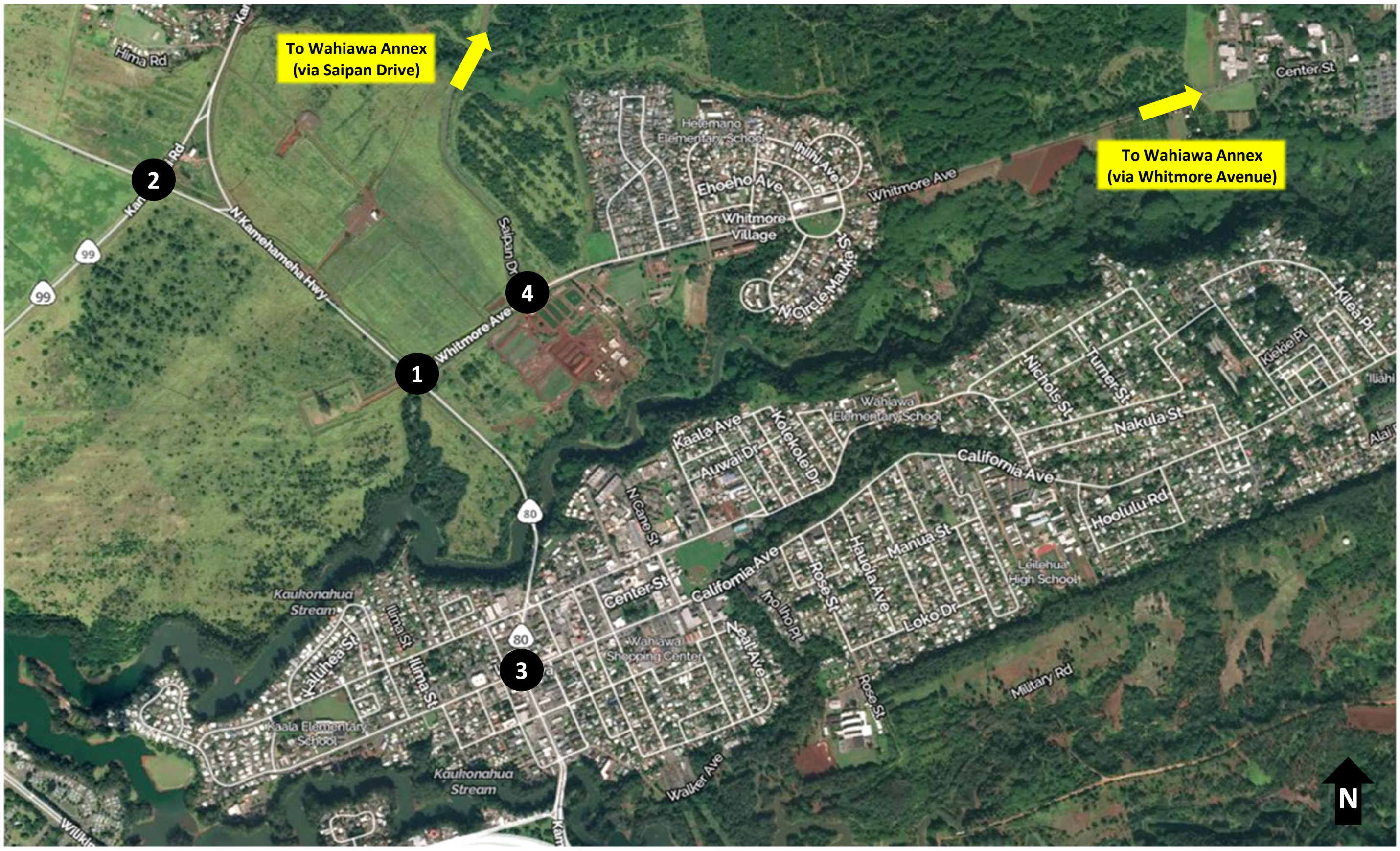
TheBus provides fixed-route transit service and paratransit service between designated park-and-ride lots and transit stops on Oahu. Bus Route 72 provides local weekday and weekend/holiday service between Whitmore Village and Schofield Barracks through Wahiawa. On weekdays, service is provided approximately every hour between 5:30 a.m. and 9:30 p.m. in both directions. From Whitmore Village, this route travels west on Whitmore Avenue (serving one stop at the intersection with Kamehameha Highway) and south on Kamehameha Highway, serving Wahiawa and the Wahiawa Transit Center on California Avenue, before heading west on Wilikina Drive to Schofield Barracks. The route serves multiple stops within Schofield Barracks before returning on its outbound path, providing reverse service along the same roadways, to Whitmore Village. This route does not serve the Wahiawa Annex.

Bus Route 51 provides service between Honolulu and Wahiawa, and it serves transit stops on Kamehameha Highway, as well as the Wahiawa Transit Center. Bus Route 52 provides service between Honolulu and the north shore, with stops along Kamehameha Highway, including one stop at Whitmore Avenue. Both regional transit routes travel on Kamehameha Highway in both directions, but they do not provide local service to Whitmore Village or the Wahiawa Annex. No other transit routes serve the study area. Existing transit maps are provided in Appendix B.

2.4 Nonmotorized Facilities

Sidewalks are provided in the westbound direction of Whitmore Avenue between Kamehameha Highway and Uakanikoo Street in Whitmore Village. The sidewalk provides a dedicated walking path from the residential neighborhood to a bus stop shelter located on northbound Kamehameha Highway at Whitmore Avenue. Kamehameha Highway north of Wahiawa does not have sidewalks in either direction. Most of Whitmore Avenue east of Uakanikoo Street to the Whitmore Gate at the Wahiawa Annex does not have sidewalks. Paved shoulders may be used by pedestrians and marked crosswalks are provided at most intersections.

Public study area roadways do not have separate, designated bicycle lanes. *Bike Map Oahu* (HDOT 2020) identifies bicycle routes based on a recommended level of bicycling skill and comfort. Kamehameha Highway within the study area and the entire public length of Whitmore Avenue are suggested as bicycle routes for experienced bicyclists because both roadways provide space for shared use between nonmotorized modes and motorists. Whitmore Avenue is a signed, shared roadway bicycle route with paved shoulders up to roughly 3 feet wide. *Bike Map Oahu* maps are provided in Appendix B.



1 Kamehameha Highway / Whitmore Avenue (Signalized Intersection)

- Southbound (Kam. Hwy): Through 370 / ***555***; Left 160 / ***120***
- Westbound (Whitmore Ave): U-turn/Left 185 / ***200***; Right 505 / ***655***
- Northbound: Through 485 / ***505***; Right 580 / ***440***

	V/C	Delay (s)	LOS
Existing AM	0.79	38.4	D
Existing PM	0.90	41.1	D

2 Kamananui Road / Kaukonahua Road (Signalized Intersection)

- Southbound (Kamananui Rd): 10 / ***5***; 195 / ***465***; 5 / ***5***
- Westbound (Kaukonahua Rd): 5 / ***5***; 50 / ***90***; 70 / ***190***
- Eastbound: 5 / ***5***; 50 / ***90***; 5 / ***5***
- Northbound: 5 / ***5***; 310 / ***425***; 85 / ***115***

	V/C	Delay (s)	LOS
Existing AM	0.40	8.9	A
Existing PM	0.67	13.6	B

3 Kamehameha Highway / California Avenue (Signalized Intersection)

- Southbound (Kam. Hwy): 35 / ***40***; 800 / ***840***; 20 / ***55***
- Westbound (California Ave): 40 / ***140***; 50 / ***100***; 640 / ***655***
- Eastbound: 20 / ***25***; 60 / ***95***; 90 / ***140***
- Northbound: 90 / ***120***; 880 / ***940***; 370 / ***505***

	V/C	Delay (s)	LOS
Existing AM	0.65	27.3	C
Existing PM	0.77	34.0	C

4 Saipan Drive / Whitmore Avenue (Stop-Controlled Approach on Saipan Dr)

- Southbound (Saipan Dr): 50 / ***275***; 5 / ***5***
- Westbound (Whitmore Ave): 5 / ***5***; 640 / ***580***
- Eastbound: 370 / ***185***; 370 / ***375***

	V/C	Delay (s)	LOS
Existing AM	0.04	32.2	D
Existing PM	0.02	20.6	C

Legend

- 2 Study Intersection Number
- STOP Stop-Controlled Approach
- Signalized Intersection
- Turning Movement Direction
- 100 AM Peak-Hour Volume
- ***100*** PM Peak-Hour Volume
- V/C Volume to Capacity Ratio
- LOS Level of Service

Notes

1. Delay and Level of Service results are based on HCM 2010 methodology. Volume-to-capacity ratios are based on HCM 2000 methodology.
2. Signalized intersection results are based on an average of all approaches.
3. Stop-control intersection delay results are shown for the worst minor street approach.

Figure 2-1

Existing (2020) Peak-Hour Traffic Conditions

JBPHH Wahiawa Annex

Oahu, Hawaii

2.5 Intersection Operations

To measure the effectiveness of the study area intersections, an existing traffic operations analysis was conducted for the morning and afternoon peak-hour traffic conditions using the turning-movement volumes collected in November 2020 adjusted to typical pre-COVID conditions. The traffic analysis volumes and lane channelization shown on Figure 2-1 were analyzed using SYNCHRO®, version 10. This software tool, based on the methodology adopted in the latest *HCM2010: Highway Capacity Manual 2010* (TRB 2010), analyzes intersections controlled by traffic signals and stop signs.

The ability of an intersection to accommodate traffic can be measured by a volume-to-capacity (v/c) ratio. This metric considers the vehicular demand at a particular intersection and compares that with the intersection's capacity, which depends on factors such as the number of lanes, the type of intersection control and phasing, and the presence of pedestrians or bicycles. A v/c ratio of 1.0 indicates the intersection is at capacity and may experience congestion with long delays and vehicle queues.

Traffic operations can also generally be described by six level of service (LOS) grades, which categorize operating conditions at an intersection based on the average vehicle delay time in seconds. LOS classifications are given a letter designation from LOS A to LOS F. LOS A generally represents ideal operating conditions with little to no delay and where movements are not influenced by other vehicles on the roadway. LOS F typically represents poor operating conditions, including high delays and extreme congestion. Table 2-1 shows the LOS categories in reference to average delay time criteria for signalized and stop-controlled intersections.

Within the city and county of Honolulu, LOS D is generally considered the acceptable level of mobility. Traffic that operates at LOS E or LOS F is considered to be less than desirable and should be examined for potential improvements to maintain acceptable operations.

Table 2-1. Intersection Level of Service Criteria

Level of Service	Average Signalized Control Delay (sec/veh)	Average Stop-Controlled Delay (sec/veh) [1]	General Description
A	Less than or equal to 10	0 to 10	Generally free flow
B	More than 10 to 20	More than 10 to 15	Stable flow (slight delays)
C	More than 20 to 35	More than 15 to 25	Stable flow (acceptable delays)
D	More than 35 to 55	More than 25 to 35	Approaching unstable flow, vehicles occasionally wait through more than one signal cycle before proceeding
E	More than 55 to 80	More than 35 to 50	Unstable flow (intolerable delay)
F	More than 80	More than 50	High delays, extreme congestion

Source: TRB (2010).

sec/veh = seconds per vehicle

[1] Includes delay on the stop-controlled approach.

Table 2-2 summarizes the existing operational results by approach movement at the study intersections. At signalized locations, the overall intersection v/c ratio, vehicle delay, and LOS are also reported.

Under existing conditions, each of the four study intersections operate at LOS D or better during the morning and afternoon peak hours. The westbound left-turn and the southbound left-turn movements at Intersection 1 (Kamehameha Highway/Whitmore Avenue) operate at LOS E during the A.M. peak hour. Relatively high vehicle volumes leaving Whitmore Village, likely headed to Honolulu during the morning commute, conflict with the southbound left-turns and contribute to delays at the traffic signal.

In the P.M. peak hour, the southbound left-turn movement at Intersection 1 operates at LOS E. This movement likely experiences relatively high delay times because the traffic signal accommodates the heavy vehicle movement leaving the Wahiawa Annex (westbound left-turns) during the afternoon.

At Intersection 3 (Kamehameha Highway at California Avenue), the reported overall intersection LOS is LOS C during the morning and afternoon peaks. This intersection was observed to experience slight vehicle queuing in the northbound and southbound directions on Kamehameha Highway. While most vehicles traveling through this intersection were served during a single traffic cycle, occasional queues developed when vehicles were affected by downstream intersections and were not able to clear the intersection in a single cycle. Existing conditions SYNCHRO model output reports are provided in Appendix C.

Table 2-2. Existing (2020) Weekday Peak-Hour Intersection Analysis

Intersection and Movement	A.M. Peak			P.M. Peak		
	v/c	Delay	LOS	v/c	Delay	LOS
1. Kamehameha Highway at Whitmore Avenue	***0.79***	***38.4***	***D***	***0.90***	***41.1***	***D***
Westbound left	0.94	57.5	E	0.95	49.2	D
Westbound right	0.00	0.0	A	0.00	0.0	A
Northbound through	0.66	29.9	C	0.82	43.6	D
Northbound right	0.00	0.0	A	0.00	0.0	A
Southbound left	0.85	62.2	E	0.82	59.8	E
Southbound through	0.37	13.3	B	0.66	25.3	C
2. Kamananui Road at Kaukonahua Road	***0.40***	***8.9***	***A***	***0.67***	***13.6***	***B***
Eastbound left/through/right	0.25	25.3	C	0.22	20.1	C
Westbound left/through/right	0.51	27.5	C	0.70	25.4	C
Northbound left/through/right	0.34	3.7	A	0.56	10.3	B
Southbound left/through/right	0.18	2.9	A	0.48	9.0	A
3. Kamehameha Highway at California Avenue	***0.65***	***27.3***	***C***	***0.77***	***34.0***	***C***
Eastbound left/through	0.48	47.5	D	0.54	46.4	D
Eastbound through/right	0.64	50.7	D	0.74	51.0	D
Westbound left/through	0.85	41.3	D	0.86	44.1	D
Westbound right	0.11	31.8	C	0.37	34.3	C
Northbound left	0.29	16.4	B	0.43	21.1	C
Northbound through	0.55	20.9	C	0.67	27.9	C
Northbound right	0.52	21.8	C	0.80	37.8	D
Southbound left	0.09	16.4	B	0.29	21.4	C
Southbound through	0.52	22.0	C	0.63	28.4	C
Southbound right	0.05	16.3	B	0.07	20.5	C
4. Saipan Drive at Whitmore Avenue						
Eastbound left	0.45	12.3	B	0.21	9.8	A
Southbound left	0.04	32.2	D	0.02	20.6	C
Southbound right	0.08	11.1	B	0.44	14.4	B

Note: Results reported are consistent with the 2010 methodology in *HCM 2010: Highway Capacity Manual 2010* (TRB 2010).

delay = average, measured in seconds per vehicle
LOS = level of service
v/c = volume-to-capacity ratio

3. Future Conditions (2025) – Construction

This traffic study includes a qualitative assessment of future traffic conditions in the year 2025 to describe potential changes to transportation during project construction. Project construction is expected to begin as early as 2024 and last approximately 39 months. For the purpose of this analysis the peak of construction activity is anticipated to occur during mid-2025.

Traffic operations at study area intersections, without construction, are likely to be similar to existing conditions. Background traffic volumes on Kamehameha Highway may increase slightly between today and the peak of construction, but increases are not anticipated to be significant due to low anticipated growth in housing and employment in Whitmore Village and on the north shore of Oahu.

3.1 Construction Trip Generation and Distribution

Large trucks and other vehicles will be necessary to transport construction materials and equipment to the project site from various locations on Oahu. Heavy-duty or oversize trucks will likely be necessary to transport excavators, tractors, cranes, backhoes, and other construction equipment components to the site. Lighter-duty trucks carrying steel, concrete, gravel, water, and other necessary supplies to the site will also be required.

Construction personnel will be required on site throughout all construction activities. The number of construction vehicles and required personnel are unknown at this time and will be determined when a construction contractor is selected. The construction contractor will be required to obtain all permits for oversize and overweight vehicle loads on state roadways. The contractor will also be responsible for obtaining all applicable governmental permits or approvals for access to weight- or size-restricted bridges and structures, if necessary.

Construction activities are anticipated to occur on weekdays only during daylight hours. No construction activity or truck deliveries are expected on weekends or overnight. Depending on delivery schedules and availability of materials, trucks may be required to enter or exit the site throughout a typical day.

3.1.1 Public Roadways

Most large construction vehicles will likely originate in Honolulu or Kapolei. From either of these locations, the recommended inbound public transporter route is the H-2 freeway northbound to its terminus at Wilikina Drive. Trucks will be directed to continue traveling westbound on Wilikina Drive, northbound on Kamananui Road and eastbound on Kaukonahua Road to southbound Kamehameha Highway.

From Kamehameha Highway, construction vehicles can make a protected left-turn to Whitmore Avenue at the traffic signal. This transporter route is recommended for construction trucks and heavy or oversized vehicles because potential construction impacts to traffic safety or maintenance are anticipated to be minimal. These roadways are on the state highway system and are constructed to design, safety, and load-bearing standards. These roadways can accommodate vehicles at the legal load limit, thereby reducing the potential for safety and maintenance impacts.

Kamehameha Highway through Wahiawa is not recommended as a transport route for heavy or large construction vehicles. The Karsten Thot Bridge on the north side of Wahiawa has a vehicle height limit of 14 feet 4 inches and a vehicle weight limit of 22 tons. These posted restrictions will limit certain construction vehicles from crossing it and, therefore, makes Kamehameha Highway south of the project site an unsuitable transporter route.

The highway through Wahiawa also has multiple driveway accesses, signalized intersections with crosswalks, and on-street parallel parking; it also experiences some level of congestion during peak hours. These factors may increase the potential for conflicts between construction trucks and passenger vehicles, pedestrians, bicyclists, and transit.

Existing structures will be demolished on the project site. Trucks will be required to remove demolition waste and excavated soils from the site. Trucks carrying debris and waste will likely dispose of these materials at specified landfills in Nanakuli or other locations to be identified at a later date. The recommended outbound public transporter route from the project site is the reverse of the inbound transporter route. Trucks will be directed to travel westbound on Whitmore Avenue, northbound on Kamehameha Highway, westbound on Kaukonahua Road, southbound on Kamananui Road, and eastbound on Wilikina Drive to the H-2 freeway. This outbound route is recommended because it bypasses the height- and load-restricted Karsten Thot Bridge and avoids potential safety conflicts in Wahiawa.

3.1.2 Installation Roadways

From Whitmore Avenue, all construction vehicles will be directed to use Saipan Drive to enter the Wahiawa Annex at the Saipan Gate. From Saipan Drive, construction vehicles will continue traveling east on Polaris Drive and south on Midway Drive to the project site. These private installation roadways are paved with one lane in each direction and appear to have adequate sight-distance and grades to accommodate large, heavy, slow-moving trucks. Installation roads have a 45-ton weight limit and are anticipated to accommodate all legal loads of 80,000 pounds of gross vehicle weight.

Construction vehicles will not be permitted access at the Whitmore Gate for multiple reasons. First, to use this gate, large trucks will have to travel through Whitmore Village, potentially resulting in safety concerns (that is, conflicts with residential vehicles and pedestrians) and adverse effects on the community. Further, once through the Whitmore Gate, trucks will also need to travel through base residential areas, navigate a tight left-turn at Midway Drive, cross a narrow bridge over a gulch, and climb a steep grade to reach the project site. Due to these challenges, access at the Whitmore Gate is not recommended for construction truck traffic and will not be permitted.

3.2 Transportation Management Plan

Significant adverse impacts to transportation on construction transporter routes are not anticipated with project implementation. Increased truck traffic volumes on Kamehameha Highway may present potential roadway hazards to bicyclists, but hazards can be minimized by adding warning signage and visual aids. Construction-related traffic also may cause short-term traffic delays (due of large, slow-moving, delivery trucks) at study intersections, however, these delays will be temporary and can be minimized through public awareness campaigns and uniformed traffic control officers.

A transportation management plan should be considered to identify potential impacts resulting from construction traffic and propose minimization strategies. This plan may include the following objectives:

- Providing notices to nearby residents and businesses, prior to construction, to inform them when construction takes place to help minimize access disruptions;
- Providing detour plans and proper roadway signage and warnings of “Equipment on Road,” “Truck Access,” or “Road Crossings” in advance of any planned traffic disturbances;
- Implementing traffic diversion equipment (such as advance signage and pilot cars) whenever possible when slow or oversize loads are being hauled;

- Employing flag persons as necessary to direct traffic when large equipment is exiting or entering public roads to minimize risk of accidents;
- Maintaining at least one travel lane at all times so that roadways will not be closed to traffic due to construction vehicles entering or exiting public roads, and if lane closures must occur, then adequate signage for potential detours or possible delays will be posted;
- Encouraging carpooling for the construction workforce to reduce traffic volume;
- Requiring all construction vehicles to yield to school-related vehicles (such as school busses) and lower their speed when approaching a school bus or bus stop along the transporter route; and
- Ensuring that all construction vehicles yield to emergency vehicles as required by local, state, and federal requirements.

4. Future Conditions (2027) – Operations

The project is anticipated to be complete and operational during mid-2027. The DCGS Pacific Hub will be staffed with up to 200 personnel, some of whom are currently stationed at other locations within the Wahiawa Annex, 24 hours a day, 7 days a week. This section evaluates potential changes in traffic at the study intersections due to project operations.

4.1 Without Project (No Action)

Traffic volumes on study area roadways are anticipated to increase slightly through the future year 2027 without the project. This scenario is referred to as the No Action condition. Moderate increases due to expanding existing land uses or new land use developments in the area surrounding the Wahiawa Annex are captured by an assumed background growth rate applied to existing traffic volumes. An estimated annual growth rate of 0.5 percent per year is assumed to forecast background vehicle volumes in 2027. This growth rate is consistent with areawide traffic growth assumptions through a similar timeframe as documented in the Traffic Study Report (Helber Hastert & Fee Planners and Julian Ng, Inc. 2019).

The future No Action intersection lane configurations are expected to be the same as existing conditions. No changes to lane capacity, signal phasing, or signal timing are assumed, and no improvements to motorized or nonmotorized modes are assumed in the No Action analysis. Table 4-1 compares existing and future No Action operation results for the A.M. peak hour. Table 4-2 shows the intersection operations results for the P.M. peak hour. Figure 4-1 shows future No Action lane channelization, traffic volumes, and overall intersection operations results at each study intersection.

With background growth, traffic operations at the study intersections during the A.M. peak hour are anticipated to be very similar to existing conditions. The individual movement delay on certain lanes will increase slightly, but the overall intersection LOS and individual movement LOS will largely remain unchanged.

The southbound and westbound left-turn movements at Intersection 1 (Kamehameha Highway and Whitmore Avenue) are expected to continue to operate at LOS E during the A.M. peak hour due to relatively high volumes leaving Whitmore Village and heading towards Honolulu. At Intersection 4, due to very minor volume increases, the stop-controlled southbound left-turn movement from Saipan Drive to Whitmore Avenue may worsen slightly from LOS D to LOS E in the A.M. peak hour as vehicles wait to find an acceptable gap in traffic. This movement is very low volume and is not expected to noticeably affect intersection operations.

During the P.M. peak hour, vehicle movements will experience only minor increases to average delay compared to existing conditions. All but two vehicle movements are expected to operate with acceptable LOS values under No Action condition. At Intersection 1, the southbound left-turn movement from Kamehameha Highway to Whitmore Avenue currently operates at LOS E and is likely to continue operating at LOS E under the No Action condition because the traffic signal may be prioritized to accommodate the westbound left-turns from Whitmore Avenue. The northbound through movement on Kamehameha Highway could worsen slightly from LOS D under existing conditions to LOS E under No Action conditions due to modest increases in background traffic volumes.

Table 4-1. Existing (2020) and No Action (2027) A.M. Peak-Hour Intersection Analysis

Intersection and Movement	Existing (2020) A.M. Peak			No Action (2027) A.M. Peak		
	v/c	Delay	LOS	v/c	Delay	LOS
1. Kamehameha Highway at Whitmore Avenue	***0.79***	***38.4***	***D***	***0.83***	***41.1***	***D***
Westbound left	0.94	57.5	E	0.95	59.7	E
Westbound right	0.00	0.0	A	0.00	0.0	A
Northbound through	0.66	29.9	C	0.72	33.8	C
Northbound right	0.00	0.0	A	0.00	0.0	A
Southbound left	0.85	62.2	E	0.86	66.0	E
Southbound through	0.37	13.3	B	0.40	14.4	B
2. Kamananui Road at Kaukonahua Road	***0.40***	***8.9***	***A***	***0.43***	***9.1***	***A***
Eastbound left/through/right	0.25	25.3	C	0.25	25.1	C
Westbound left/through/right	0.51	27.5	C	0.53	27.5	C
Northbound left/through/right	0.34	3.7	A	0.37	4.1	A
Southbound left/through/right	0.18	2.9	A	0.20	3.1	A
3. Kamehameha Highway at California Avenue	***0.65***	***27.3***	***C***	***0.69***	***29.4***	***C***
Eastbound left/through	0.48	47.5	D	0.51	49.2	D
Eastbound through/right	0.64	50.7	D	0.67	52.7	D
Westbound left/through	0.85	41.3	D	0.86	43.7	D
Westbound right	0.11	31.8	C	0.14	32.8	C
Northbound left	0.29	16.4	B	0.34	17.9	B
Northbound through	0.55	20.9	C	0.58	22.9	C
Northbound right	0.52	21.8	C	0.55	23.9	C
Southbound left	0.09	16.4	B	0.12	17.8	B
Southbound through	0.52	22.0	C	0.56	24.0	C
Southbound right	0.05	16.3	B	0.06	17.6	B
4. Saipan Drive at Whitmore Avenue						
Eastbound left	0.45	12.3	B	0.48	12.9	B
Southbound left	0.04	32.2	D	0.09	36.3	E
Southbound right	0.08	11.1	B	0.10	11.4	B

Note: Results reported are consistent with the 2010 methodology in *HCM2010: Highway Capacity Manual 2010* (TRB 2010).

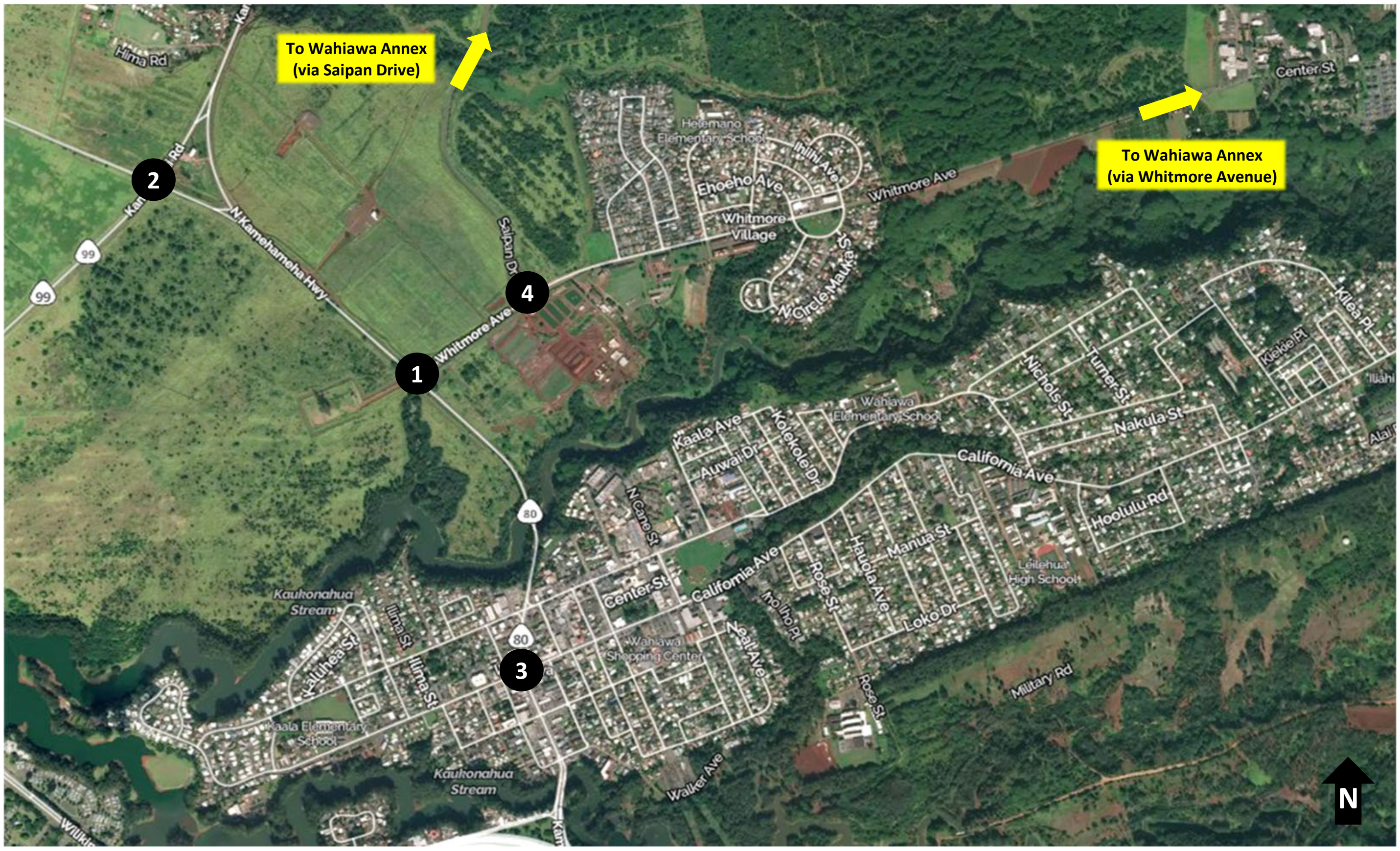
delay = average, measured in seconds per vehicle
LOS = level of service
v/c = volume-to-capacity ratio

Table 4-2. Existing (2020) and No Action (2027) P.M. Peak-Hour Intersection Analysis

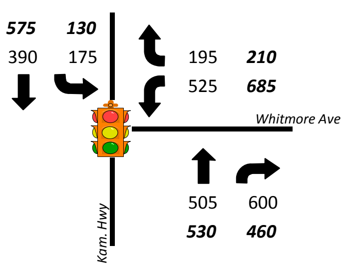
Intersection and Movement	Existing (2020) P.M. Peak			No Action (2027) P.M. Peak		
	v/c	Delay	LOS	v/c	Delay	LOS
1. Kamehameha Highway at Whitmore Avenue	***0.90***	***41.1***	***D***	***0.95***	***46.5***	***D***
Westbound left	0.95	49.2	D	0.96	52.0	D
Westbound right	0.00	0.0	A	0.00	0.0	A
Northbound through	0.82	43.6	D	0.91	55.5	E
Northbound right	0.00	0.0	A	0.00	0.0	A
Southbound left	0.82	59.8	E	0.83	60.9	E
Southbound through	0.66	25.3	C	0.71	28.4	C
2. Kamananui Road at Kaukonahua Road	***0.67***	***13.6***	***B***	***0.73***	***14.9***	***B***
Eastbound left/through/right	0.22	20.1	C	0.23	19.7	B
Westbound left/through/right	0.70	25.4	C	0.72	25.9	C
Northbound left/through/right	0.56	10.3	B	0.61	12.1	B
Southbound left/through/right	0.48	9.0	A	0.51	10.2	B
3. Kamehameha Highway at California Avenue	***0.77***	***34.0***	***C***	***0.82***	***36.9***	***D***
Eastbound left/through	0.54	46.4	D	0.58	48.4	D
Eastbound through/right	0.74	51.0	D	0.76	53.0	D
Westbound left/through	0.86	44.1	D	0.88	47.3	D
Westbound right	0.37	34.3	C	0.39	35.4	D
Northbound left	0.43	21.1	C	0.50	23.1	C
Northbound through	0.67	27.9	C	0.70	30.3	C
Northbound right	0.80	37.8	D	0.85	43.0	D
Southbound left	0.29	21.4	C	0.34	23.6	C
Southbound through	0.63	28.4	C	0.67	31.1	C
Southbound right	0.07	20.5	C	0.08	22.1	C
4. Saipan Drive at Whitmore Avenue						
Eastbound left	0.21	9.8	A	0.23	10.1	B
Southbound left	0.02	20.6	C	0.05	22.4	C
Southbound right	0.44	14.4	B	0.47	15.3	C

Note: Results reported are consistent with the 2010 methodology in *HCM 2010: Highway Capacity Manual 2010* (TRB 2010).

delay = average, measured in seconds per vehicle
LOS = level of service
v/c = volume-to-capacity ratio

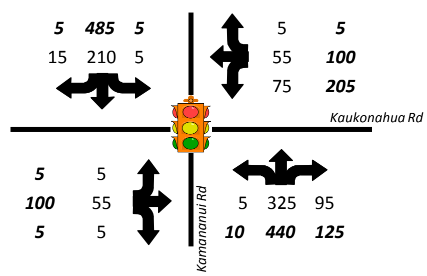


1 Kamehameha Highway / Whitmore Avenue



	V/C	Delay (s)	LOS
No Action AM	0.83	41.1	D
No Action PM	0.95	46.5	D

2 Kamananui Road / Kaukonahua Road



	V/C	Delay (s)	LOS
No Action AM	0.43	9.1	A
No Action PM	0.73	14.9	B

Legend

2 Study Intersection Number

STOP Stop-Controlled Approach

Signalized Intersection

Turning Movement Direction

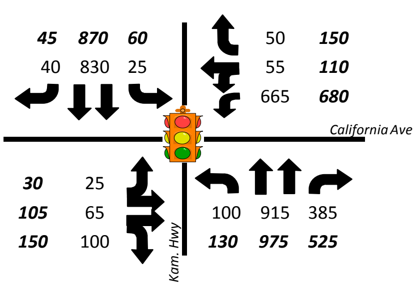
100 AM Peak-Hour Volume

100 PM Peak-Hour Volume

V/C Volume to Capacity Ratio

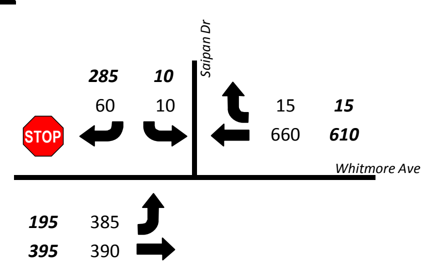
LOS Level of Service

3 Kamehameha Highway / California Avenue



	V/C	Delay (s)	LOS
No Action AM	0.69	29.4	C
No Action PM	0.82	36.9	D

4 Saipan Drive / Whitmore Avenue



	V/C	Delay (s)	LOS
No Action AM	0.09	36.3	E
No Action PM	0.05	22.4	C

Notes

1. Delay and Level of Service results are based on HCM 2010 methodology. Volume-to-capacity ratios are based on HCM 2000 methodology.
2. Signalized intersection results are based on an average of all approaches.
3. Stop-control intersection delay results are shown for the worst minor street approach.

Figure 4-1

No Action (2027) Peak-Hour Traffic Conditions

JBPHH Wahiawa Annex

Oahu, Hawaii

4.2 With Project (Build)

The Build analysis includes project-generated operations trips added to the No Action conditions traffic volumes at each study intersection. Intersection lane geometry and traffic-signal phasing are assumed to be the same as the No Action condition.

4.2.1 Trip Generation and Distribution

When DCGS Pacific Hub operations begin, staff will be on site 24 hours per day, 7 days a week to maintain operations. Approximately 180 to 200 personnel are anticipated to occupy the Hub during operations. Most personnel occupying the Hub (approximately 158) currently live or work in the project area. Most remaining personnel (approximately 50 personnel) to occupy the Hub are expected to be from the local workforce. Military personnel that will occupy the Hub are housed at Helemano or Schofield Barracks, in the Wahiawa area, at Hickam AFB, at Navy housing near Hickam AFB, or at Aliamanu Military Reservation, near Honolulu

Of the 200 personnel to occupy the DCGS Pacific Hub, approximately 50 personnel are anticipated to be currently working at the Wahiawa Annex and will be reassigned to this Hub. Assuming the remaining 150 personnel will travel to the Hub alone (no carpooling assumed), 150 new vehicle round trips (one inbound trip and one outbound trip) will be generated each day and added to the transportation network.

These 150 personnel vehicle trips to and from the DCGS Pacific Hub are not anticipated to affect regional traffic patterns or contribute to commute peak congestion on the H-1 or H-2 freeways. Staff commuting to and from the Wahiawa Annex will likely travel in the opposite direction of commuter traffic for employment based in downtown Honolulu or Kapolei, the islands primary business centers. Also, because of the Hub’s unique staffing and operations requirements, personnel arrivals and departures at the Hub during operations will occur throughout the day as necessary and will not be concentrated around the typical morning or afternoon commute peaks.

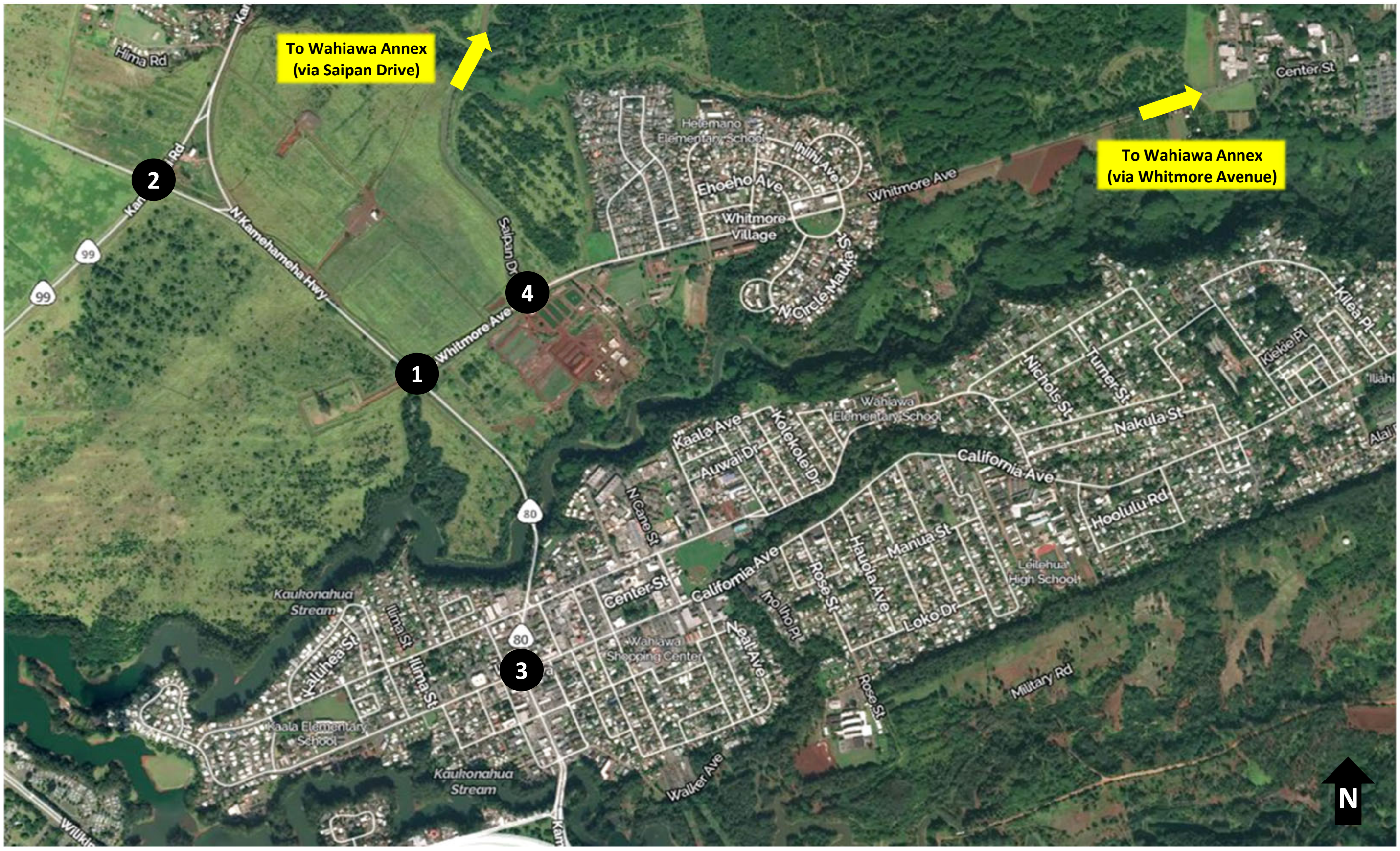
DCGS Pacific Hub job duties and personnel shift schedules are unknown at this time. Conservatively, up to 25 personnel—of the expected 150 new personnel—are likely to arrive and depart the Wahiawa Annex during the peak hours. The traffic analysis with project-generated vehicle trips assumes 25 vehicles will enter (25 one-way trips inbound) and 25 vehicles will exit (25 one-way trips outbound) the Wahiawa Annex during the A.M. and P.M. analysis peak hours.

4.2.2 Intersection Operations

The No Action and Build analysis traffic volumes are shown on Figures 4-2 and 4-3. Intersection volumes associated with project operations are highlighted on Figures 4-2 and 4-3 for A.M. and P.M. peak-hour operations, respectively. Most turning-movement volumes are expected to remain unchanged from the No Action condition.

Tables 4-3 and 4-4 summarize the intersection operational results, compared with No Action, for each Build condition. With operations trips, the minor increases to average vehicle delay for individual turning movements are negligible and the majority of movements are expected to operate within the acceptable LOS D threshold.

Intersection turning movements that are expected to operate at LOS E under the No Action condition will continue to do so with the project trips. Project-generated vehicle trips are not anticipated to degrade operations or adversely impact the intersections during the A.M. or the P.M. peak hour of analyses. The future year 2027 SYNCHRO model output reports for the No Action and Build scenarios are provided in Appendix D.



1 Kamehameha Highway / Whitmore Avenue

		No Action	Build w/ Project
Southbound (Kam. Hwy)	Through	390	**390**
Southbound (Kam. Hwy)	Left	175	**185**
Westbound (Whitmore Ave)	Right	195	**205**
Westbound (Whitmore Ave)	Left	525	**540**
Northbound (Kam. Hwy)	Through	505	**505**
Northbound (Kam. Hwy)	Right	600	**615**

	V/C	Delay (s)	LOS
No Action	0.83	41.1	D
Build w/ Project	0.84	43.2	D

2 Kamananui Road / Kaukonahua Road

	No Action	Build w/ Project
Southbound (Kamananui Rd)	15 / 210 / 5	**15 / 210 / 5**
Westbound (Kaukonahua Rd)	5 / 55 / 75	**5 / 55 / 80**
Eastbound	5 / 55 / 5	**5 / 55 / 5**
Northbound (Kamananui Rd)	5 / 325 / 95	**5 / 325 / 100**

	V/C	Delay (s)	LOS
No Action	0.43	9.1	A
Build w/ Project	0.44	9.3	A

3 Kamehameha Highway / California Avenue

	No Action	Build w/ Project
Southbound (Kam. Hwy)	40 / 830 / 25	**40 / 845 / 25**
Westbound (California Ave)	50 / 55 / 665	**50 / 55 / 665**
Eastbound	25 / 65 / 100	**25 / 65 / 100**
Northbound (Kam. Hwy)	100 / 915 / 385	**100 / 930 / 385**

	V/C	Delay (s)	LOS
No Action	0.69	29.4	C
Build w/ Project	0.69	29.4	C

4 Saipan Drive / Whitmore Avenue

		No Action	Build w/ Project
Southbound (Saipan Dr, STOP)	Right	60	**75**
Southbound (Saipan Dr, STOP)	Left	10	**10**
Westbound (Whitmore Ave)	Right	15	**15**
Westbound (Whitmore Ave)	Through	660	**670**
Eastbound (Whitmore Ave)	Left	385	**400**
Eastbound (Whitmore Ave)	Through	390	**400**

	V/C	Delay (s)	LOS
No Action	0.09	36.3	E
Build w/ Project	0.09	38.3	E

Legend

- (2) Study Intersection Number
- STOP Stop-Controlled Approach
- Signalized Intersection
- Turning Movement Direction
- 100 No Action Volume
- **100** Build w/ Project Volume
- **100** (highlighted) Includes Project-generated Trips
- V/C Volume to Capacity Ratio
- LOS Level of Service

Notes

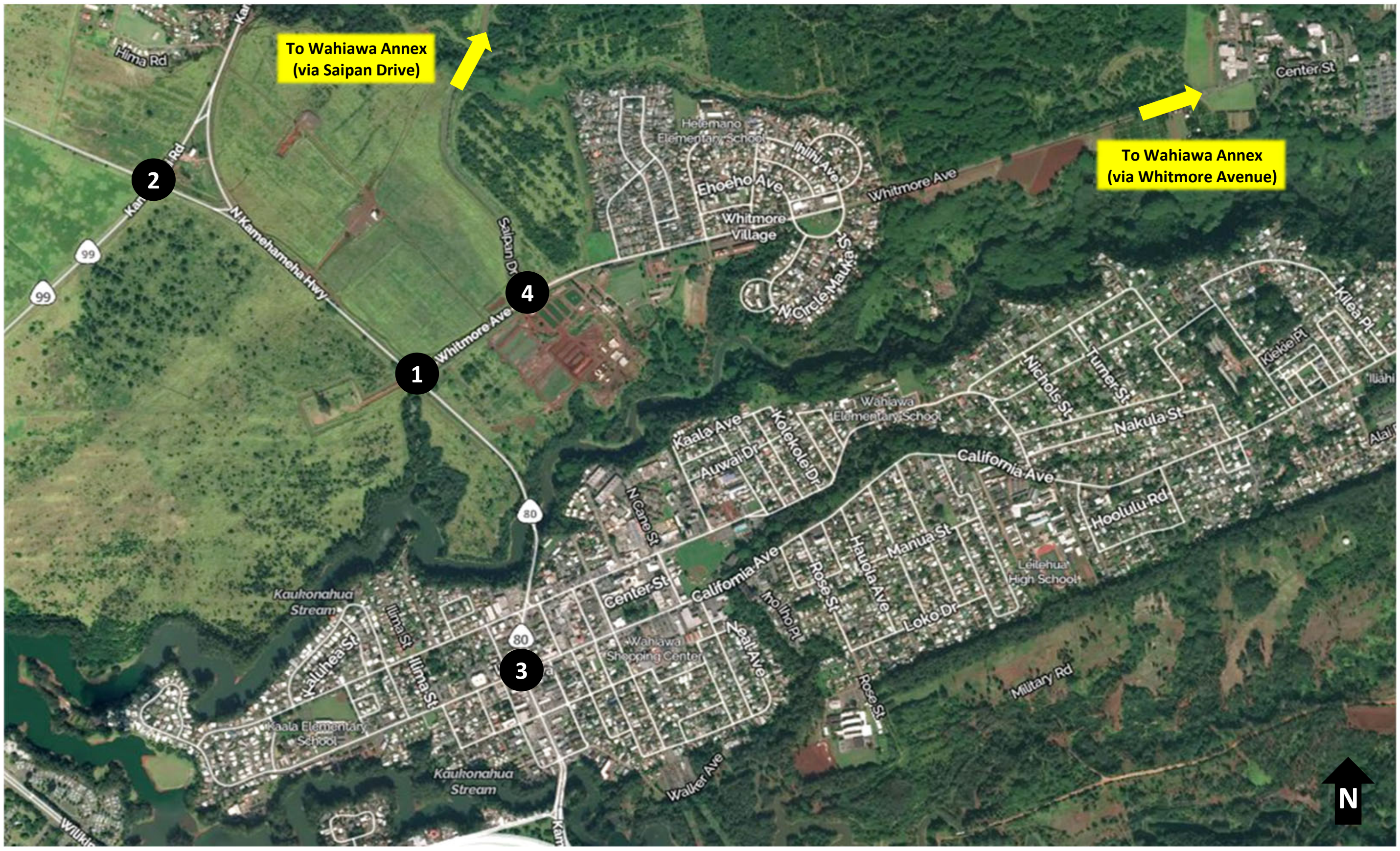
1. Delay and Level of Service results are based on HCM 2010 methodology. Volume-to-capacity ratios are based on HCM 2000 methodology.
2. Signalized intersection results are based on an average of all approaches.
3. Stop-control intersection delay results are shown for the worst minor street approach.
4. Turning movements with project-generated vehicle trips are highlighted blue.

Figure 4-2

Build (2027) A.M. Peak-Hour Traffic Conditions

JBPHH Wahiawa Annex

Oahu, Hawaii



1 Kamehameha Highway / Whitmore Avenue

Southbound (Kam. Hwy): 575 / 575 (through), **140** / 130 (left)
Westbound (Whitmore Ave): **220** / 210 (right), **700** / 685 (left)
Northbound (Kam. Hwy): **530** / 530 (through), **475** / 460 (right)

	V/C	Delay (s)	LOS
No Action	0.95	46.5	D
Build w/ Project	0.96	49.4	D

2 Kamananui Road / Kaukonahua Road

Southbound (Kamananui Rd): **5 485 5** / 5 485 5
Westbound (Kaukonahua Rd): **5** / 5, **100** / 100, **210** / 205
Eastbound: **5** / 5, **100** / 100, **5** / 5
Northbound: **10** / 10, **440** / 440, **130** / 125

	V/C	Delay (s)	LOS
No Action	0.73	14.9	B
Build w/ Project	0.73	15.2	B

Legend

2 Study Intersection Number
STOP Stop-Controlled Approach
Signalized Intersection
Turning Movement Direction
100 No Action Volume
100 Build w/ Project Volume
100 Includes Project-generated Trips
V/C Volume to Capacity Ratio
LOS Level of Service

3 Kamehameha Highway / California Avenue

Southbound (Kam. Hwy): **45** / 45, **885** / 870, **60** / 60
Westbound (California Ave): **150** / 150, **110** / 110, **680** / 680
Eastbound: **30** / 30, **105** / 105, **150** / 150
Northbound: **130** / 130, **990** / 975, **525** / 525

	V/C	Delay (s)	LOS
No Action	0.82	36.9	D
Build w/ Project	0.83	37.0	D

4 Saipan Drive / Whitmore Avenue

Southbound (Saipan Dr, STOP): **300** / 285, **10** / 10
Westbound (Whitmore Ave): **15** / 15, **620** / 610
Eastbound: **210** / 195, **405** / 395

	V/C	Delay (s)	LOS
No Action	0.05	22.4	C
Build w/ Project	0.05	23.4	C

Notes

1. Delay and Level of Service results are based on HCM 2010 methodology. Volume-to-capacity ratios are based on HCM 2000 methodology.
2. Signalized intersection results are based on an average of all approaches.
3. Stop-control intersection delay results are shown for the worst minor street approach.
4. Turning movements with project-generated vehicle trips are highlighted blue.

Figure 4-3

Build (2027) P.M. Peak-Hour Traffic Conditions

JBPHH Wahiawa Annex

Oahu, Hawaii

Table 4-3. No Action and Build (2027) A.M. Peak-Hour Intersection Analysis

Intersection and Movement	No Action (2027) A.M. Peak			Build (2027) A.M. Peak		
	v/c	Delay	LOS	v/c	Delay	LOS
1. Kamehameha Highway at Whitmore Avenue	***0.83***	***41.1***	***D***	***0.84***	***43.2***	***D***
Westbound left	0.95	59.7	E	0.96	61.4	E
Westbound right	0.00	0.0	A	0.00	0.0	A
Northbound through	0.72	33.8	C	0.74	36.1	D
Northbound right	0.00	0.0	A	0.00	0.0	A
Southbound left	0.86	66.0	E	0.87	68.6	E
Southbound through	.40	14.4	B	0.40	15.0	B
2. Kamananui Road at Kaukonahua Road	***0.43***	***9.1***	***A***	***0.44***	***9.3***	***A***
Eastbound left/through/right	0.25	25.1	C	0.25	25.0	C
Westbound left/through/right	0.53	27.5	C	0.54	27.5	C
Northbound left/through/right	0.37	4.1	A	0.38	4.2	A
Southbound left/through/right	0.20	3.1	A	0.20	3.2	A
3. Kamehameha Highway at California Avenue	***0.69***	***29.4***	***C***	***0.69***	***29.4***	***C***
Eastbound left/through	0.51	49.2	D	0.51	49.2	D
Eastbound through/right	0.67	52.7	D	0.67	52.7	D
Westbound left/through	0.86	43.7	D	0.86	43.7	D
Westbound right	0.14	32.8	C	0.14	32.8	C
Northbound left	0.34	17.9	B	0.34	18.0	B
Northbound through	0.58	22.9	C	0.59	23.1	C
Northbound right	0.55	23.9	C	0.55	23.9	C
Southbound left	0.12	17.8	B	0.12	17.9	B
Southbound through	0.56	24.0	C	0.57	24.2	C
Southbound right	0.06	17.6	B	0.06	17.6	B
4. Saipan Drive at Whitmore Avenue						
Eastbound left	0.48	12.9	B	0.51	13.4	B
Southbound left	0.09	36.3	E	0.09	38.3	E
Southbound right	0.10	11.4	B	0.13	11.6	B

Note: Results reported are consistent with the 2010 methodology in *HCM2010: Highway Capacity Manual 2010* (TRB 2010).

delay = average, measured in seconds per vehicle
LOS = level of service
v/c = volume-to-capacity ratio

Table 4-4. No Action and Build (2027) P.M. Peak-Hour Intersection Analysis

Intersection and Movement	No Action (2027) P.M. Peak			Build (2027) P.M. Peak		
	v/c	Delay	LOS	v/c	Delay	LOS
1. Kamehameha Highway at Whitmore Avenue	***0.95***	***46.5***	***D***	***0.96***	***49.4***	***D***
Westbound left	0.96	52.0	D	0.96	53.6	D
Westbound right	0.00	0.0	A	0.00	0.0	A
Northbound through	0.91	55.5	E	0.94	62.5	E
Northbound right	0.00	0.0	A	0.00	0.0	A
Southbound left	0.83	60.9	E	0.84	61.2	E
Southbound through	0.71	28.4	C	0.72	29.5	C
2. Kamananui Road at Kaukonahua Road	***0.73***	***14.9***	***B***	***0.73***	***15.2***	***B***
Eastbound left/through/right	0.23	19.7	B	0.22	19.6	B
Westbound left/through/right	0.72	25.9	C	0.73	26.1	C
Northbound left/through/right	0.61	12.1	B	0.62	12.5	B
Southbound left/through/right	0.51	10.2	B	0.51	10.5	B
3. Kamehameha Highway at California Avenue	***0.82***	***36.9***	***D***	***0.83***	***37.0***	***D***
Eastbound left/through	0.58	48.4	D	0.58	48.4	D
Eastbound through/right	0.76	53.0	D	0.76	53.0	D
Westbound left/through	0.88	47.3	D	0.88	47.3	D
Westbound right	0.39	35.4	D	0.39	35.4	D
Northbound left	0.50	23.1	C	0.50	23.4	C
Northbound through	0.70	30.3	C	0.71	30.6	C
Northbound right	0.85	43.0	D	0.85	43.0	D
Southbound left	0.34	23.6	C	0.34	23.8	C
Southbound through	0.67	31.1	C	0.68	31.4	C
Southbound right	0.08	22.1	C	0.08	22.1	C
4. Saipan Drive at Whitmore Avenue						
Eastbound left	0.23	10.1	B	0.25	10.3	B
Southbound left	0.05	22.4	C	0.05	23.4	C
Southbound right	0.47	15.3	C	0.50	15.9	C

Note: Results reported are consistent with the 2010 methodology in *HCM2010: Highway Capacity Manual 2010* (TRB 2010).

delay = average, measured in seconds per vehicle
LOS = level of service
v/c = volume-to-capacity ratio;

4.2.3 Summary

Changes to lane configurations are not recommended at any study intersection. Most intersection movements will operate within the acceptable LOS D threshold during DCGS Pacific Hub operations. Intersection movements that are anticipated to operate at LOS E when DCGS Pacific Hub operations begin will do so with or without the project, not as a result of project-generated operations trips on the transportation network.

During project construction, travelers at the study intersections will likely experience temporary increases in average vehicle delay and longer queue lengths when large, heavy, slow-moving trucks are traveling along the study area roadways between the Wahiawa Annex and Honolulu. While these impacts may be noticeable, they will be temporary and can be minimized by providing advanced warning of construction activities, implementing a traffic management plan and coordinating with state and local transportation authorities.

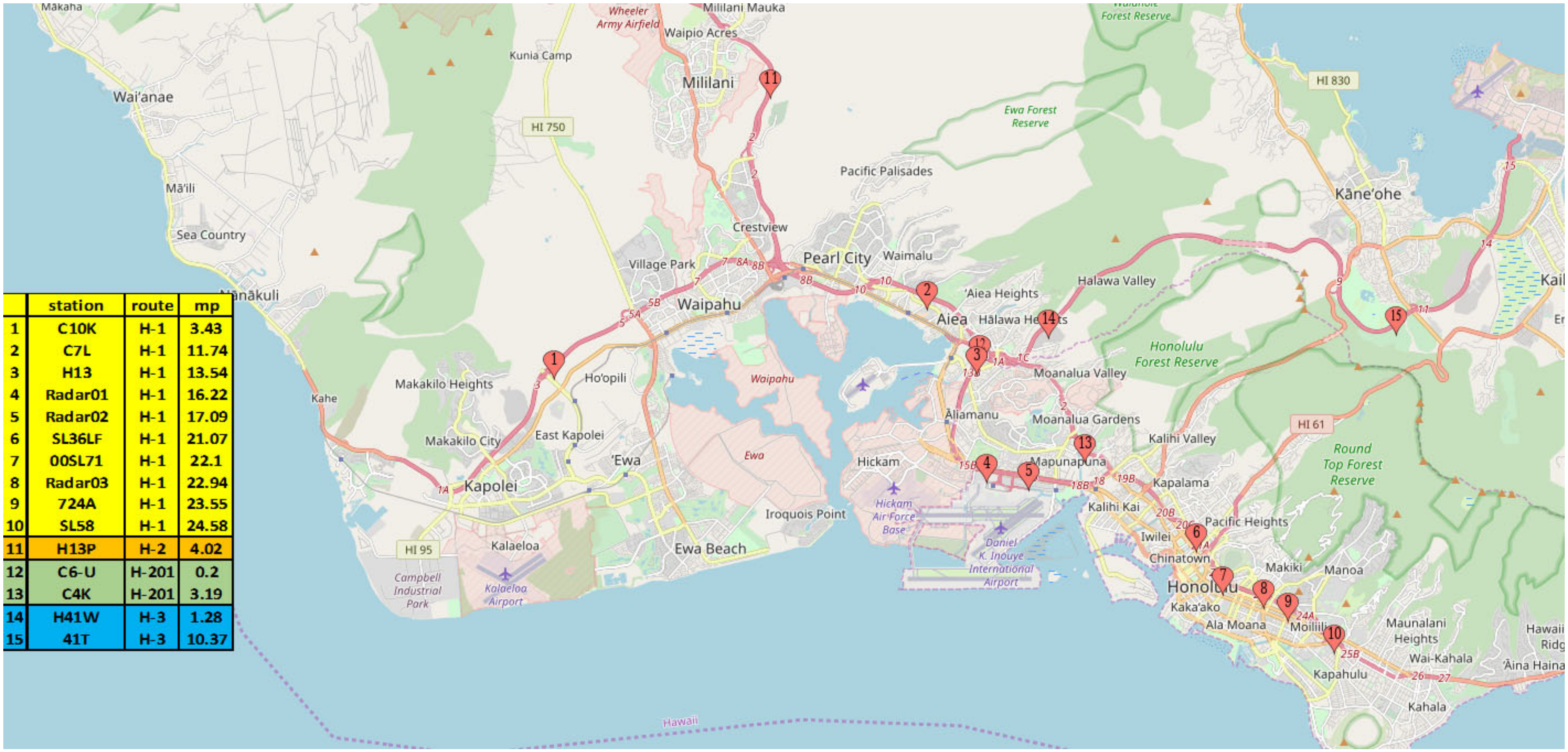
5. Works Cited

Hawaii Department of Transportation (HDOT). 2020. *Bike Map Oahu*. Accessed at https://hidot.hawaii.gov/highways/bike-map-oahu/. Accessed on November 29, 2020.

Helber Hastert & Fee Planners and Julian Ng, Inc.. 2019. *Traffic Study Report for MILCON P-013 NIOC Hawaii Communications/ Cryptologic Facilities at JBPHH Wahiawa Annex*. Final. Prepared for NAVFAC Pacific, Navy Contract N62742-17-D-1804, Delivery Order N6274218F0194. March 20.

Transportation Research Board (TRB). 2010. *HCM2010: Highway Capacity Manual*. Fifth edition. Washington D.C.: National Research Council, Transportation Research Board.

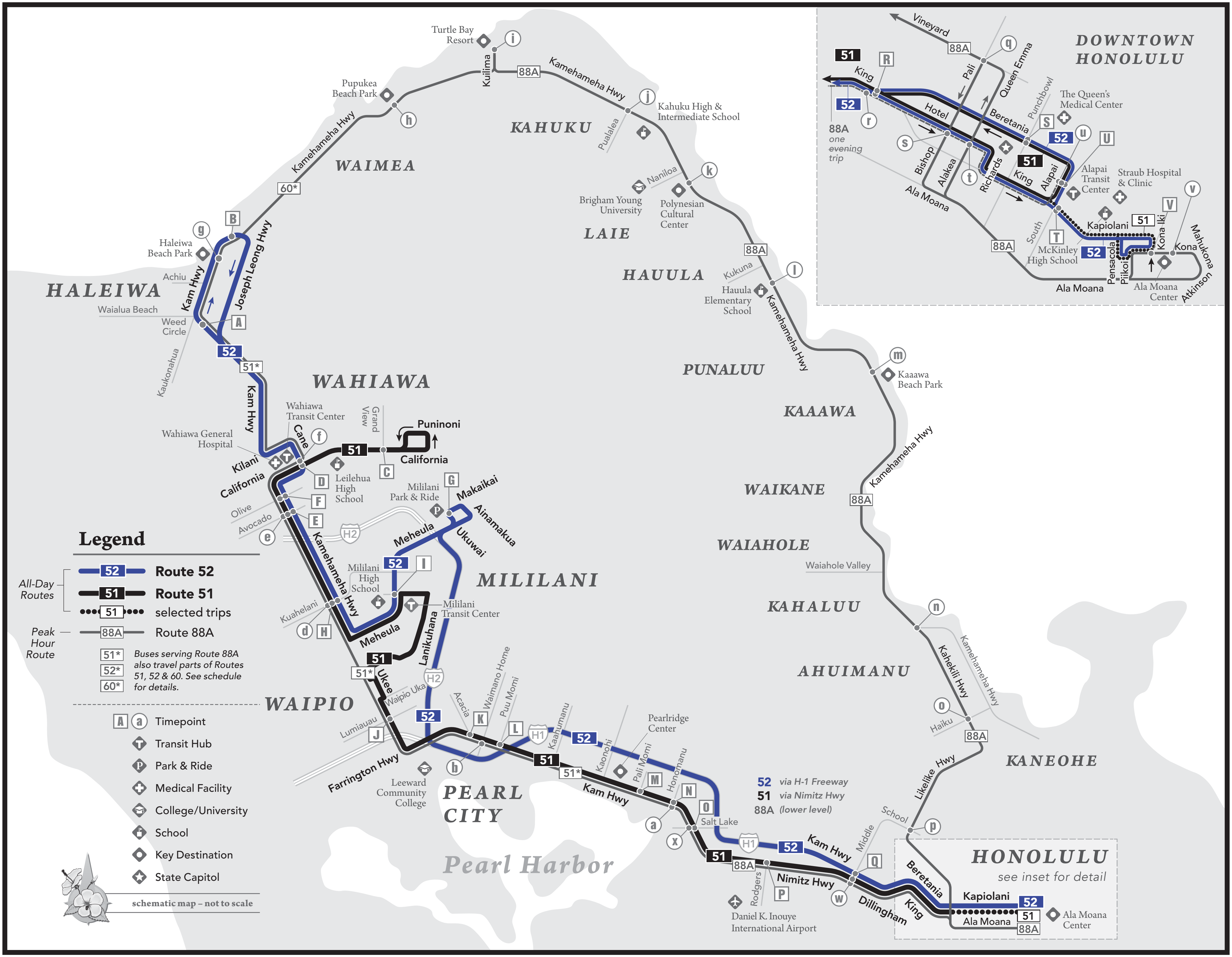
Appendix A
Hawaii Department of Transportation Traffic Counts (pre-COVID)



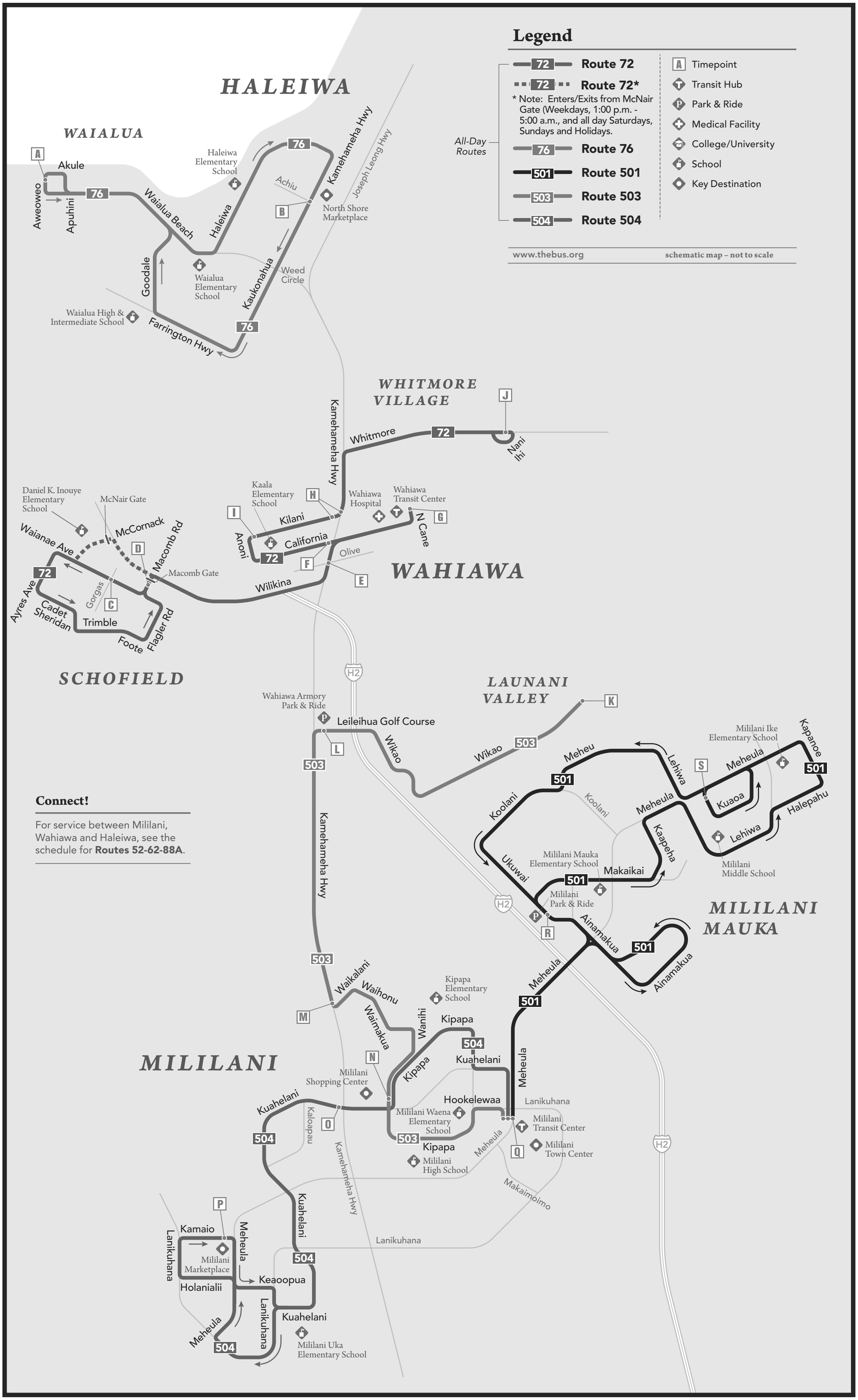
	station	route	mp
1	C10K	H-1	3.43
2	C7L	H-1	11.74
3	H13	H-1	13.54
4	Radar01	H-1	16.22
5	Radar02	H-1	17.09
6	SL36LF	H-1	21.07
7	00SL71	H-1	22.1
8	Radar03	H-1	22.94
9	724A	H-1	23.55
10	SL58	H-1	24.58
11	H13P	H-2	4.02
12	C6-U	H-201	0.2
13	C4K	H-201	3.19
14	H41W	H-3	1.28
15	41T	H-3	10.37

No.	Station ID	Route	Mile Marker	2019 AADT	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	11/4/20	11/10/20	11/18/20
1	C10K	H-1	3.43	99,210	4%	3%	-18%	-34%	-23%	-16%	-14%	-16%	-21%	-15%	-14%	-11%	-13%
2	C7L	H-1	11.74	263,152	4%	3%	-18%	-38%	-25%	-17%	-14%	-17%	-22%	-17%	-16%	-14%	---
3	H13	H-1	13.54	120,008	4%	2%	-21%	-44%	-32%	-24%	-22%	-25%	-29%	-24%	-24%	-21%	-21%
4	Radar01	H-1	16.22	106,504	6%	2%	-26%	-46%	-36%	-28%	-26%	-30%	-35%	-30%	-30%	-27%	-25%
5	Radar02	H-1	17.09	96,377	4%	4%	-30%	-51%	-45%	-31%	-26%	-30%	-34%	-30%	-31%	-27%	-24%
6	SL36LF	H-1	21.07	200,936	0%	0%	-25%	-45%	-33%	-24%	-20%	-23%	-29%	-22%	-20%	-18%	-20%
7	00SL71	H-1	22.1	180,747	4%	5%	-25%	-46%	-34%	-24%	-21%	-23%	-29%	-21%	-19%	-16%	-18%
8	Radar03	H-1	22.94	196,163	3%	3%	-24%	-45%	-32%	-22%	-19%	-22%	-28%	-20%	-18%	---	---
9	724A	H-1	23.55	144,848	4%	5%	-26%	-44%	-31%	-21%	-19%	-22%	-27%	-21%	-19%	-17%	-19%
10	SL58	H-1	24.58	114,355	3%	3%	-26%	-43%	-29%	-19%	-15%	-19%	-25%	-19%	-17%	-15%	-18%
11	H13P	H-2	4.02	102,551	0%	3%	-21%	-39%	-24%	-16%	-13%	-15%	-22%	-18%	-16%	-14%	-15%
12	C6-U	H-201	0.2	52,285	5%	6%	-26%	-43%	-29%	-19%	-15%	-19%	-27%	-17%	-16%	-13%	-16%
13	C4K	H-201	3.19	113,439	0%	3%	-24%	-41%	-26%	-24%	---	---	---	---	---	---	---
14	H41W	H-3	1.28	55,524	-3%	-4%	-23%	-37%	-26%	-18%	-17%	-20%	-24%	-20%	-19%	-17%	-21%
15	41T	H-3	10.37	32,627	-7%	-7%	-25%	-38%	-29%	-22%	-20%	-25%	-24%	-23%	-22%	-22%	-24%

Appendix B
Transit and Bicycle Maps



DOWNTOWN HONOLULU
Vineyard
88A
Pali
Queen Emma
Punchbowl
The Queen's Medical Center
King
Hotel
Beretania
Bishop
Alakea
Richards
Alapai
Ala Moana
South
McKinley High School
Alapai Transit Center
Straub Hospital & Clinic
Kapiolani
Kona Iki
Kona
Mahukona
Atkinson
Pensacola
Piikoi
Ala Moana Center
88A one evening trip
51
52
Turtle Bay Resort
Kuilima
Kamehameha Hwy
Kahuku High & Intermediate School
Pupukea Beach Park
KAHUKU
Pualalea
WAIMEA
Naniloa
Brigham Young University
Polynesian Cultural Center
LAIE
60*
Haleiwa Beach Park
Achiu
Kam Hwy
Joseph Leong Hwy
HALEIWA
Waialua Beach
Weed Circle
HAUULA
Kukuna
Hauula Elementary School
Kaukonahua
51*
PUNALUU
WAHIAWA
Kaaawa Beach Park
Wahiawa Transit Center
Grand View
Puninoni
KAAAWA
Wahiawa General Hospital
Cane
California
Kilani
Leilehua High School
Milliani Park & Ride
Makaikai
WAIKANE
Olive
Avocado
Ainamakua
Meheula
Ukuwai
H2
WAIAHOLE
Waiahole Valley
Legend
Route 52
Route 51
selected trips
Route 88A
All-Day Routes
Peak Hour Route
Buses serving Route 88A also travel parts of Routes 51, 52 & 60. See schedule for details.
Timepoint
Transit Hub
Park & Ride
Medical Facility
College/University
School
Key Destination
State Capitol
schematic map – not to scale
Mililani High School
MILILANI
KAHALUU
Kuahelani
Mililani Transit Center
Lanikuhana
Kahekili Hwy
AHUIMANU
Ukee
Waipio Uka
WAIPIO
Acacia
Waimano Home
Puu Momi
Haiku
Lumiauau
Kaahumanu
Pearlridge Center
KANEOHE
Farrington Hwy
Leeward Community College
Kaonohi
Pali Momi
Honomanu
Likelike Hwy
PEARL CITY
Kam Hwy
52 via H-1 Freeway
51 via Nimitz Hwy
88A (lower level)
Salt Lake
School
Middle
H1
Pearl Harbor
Nimitz Hwy
Rodgers
Daniel K. Inouye International Airport
Dillingham
HONOLULU
see inset for detail
Beretania
King
Kapiolani
Ala Moana
Ala Moana Center



Legend
72 Route 72
72 Route 72*
* Note: Enters/Exits from McNair Gate (Weekdays, 1:00 p.m. - 5:00 a.m., and all day Saturdays, Sundays and Holidays.
All-Day Routes
76 Route 76
501 Route 501
503 Route 503
504 Route 504
A Timepoint
Transit Hub
Park & Ride
Medical Facility
College/University
School
Key Destination
www.thebus.org
schematic map – not to scale
HALEIWA
WAIALUA
Akule
Aweoweo
Apuhini
Waialua Beach
Haleiwa
Haleiwa Elementary School
Kamehameha Hwy
Joseph Leong Hwy
Achiu
North Shore Marketplace
Goodale
Waialua Elementary School
Kaukonahua
Weed Circle
Waialua High & Intermediate School
Farrington Hwy
WHITMORE VILLAGE
Whitmore
Nani
Ihi
Kamehameha Hwy
Daniel K. Inouye Elementary School
McNair Gate
Kaala Elementary School
Wahiawa Hospital
Wahiawa Transit Center
McCornack
Macomb Rd
Kilani
Anoni
California
N Cane
Olive
Waianae Ave
Macomb Gate
Wilikina
WAHIAWA
Ayres Ave
Gorgas
Cadet
Sheridan
Trimble
Foote
Flagler Rd
SCHOFIELD
LAUNANI VALLEY
Wahiawa Armory Park & Ride
Leileihua Golf Course
Wikao
Connect!
For service between Mililani, Wahiawa and Haleiwa, see the schedule for Routes 52-62-88A.
Kamehameha Hwy
Meheu
Lehiwa
Mililani Ike Elementary School
Kapanoe
Meheula
Koolani
Kuaoa
Halepahu
Lehiwa
Mililani Middle School
Kaapeha
Ukuwai
Mililani Mauka Elementary School
Makaikai
Mililani Park & Ride
Ainamakua
MILILANI MAUKA
Meheula
Waikalani
Waihonu
Kipapa Elementary School
Waimakua
Wanihi
Kipapa
Kuahelani
MILILANI
Mililani Shopping Center
Hookelewaa
Lanikuhana
Kuahelani
Kaloapau
Mililani Waena Elementary School
Mililani Transit Center
Mililani Town Center
Kipapa
Mililani High School
Meheula
Makaimoimo
Kamehameha Hwy
Lanikuhana
Kamaio
Mililani Marketplace
Meheula
Keaoopua
Holanialii
Lanikuhana
Kuahelani
Mililani Uka Elementary School

BIKE O'AHU

MAP OF BICYCLE ROUTES AROUND THE ISLAND

LEGEND FOR MAPS	
	Suggested Routes for Novice Bicyclists These include bicycle paths, roads with bicycle lanes or roads that are wide enough to accommodate bicyclists
	Suggested Routes for Experienced Bicyclists These include roads with space for adequate shared use between bicyclists and motorists
	Routes Which Are Not "Bicycle Friendly" These include roads that have heavy traffic and do not have adequate shared use between bicyclists and motorists
	Restrooms
	Water
	Food
	Significant Grade
	Average Paved Shoulder Width

Appendix C
Existing (2020) Synchro Reports

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	505	185	485	580	160	370
Future Volume (veh/h)	505	185	485	580	160	370
Number	3	18	2	12	1	6
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	555	0	533	0	176	407
Adj No. of Lanes	1	1	1	1	1	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	589	526	808	687	207	1098
Arrive On Green	0.33	0.00	0.43	0.00	0.12	0.59
Sat Flow, veh/h	1774	1583	1863	1583	1774	1863
Grp Volume(v), veh/h	555	0	533	0	176	407
Grp Sat Flow(s),veh/h/ln	1774	1583	1863	1583	1774	1863
Q Serve(g_s), s	34.8	0.0	26.0	0.0	11.1	13.1
Cycle Q Clear(g_c), s	34.8	0.0	26.0	0.0	11.1	13.1
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	589	526	808	687	207	1098
V/C Ratio(X)	0.94	0.00	0.66	0.00	0.85	0.37
Avail Cap(c_a), veh/h	674	601	808	687	318	1098
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	37.2	0.0	25.7	0.0	49.6	12.3
Incr Delay (d2), s/veh	20.3	0.0	4.2	0.0	12.6	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	20.3	0.0	14.3	0.0	6.2	7.0
LnGrp Delay(d),s/veh	57.5	0.0	29.9	0.0	62.2	13.3
LnGrp LOS	E		C		E	B
Approach Vol, veh/h	555		533			583
Approach Delay, s/veh	57.5		29.9			28.1
Approach LOS	E		C			C

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	17.8	54.2				72.0		42.5
Change Period (Y+Rc), s	4.5	4.5				4.5		4.5
Max Green Setting (Gmax), s	20.5	42.5				67.5		43.5
Max Q Clear Time (g_c+I1), s	13.1	28.0				15.1		36.8
Green Ext Time (p_c), s	0.3	2.9				2.7		1.2

Intersection Summary	
HCM 2010 Ctrl Delay	38.4
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	50	5	70	50	5	5	310	85	5	195	10
Future Volume (veh/h)	5	50	5	70	50	5	5	310	85	5	195	10
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1863	1900	1900	1863	1900	1900	1863	1900
Adj Flow Rate, veh/h	6	59	6	82	59	6	6	365	100	6	229	12
Adj No. of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	71	199	19	190	91	8	62	1028	278	67	1269	65
Arrive On Green	0.12	0.12	0.12	0.12	0.12	0.12	0.73	0.73	0.73	0.73	0.73	0.73
Sat Flow, veh/h	68	1598	154	807	730	65	5	1406	381	11	1736	89
Grp Volume(v), veh/h	71	0	0	147	0	0	471	0	0	247	0	0
Grp Sat Flow(s),veh/h/ln	1820	0	0	1602	0	0	1792	0	0	1836	0	0
Q Serve(g_s), s	0.0	0.0	0.0	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	2.2	0.0	0.0	5.4	0.0	0.0	6.0	0.0	0.0	2.6	0.0	0.0
Prop In Lane	0.08		0.08	0.56		0.04	0.01		0.21	0.02		0.05
Lane Grp Cap(c), veh/h	289	0	0	289	0	0	1369	0	0	1402	0	0
V/C Ratio(X)	0.25	0.00	0.00	0.51	0.00	0.00	0.34	0.00	0.00	0.18	0.00	0.00
Avail Cap(c_a), veh/h	653	0	0	600	0	0	1369	0	0	1402	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	24.8	0.0	0.0	26.1	0.0	0.0	3.0	0.0	0.0	2.6	0.0	0.0
Incr Delay (d2), s/veh	0.4	0.0	0.0	1.4	0.0	0.0	0.7	0.0	0.0	0.3	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	0.0	0.0	2.5	0.0	0.0	3.1	0.0	0.0	1.4	0.0	0.0
LnGrp Delay(d),s/veh	25.3	0.0	0.0	27.5	0.0	0.0	3.7	0.0	0.0	2.9	0.0	0.0
LnGrp LOS	C			C			A			A		
Approach Vol, veh/h		71			147			471			247	
Approach Delay, s/veh		25.3			27.5			3.7			2.9	
Approach LOS		C			C			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		50.0		12.2		50.0		12.2
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5
Max Green Setting (Gmax), s		45.5		20.5		45.5		20.5
Max Q Clear Time (g_c+I1), s		8.0		4.2		4.6		7.4
Green Ext Time (p_c), s		3.0		0.2		1.5		0.6

Intersection Summary	
HCM 2010 Ctrl Delay	8.9
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	60	90	640	50	40	90	880	370	20	800	35
Future Volume (veh/h)	20	60	90	640	50	40	90	880	370	20	800	35
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.99	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	21	63	95	712	0	42	95	926	389	21	842	37
Adj No. of Lanes	0	2	0	2	0	1	1	2	1	1	2	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	44	131	148	839	0	372	325	1687	752	228	1605	714
Arrive On Green	0.10	0.10	0.10	0.24	0.00	0.24	0.04	0.48	0.48	0.02	0.45	0.45
Sat Flow, veh/h	460	1380	1558	3548	0	1573	1774	3539	1578	1774	3539	1575
Grp Volume(v), veh/h	84	0	95	712	0	42	95	926	389	21	842	37
Grp Sat Flow(s),veh/h/ln	1840	0	1558	1774	0	1573	1774	1770	1578	1774	1770	1575
Q Serve(g_s), s	4.6	0.0	6.2	20.3	0.0	2.2	3.0	19.6	18.1	0.7	18.1	1.4
Cycle Q Clear(g_c), s	4.6	0.0	6.2	20.3	0.0	2.2	3.0	19.6	18.1	0.7	18.1	1.4
Prop In Lane	0.25		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	175	0	148	839	0	372	325	1687	752	228	1605	714
V/C Ratio(X)	0.48	0.00	0.64	0.85	0.00	0.11	0.29	0.55	0.52	0.09	0.52	0.05
Avail Cap(c_a), veh/h	417	0	353	1391	0	617	388	1687	752	332	1605	714
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	45.4	0.0	46.2	38.6	0.0	31.7	15.9	19.6	19.2	16.2	20.7	16.2
Incr Delay (d2), s/veh	2.0	0.0	4.6	2.7	0.0	0.1	0.5	1.3	2.5	0.2	1.2	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.4	0.0	2.9	10.2	0.0	1.0	1.5	9.8	8.4	0.3	9.0	0.6
LnGrp Delay(d),s/veh	47.5	0.0	50.7	41.3	0.0	31.8	16.4	20.9	21.8	16.4	22.0	16.3
LnGrp LOS	D		D	D		C	B	C	C	B	C	B
Approach Vol, veh/h		179			754			1410			900	
Approach Delay, s/veh		49.2			40.8			20.9			21.6	
Approach LOS		D			D			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	6.8	54.9		14.6	9.3	52.5		29.5
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	8.5	48.0		24.0	8.5	48.0		41.5
Max Q Clear Time (g_c+I1), s	2.7	21.6		8.2	5.0	20.1		22.3
Green Ext Time (p_c), s	0.0	8.9		0.8	0.1	6.5		2.7

Intersection Summary	
HCM 2010 Ctrl Delay	27.3
HCM 2010 LOS	C

Notes

User approved volume balancing among the lanes for turning movement.

Intersection						
Int Delay, s/veh	3.6					

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	370	370	640	5	5	50
Future Vol, veh/h	370	370	640	5	5	50
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	300	250	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	402	402	696	5	5	54

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	701	0	-	0	1905	351
Stage 1	-	-	-	-	699	-
Stage 2	-	-	-	-	1206	-
Critical Hdwy	4.13	-	-	-	6.63	6.93
Critical Hdwy Stg 1	-	-	-	-	5.83	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.219	-	-	-	3.519	3.319
Pot Cap-1 Maneuver	894	-	-	-	68	646
Stage 1	-	-	-	-	455	-
Stage 2	-	-	-	-	282	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	894	-	-	-	37	646
Mov Cap-2 Maneuver	-	-	-	-	138	-
Stage 1	-	-	-	-	250	-
Stage 2	-	-	-	-	282	-

Approach	EB	WB	SB
HCM Control Delay, s	6.1	0	13
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	894	-	-	-	138	646
HCM Lane V/C Ratio	0.45	-	-	-	0.039	0.084
HCM Control Delay (s)	12.3	-	-	-	32.2	11.1
HCM Lane LOS	B	-	-	-	D	B
HCM 95th %tile Q(veh)	2.4	-	-	-	0.1	0.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	655	200	505	440	120	555
Future Volume (veh/h)	655	200	505	440	120	555
Number	3	18	2	12	1	6
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	720	0	555	0	132	610
Adj No. of Lanes	1	1	1	1	1	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	758	676	674	573	162	918
Arrive On Green	0.43	0.00	0.36	0.00	0.09	0.49
Sat Flow, veh/h	1774	1583	1863	1583	1774	1863
Grp Volume(v), veh/h	720	0	555	0	132	610
Grp Sat Flow(s),veh/h/ln	1774	1583	1863	1583	1774	1863
Q Serve(g_s), s	44.1	0.0	30.5	0.0	8.2	27.8
Cycle Q Clear(g_c), s	44.1	0.0	30.5	0.0	8.2	27.8
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	758	676	674	573	162	918
V/C Ratio(X)	0.95	0.00	0.82	0.00	0.82	0.66
Avail Cap(c_a), veh/h	875	780	674	573	323	918
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	31.1	0.0	32.7	0.0	50.2	21.5
Incr Delay (d2), s/veh	18.1	0.0	11.0	0.0	9.5	3.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	25.2	0.0	17.6	0.0	4.5	15.2
LnGrp Delay(d),s/veh	49.2	0.0	43.6	0.0	59.8	25.3
LnGrp LOS	D		D		E	C
Approach Vol, veh/h	720		555			742
Approach Delay, s/veh	49.2		43.6			31.4
Approach LOS	D		D			C

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	14.8	45.2				60.0		52.6
Change Period (Y+Rc), s	4.5	4.5				4.5		4.5
Max Green Setting (Gmax), s	20.5	30.5				55.5		55.5
Max Q Clear Time (g_c+I1), s	10.2	32.5				29.8		46.1
Green Ext Time (p_c), s	0.2	0.0				4.2		2.0

Intersection Summary	
HCM 2010 Ctrl Delay	41.1
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	90	5	190	90	5	5	425	115	5	465	5
Future Volume (veh/h)	5	90	5	190	90	5	5	425	115	5	465	5
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1863	1900	1900	1863	1900	1900	1863	1900
Adj Flow Rate, veh/h	6	106	6	224	106	6	6	500	135	6	547	6
Adj No. of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	63	452	25	348	126	7	55	854	228	56	1107	12
Arrive On Green	0.26	0.26	0.26	0.26	0.26	0.26	0.61	0.61	0.61	0.61	0.61	0.61
Sat Flow, veh/h	29	1717	94	988	480	27	4	1410	377	5	1828	20
Grp Volume(v), veh/h	118	0	0	336	0	0	641	0	0	559	0	0
Grp Sat Flow(s),veh/h/ln	1839	0	0	1495	0	0	1791	0	0	1853	0	0
Q Serve(g_s), s	0.0	0.0	0.0	11.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	3.4	0.0	0.0	14.4	0.0	0.0	15.0	0.0	0.0	11.6	0.0	0.0
Prop In Lane	0.05		0.05	0.67		0.02	0.01		0.21	0.01		0.01
Lane Grp Cap(c), veh/h	539	0	0	481	0	0	1137	0	0	1175	0	0
V/C Ratio(X)	0.22	0.00	0.00	0.70	0.00	0.00	0.56	0.00	0.00	0.48	0.00	0.00
Avail Cap(c_a), veh/h	841	0	0	719	0	0	1137	0	0	1175	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	19.9	0.0	0.0	23.6	0.0	0.0	8.3	0.0	0.0	7.6	0.0	0.0
Incr Delay (d2), s/veh	0.2	0.0	0.0	1.8	0.0	0.0	2.0	0.0	0.0	1.4	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.8	0.0	0.0	6.2	0.0	0.0	7.9	0.0	0.0	6.4	0.0	0.0
LnGrp Delay(d),s/veh	20.1	0.0	0.0	25.4	0.0	0.0	10.3	0.0	0.0	9.0	0.0	0.0
LnGrp LOS	C			C			B			A		
Approach Vol, veh/h		118			336			641			559	
Approach Delay, s/veh		20.1			25.4			10.3			9.0	
Approach LOS		C			C			B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		46.0		22.5		46.0		22.5
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5
Max Green Setting (Gmax), s		41.5		29.5		41.5		29.5
Max Q Clear Time (g_c+I1), s		17.0		5.4		13.6		16.4
Green Ext Time (p_c), s		4.2		0.6		3.8		1.6

Intersection Summary	
HCM 2010 Ctrl Delay	13.6
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	25	95	140	655	100	140	120	940	505	55	840	40
Future Volume (veh/h)	25	95	140	655	100	140	120	940	505	55	840	40
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	26	100	147	764	0	147	126	989	532	58	884	42
Adj No. of Lanes	0	2	0	2	0	1	1	2	1	1	2	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	48	186	199	888	0	394	290	1483	661	200	1408	626
Arrive On Green	0.13	0.13	0.13	0.25	0.00	0.25	0.06	0.42	0.42	0.04	0.40	0.40
Sat Flow, veh/h	380	1463	1565	3548	0	1574	1774	3539	1578	1774	3539	1573
Grp Volume(v), veh/h	126	0	147	764	0	147	126	989	532	58	884	42
Grp Sat Flow(s),veh/h/ln	1844	0	1565	1774	0	1574	1774	1770	1578	1774	1770	1573
Q Serve(g_s), s	7.0	0.0	9.8	22.4	0.0	8.4	4.5	24.5	32.2	2.1	21.8	1.8
Cycle Q Clear(g_c), s	7.0	0.0	9.8	22.4	0.0	8.4	4.5	24.5	32.2	2.1	21.8	1.8
Prop In Lane	0.21		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	234	0	199	888	0	394	290	1483	661	200	1408	626
V/C Ratio(X)	0.54	0.00	0.74	0.86	0.00	0.37	0.43	0.67	0.80	0.29	0.63	0.07
Avail Cap(c_a), veh/h	407	0	345	1180	0	524	324	1483	661	271	1408	626
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	44.5	0.0	45.7	39.0	0.0	33.7	20.0	25.5	27.7	20.6	26.3	20.3
Incr Delay (d2), s/veh	1.9	0.0	5.3	5.1	0.0	0.6	1.0	2.4	10.1	0.8	2.1	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.7	0.0	4.5	11.6	0.0	3.7	2.3	12.4	15.7	1.0	11.1	0.8
LnGrp Delay(d),s/veh	46.4	0.0	51.0	44.1	0.0	34.3	21.1	27.9	37.8	21.4	28.4	20.5
LnGrp LOS	D		D	D		C	C	C	D	C	C	C
Approach Vol, veh/h		273			911			1647			984	
Approach Delay, s/veh		48.9			42.5			30.6			27.7	
Approach LOS		D			D			C			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.6	50.1		18.3	10.9	47.8		31.7				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	8.5	43.3		24.0	8.5	43.3		36.2				
Max Q Clear Time (g_c+I1), s	4.1	34.2		11.8	6.5	23.8		24.4				
Green Ext Time (p_c), s	0.0	5.6		1.2	0.1	6.1		2.9				
Intersection Summary												
HCM 2010 Ctrl Delay			34.0									
HCM 2010 LOS			C									
Notes												

User approved volume balancing among the lanes for turning movement.

Intersection	
Int Delay, s/veh	4.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	185	375	580	5	5	275
Future Vol, veh/h	185	375	580	5	5	275
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	300	250	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	201	408	630	5	5	299

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	635	0	-	0	1443	318
Stage 1	-	-	-	-	633	-
Stage 2	-	-	-	-	810	-
Critical Hdwy	4.13	-	-	-	6.63	6.93
Critical Hdwy Stg 1	-	-	-	-	5.83	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.219	-	-	-	3.519	3.319
Pot Cap-1 Maneuver	946	-	-	-	134	679
Stage 1	-	-	-	-	492	-
Stage 2	-	-	-	-	436	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	946	-	-	-	106	679
Mov Cap-2 Maneuver	-	-	-	-	236	-
Stage 1	-	-	-	-	388	-
Stage 2	-	-	-	-	436	-

Approach	EB	WB	SB
HCM Control Delay, s	3.2	0	14.5
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	946	-	-	-	236	679
HCM Lane V/C Ratio	0.213	-	-	-	0.023	0.44
HCM Control Delay (s)	9.8	-	-	-	20.6	14.4
HCM Lane LOS	A	-	-	-	C	B
HCM 95th %tile Q(veh)	0.8	-	-	-	0.1	2.3

Appendix D
Future (2027) Synchro Reports

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	525	195	505	600	175	390
Future Volume (veh/h)	525	195	505	600	175	390
Number	3	18	2	12	1	6
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	577	0	555	0	192	429
Adj No. of Lanes	1	1	1	1	1	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	608	542	775	659	222	1081
Arrive On Green	0.34	0.00	0.42	0.00	0.13	0.58
Sat Flow, veh/h	1774	1583	1863	1583	1774	1863
Grp Volume(v), veh/h	577	0	555	0	192	429
Grp Sat Flow(s),veh/h/ln	1774	1583	1863	1583	1774	1863
Q Serve(g_s), s	36.9	0.0	28.8	0.0	12.4	14.6
Cycle Q Clear(g_c), s	36.9	0.0	28.8	0.0	12.4	14.6
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	608	542	775	659	222	1081
V/C Ratio(X)	0.95	0.00	0.72	0.00	0.86	0.40
Avail Cap(c_a), veh/h	663	592	775	659	313	1081
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	37.3	0.0	28.2	0.0	49.9	13.3
Incr Delay (d2), s/veh	22.4	0.0	5.6	0.0	16.1	1.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	21.7	0.0	16.0	0.0	7.1	7.8
LnGrp Delay(d),s/veh	59.7	0.0	33.8	0.0	66.0	14.4
LnGrp LOS	E		C		E	B
Approach Vol, veh/h	577		555			621
Approach Delay, s/veh	59.7		33.8			30.4
Approach LOS	E		C			C

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	19.1	52.9				72.0		44.3
Change Period (Y+Rc), s	4.5	4.5				4.5		4.5
Max Green Setting (Gmax), s	20.5	42.5				67.5		43.5
Max Q Clear Time (g_c+I1), s	14.4	30.8				16.6		38.9
Green Ext Time (p_c), s	0.3	2.7				2.9		1.0

Intersection Summary	
HCM 2010 Ctrl Delay	41.1
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	55	5	75	55	5	5	325	95	5	210	15
Future Volume (veh/h)	5	55	5	75	55	5	5	325	95	5	210	15
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1863	1900	1900	1863	1900	1900	1863	1900
Adj Flow Rate, veh/h	6	65	6	88	65	6	6	382	112	6	247	18
Adj No. of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	70	215	19	195	98	8	62	1002	290	65	1232	88
Arrive On Green	0.13	0.13	0.13	0.13	0.13	0.13	0.72	0.72	0.72	0.72	0.72	0.72
Sat Flow, veh/h	60	1621	142	800	740	60	5	1383	401	9	1701	122
Grp Volume(v), veh/h	77	0	0	159	0	0	500	0	0	271	0	0
Grp Sat Flow(s),veh/h/ln	1823	0	0	1601	0	0	1789	0	0	1831	0	0
Q Serve(g_s), s	0.0	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	2.4	0.0	0.0	5.9	0.0	0.0	6.7	0.0	0.0	3.0	0.0	0.0
Prop In Lane	0.08		0.08	0.55		0.04	0.01		0.22	0.02		0.07
Lane Grp Cap(c), veh/h	303	0	0	301	0	0	1354	0	0	1385	0	0
V/C Ratio(X)	0.25	0.00	0.00	0.53	0.00	0.00	0.37	0.00	0.00	0.20	0.00	0.00
Avail Cap(c_a), veh/h	649	0	0	594	0	0	1354	0	0	1385	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	24.7	0.0	0.0	26.1	0.0	0.0	3.3	0.0	0.0	2.8	0.0	0.0
Incr Delay (d2), s/veh	0.4	0.0	0.0	1.4	0.0	0.0	0.8	0.0	0.0	0.3	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	0.0	0.0	2.8	0.0	0.0	3.5	0.0	0.0	1.6	0.0	0.0
LnGrp Delay(d),s/veh	25.1	0.0	0.0	27.5	0.0	0.0	4.1	0.0	0.0	3.1	0.0	0.0
LnGrp LOS	C			C			A			A		
Approach Vol, veh/h		77			159			500			271	
Approach Delay, s/veh		25.1			27.5			4.1			3.1	
Approach LOS		C			C			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		50.0		12.8		50.0		12.8
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5
Max Green Setting (Gmax), s		45.5		20.5		45.5		20.5
Max Q Clear Time (g_c+I1), s		8.7		4.4		5.0		7.9
Green Ext Time (p_c), s		3.2		0.3		1.7		0.6

Intersection Summary	
HCM 2010 Ctrl Delay	9.1
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	25	65	100	665	55	50	100	915	385	25	830	40
Future Volume (veh/h)	25	65	100	665	55	50	100	915	385	25	830	40
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	26	68	105	741	0	53	105	963	405	26	874	42
Adj No. of Lanes	0	2	0	2	0	1	1	2	1	1	2	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	51	134	157	863	0	383	311	1657	739	216	1573	700
Arrive On Green	0.10	0.10	0.10	0.24	0.00	0.24	0.05	0.47	0.47	0.02	0.44	0.44
Sat Flow, veh/h	508	1329	1560	3548	0	1574	1774	3539	1578	1774	3539	1574
Grp Volume(v), veh/h	94	0	105	741	0	53	105	963	405	26	874	42
Grp Sat Flow(s),veh/h/ln	1837	0	1560	1774	0	1574	1774	1770	1578	1774	1770	1574
Q Serve(g_s), s	5.3	0.0	7.2	22.0	0.0	2.9	3.5	21.9	20.2	0.9	20.1	1.7
Cycle Q Clear(g_c), s	5.3	0.0	7.2	22.0	0.0	2.9	3.5	21.9	20.2	0.9	20.1	1.7
Prop In Lane	0.28		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	185	0	157	863	0	383	311	1657	739	216	1573	700
V/C Ratio(X)	0.51	0.00	0.67	0.86	0.00	0.14	0.34	0.58	0.55	0.12	0.56	0.06
Avail Cap(c_a), veh/h	400	0	340	1304	0	578	361	1657	739	309	1573	700
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	47.0	0.0	47.8	39.9	0.0	32.7	17.2	21.4	21.0	17.6	22.6	17.5
Incr Delay (d2), s/veh	2.2	0.0	4.9	3.9	0.0	0.2	0.6	1.5	2.9	0.2	1.4	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.8	0.0	3.3	11.3	0.0	1.3	1.7	11.0	9.4	0.4	10.1	0.8
LnGrp Delay(d),s/veh	49.2	0.0	52.7	43.7	0.0	32.8	17.9	22.9	23.9	17.8	24.0	17.6
LnGrp LOS	D		D	D		C	B	C	C	B	C	B
Approach Vol, veh/h		199			794			1473			942	
Approach Delay, s/veh		51.0			43.0			22.8			23.6	
Approach LOS		D			D			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	7.2	56.1		15.6	9.8	53.5		31.3
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	8.5	49.0		24.0	8.5	49.0		40.5
Max Q Clear Time (g_c+I1), s	2.9	23.9		9.2	5.5	22.1		24.0
Green Ext Time (p_c), s	0.0	9.2		0.9	0.1	6.8		2.8

Intersection Summary	
HCM 2010 Ctrl Delay	29.4
HCM 2010 LOS	C

Notes

User approved volume balancing among the lanes for turning movement.

Intersection	
Int Delay, s/veh	4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑	↑↱		↰	↱
Traffic Vol, veh/h	385	390	660	15	10	60
Future Vol, veh/h	385	390	660	15	10	60
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	300	250	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	418	424	717	16	11	65

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	733	0	-	0	1985	367
Stage 1	-	-	-	-	725	-
Stage 2	-	-	-	-	1260	-
Critical Hdwy	4.13	-	-	-	6.63	6.93
Critical Hdwy Stg 1	-	-	-	-	5.83	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.219	-	-	-	3.519	3.319
Pot Cap-1 Maneuver	870	-	-	-	60	631
Stage 1	-	-	-	-	441	-
Stage 2	-	-	-	-	266	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	870	-	-	-	31	631
Mov Cap-2 Maneuver	-	-	-	-	126	-
Stage 1	-	-	-	-	229	-
Stage 2	-	-	-	-	266	-

Approach	EB	WB	SB
HCM Control Delay, s	6.4	0	15
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	870	-	-	-	126	631
HCM Lane V/C Ratio	0.481	-	-	-	0.086	0.103
HCM Control Delay (s)	12.9	-	-	-	36.3	11.4
HCM Lane LOS	B	-	-	-	E	B
HCM 95th %tile Q(veh)	2.7	-	-	-	0.3	0.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	540	205	505	615	185	390
Future Volume (veh/h)	540	205	505	615	185	390
Number	3	18	2	12	1	6
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	593	0	555	0	203	429
Adj No. of Lanes	1	1	1	1	1	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	620	554	753	640	233	1069
Arrive On Green	0.35	0.00	0.40	0.00	0.13	0.57
Sat Flow, veh/h	1774	1583	1863	1583	1774	1863
Grp Volume(v), veh/h	593	0	555	0	203	429
Grp Sat Flow(s),veh/h/ln	1774	1583	1863	1583	1774	1863
Q Serve(g_s), s	38.4	0.0	29.7	0.0	13.2	15.0
Cycle Q Clear(g_c), s	38.4	0.0	29.7	0.0	13.2	15.0
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	620	554	753	640	233	1069
V/C Ratio(X)	0.96	0.00	0.74	0.00	0.87	0.40
Avail Cap(c_a), veh/h	656	585	753	640	309	1069
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	37.4	0.0	29.7	0.0	50.1	13.9
Incr Delay (d2), s/veh	24.1	0.0	6.4	0.0	18.5	1.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	22.9	0.0	16.6	0.0	7.7	8.0
LnGrp Delay(d),s/veh	61.4	0.0	36.1	0.0	68.6	15.0
LnGrp LOS	E		D		E	B
Approach Vol, veh/h	593		555			632
Approach Delay, s/veh	61.4		36.1			32.2
Approach LOS	E		D			C

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	19.9	52.1				72.0		45.6
Change Period (Y+Rc), s	4.5	4.5				4.5		4.5
Max Green Setting (Gmax), s	20.5	42.5				67.5		43.5
Max Q Clear Time (g_c+I1), s	15.2	31.7				17.0		40.4
Green Ext Time (p_c), s	0.2	2.6				2.9		0.7

Intersection Summary		
HCM 2010 Ctrl Delay		43.2
HCM 2010 LOS		D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	55	5	80	55	5	5	325	100	5	210	15
Future Volume (veh/h)	5	55	5	80	55	5	5	325	100	5	210	15
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1863	1900	1900	1863	1900	1900	1863	1900
Adj Flow Rate, veh/h	6	65	6	94	65	6	6	382	118	6	247	18
Adj No. of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	70	222	19	203	97	8	61	983	300	65	1225	88
Arrive On Green	0.14	0.14	0.14	0.14	0.14	0.14	0.72	0.72	0.72	0.72	0.72	0.72
Sat Flow, veh/h	59	1623	142	826	708	58	5	1365	416	9	1700	122
Grp Volume(v), veh/h	77	0	0	165	0	0	506	0	0	271	0	0
Grp Sat Flow(s),veh/h/ln	1824	0	0	1592	0	0	1786	0	0	1831	0	0
Q Serve(g_s), s	0.0	0.0	0.0	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	2.4	0.0	0.0	6.1	0.0	0.0	7.0	0.0	0.0	3.0	0.0	0.0
Prop In Lane	0.08		0.08	0.57		0.04	0.01		0.23	0.02		0.07
Lane Grp Cap(c), veh/h	311	0	0	307	0	0	1345	0	0	1378	0	0
V/C Ratio(X)	0.25	0.00	0.00	0.54	0.00	0.00	0.38	0.00	0.00	0.20	0.00	0.00
Avail Cap(c_a), veh/h	646	0	0	590	0	0	1345	0	0	1378	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	24.5	0.0	0.0	26.0	0.0	0.0	3.4	0.0	0.0	2.9	0.0	0.0
Incr Delay (d2), s/veh	0.4	0.0	0.0	1.5	0.0	0.0	0.8	0.0	0.0	0.3	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	0.0	0.0	2.9	0.0	0.0	3.7	0.0	0.0	1.6	0.0	0.0
LnGrp Delay(d),s/veh	25.0	0.0	0.0	27.5	0.0	0.0	4.2	0.0	0.0	3.2	0.0	0.0
LnGrp LOS	C			C			A			A		
Approach Vol, veh/h		77			165			506			271	
Approach Delay, s/veh		25.0			27.5			4.2			3.2	
Approach LOS		C			C			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		50.0		13.1		50.0		13.1
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5
Max Green Setting (Gmax), s		45.5		20.5		45.5		20.5
Max Q Clear Time (g_c+I1), s		9.0		4.4		5.0		8.1
Green Ext Time (p_c), s		3.3		0.3		1.7		0.6

Intersection Summary	
HCM 2010 Ctrl Delay	9.3
HCM 2010 LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	25	65	100	665	55	50	100	930	385	25	845	40
Future Volume (veh/h)	25	65	100	665	55	50	100	930	385	25	845	40
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	26	68	105	741	0	53	105	979	405	26	889	42
Adj No. of Lanes	0	2	0	2	0	1	1	2	1	1	2	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	51	134	157	863	0	383	306	1657	739	213	1573	700
Arrive On Green	0.10	0.10	0.10	0.24	0.00	0.24	0.05	0.47	0.47	0.02	0.44	0.44
Sat Flow, veh/h	508	1329	1560	3548	0	1574	1774	3539	1578	1774	3539	1574
Grp Volume(v), veh/h	94	0	105	741	0	53	105	979	405	26	889	42
Grp Sat Flow(s),veh/h/ln	1837	0	1560	1774	0	1574	1774	1770	1578	1774	1770	1574
Q Serve(g_s), s	5.3	0.0	7.2	22.0	0.0	2.9	3.5	22.4	20.2	0.9	20.5	1.7
Cycle Q Clear(g_c), s	5.3	0.0	7.2	22.0	0.0	2.9	3.5	22.4	20.2	0.9	20.5	1.7
Prop In Lane	0.28		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	185	0	157	863	0	383	306	1657	739	213	1573	700
V/C Ratio(X)	0.51	0.00	0.67	0.86	0.00	0.14	0.34	0.59	0.55	0.12	0.57	0.06
Avail Cap(c_a), veh/h	400	0	340	1304	0	578	357	1657	739	305	1573	700
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	47.0	0.0	47.8	39.9	0.0	32.7	17.4	21.6	21.0	17.7	22.7	17.5
Incr Delay (d2), s/veh	2.2	0.0	4.9	3.9	0.0	0.2	0.7	1.6	2.9	0.3	1.5	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.8	0.0	3.3	11.3	0.0	1.3	1.7	11.2	9.4	0.4	10.3	0.8
LnGrp Delay(d),s/veh	49.2	0.0	52.7	43.7	0.0	32.8	18.0	23.1	23.9	17.9	24.2	17.6
LnGrp LOS	D		D	D		C	B	C	C	B	C	B
Approach Vol, veh/h		199			794			1489			957	
Approach Delay, s/veh		51.0			43.0			23.0			23.7	
Approach LOS		D			D			C			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.2	56.1		15.6	9.8	53.5		31.3				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	8.5	49.0		24.0	8.5	49.0		40.5				
Max Q Clear Time (g_c+I1), s	2.9	24.4		9.2	5.5	22.5		24.0				
Green Ext Time (p_c), s	0.0	9.3		0.9	0.1	6.9		2.8				
Intersection Summary												
HCM 2010 Ctrl Delay			29.4									
HCM 2010 LOS			C									
Notes												

User approved volume balancing among the lanes for turning movement.

Intersection	
Int Delay, s/veh	4.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑	↑↱		↰	↱
Traffic Vol, veh/h	400	400	670	15	10	75
Future Vol, veh/h	400	400	670	15	10	75
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	300	250	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	435	435	728	16	11	82

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	744	0	-	0	2041	372
Stage 1	-	-	-	-	736	-
Stage 2	-	-	-	-	1305	-
Critical Hdwy	4.13	-	-	-	6.63	6.93
Critical Hdwy Stg 1	-	-	-	-	5.83	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.219	-	-	-	3.519	3.319
Pot Cap-1 Maneuver	861	-	-	-	55	626
Stage 1	-	-	-	-	436	-
Stage 2	-	-	-	-	253	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	861	-	-	-	27	626
Mov Cap-2 Maneuver	-	-	-	-	119	-
Stage 1	-	-	-	-	216	-
Stage 2	-	-	-	-	253	-

Approach	EB	WB	SB
HCM Control Delay, s	6.7	0	14.7
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	861	-	-	-	119	626
HCM Lane V/C Ratio	0.505	-	-	-	0.091	0.13
HCM Control Delay (s)	13.4	-	-	-	38.3	11.6
HCM Lane LOS	B	-	-	-	E	B
HCM 95th %tile Q(veh)	2.9	-	-	-	0.3	0.4

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	685	210	530	460	130	575
Future Volume (veh/h)	685	210	530	460	130	575
Number	3	18	2	12	1	6
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	753	0	582	0	143	632
Adj No. of Lanes	1	1	1	1	1	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	785	701	640	544	173	894
Arrive On Green	0.44	0.00	0.34	0.00	0.10	0.48
Sat Flow, veh/h	1774	1583	1863	1583	1774	1863
Grp Volume(v), veh/h	753	0	582	0	143	632
Grp Sat Flow(s),veh/h/ln	1774	1583	1863	1583	1774	1863
Q Serve(g_s), s	47.6	0.0	34.5	0.0	9.2	30.9
Cycle Q Clear(g_c), s	47.6	0.0	34.5	0.0	9.2	30.9
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	785	701	640	544	173	894
V/C Ratio(X)	0.96	0.00	0.91	0.00	0.83	0.71
Avail Cap(c_a), veh/h	851	759	640	544	314	894
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	31.2	0.0	36.3	0.0	51.3	23.7
Incr Delay (d2), s/veh	20.7	0.0	19.3	0.0	9.6	4.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	27.7	0.0	21.2	0.0	5.0	17.0
LnGrp Delay(d),s/veh	52.0	0.0	55.5	0.0	60.9	28.4
LnGrp LOS	D		E		E	C
Approach Vol, veh/h	753		582			775
Approach Delay, s/veh	52.0		55.5			34.4
Approach LOS	D		E			C

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	15.8	44.2				60.0		55.7
Change Period (Y+Rc), s	4.5	4.5				4.5		4.5
Max Green Setting (Gmax), s	20.5	30.5				55.5		55.5
Max Q Clear Time (g_c+I1), s	11.2	36.5				32.9		49.6
Green Ext Time (p_c), s	0.2	0.0				4.3		1.6

Intersection Summary	
HCM 2010 Ctrl Delay	46.5
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	100	5	205	100	5	10	440	125	5	485	5
Future Volume (veh/h)	5	100	5	205	100	5	10	440	125	5	485	5
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1863	1900	1900	1863	1900	1900	1863	1900
Adj Flow Rate, veh/h	6	118	6	241	118	6	12	518	147	6	571	6
Adj No. of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	61	489	24	362	136	7	58	816	228	54	1079	11
Arrive On Green	0.28	0.28	0.28	0.28	0.28	0.28	0.59	0.59	0.59	0.59	0.59	0.59
Sat Flow, veh/h	25	1731	85	981	483	24	11	1384	387	5	1829	19
Grp Volume(v), veh/h	130	0	0	365	0	0	677	0	0	583	0	0
Grp Sat Flow(s),veh/h/ln	1842	0	0	1489	0	0	1781	0	0	1853	0	0
Q Serve(g_s), s	0.0	0.0	0.0	12.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	3.8	0.0	0.0	16.2	0.0	0.0	17.5	0.0	0.0	13.2	0.0	0.0
Prop In Lane	0.05		0.05	0.66		0.02	0.02		0.22	0.01		0.01
Lane Grp Cap(c), veh/h	573	0	0	505	0	0	1103	0	0	1145	0	0
V/C Ratio(X)	0.23	0.00	0.00	0.72	0.00	0.00	0.61	0.00	0.00	0.51	0.00	0.00
Avail Cap(c_a), veh/h	821	0	0	699	0	0	1103	0	0	1145	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	19.5	0.0	0.0	23.6	0.0	0.0	9.5	0.0	0.0	8.6	0.0	0.0
Incr Delay (d2), s/veh	0.2	0.0	0.0	2.3	0.0	0.0	2.6	0.0	0.0	1.6	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.0	0.0	0.0	7.0	0.0	0.0	9.2	0.0	0.0	7.2	0.0	0.0
LnGrp Delay(d),s/veh	19.7	0.0	0.0	25.9	0.0	0.0	12.1	0.0	0.0	10.2	0.0	0.0
LnGrp LOS	B			C			B			B		
Approach Vol, veh/h		130			365			677			583	
Approach Delay, s/veh		19.7			25.9			12.1			10.2	
Approach LOS		B			C			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		46.0		24.4		46.0		24.4
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5
Max Green Setting (Gmax), s		41.5		29.5		41.5		29.5
Max Q Clear Time (g_c+I1), s		19.5		5.8		15.2		18.2
Green Ext Time (p_c), s		4.4		0.6		4.0		1.7

Intersection Summary	
HCM 2010 Ctrl Delay	14.9
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰↑↱		↰	↰	↱	↰	↑↑	↱	↰	↑↑	↱
Traffic Volume (veh/h)	30	105	150	680	110	150	130	975	525	60	870	45
Future Volume (veh/h)	30	105	150	680	110	150	130	975	525	60	870	45
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	32	111	158	799	0	158	137	1026	553	63	916	47
Adj No. of Lanes	0	2	0	2	0	1	1	2	1	1	2	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	55	190	208	912	0	405	277	1463	652	187	1375	611
Arrive On Green	0.13	0.13	0.13	0.26	0.00	0.26	0.06	0.41	0.41	0.04	0.39	0.39
Sat Flow, veh/h	412	1430	1565	3548	0	1574	1774	3539	1578	1774	3539	1573
Grp Volume(v), veh/h	143	0	158	799	0	158	137	1026	553	63	916	47
Grp Sat Flow(s),veh/h/ln	1842	0	1565	1774	0	1574	1774	1770	1578	1774	1770	1573
Q Serve(g_s), s	8.3	0.0	11.0	24.5	0.0	9.4	5.2	27.1	35.9	2.4	24.2	2.1
Cycle Q Clear(g_c), s	8.3	0.0	11.0	24.5	0.0	9.4	5.2	27.1	35.9	2.4	24.2	2.1
Prop In Lane	0.22		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	244	0	208	912	0	405	277	1463	652	187	1375	611
V/C Ratio(X)	0.58	0.00	0.76	0.88	0.00	0.39	0.50	0.70	0.85	0.34	0.67	0.08
Avail Cap(c_a), veh/h	390	0	332	1112	0	493	298	1463	652	253	1375	611
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	46.2	0.0	47.4	40.3	0.0	34.7	21.8	27.5	30.0	22.6	28.6	21.8
Incr Delay (d2), s/veh	2.2	0.0	5.7	6.9	0.0	0.6	1.4	2.8	13.0	1.0	2.6	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.4	0.0	5.1	12.9	0.0	4.2	2.6	13.8	17.9	1.2	12.3	1.0
LnGrp Delay(d),s/veh	48.4	0.0	53.0	47.3	0.0	35.4	23.1	30.3	43.0	23.6	31.1	22.1
LnGrp LOS	D		D	D		D	C	C	D	C	C	C
Approach Vol, veh/h		301			957			1716			1026	
Approach Delay, s/veh		50.8			45.3			33.8			30.3	
Approach LOS		D			D			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.8	51.3		19.5	11.6	48.5		33.6
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	8.5	44.0		24.0	8.5	44.0		35.5
Max Q Clear Time (g_c+I1), s	4.4	37.9		13.0	7.2	26.2		26.5
Green Ext Time (p_c), s	0.0	4.2		1.3	0.0	6.2		2.7

Intersection Summary	
HCM 2010 Ctrl Delay	36.9
HCM 2010 LOS	D

Notes

User approved volume balancing among the lanes for turning movement.

Intersection	
Int Delay, s/veh	4.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	195	395	610	15	10	285
Future Vol, veh/h	195	395	610	15	10	285
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	300	250	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	212	429	663	16	11	310

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	679	0	-	0	1524	340
Stage 1	-	-	-	-	671	-
Stage 2	-	-	-	-	853	-
Critical Hdwy	4.13	-	-	-	6.63	6.93
Critical Hdwy Stg 1	-	-	-	-	5.83	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.219	-	-	-	3.519	3.319
Pot Cap-1 Maneuver	911	-	-	-	119	657
Stage 1	-	-	-	-	471	-
Stage 2	-	-	-	-	417	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	911	-	-	-	91	657
Mov Cap-2 Maneuver	-	-	-	-	218	-
Stage 1	-	-	-	-	361	-
Stage 2	-	-	-	-	417	-

Approach	EB	WB	SB
HCM Control Delay, s	3.4	0	15.5
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	911	-	-	-	218	657
HCM Lane V/C Ratio	0.233	-	-	-	0.05	0.472
HCM Control Delay (s)	10.1	-	-	-	22.4	15.3
HCM Lane LOS	B	-	-	-	C	C
HCM 95th %tile Q(veh)	0.9	-	-	-	0.2	2.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	700	220	530	475	140	575
Future Volume (veh/h)	700	220	530	475	140	575
Number	3	18	2	12	1	6
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	769	0	582	0	154	632
Adj No. of Lanes	1	1	1	1	1	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	2	2	2	2
Cap, veh/h	797	712	618	525	184	882
Arrive On Green	0.45	0.00	0.33	0.00	0.10	0.47
Sat Flow, veh/h	1774	1583	1863	1583	1774	1863
Grp Volume(v), veh/h	769	0	582	0	154	632
Grp Sat Flow(s),veh/h/ln	1774	1583	1863	1583	1774	1863
Q Serve(g_s), s	49.4	0.0	35.6	0.0	10.0	31.7
Cycle Q Clear(g_c), s	49.4	0.0	35.6	0.0	10.0	31.7
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	797	712	618	525	184	882
V/C Ratio(X)	0.96	0.00	0.94	0.00	0.84	0.72
Avail Cap(c_a), veh/h	840	750	618	525	310	882
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	1.00	1.00
Uniform Delay (d), s/veh	31.3	0.0	38.0	0.0	51.5	24.6
Incr Delay (d2), s/veh	22.2	0.0	24.4	0.0	9.7	5.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	29.1	0.0	22.5	0.0	5.4	17.4
LnGrp Delay(d),s/veh	53.6	0.0	62.5	0.0	61.2	29.5
LnGrp LOS	D		E		E	C
Approach Vol, veh/h	769		582			786
Approach Delay, s/veh	53.6		62.5			35.7
Approach LOS	D		E			D

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	16.6	43.4				60.0		57.2
Change Period (Y+Rc), s	4.5	4.5				4.5		4.5
Max Green Setting (Gmax), s	20.5	30.5				55.5		55.5
Max Q Clear Time (g_c+I1), s	12.0	37.6				33.7		51.4
Green Ext Time (p_c), s	0.2	0.0				4.2		1.3

Intersection Summary	
HCM 2010 Ctrl Delay	49.4
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Traffic Volume (veh/h)	5	100	5	210	100	5	10	440	130	5	485	5
Future Volume (veh/h)	5	100	5	210	100	5	10	440	130	5	485	5
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1900	1863	1900	1900	1863	1900	1900	1863	1900
Adj Flow Rate, veh/h	6	118	6	247	118	6	12	518	153	6	571	6
Adj No. of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	60	497	24	368	135	7	58	803	234	54	1072	11
Arrive On Green	0.29	0.29	0.29	0.29	0.29	0.29	0.59	0.59	0.59	0.59	0.59	0.59
Sat Flow, veh/h	25	1732	85	987	472	24	11	1370	399	5	1829	19
Grp Volume(v), veh/h	130	0	0	371	0	0	683	0	0	583	0	0
Grp Sat Flow(s),veh/h/ln	1842	0	0	1483	0	0	1779	0	0	1853	0	0
Q Serve(g_s), s	0.0	0.0	0.0	12.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	3.8	0.0	0.0	16.6	0.0	0.0	18.1	0.0	0.0	13.4	0.0	0.0
Prop In Lane	0.05		0.05	0.67		0.02	0.02		0.22	0.01		0.01
Lane Grp Cap(c), veh/h	581	0	0	510	0	0	1095	0	0	1137	0	0
V/C Ratio(X)	0.22	0.00	0.00	0.73	0.00	0.00	0.62	0.00	0.00	0.51	0.00	0.00
Avail Cap(c_a), veh/h	816	0	0	693	0	0	1095	0	0	1137	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	19.4	0.0	0.0	23.6	0.0	0.0	9.8	0.0	0.0	8.8	0.0	0.0
Incr Delay (d2), s/veh	0.2	0.0	0.0	2.5	0.0	0.0	2.7	0.0	0.0	1.7	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.0	0.0	0.0	7.2	0.0	0.0	9.5	0.0	0.0	7.3	0.0	0.0
LnGrp Delay(d),s/veh	19.6	0.0	0.0	26.1	0.0	0.0	12.5	0.0	0.0	10.5	0.0	0.0
LnGrp LOS	B			C			B			B		
Approach Vol, veh/h		130			371			683			583	
Approach Delay, s/veh		19.6			26.1			12.5			10.5	
Approach LOS		B			C			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		46.0		24.8		46.0		24.8
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5
Max Green Setting (Gmax), s		41.5		29.5		41.5		29.5
Max Q Clear Time (g_c+I1), s		20.1		5.8		15.4		18.6
Green Ext Time (p_c), s		4.5		0.6		4.0		1.7

Intersection Summary	
HCM 2010 Ctrl Delay	15.2
HCM 2010 LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	30	105	150	680	110	150	130	990	525	60	885	45
Future Volume (veh/h)	30	105	150	680	110	150	130	990	525	60	885	45
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	32	111	158	799	0	158	137	1042	553	63	932	47
Adj No. of Lanes	0	2	0	2	0	1	1	2	1	1	2	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	55	190	208	912	0	405	272	1463	652	185	1375	611
Arrive On Green	0.13	0.13	0.13	0.26	0.00	0.26	0.06	0.41	0.41	0.04	0.39	0.39
Sat Flow, veh/h	412	1430	1565	3548	0	1574	1774	3539	1578	1774	3539	1573
Grp Volume(v), veh/h	143	0	158	799	0	158	137	1042	553	63	932	47
Grp Sat Flow(s),veh/h/ln	1842	0	1565	1774	0	1574	1774	1770	1578	1774	1770	1573
Q Serve(g_s), s	8.3	0.0	11.0	24.5	0.0	9.4	5.2	27.7	35.9	2.4	24.8	2.1
Cycle Q Clear(g_c), s	8.3	0.0	11.0	24.5	0.0	9.4	5.2	27.7	35.9	2.4	24.8	2.1
Prop In Lane	0.22		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	244	0	208	912	0	405	272	1463	652	185	1375	611
V/C Ratio(X)	0.58	0.00	0.76	0.88	0.00	0.39	0.50	0.71	0.85	0.34	0.68	0.08
Avail Cap(c_a), veh/h	390	0	332	1112	0	493	294	1463	652	250	1375	611
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	46.2	0.0	47.4	40.3	0.0	34.7	21.9	27.6	30.0	22.7	28.7	21.8
Incr Delay (d2), s/veh	2.2	0.0	5.7	6.9	0.0	0.6	1.4	3.0	13.0	1.1	2.7	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.4	0.0	5.1	12.9	0.0	4.2	2.6	14.1	17.9	1.2	12.6	1.0
LnGrp Delay(d),s/veh	48.4	0.0	53.0	47.3	0.0	35.4	23.4	30.6	43.0	23.8	31.4	22.1
LnGrp LOS	D		D	D		D	C	C	D	C	C	C
Approach Vol, veh/h		301			957			1732			1042	
Approach Delay, s/veh		50.8			45.3			34.0			30.6	
Approach LOS		D			D			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.8	51.3		19.5	11.6	48.5		33.6
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	8.5	44.0		24.0	8.5	44.0		35.5
Max Q Clear Time (g_c+I1), s	4.4	37.9		13.0	7.2	26.8		26.5
Green Ext Time (p_c), s	0.0	4.2		1.3	0.0	6.2		2.7

Intersection Summary	
HCM 2010 Ctrl Delay	37.0
HCM 2010 LOS	D

Notes

User approved volume balancing among the lanes for turning movement.

Intersection	
Int Delay, s/veh	4.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	210	405	620	15	10	300
Future Vol, veh/h	210	405	620	15	10	300
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	300	250	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	228	440	674	16	11	326

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	690	0	-	0	1578	345
Stage 1	-	-	-	-	682	-
Stage 2	-	-	-	-	896	-
Critical Hdwy	4.13	-	-	-	6.63	6.93
Critical Hdwy Stg 1	-	-	-	-	5.83	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.219	-	-	-	3.519	3.319
Pot Cap-1 Maneuver	903	-	-	-	110	652
Stage 1	-	-	-	-	464	-
Stage 2	-	-	-	-	398	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	903	-	-	-	82	652
Mov Cap-2 Maneuver	-	-	-	-	206	-
Stage 1	-	-	-	-	347	-
Stage 2	-	-	-	-	398	-

Approach	EB	WB	SB
HCM Control Delay, s	3.5	0	16.1
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	903	-	-	-	206	652
HCM Lane V/C Ratio	0.253	-	-	-	0.053	0.5
HCM Control Delay (s)	10.3	-	-	-	23.4	15.9
HCM Lane LOS	B	-	-	-	C	C
HCM 95th %tile Q(veh)	1	-	-	-	0.2	2.8

Appendix D
Air Quality Monitoring Data

Construction Information used in ACAM Emission Calculation

	Phase/Activities	Duration	Number of Months	Construction Information
1	Demolish warehouses	1/1/2024-1/31/2024	1	Each warehouse is 100' L X 10' W X 12' H. Total of 6000 SF demolished.
2	Demolish access road/paved areas	1/1/2024-1/31/2024	1	Paved areas: 46650 SF (1.1 acre). Assumed a depth of 1 ft of pavement removed.
3	Grading and retaining walls	2/1/2024-3/31/2024	2	Grading: Total project is 18.6 acres (810,216 SF). 10.26 (446,926 SF) acres will be graded. Assumed no material hauling needed.
		4/1/2024-4/30/2025	1	Retaining walls: total 635' of retaining wall. Assumed all walls are 18' high, 3' wide.
4	Construct pacific hub building, pave sidewalks, parking, and delivery areas	1/1/2024-12/31/2024	12	Building Construction: 100000 SF, 2-story building. Building height assumed to be 30'.
		11/1/2024-12/31/2024	2	Architectural coating: for 100,000 SF building
		12/1/2024-12/31/2024	1	Paving: 189,000 SF (4.3 acre)
5	Install utilities	10/1/2024-11/31/2024	2	Include water force main of 2150' X 20' and electric line trenching of 2900' X 20' , for a total of 101,000 SF. Assumed no hauling needed.
		11/1/2024-11/30/2025	1	Building construction: assumed a total of 300 SF of structures for utility (lift station, generator plant, etc.)

Operation Information used in ACAM Operation Emission Calculation

1	Personnel	After construction		150 additional personnel travel to the facility. Other personnel are already live or work near the base.
2	Emergency generator	After construction		3 diesel emergency generators. 2500 kw (3351 hp) each. Assumed 200 hours/year each engine, including emergency and maintenance hours
3	Tanks	After construction		Diesel storage tank. 16000 gallon capacity each. Assumes 10'D X 30'L. Assumes 0.05 gallon/hp-hr. 51015 gallon throughput for 3 emergency engines and one fire pump engine.
4	Fire pump	After construction		1 fire pump engine. Assumed 150 hp, 200 hours/year.

AIR CONFORMITY APPLICABILITY MODEL REPORT
RECORD OF AIR ANALYSIS (ROAA)

1. General Information: The Air Force's Air Conformity Applicability Model (ACAM) was used to perform an analysis to assess the potential air quality impact/s associated with the action in accordance with the Air Force Manual 32-7002, Environmental Compliance and Pollution Prevention; the Environmental Impact Analysis Process (EIAP, 32 CFR 989); and the General Conformity Rule (GCR, 40 CFR 93 Subpart B). This report provides a summary of the ACAM analysis.

a. Action Location:
Base: HICKAM AFB
State: Hawaii
County(s): Honolulu
Regulatory Area(s): NOT IN A REGULATORY AREA

b. Action Title: Environmental Assessment for the Distributed Common Ground Station Pacific Hub at Joint Base Pearl Harbor-Hickam, Wahiawa Annex, Oahu, Hawaii

c. Project Number/s (if applicable):

d. Projected Action Start Date: 1 / 2024

e. Action Description:

The Proposed Action would construct a new DCGS Pacific Hub on the Wahiawa Annex. The project site is located in the southeastern portion of the Wahiawa Annex and is bisected by Midway Drive. Existing structures on the site include six warehouses, concrete pads, and an access road, all of which would be demolished as part of the Proposed Action.
Proposed Action construction and operation discussed in the following subsections are based largely on information in the Distributed Common Ground Station Pacific Hub User Requirements Document (Jacobs, 2019).

f. Point of Contact:
Name: Sara Van Klooster
Title: Senior Scientist
Organization: Jacobs
Email: sara.vanklooster@jacobs.com
Phone Number: 414-429-6681

2. Air Impact Analysis: Based on the attainment status at the action location, the requirements of the General Conformity Rule are:

_____ applicable
__X__ not applicable

Total net direct and indirect emissions associated with the action were estimated through ACAM on a calendar-year basis for the start of the action through achieving "steady state" (i.e., net gain/loss upon action fully implemented) emissions. The ACAM analysis used the latest and most accurate emission estimation techniques available; all algorithms, emission factors, and methodologies used are described in detail in the USAF Air Emissions Guide for Air Force Stationary Sources, the USAF Air Emissions Guide for Air Force Mobile Sources, and the USAF Air Emissions Guide for Air Force Transitory Sources.

"Insignificance Indicators" were used in the analysis to provide an indication of the significance of potential impacts to air quality based on current ambient air quality relative to the National Ambient Air Quality Standards (NAAQSs). These insignificance indicators are the 250 ton/yr Prevention of Significant Deterioration (PSD) major source threshold for actions occurring in areas that are "Clearly Attainment" (i.e., not within 5% of any NAAQS) and the GCR de minimis values (25 ton/yr for lead and 100 ton/yr for all other criteria pollutants) for actions occurring in areas that are "Near Nonattainment" (i.e., within 5% of any NAAQS). These indicators do not define a significant impact; however, they do provide a threshold to identify actions that are insignificant. Any action with net emissions below the insignificance indicators for all criteria pollutant is considered so insignificant that the action will not cause or contribute to an exceedance on one or more NAAQSs. For further detail on insignificance indicators see chapter 4 of the Air Force Air Quality Environmental Impact Analysis Process (EIAP) Guide, Volume II - Advanced Assessments.

The action's net emissions for every year through achieving steady state were compared against the Insignificance Indicator and are summarized below.

Analysis Summary:

2024

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	1.677	250	No
NOx	2.968	250	No
CO	3.779	250	No
SOx	0.009	250	No
PM 10	0.321	250	No
PM 2.5	0.114	250	No
Pb	0.000	25	No
NH3	0.003	250	No
CO2e	924.0		

2025

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	1.104	250	No
NOx	26.483	250	No
CO	10.961	250	No
SOx	0.050	250	No
PM 10	0.857	250	No
PM 2.5	0.856	250	No
Pb	0.000	25	No
NH3	0.021	250	No
CO2e	1693.4		

2026 - (Steady State)

Pollutant	Action Emissions (ton/yr)	INSIGNIFICANCE INDICATOR	
		Indicator (ton/yr)	Exceedance (Yes or No)
NOT IN A REGULATORY AREA			
VOC	1.104	250	No
NOx	26.483	250	No
CO	10.961	250	No
SOx	0.050	250	No
PM 10	0.857	250	No
PM 2.5	0.856	250	No
Pb	0.000	25	No
NH3	0.021	250	No

AIR CONFORMITY APPLICABILITY MODEL REPORT
RECORD OF AIR ANALYSIS (ROAA)

CO2e	1693.4		

None of estimated annual net emissions associated with this action are above the insignificance indicators, indicating no significant impact to air quality.Therefore, the action will not cause or contribute to an exceedance on one or more NAAQSs.No further air assessment is needed.

____ ____2/1/21_______

Sara Van Klooster, Senior Scientist DATE

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

1. General Information

- Action Location
Base: HICKAM AFB
State: Hawaii
County(s): Honolulu
Regulatory Area(s): NOT IN A REGULATORY AREA

- Action Title: Environmental Assessment for the Distributed Common Ground Station Pacific Hub at Joint Base Pearl Harbor-Hickam, Wahiawa Annex, Oahu, Hawaii

- Project Number/s (if applicable):

- Projected Action Start Date: 1 / 2024

- Action Purpose and Need:
The purpose of the Proposed Action is to provide the necessary facility for the 480th ISR Wing and 692 ISRG to provide secure communications support for Pacific region ISR operations. The Proposed Action is needed because current facilities at JBPHH used by the 692 ISRG were not designed or constructed to support technology intensive systems equipment or enable modernization efforts needed by the 692 ISRG.
The existing facilities on JBPHH are World War II era buildings currently at capacity on occupancy, power, cooling, and data center capability. These facilities, designed as aircraft hangars and administrative offices, have been modified numerous times to support operations of past generations. The facilities now struggle to adequately meet current mission loads and are cannot support an increase in steady-state missions, wartime and surge operations tempo, or evolving ISR data architecture.

- Action Description:
The Proposed Action would construct a new DCGS Pacific Hub on the Wahiawa Annex. The project site is located in the southeastern portion of the Wahiawa Annex and is bisected by Midway Drive. Existing structures on the site include six warehouses, concrete pads, and an access road, all of which would be demolished as part of the Proposed Action.
Proposed Action construction and operation discussed in the following subsections are based largely on information in the Distributed Common Ground Station Pacific Hub User Requirements Document (Jacobs, 2019).

- Point of Contact

Name: Sara Van Klooster
Title: Senior Scientist
Organization: Jacobs
Email: sara.vanklooster@jacobs.com
Phone Number: 414-429-6681

- Activity List:

Activity Type		Activity Title
2.	Construction / Demolition	Phase 1: Demolish warehouses
3.	Construction / Demolition	Phase 2: Demolish access road/paved areas
4.	Construction / Demolition	Phase 3: Grading and retaining walls
5.	Construction / Demolition	Phase 4: Construct Pacific Hub Bldg, pave sidewalks, parking, and delivery areas
6.	Construction / Demolition	Phase 5: Install utilities
7.	Personnel	Additional Personnel
8.	Emergency Generator	Emergency generators (3)
9.	Tanks	Tank No.1
10.	Tanks	Tank No. 2

11.	Emergency Generator	Fire Pump

Emission factors and air emission estimating methods come from the United States Air Force's Air Emissions Guide for Air Force Stationary Sources, Air Emissions Guide for Air Force Mobile Sources, and Air Emissions Guide for Air Force Transitory Sources.

2. Construction / Demolition

2.1 General Information & Timeline Assumptions

- Activity Location
County: Honolulu
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Phase 1: Demolish warehouses

- Activity Description:

- Activity Start Date
Start Month: 1
Start Month: 2024

- Activity End Date
Indefinite: False
End Month: 1
End Month: 2024

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.010511
SO_x	0.000185
NO_x	0.064307
CO	0.097355
PM 10	0.017576

Pollutant	Total Emissions (TONs)
PM 2.5	0.002445
Pb	0.000000
NH_3	0.000075
CO_2e	18.4

2.1 Demolition Phase

2.1.1 Demolition Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2024

- Phase Duration
Number of Month: 1
Number of Days: 0

2.1.2 Demolition Phase Assumptions

- General Demolition Information
Area of Building to be demolished (ft^2): 6000

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Height of Building to be demolished (ft): 12

- Default Settings Used: Yes

- Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Concrete/Industrial Saws Composite	1	8
Rubber Tired Dozers Composite	1	1
Tractors/Loaders/Backhoes Composite	2	6

- Vehicle Exhaust

Average Hauling Truck Capacity (yd^3): 20 (default)
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips

Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

2.1.3 Demolition Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Concrete/Industrial Saws Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0357	0.0006	0.2608	0.3715	0.0109	0.0109	0.0032	58.544
Rubber Tired Dozers Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.1747	0.0024	1.1695	0.6834	0.0454	0.0454	0.0157	239.47
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0348	0.0007	0.1980	0.3589	0.0068	0.0068	0.0031	66.875

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.280	000.002	000.208	003.467	000.005	000.005		000.023	00332.267
LDGT	000.373	000.003	000.374	004.989	000.007	000.006		000.024	00427.713
HDGV	000.801	000.005	000.972	016.626	000.015	000.013		000.046	00789.621
LDDV	000.079	000.003	000.127	002.707	000.004	000.004		000.008	00325.337
LDDT	000.218	000.004	000.362	004.629	000.007	000.006		000.008	00461.106
HDDV	000.300	000.013	003.537	001.358	000.165	000.152		000.026	01490.613
MC	002.824	000.003	000.676	013.057	000.025	000.023		000.053	00392.231

2.1.4 Demolition Phase Formula(s)

- Fugitive Dust Emissions per Phase

$PM10_{FD} = (0.00042 * BA * BH) / 2000$

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
0.00042: Emission Factor (lb/ft^3)
BA: Area of Building to be demolished (ft^2)
BH: Height of Building to be demolished (ft)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase
$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
$VMT_{VE} = BA * BH * (1 / 27) * 0.25 * (1 / HC) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building being demolish (ft^2)
BH: Height of Building being demolish (ft)
(1 / 27): Conversion Factor cubic feet to cubic yards ($1\ yd^3 / 27\ ft^3$)
0.25: Volume reduction factor (material reduced by 75% to account for air space)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)

2000: Conversion Factor pounds to tons

3. Construction / Demolition

3.1 General Information & Timeline Assumptions

- Activity Location
County: Honolulu
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Phase 2: Demolish access road/paved areas

- Activity Description:

- Activity Start Date
Start Month: 1
Start Month: 2024

- Activity End Date
Indefinite: False
End Month: 1
End Month: 2024

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.010433
SO_x	0.000181
NO_x	0.063392
CO	0.097004
PM 10	0.012210

Pollutant	Total Emissions (TONs)
PM 2.5	0.002406
Pb	0.000000
NH_3	0.000069
CO_2e	18.0

3.1 Demolition Phase

3.1.1 Demolition Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2024

- Phase Duration
Number of Month: 1
Number of Days: 0

3.1.2 Demolition Phase Assumptions

- General Demolition Information
Area of Building to be demolished (ft^2): 46650
Height of Building to be demolished (ft): 1

- Default Settings Used: Yes

- Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Concrete/Industrial Saws Composite	1	8
Rubber Tired Dozers Composite	1	1
Tractors/Loaders/Backhoes Composite	2	6

- Vehicle Exhaust

Average Hauling Truck Capacity (yd^3): 20 (default)
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips

Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

3.1.3 Demolition Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Concrete/Industrial Saws Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0357	0.0006	0.2608	0.3715	0.0109	0.0109	0.0032	58.544
Rubber Tired Dozers Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.1747	0.0024	1.1695	0.6834	0.0454	0.0454	0.0157	239.47
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0348	0.0007	0.1980	0.3589	0.0068	0.0068	0.0031	66.875

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.280	000.002	000.208	003.467	000.005	000.005		000.023	00332.267
LDGT	000.373	000.003	000.374	004.989	000.007	000.006		000.024	00427.713
HDGV	000.801	000.005	000.972	016.626	000.015	000.013		000.046	00789.621
LDDV	000.079	000.003	000.127	002.707	000.004	000.004		000.008	00325.337
LDDT	000.218	000.004	000.362	004.629	000.007	000.006		000.008	00461.106
HDDV	000.300	000.013	003.537	001.358	000.165	000.152		000.026	01490.613
MC	002.824	000.003	000.676	013.057	000.025	000.023		000.053	00392.231

3.1.4 Demolition Phase Formula(s)

- Fugitive Dust Emissions per Phase

$PM10_{FD} = (0.00042 * BA * BH) / 2000$

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
0.00042: Emission Factor (lb/ft^3)

BA: Area of Building to be demolished (ft^2)
BH: Height of Building to be demolished (ft)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase
$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
$VMT_{VE} = BA * BH * (1 / 27) * 0.25 * (1 / HC) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building being demolish (ft^2)
BH: Height of Building being demolish (ft)
(1 / 27): Conversion Factor cubic feet to cubic yards (1 yd^3 / 27 ft^3)
0.25: Volume reduction factor (material reduced by 75% to account for air space)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

4. Construction / Demolition

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

4.1 General Information & Timeline Assumptions

- Activity Location
County: Honolulu
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Phase 3: Grading and retaining walls

- Activity Description:

- Activity Start Date
Start Month: 2
Start Month: 2024

- Activity End Date
Indefinite: False
End Month: 4
End Month: 2024

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.150115
SO_x	0.002619
NO_x	0.848876
CO	0.872248
PM 10	0.181388

Pollutant	Total Emissions (TONs)
PM 2.5	0.033169
Pb	0.000000
NH_3	0.000297
CO_2e	261.2

4.1 Site Grading Phase

4.1.1 Site Grading Phase Timeline Assumptions

- Phase Start Date
Start Month: 2
Start Quarter: 1
Start Year: 2024

- Phase Duration
Number of Month: 2
Number of Days: 0

4.1.2 Site Grading Phase Assumptions

- General Site Grading Information
Area of Site to be Graded (ft^2): 7449
Amount of Material to be Hauled On-Site (yd^3): 0
Amount of Material to be Hauled Off-Site (yd^3): 0

- Site Grading Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of	Hours Per Day

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	Equipment	
Excavators Composite	1	8
Graders Composite	1	6
Other Construction Equipment Composite	1	8
Rubber Tired Dozers Composite	1	6
Scrapers Composite	3	8
Tractors/Loaders/Backhoes Composite	1	7

- Vehicle Exhaust

Average Hauling Truck Capacity (yd^3): 20 (default)

Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips

Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

4.1.3 Site Grading Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Excavators Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0584	0.0013	0.2523	0.5090	0.0100	0.0100	0.0052	119.71
Graders Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0714	0.0014	0.3708	0.5706	0.0167	0.0167	0.0064	132.90
Other Construction Equipment Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0461	0.0012	0.2243	0.3477	0.0079	0.0079	0.0041	122.61
Rubber Tired Dozers Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.1747	0.0024	1.1695	0.6834	0.0454	0.0454	0.0157	239.47
Scrapers Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.1564	0.0026	0.9241	0.7301	0.0368	0.0368	0.0141	262.83
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0348	0.0007	0.1980	0.3589	0.0068	0.0068	0.0031	66.875

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.280	000.002	000.208	003.467	000.005	000.005		000.023	00332.267
LDGT	000.373	000.003	000.374	004.989	000.007	000.006		000.024	00427.713
HDGV	000.801	000.005	000.972	016.626	000.015	000.013		000.046	00789.621
LDDV	000.079	000.003	000.127	002.707	000.004	000.004		000.008	00325.337
LDDT	000.218	000.004	000.362	004.629	000.007	000.006		000.008	00461.106
HDDV	000.300	000.013	003.537	001.358	000.165	000.152		000.026	01490.613
MC	002.824	000.003	000.676	013.057	000.025	000.023		000.053	00392.231

4.1.4 Site Grading Phase Formula(s)

- Fugitive Dust Emissions per Phase
$PM10_{FD}$ = (20 * ACRE * WD) / 2000

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase
CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
VMT_{VE} = (HA_{OnSite} + $HA_{OffSite}$) * (1 / HC) * HT

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
VMT_{WT} = WD * WT * 1.25 * NE

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds

EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

4.2 Building Construction Phase

4.2.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 4
Start Quarter: 1
Start Year: 2024

- Phase Duration
Number of Month: 1
Number of Days: 0

4.2.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 2000
Height of Building (ft): 18
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Cranes Composite	1	4
Forklifts Composite	2	6
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 40 (default)

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC

POVs	0	0	0	0	0	100.00	0

4.2.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Cranes Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0715	0.0013	0.4600	0.3758	0.0161	0.0161	0.0064	128.78
Forklifts Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0246	0.0006	0.0973	0.2146	0.0029	0.0029	0.0022	54.451
Tractors/Loaders/Backhoes Composite								
	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**CH_4**	**CO_2e**
Emission Factors	0.0348	0.0007	0.1980	0.3589	0.0068	0.0068	0.0031	66.875

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	**SO_x**	**NO_x**	**CO**	**PM 10**	**PM 2.5**	**Pb**	**NH_3**	**CO_2e**
LDGV	000.280	000.002	000.208	003.467	000.005	000.005		000.023	00332.267
LDGT	000.373	000.003	000.374	004.989	000.007	000.006		000.024	00427.713
HDGV	000.801	000.005	000.972	016.626	000.015	000.013		000.046	00789.621
LDDV	000.079	000.003	000.127	002.707	000.004	000.004		000.008	00325.337
LDDT	000.218	000.004	000.362	004.629	000.007	000.006		000.008	00461.106
HDDV	000.300	000.013	003.537	001.358	000.165	000.152		000.026	01490.613
MC	002.824	000.003	000.676	013.057	000.025	000.023		000.053	00392.231

4.2.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
VMT_{WT} = WD * WT * 1.25 * NE

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
VMT_{VT} = BA * BH * (0.38 / 1000) * HT

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

5. Construction / Demolition

5.1 General Information & Timeline Assumptions

- Activity Location
County: Honolulu
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Phase 4: Construct Pacific Hub Bldg, pave sidewalks, parking, and delivery areas

- Activity Description:

- Activity Start Date
Start Month: 1
Start Month: 2024

- Activity End Date

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Indefinite: False
End Month: 12
End Month: 2024

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	1.453978
SO_x	0.005337
NO_x	1.741931
CO	2.290581
PM 10	0.067622

Pollutant	Total Emissions (TONs)
PM 2.5	0.066878
Pb	0.000000
NH_3	0.002886
CO_2e	525.7

5.1 Building Construction Phase

5.1.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 1
Start Quarter: 1
Start Year: 2024

- Phase Duration
Number of Month: 12
Number of Days: 0

5.1.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 100000
Height of Building (ft): 30
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Cranes Composite	1	6
Forklifts Composite	2	6
Generator Sets Composite	1	8
Tractors/Loaders/Backhoes Composite	1	8
Welders Composite	3	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips

Average Vendor Round Trip Commute (mile): 40 (default)

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

5.1.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Cranes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0715	0.0013	0.4600	0.3758	0.0161	0.0161	0.0064	128.78
Forklifts Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0246	0.0006	0.0973	0.2146	0.0029	0.0029	0.0022	54.451
Generator Sets Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0303	0.0006	0.2464	0.2674	0.0091	0.0091	0.0027	61.061
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0348	0.0007	0.1980	0.3589	0.0068	0.0068	0.0031	66.875
Welders Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0227	0.0003	0.1427	0.1752	0.0059	0.0059	0.0020	25.653

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.280	000.002	000.208	003.467	000.005	000.005		000.023	00332.267
LDGT	000.373	000.003	000.374	004.989	000.007	000.006		000.024	00427.713
HDGV	000.801	000.005	000.972	016.626	000.015	000.013		000.046	00789.621
LDDV	000.079	000.003	000.127	002.707	000.004	000.004		000.008	00325.337
LDDT	000.218	000.004	000.362	004.629	000.007	000.006		000.008	00461.106
HDDV	000.300	000.013	003.537	001.358	000.165	000.152		000.026	01490.613
MC	002.824	000.003	000.676	013.057	000.025	000.023		000.053	00392.231

5.1.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

VMT_{VE} = BA * BH * (0.42 / 1000) * HT

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
VMT_{WT} = WD * WT * 1.25 * NE

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
VMT_{VT} = BA * BH * (0.38 / 1000) * HT

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

5.2 Architectural Coatings Phase

5.2.1 Architectural Coatings Phase Timeline Assumptions

- Phase Start Date
Start Month: 11
Start Quarter: 1
Start Year: 2024

- Phase Duration
Number of Month: 2
Number of Days: 0

5.2.2 Architectural Coatings Phase Assumptions

- General Architectural Coatings Information
Building Category: Non-Residential
Total Square Footage (ft^2): 100000
Number of Units: N/A

- Architectural Coatings Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

5.2.3 Architectural Coatings Phase Emission Factor(s)

- Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.280	000.002	000.208	003.467	000.005	000.005		000.023	00332.267
LDGT	000.373	000.003	000.374	004.989	000.007	000.006		000.024	00427.713
HDGV	000.801	000.005	000.972	016.626	000.015	000.013		000.046	00789.621
LDDV	000.079	000.003	000.127	002.707	000.004	000.004		000.008	00325.337
LDDT	000.218	000.004	000.362	004.629	000.007	000.006		000.008	00461.106
HDDV	000.300	000.013	003.537	001.358	000.165	000.152		000.026	01490.613
MC	002.824	000.003	000.676	013.057	000.025	000.023		000.053	00392.231

5.2.4 Architectural Coatings Phase Formula(s)

- Worker Trips Emissions per Phase
$VMT_{WT} = (1 * WT * PA) / 800$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
1: Conversion Factor man days to trips (1 trip / 1 man * day)
WT: Average Worker Round Trip Commute (mile)
PA: Paint Area (ft^2)
800: Conversion Factor square feet to man days (1 ft^2 / 1 man * day)

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Off-Gassing Emissions per Phase
VOC_{AC} = (AB * 2.0 * 0.0116) / 2000.0

VOC_{AC}: Architectural Coating VOC Emissions (TONs)
BA: Area of Building (ft^2)
2.0: Conversion Factor total area to coated area (2.0 ft^2 coated area / total area)
0.0116: Emission Factor (lb/ft^2)
2000: Conversion Factor pounds to tons

5.3 Paving Phase

5.3.1 Paving Phase Timeline Assumptions

- Phase Start Date
Start Month: 12
Start Quarter: 1
Start Year: 2024

- Phase Duration
Number of Month: 1
Number of Days: 0

5.3.2 Paving Phase Assumptions

- General Paving Information
Paving Area (ft^2): 189000

- Paving Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Cement and Mortar Mixers Composite	4	6
Pavers Composite	1	7
Paving Equipment Composite	2	6
Rollers Composite	1	7

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

5.3.3 Paving Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.569	000.008	000.606	005.120	000.008	000.007		000.034	00381.013
LDGT	000.807	000.010	001.051	008.641	000.009	000.008		000.034	00508.378
HDGV	001.513	000.016	002.777	026.893	000.020	000.018		000.046	00789.086
LDDV	000.207	000.003	000.305	003.836	000.006	000.006		000.008	00391.624
LDDT	000.520	000.005	000.815	007.812	000.008	000.008		000.008	00609.856
HDDV	000.593	000.014	006.848	002.466	000.375	000.345		000.026	01559.210
MC	002.959	000.008	000.696	014.613	000.026	000.023		000.049	00391.464

5.3.4 Paving Phase Formula(s)

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = PA * 0.25 * (1 / 27) * (1 / HC) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
PA: Paving Area (ft^2)
0.25: Thickness of Paving Area (ft)
(1 / 27): Conversion Factor cubic feet to cubic yards (1 yd^3 / 27 ft^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase

$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)

WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Off-Gassing Emissions per Phase
$VOC_P = (2.62 * PA) / 43560$

VOC_P: Paving VOC Emissions (TONs)
2.62: Emission Factor (lb/acre)
PA: Paving Area (ft^2)
43560: Conversion Factor square feet to acre (43560 ft2 / acre)^2 / acre)

6. Construction / Demolition

6.1 General Information & Timeline Assumptions

- Activity Location
County: Honolulu
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Phase 5: Install utilities

- Activity Description:

- Activity Start Date
Start Month: 10
Start Month: 2024

- Activity End Date
Indefinite: False
End Month: 11
End Month: 2024

- Activity Emissions:

Pollutant	Total Emissions (TONs)
VOC	0.051538
SO_x	0.001063
NO_x	0.249444
CO	0.421382
PM 10	0.042465

Pollutant	Total Emissions (TONs)
PM 2.5	0.008976
Pb	0.000000
NH_3	0.000170
CO_2e	100.8

6.1 Trenching/Excavating Phase

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

6.1.1 Trenching / Excavating Phase Timeline Assumptions

- Phase Start Date
Start Month: 10
Start Quarter: 1
Start Year: 2024

- Phase Duration
Number of Month: 2
Number of Days: 0

6.1.2 Trenching / Excavating Phase Assumptions

- General Trenching/Excavating Information
Area of Site to be Trenched/Excavated (ft^2): 1683
Amount of Material to be Hauled On-Site (yd^3): 0
Amount of Material to be Hauled Off-Site (yd^3): 0

- Trenching Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Excavators Composite	2	8
Other General Industrial Equipmen Composite	1	8
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Capacity (yd^3): 20 (default)
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

6.1.3 Trenching / Excavating Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.569	000.008	000.606	005.120	000.008	000.007		000.034	00381.013
LDGT	000.807	000.010	001.051	008.641	000.009	000.008		000.034	00508.378
HDGV	001.513	000.016	002.777	026.893	000.020	000.018		000.046	00789.086
LDDV	000.207	000.003	000.305	003.836	000.006	000.006		000.008	00391.624

LDDT	000.520	000.005	000.815	007.812	000.008	000.008		000.008	00609.856
HDDV	000.593	000.014	006.848	002.466	000.375	000.345		000.026	01559.210
MC	002.959	000.008	000.696	014.613	000.026	000.023		000.049	00391.464

6.1.4 Trenching / Excavating Phase Formula(s)

- Fugitive Dust Emissions per Phase
$PM10_{FD}$ = (20 * ACRE * WD) / 2000

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (TONs)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase
CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase
VMT_{VE} = (HA_{OnSite} + $HA_{OffSite}$) * (1 / HC) * HT

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
VMT_{WT} = WD * WT * 1.25 * NE

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

6.2 Building Construction Phase

6.2.1 Building Construction Phase Timeline Assumptions

- Phase Start Date
Start Month: 11
Start Quarter: 1
Start Year: 2024

- Phase Duration
Number of Month: 1
Number of Days: 0

6.2.2 Building Construction Phase Assumptions

- General Building Construction Information
Building Category: Office or Industrial
Area of Building (ft^2): 300
Height of Building (ft): 12
Number of Units: N/A

- Building Construction Default Settings
Default Settings Used: Yes
Average Day(s) worked per week: 5 (default)

- Construction Exhaust (default)

Equipment Name	Number Of Equipment	Hours Per Day
Cranes Composite	1	4
Forklifts Composite	2	6
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
Average Hauling Truck Round Trip Commute (mile): 20 (default)

- Vehicle Exhaust Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
Average Worker Round Trip Commute (mile): 20 (default)

- Worker Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
Average Vendor Round Trip Commute (mile): 40 (default)

- Vendor Trips Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

6.2.3 Building Construction Phase Emission Factor(s)

- Construction Exhaust Emission Factors (lb/hour) (default)

Cranes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0715	0.0013	0.4600	0.3758	0.0161	0.0161	0.0064	128.78
Forklifts Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0246	0.0006	0.0973	0.2146	0.0029	0.0029	0.0022	54.451
Tractors/Loaders/Backhoes Composite								
	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CH_4	CO_2e
Emission Factors	0.0348	0.0007	0.1980	0.3589	0.0068	0.0068	0.0031	66.875

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.280	000.002	000.208	003.467	000.005	000.005		000.023	00332.267
LDGT	000.373	000.003	000.374	004.989	000.007	000.006		000.024	00427.713
HDGV	000.801	000.005	000.972	016.626	000.015	000.013		000.046	00789.621
LDDV	000.079	000.003	000.127	002.707	000.004	000.004		000.008	00325.337
LDDT	000.218	000.004	000.362	004.629	000.007	000.006		000.008	00461.106
HDDV	000.300	000.013	003.537	001.358	000.165	000.152		000.026	01490.613
MC	002.824	000.003	000.676	013.057	000.025	000.023		000.053	00392.231

6.2.4 Building Construction Phase Formula(s)

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (TONs)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)

VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Number of Construction Equipment to Number of Works
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase
$VMT_{VT} = BA * BH * (0.38 / 1000) * HT$

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

7. Personnel

7.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Honolulu
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Additional Personnel

- Activity Description:

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

- Activity Start Date
Start Month: 1
Start Year: 2025

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.330435
SO_x	0.002259
NO_x	0.272868
CO	3.929435
PM 10	0.005667

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.005114
Pb	0.000000
NH_3	0.020758
CO_2e	336.4

7.2 Personnel Assumptions

- Number of Personnel
Active Duty Personnel: 0
Civilian Personnel: 150
Support Contractor Personnel: 0
Air National Guard (ANG) Personnel: 0
Reserve Personnel: 0

- Default Settings Used: Yes

- Average Personnel Round Trip Commute (mile): 20 (default)

- Personnel Work Schedule
Active Duty Personnel: 5 Days Per Week (default)
Civilian Personnel: 5 Days Per Week (default)
Support Contractor Personnel: 5 Days Per Week (default)
Air National Guard (ANG) Personnel: 4 Days Per Week (default)
Reserve Personnel: 4 Days Per Month (default)

7.3 Personnel On Road Vehicle Mixture

- On Road Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	37.55	60.32	0	0.03	0.2	0	1.9
GOVs	54.49	37.73	4.67	0	0	3.11	0

7.4 Personnel Emission Factor(s)

- On Road Vehicle Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.280	000.002	000.208	003.467	000.005	000.005		000.023	00332.267
LDGT	000.373	000.003	000.374	004.989	000.007	000.006		000.024	00427.713
HDGV	000.801	000.005	000.972	016.626	000.015	000.013		000.046	00789.621
LDDV	000.079	000.003	000.127	002.707	000.004	000.004		000.008	00325.337
LDDT	000.218	000.004	000.362	004.629	000.007	000.006		000.008	00461.106
HDDV	000.300	000.013	003.537	001.358	000.165	000.152		000.026	01490.613

MC	002.824	000.003	000.676	013.057	000.025	000.023		000.053	00392.231

7.5 Personnel Formula(s)

- Personnel Vehicle Miles Travel for Work Days per Year
$VMT_P = NP * WD * AC$

VMT_P: Personnel Vehicle Miles Travel (miles/year)
NP: Number of Personnel
WD: Work Days per Year
AC: Average Commute (miles)

- Total Vehicle Miles Travel per Year
$VMT_{Total} = VMT_{AD} + VMT_C + VMT_{SC} + VMT_{ANG} + VMT_{AFRC}$

VMT_{Total}: Total Vehicle Miles Travel (miles)
VMT_{AD}: Active Duty Personnel Vehicle Miles Travel (miles)
VMT_C: Civilian Personnel Vehicle Miles Travel (miles)
VMT_{SC}: Support Contractor Personnel Vehicle Miles Travel (miles)
VMT_{ANG}: Air National Guard Personnel Vehicle Miles Travel (miles)
VMT_{AFRC}: Reserve Personnel Vehicle Miles Travel (miles)

- Vehicle Emissions per Year
$V_{POL} = (VMT_{Total} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{Total}: Total Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Personnel On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

8. Emergency Generator

8.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Honolulu
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Emergency generators (3)

- Activity Description:

- Activity Start Date
Start Month: 1
Start Year: 2025

- Activity End Date
Indefinite: Yes

End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.719795
SO_x	0.012566
NO_x	26.037270
CO	6.916464
PM 10	0.813288

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.813288
Pb	0.000000
NH_3	0.000000
CO_2e	1337.0

8.2 Emergency Generator Assumptions

- Emergency Generator
Type of Fuel used in Emergency Generator: Diesel
Number of Emergency Generators: 3

- Default Settings Used: No

- Emergency Generators Consumption
Emergency Generator's Horsepower: 3351
Average Operating Hours Per Year (hours): 200

8.3 Emergency Generator Emission Factor(s)

- Emergency Generators Emission Factor (lb/hp-hr)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
0.000716	0.0000125	0.0259	0.00688	0.000809	0.000809			1.33

8.4 Emergency Generator Formula(s)

- Emergency Generator Emissions per Year
AE_{POL}= (NGEN * HP * OT * EF_{POL}) / 2000

AE_{POL}: Activity Emissions (TONs per Year)
NGEN: Number of Emergency Generators
HP: Emergency Generator's Horsepower (hp)
OT: Average Operating Hours Per Year (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hp-hr)

9. Tanks

9.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Honolulu
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Tank No.1

- Activity Description:

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

- Activity Start Date
Start Month: 1
Start Year: 2025

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.006012
SO_x	0.000000
NO_x	0.000000
CO	0.000000
PM 10	0.000000

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.000000
Pb	0.000000
NH_3	0.000000
CO_2e	0.0

9.2 Tanks Assumptions

- Chemical
Chemical Name: Fuel oil no. 2
Chemical Category: Petroleum Distillates
Chemical Density: 7.1
Vapor Molecular Weight (lb/lb-mole): 130
Stock Vapor Density (lb/ft^3): 0.000129553551395334
Vapor Pressure: 0.0055
Vapor Space Expansion Factor (dimensionless): 0.068

- Tank
Type of Tank: Horizontal Tank
Tank Length (ft): 30
Tank Diameter (ft): 10
Annual Net Throughput (gallon/year): 51015

9.3 Tank Formula(s)

- Vapor Space Volume
VSV = (PI / 4) * D^2 * L / 2

VSV: Vapor Space Volume (ft^3)
PI: PI Math Constant
D^2: Tank Diameter (ft)
L: Tank Length (ft)
2: Convertion Factor (Vapor Space Volume is assumed to be one-half of the tank volume)

- Vented Vapor Saturation Factor
VVSF = 1 / (1 + (0.053 * VP * L / 2))

VVSF: Vented Vapor Saturation Factor (dimensionless)
0.053: Constant
VP: Vapor Pressure (psia)
L: Tank Length (ft)

- Standing Storage Loss per Year

SSL_{VOC} = 365 * VSV * SVD * VSEF * VVSF / 2000

SSL_{VOC}: Standing Storage Loss Emissions (TONs)
365: Number of Daily Events in a Year (Constant)
VSV: Vapor Space Volume (ft^3)
SVD: Stock Vapor Density (lb/ft^3)
VSEF: Vapor Space Expansion Factor (dimensionless)
VVSF: Vented Vapor Saturation Factor (dimensionless)
2000: Conversion Factor pounds to tons

- Number of Turnovers per Year

NT = (7.48 * ANT) / ((PI / 4.0) * D * L)

NT: Number of Turnovers per Year
7.48: Constant
ANT: Annual Net Throughput
PI: PI Math Constant
D^2: Tank Diameter (ft)
L: Tank Length (ft)

- Working Loss Turnover (Saturation) Factor per Year

WLSF = (18 + NT) / (6 * NT)

WLSF: Working Loss Turnover (Saturation) Factor per Year
18: Constant
NT: Number of Turnovers per Year
6: Constant

- Working Loss per Year

WL_{VOC} = 0.0010 * VMW * VP * ANT * WLSF / 2000

0.0010: Constant
VMW: Vapor Molecular Weight (lb/lb-mole)
VP: Vapor Pressure (psia)
ANT: Annual Net Throughput
WLSF: Working Loss Turnover (Saturation) Factor
2000: Conversion Factor pounds to tons

10. Tanks

10.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location

County: Honolulu
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Tank No. 2

- Activity Description:

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

- Activity Start Date
Start Month: 1
Start Year: 2025

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.006012
SO_x	0.000000
NO_x	0.000000
CO	0.000000
PM 10	0.000000

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.000000
Pb	0.000000
NH_3	0.000000
CO_2e	0.0

10.2 Tanks Assumptions

- Chemical
Chemical Name: Fuel oil no. 2
Chemical Category: Petroleum Distillates
Chemical Density: 7.1
Vapor Molecular Weight (lb/lb-mole): 130
Stock Vapor Density (lb/ft^3): 0.000129553551395334
Vapor Pressure: 0.0055
Vapor Space Expansion Factor (dimensionless): 0.068

- Tank
Type of Tank: Horizontal Tank
Tank Length (ft): 30
Tank Diameter (ft): 10
Annual Net Throughput (gallon/year): 51015

10.3 Tank Formula(s)

- Vapor Space Volume
$VSV = (PI / 4) * D^2 * L / 2$

VSV: Vapor Space Volume (ft^3)
PI: PI Math Constant
D^2: Tank Diameter (ft)
L: Tank Length (ft)
2: Convertion Factor (Vapor Space Volume is assumed to be one-half of the tank volume)

- Vented Vapor Saturation Factor
VVSF = 1 / (1 + (0.053 * VP * L / 2))

VVSF: Vented Vapor Saturation Factor (dimensionless)
0.053: Constant
VP: Vapor Pressure (psia)
L: Tank Length (ft)

- Standing Storage Loss per Year
$SSL_{VOC} = 365 * VSV * SVD * VSEF * VVSF / 2000$

SSL_{VOC}: Standing Storage Loss Emissions (TONs)
365: Number of Daily Events in a Year (Constant)
VSV: Vapor Space Volume (ft^3)
SVD: Stock Vapor Density (lb/ft^3)
VSEF: Vapor Space Expansion Factor (dimensionless)
VVSF: Vented Vapor Saturation Factor (dimensionless)
2000: Conversion Factor pounds to tons

- Number of Turnovers per Year
NT = (7.48 * ANT) / ((PI / 4.0) * D * L)

NT: Number of Turnovers per Year
7.48: Constant
ANT: Annual Net Throughput
PI: PI Math Constant
D^2: Tank Diameter (ft)
L: Tank Length (ft)

- Working Loss Turnover (Saturation) Factor per Year
WLSF = (18 + NT) / (6 * NT)

WLSF: Working Loss Turnover (Saturation) Factor per Year
18: Constant
NT: Number of Turnovers per Year
6: Constant

- Working Loss per Year
WL_{VOC} = 0.0010 * VMW * VP * ANT * WLSF / 2000

0.0010: Constant
VMW: Vapor Molecular Weight (lb/lb-mole)
VP: Vapor Pressure (psia)
ANT: Annual Net Throughput
WLSF: Working Loss Turnover (Saturation) Factor
2000: Conversion Factor pounds to tons

11. Emergency Generator

11.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Honolulu
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Fire Pump

- Activity Description:

- Activity Start Date
Start Month: 1

DETAIL AIR CONFORMITY APPLICABILITY MODEL REPORT

Start Year: 2025

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.041850
SO_x	0.035250
NO_x	0.172500
CO	0.115200
PM 10	0.037650

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.037650
Pb	0.000000
NH_3	0.000000
CO_2e	20.0

11.2 Emergency Generator Assumptions

- Emergency Generator
Type of Fuel used in Emergency Generator: Diesel
Number of Emergency Generators: 1

- Default Settings Used: No

- Emergency Generators Consumption
Emergency Generator's Horsepower: 150
Average Operating Hours Per Year (hours): 200

11.3 Emergency Generator Emission Factor(s)

- Emergency Generators Emission Factor (lb/hp-hr)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
0.00279	0.00235	0.0115	0.00768	0.00251	0.00251			1.33

11.4 Emergency Generator Formula(s)

- Emergency Generator Emissions per Year

AE_{POL}= (NGEN * HP * OT * EF_{POL}) / 2000

AE_{POL}: Activity Emissions (TONs per Year)
NGEN: Number of Emergency Generators
HP: Emergency Generator's Horsepower (hp)
OT: Average Operating Hours Per Year (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hp-hr)

Appendix E
U.S. Fish and Wildlife Service Consultation

DEPARTMENT OF THE AIR FORCE
692D INTELLIGENCE, SURVEILLANCE, AND
RECONNAISSANCE GROUP (ACC)
JOINT BASE PEARL HARBOR-HICKAM, HAWAII

12 Apr 21

Dr. Mary Abrams
Field Supervisor
U.S. Fish and Wildlife Service,
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard
Room 3-122, Box 50088
Honolulu, Hawaii 96850

Dear Dr. Abrams,

SUBJECT: SECTION 7 INFORMAL CONSULTATION FOR DISTRIBUTED COMMON GROUND STATION PACIFIC HUB AT JOINT BASE PEARL HARBOR-HICKAM, OAHU.

Pursuant to Section 7(a)(2) of the Endangered Act (ESA) and its implementing regulations [50 CFR Part 402], Joint Base Pearl Harbor-Hickam (JBPHH) requests informal consultation related to the Distributed Common Ground Station Pacific Hub (DCGS Pacific Hub) at Wahiawa Annex, Joint Base Pearl Harbor Hickam (JBPHH). The proposed action consists of construction and operation of the DCGS Pacific Hub.

JBPHH has developed this Biological Assessment (BA) to assess potential impacts to the Band-rumped storm-petrel (*Hydrobates castro*) and Hawaiian petrel (*Pterodroma sandwichensis*), listed as endangered, and Newell's shearwater (*Puffinus newelli*), listed as threatened, under the ESA. Based on the evaluation presented in this BA, JBPHH has made the determination that the proposed construction activities and operation of the facility may affect, but are not likely to adversely affect, the Band-rumped storm-petrel, Hawaiian petrel, and Newell's shearwater**.** JBPHH requests your concurrence with our finding based on information provided in the attached BA, which includes the following:

- A description of the action being considered
- A description of the specific area that may be affected by the action
- A description of any listed species or critical habitat that may be affected by the action
- A description of the manner in which the action may affect any listed species or critical habitat, and analysis of any cumulative effects;
- A list of all referenced reports, studies or information available on the action, the affected listed species, or critical habitat.

Please direct correspondence regarding this matter to Corrina Carnes (808) 471-0378 or corrina.carnes@navy.mil.

Sincerely,

MACK.ERIC.GREGORY.1154201480 Digitally signed by MACK.ERIC.GREGORY.1154201480 Date: 2021.04.12 16:17:37 -10'00'

ERIC G. MACK, Colonel, USAF
Commander

Enclosure: 1. Biological Assessment for Distributed Common Ground Station Pacific Hub at Wahiawa Annex, Joint Base Pearl Harbor-Hickam, Oahu