FHWA-HI-EIS-17-01-D

SADDLE ROAD EXTENSION
SOUTH KOHALA, HAWAI‘I
Project Number DP-HI-0200(5)

DRAFT

ENVIRONMENTAL IMPACT STATEMENT

April 2017

Submitted Pursuant to the National Environmental Policy Act (NEPA),
42 U.S.C. 4332 (2)(c), Section 4(f) of the Department of Transportation Act (DOT)
49 U.S.C. 303, and Chapter 343, Hawai‘i Revised Statutes (HRS)

U.S. Department of Transportation, Federal Highway Administration (FHWA)
State of Hawai‘i, Department of Transportation, Highways Division

NATIONAL ENVIRONMENTAL POLICY ACT STATEMENT

The National Environmental Policy Act (NEPA) 42 U.S.C. 4321-4347, became effective January 1, 1970. This law requires that all federal agencies shall prepare a detailed Environmental Impact Statement (EIS) for every recommendation or report on proposals for legislation and other major federal actions significantly affecting the quality of the human environment. The Federal Highway Administration (FHWA) is, therefore, required to have an EIS prepared on proposals funded under its authority if the proposal is determined to be a major action significantly affecting the quality of the human environment.

EISs are required for many transportation projects as outlined in NEPA. The processing of an EIS is carried out in two stages. Draft EISs are first written and forwarded for review and comment to federal, state and local agencies with jurisdiction by law or special expertise and are made available to the public. This availability to the public must occur at least 15 days before the public hearing and not later than the time of the first public hearing notice or notice of opportunity for a hearing. Normally, 45 days, plus mailing time, will be allowed for comments to be made on the Draft EIS unless a time extension is granted by the proponent agencies. After this period has elapsed, preparation can begin on the Final EIS.

A Final EIS is prepared that modifies the Draft EIS as follows:

1. Basic content of the Draft EIS is amended due to internal agency comments, editing, additional alternatives being considered, and changes due to the time-lag between the Draft and Final EIS.
2. Inclusion of summary of public hearing comments.
3. Inclusion of comments received on the Draft EIS.
4. Evaluation and disposition of each substantive comment.

Administrative action cannot take place sooner than 90 days after circulation of the Draft EIS to the U.S. Environmental Protection Agency (USEPA) or 30 days after submittal of the Final EIS to the EPA.

Both the Draft and Final EIS are full disclosure documents which provide a full description of the proposed Project, the existing environment, and analysis of the anticipated beneficial and adverse environmental effects.

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SADDLE ROAD EXTENSION
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Project Number DP-HI-0200(5)

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ENVIRONMENTAL IMPACT STATEMENT

Submitted Pursuant to the National Environmental Policy Act (NEPA), 16 USC § 4601-4, 23 U.S.C. §138, 42 U.S.C. §4332 (2)(c), Section 4(f) of the Department of Transportation Act (DOT) 49 U.S.C. § 303, and Chapter 343, Hawai'i Revised Statutes (HRS)

U.S. Department of Transportation,
Federal Highway Administration (FHWA)
Central Federal Lands Highway Division (CFLHD)
and
State of Hawai'i,
Department of Transportation (HDOT), Highways Division

Cooperating Agencies
U.S. Army Corps of Engineers

Mr. Ricardo Suarez, Division Director,
Central Federal Lands Highway Division,
Federal Highway Administration

3/17/2017
Date of Approval

Mr. Ford Fuchigami, Director
Hawai'i Department of Transportation

3.21.17
Date of Approval

The Federal Highway Administration may publish a notice in the *Federal Register*, pursuant to 23 United States Code (USC) Section 139(l), when the Record of Decision is approved. If such a notice is published, a claim arising under federal law seeking judicial review of a permit, license, or approval issued by a federal agency for a highway or public transportation capital project shall be barred unless it is filed within 150 days after publication of a notice in the *Federal Register* announcing the permit, license, or approval is final pursuant to the law under which judicial review is allowed. If no notice is published, then the periods of time that otherwise are provided by the federal laws governing such claims will apply.

ABSTRACT

This Draft Environmental Impact Statement describes and evaluates the impacts associated with a new highway proposed by the Hawai‘i State Department of Transportation and the Federal Highway Administration. Destinations spurring cross-island traffic on the island of Hawai‘i include the towns of Hilo, Waimea, Waikoloa Village and Kailua; the two airports and two harbors that serve the island; and the major resorts centered on the west coast of the island (see ***Figure S-1***).

Traffic demand is currently met by State Route 19 along the Hamakua Coast and through Honoka‘a and Waimea and on to Queen Ka‘ahumanu Highway; by the Daniel K. Inouye Highway (State Route 200) in combination with Waikoloa Road and Māmalahoa Highway across the center of the island; and by the much longer route around the southern end of the island (State Route 11). The highway agencies propose three alternative highway alignments that would directly connect the western terminus of the Daniel K. Inouye Highway to the intersection of the Queen Ka‘ahumanu Highway with Waikoloa Beach Drive, saving drivers up to 6.6 minutes per one-way trip and reducing fuel costs, energy use and congestion.

The overarching, primary purpose of the proposed project is to provide a modern State Highway link connecting for motorists traveling between Hilo and coastal South Kohala/Kona on the Daniel K. Inouye Highway. Secondary and supporting purposes to this primary goal are to:

- Improve the general efficiency and operational level of traffic movement between East Hawai‘i and West Hawai‘i;
- Support special traffic needs, including commercial truck traffic and military traffic between Kawaihae and the Pōhakuloa Training Area; and
- Improve safety for all users.

Any direct, indirect, cumulative, and construction effects of the alternatives are identified in a broad range of categories, including traffic, social and economic conditions, environmental justice, land use, relocations and displacements, historic preservation, visual resources and aesthetic qualities, public facilities and services, air quality, energy, noise, biological resources, floodplains and drainage/hydrology, waters of the U.S., water quality, geology and soils, hazardous materials, utilities, and Section 4(f) resources. Mitigation measures are identified to address impacts to all resources. Environmental impacts related to wildfire potential, protected species of flora and fauna, and archaeological and cultural resources have been avoided or greatly reduced through design or can be otherwise mitigated to acceptable levels. The No Action Alternative, would continue use of the existing circuitous routes, and would have greater traffic, noise, air quality, and energy impacts than any Build Alternative.

Visit the project website at https://flh.fhwa.dot.gov/projects/hi/hi-stp-sr200-saddle-road-extension-12241/ for an electronic version of the Final EIS and attachments, including technical reports. The project website lists locations where hard copies of the Final EIS and associated materials are available for public review. Information on dates, times, and locations of public meetings that will be held during the public review period also are included on the project website. An electronic copy of the EIS is also available at http://health.hawaii.gov/oeqc/.

The following persons may be contacted for additional information concerning this document:

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Comments on this DEIS are due on or before the close of business June 7, 2017, and may be sent to the persons and addresses previously indicated.

The Draft EIS and all ancillary documents were prepared under the Hawai‘i Department of Transportation's (HDOT) direction or supervision and the information submitted, to the best of the Department's knowledge, fully addresses the document content requirements as set forth in sections 11-200-17 and 11-200-18, Hawai‘i Administrative Rules.

Mr. Ford Fuchigami, Director
Hawai‘i Department of Transportation

3.21.17
Date

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Note: Units of measurement used in this EIS are English

LIST OF ACRONYMS AND ABBREVIATIONS

AAQS............ Ambient Air Quality Standards
AASHTO ....American Association of State Highway and Transportation Officials
ACC/MVM ....accidents per million vehicle miles
ADT .... average daily traffic
ALISH............ Agricultural Lands of Importance to the State of Hawai‘i
APE............ Area of Potential Effect
ASTM .... American Society of Testing and Materials
BA ....Biological Assessment
BCE............before the Common Era
BMP ....best management practice
BO............Biological Opinion
BRD .... Biological Resources Division
CAA ....Federal Clean Air Act
CAAA ....1990 Clean Air Act Amendments
CDP............Community Development Plan *or* Census Designated Place
CDUA/P............ Conservation District Use Application/Permit
CE ....Common Era
CFLHD .... Central Federal Lands Highway Division
CFR............ Code of Federal Regulations
CO............ carbon monoxide
CP............Coordination Plan
CWA .... Clean Water Act
CZM............ Hawai‘i Coastal Zone Management
DAR............ Defense Access Road
dB............decibels
dBA............A-weighted decibel scale
DEIS............Draft Environmental Impact Statement
DHHL .... State of Hawai‘i Department of Hawaiian Home Lands
DLNR............State of Hawai‘i Department of Land and Natural Resources
DHHS............ State of Hawai‘i Department of Health and Human Services
DOA............U.S. Department of the Army
DOD............U.S. Department of Defense
DOFAW............State of Hawai‘i Division of Forestry and Wildlife
DOH............ State of Hawai‘i Department of Health
EIS .... Environmental Impact Statement
EMP .... Ecosystem Management Program
EO-PTA ....Environmental Office of the PTA
EPA............Environmental Protection Agency
ESA............ Endangered Species Act
FEIS .... Final Environmental Impact Statement
FEMA ....Federal Emergency Management Agency

FHWA........ Federal Highway Administration
GMA........ Game Management Area
HAR........ Hawai‘i Administrative Rules
HCM........ Highway Capacity Manual
HDLIR........ State of Hawai‘i Department of Labor and Industrial Relations
HDOT........ State of Hawai‘i Department of Transportation
HFBS........ Hawai‘i Forest Bird Survey
HHCA........ Hawaiian Homes Commission Act
HHL........ Hawaiian Home Land
HHLP........ Hawaiian Home Land Program
HLRLTP........ Hawai‘i Long Range Land Transportation Plan
HOV........ High Occupancy Vehicle
HRS........ Hawai‘i Revised Statutes
IfA........ Institute for Astronomy (University of Hawai‘i)
IWFMP........ Integrated Wildland Fire Management Plan (Oahu and Pōhakuloa Training Areas)
kV........ kilovolt
L........ liters
L_{eq}........ average noise level over a 1-hour period
LOS........ Level of Service
LUPAG........ Land Use Pattern Allocation Guide
m........ meters
m^3........ cubic meters
mGALs........ million gallons
mm........ millimeters
MOA........ Memorandum of Agreement (Section 106)
MOU........ Memorandum of Understanding
MP........ milepost
mph........ miles per hour
NAAQS........ National Ambient Air Quality Standards
NAC........ Noise Abatement Criteria
NEPA........ National Environmental Policy Act
NHPA........ National Historic Preservation Act
NMFS........ National Marine Fisheries Service
NOAA........ National Oceanic and Atmospheric Administration
NOI........ (federal EIS) Notice of Intent
NPDES........ National Pollutant Discharge Elimination System
NPL........ National Priority List
NPS........ National Park Service
NRC........ National Research Council
NRCS........ U.S. Natural Resources Conservation Service
NRHP........ National Register of Historic Places
OHA........ Office of Hawaiian Affairs
OMKM........ Office of Mauna KEA Management
PLF........ Pahoehoe Lava Flows
PM_{10}........ particulate matter smaller than ten microns in diameter
PTA........ Pōhakuloa Training Area
RCRA........ Resource Conservation Recovery Act
ROD........ Record of Decision
ROW........ right-of-way
RPW........ Relatively Permanent Water
RSA........ Resource Study Area (cumulative impacts)

SEE Team .... Social, Economic, and Environmental Study Team
SEIS ....Supplemental Environmental Impact Statement
SHPD ....State Historic Preservation Division
SHPO ....State Historic Preservation Officer
SIPs ....State Implementation Plans
SLU ....State Land Use
SMA ....Special Management Area
SO_2 ....sulfur dioxide
SPUI ....single-point urban interchange
SR 200 ....State Route 200 (Saddle Road)
SR 190 ....State Route 190 (Māmalahoa Highway)
SR 19 ....State Route 19
SR 11 ....State Route 11
SRTF ....Saddle Road Community Task Force
SWPPP ....Stormwater Pollution Prevention Plan
TAZs ....Traffic Analysis Zones
TEUs ....container equivalent units
TNM ....Traffic Noise Model (FHWA)
TNW ....Traditional Navigable Water
TRB ....Transportation Research Board
TSM ....Transportation Systems Management
TDM ....Travel Demand Management
URARPAPA .... Uniform Relocation Assistance and Real Property Acquisition Policies Act
U.S. DOT ....U.S. Department of Transportation
USACE ....U.S. Army Corps of Engineers
USARPAC ....U.S. Army Pacific Command
USFWS ....U.S. Fish and Wildlife Service
USGS ....U.S. Geological Survey
UST ....underground storage tanks
V/C ....(traffic) volume to capacity
vpd ....vehicles per day
VMT ....vehicles miles travelled
WMA ....Waikoloa Maneuver Area
WUS ....Waters of the United States
TAZ ....traffic analysis zone

SUMMARY

S.1 PROJECT LOCATION AND PURPOSE AND NEED

S.1.1 Project Location, Lead Agencies and Background

The Hawaiʻi State Department of Transportation (HDOT) and the Federal Highway Administration (FHWA), the "Lead Agencies", propose an arterial connector highway between Māmalahoa Highway, (State Route [SR] 190), and Queen Kaʻahumanu Highway (SR 19) (***Figure S.1***). The Project is referred to as the Saddle Road Extension.

Major destinations spurring cross-island traffic on the island of Hawaiʻi include airports (Kona International Airport and Hilo International Airport), State harbors (Kawaihae and Hilo), beaches and resorts (South Kohala and Kona), and population centers (Hilo, Waimea, Waikoloa Village and Kailua). Traffic capacity demand is currently met by SR 19 along the Hamakua Coast and through Honokaʻa and Waimea; by the Saddle Road (SR 200) (now known as Daniel K. Inouye or DKI Highway) in combination with Waikoloa Road and Māmalahoa Highway across the center of the island; and by the longer route around the southern end of the island through the Kaʻū and Kona Districts on SR 11 refer to ***Fig. S.1***).

The project termini for the proposed Saddle Road Extension were set based on accommodating the critical area of expected traffic growth. The eastern or *mauka* project limit was anticipated to be Māmalahoa Highway at or near the realigned Saddle Road terminus. At the Project's outset in the early 2000s, this point had been set two miles north of the current terminus based on the 1999 Saddle Road Improvements Project Final EIS. The western or *makai* terminus is the Queen Ka'ahumanu Highway (SR 19) at the southern leg of Waikoloa Beach Drive, a point planned for decades to be the major intersection in this segment of SR 19.

The project study area is a corridor extending in an east-west direction for approximately 10.5 miles within the districts of South Kohala and North Kona. This area corridor is open land that is lightly grazed on the *mauka* portion and mostly unused on the lower portion (***Figure 1.2***).

The Environmental Impact Statement (EIS) for the Project was originally begun in 1999. It was delayed for eight years beginning in 2003 due to uncertainty about the western terminus of the Saddle Road Improvements, which was related to the U.S. Army's purchase for military training of Parker Ranch's Keʻāmuku Parcel, through which the western portion of the realigned Saddle Road had been planned. The U.S. Army's EIS process concluded in April 2008. Shortly afterwards, the Army determined that FHWA and HDOT would need to relocate the planned western portion of the Saddle Road to the south in order to reasonably accommodate training activities in the newly acquired Keʻāmuku Parcel. This major change necessitated preparation of a Supplemental EIS (SEIS) for the Saddle Road Improvements Project. The SEIS process was subsequently conducted, and a Record of Decision (ROD) was completed in 2010, and the western portion of the highway was built in 2013. The Saddle Road Extension project had been on hold from 2003 to 2010. The EIS process for the Saddle Road Extension was resumed in late 2011. A revised State of Hawaiʻi EISPN was issued in May 2012, and a National Environmental Policy Act (NEPA) Revised NOI was issued on March 11, 2014.

S.1.2 PURPOSE AND NEED

The purpose and need for the Project are based on existing inefficiencies of the highway system. This includes circuitous routes that lead to additional vehicle miles traveled and thus increased fuel consumption resulting in greater fuel costs, vehicle emissions and time lost to driving that could be spent in work, social and recreational activities, as well as use of County roads for purposes more suited to State Highways.

Need for Improved Arterial Connection to State Route 19 from DKI Highway

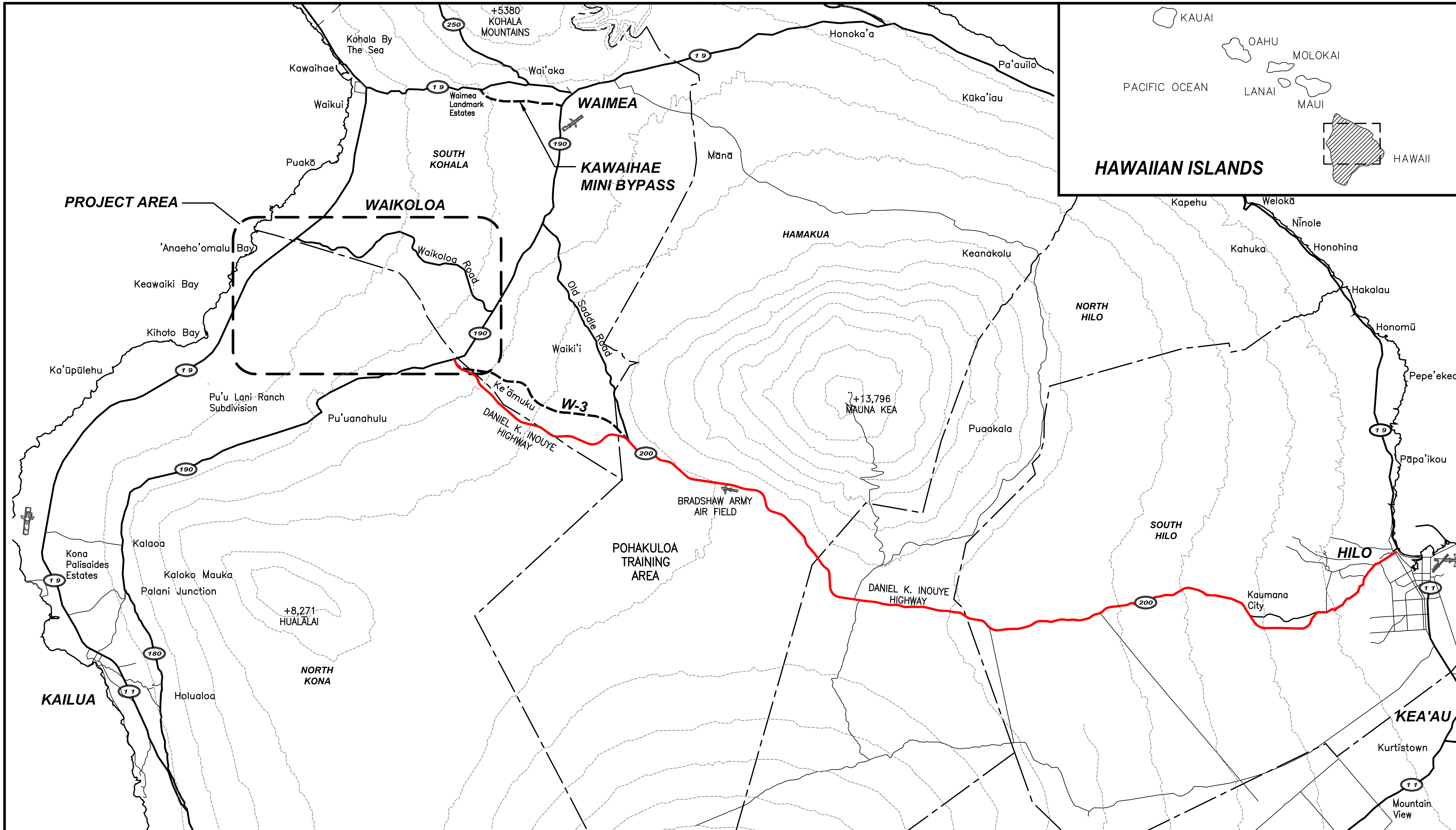
There is currently a long gap in the modern State Highway system between East Hawaiʻi and the coastal South Kohala/Kona area for motorists on the DKI Highway (refer to ***Fig. S.1***). A little over half the traffic on the DKI Highway travels between East Hawaiʻi (or Saddle destinations) and Kona; about a quarter is between Hilo and Waikoloa Village or the South Kohala resorts; and about one fifth is between Hilo and Waimea. Both the western terminus of the Old Saddle Road and the new, realigned western terminus of the DKI Highway are located in the middle of pasture lands on Māmalahoa Highway (SR 190), far from most motorists' destinations.

Presently, two options are available to access the center of Kailua town and points south in Kona. The first is via Māmalahoa Highway, which provides a relatively direct (36.7 miles) but winding and narrow route through upper Kona. This route lacks adequately wide shoulders for most of its length south of Waikoloa Road, and traverses a populated corridor with numerous streets and driveways for the last 8.7 miles. The other option is via Waikoloa Road (a long detour to the northwest along a County road that passes through a growing urban community) to SR 19, Queen Kaʻahumanu Highway, for a total distance of 42.8 miles. The route between the end of the Daniel K. Inouye Highway and the major intersection on Queen Kaʻahumanu Highway, Waikoloa Beach Drive, is nearly 16 miles in length, although the straight-line distance is only 11 miles. An efficient connection from the Daniel K. Inouye Highway and the South Kohala/Kona coastal area is thus still lacking.

This need is particularly pressing given growing DKI Highway traffic volume, which has increased from 843 vehicles per day in 1993 to over 3,000 in 2017. Traffic models forecast a continuing, steady increase in traffic volumes at the western terminus of the Daniel K. Inouye Highway over the next 20 years. By the year 2035, an estimated 19,400 vehicles per day (vpd) will utilize the DKI Highway. The need to serve DKI traffic existed at the Project's inception in 1999 but has grown rapidly since.

Need to Meet General Cross-Island Traffic Demand

Related but clearly distinct is the increase in the general volume of traffic in the South Kohala area, including the traffic between East and West Hawaiʻi. Demand here is currently met partly by the DKI Highway, but mostly by SR 19, transiting the Hamakua coast. SR 19, which provides a relatively direct and safe route between the three major population centers, services the large



FA PROJECT NO. DP-HI-0200(5)

SADDLE ROAD EXTENSION

FIGURE S.1 ~ PROJECT AREA

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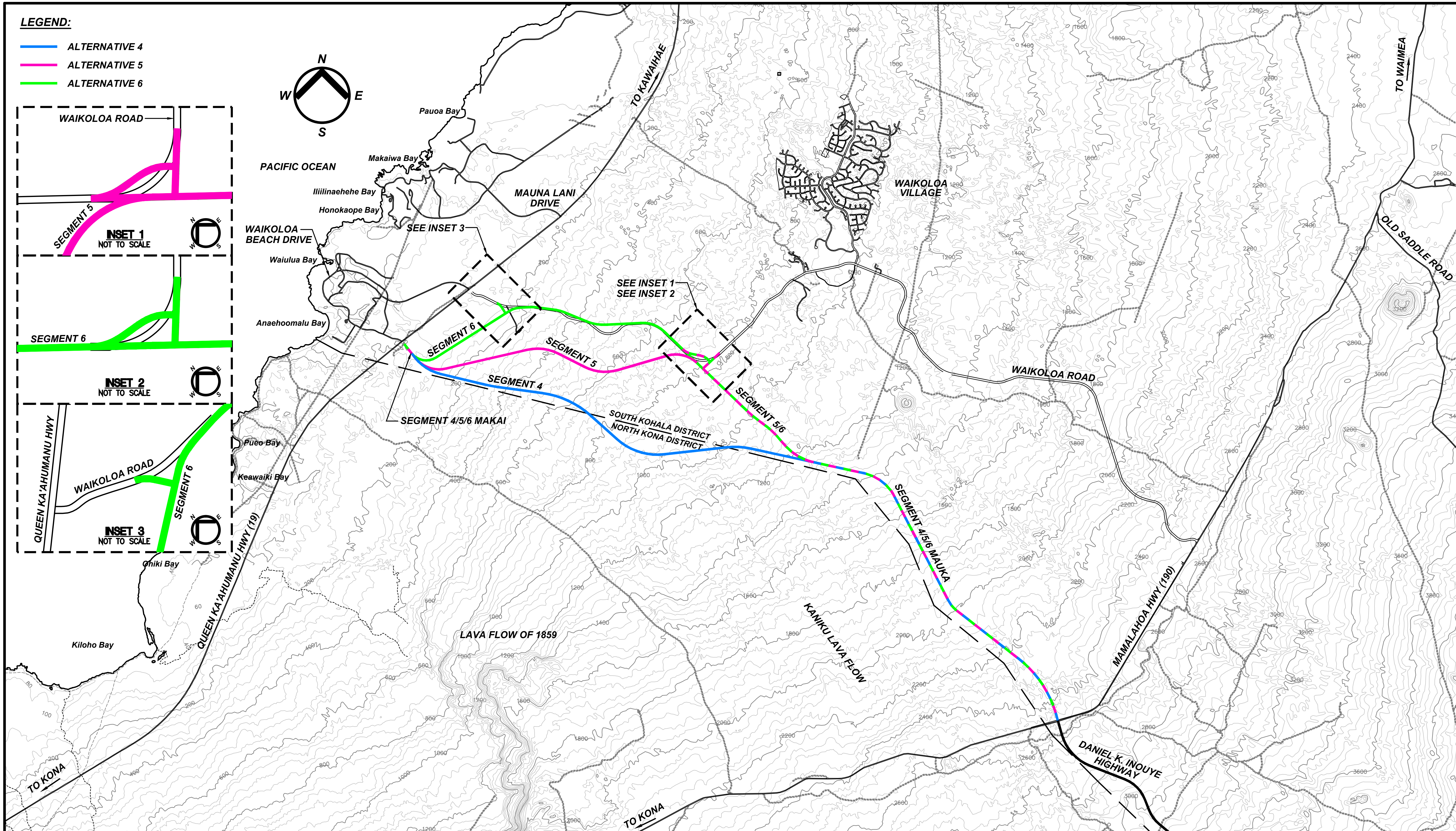

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GRAPHIC SCALE IN FEET

SADDLE ROAD EXTENSION

FIGURE S.2 ~ ALTERNATIVES ADVANCED FOR STUDY TO THE DRAFT EIS

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majority of this traffic, in particular commercial truck traffic, which contributes to the daily traffic congestion in Waimea during AM and PM peak hours.

The long-range *Federal-Aid Highways 2035 Transportation Plan for the District of Hawaii* (HDOT 2014) incorporated technical input and community values to guide future multimodal transportation solutions. Population, household, and employment information were grouped into traffic analysis zones to model growth. South Kohala and certain areas of Kona are expected to have larger populations, more jobs, and new residential developments. By 2035, traffic volumes on Queen Kaʻahumanu Highway (SR 19) are forecast to increase to the point where volume exceeds capacity, leading to poor highway operations, from Kawaihae to Waikoloa Beach Drive (refer to ***Fig. S.1***). All roads near Waimea will be at or near capacity, and all of Waikoloa Road and the portion of Māmalahoa Highway between the DKI Highway and Waikoloa Road will be at or over capacity. The DKI Highway itself was projected to retain capacity above its volume and have good operations.

The DKI Highway offers an important alternative route for much of the future traffic that is forecast to cause congestion on SR 19 route from Hilo to Honokaʻa, and on to Waimea, Kawaihae and Waikoloa. Regardless of traffic growth on the DKI Highway, traffic volumes are still forecasted to rise on SR 19, as Waimea and the South Kohala coastal resort areas continue to grow. Although there is also a need for additional capacity in the SR 19 system, such as that being proposed in the Kawaihae Road Mini-Bypass (refer to ***Fig. S.1***), the expected growth in traffic volume creates a need for a system of highway improvements that increases cross-island capacity by offering efficient, safe alternative routes. Such a route will be critical for emergencies such as major traffic crashes, fires, floods and landslides that close SR 19.

Commercial and Military Traffic Need

Ports at Kawaihae and Hilo airports at Kona and Hilo, and commercial, manufacturing and civic centers generate substantial commercial truck traffic between East Hawaiʻi and West Hawaiʻi (refer to ***Fig. S.1***). Hilo Harbor annually handles 1.7 million tons of cargo and Kawaihae Harbor handles 1.0 million tons, and Kona and Hilo International Airports accommodate 22,300 tons and 24,100 tons respectively. Freight vehicles use arterial and local roadways to distribute goods to communities around the island. By 2035, highway-borne freight, air cargo and harbor freight are all expected to increase by about 50 percent. The sustained seven percent grades and a summit 6,500 feet above sea level make the DKI Highway unsuitable for certain trucks and loads. However, since completion of the western leg in September 2013, truck traffic has increased in volume at a greater proportion than automobile traffic. In addition to serving DKI Highway traffic, the proposed Saddle Road Extension could also provide an effective route for cargo, including potentially solid waste and useful byproducts, between Waimea and the Kohala Resorts and Kona. This could include solid waste or (or its useful byproducts) destined for the Puʻuanahulu Sanitary Landfill and other sites. Use of the Saddle Road Extension could remove a large volume of truck traffic from Waikoloa Road, where there are long delays for other motor vehicles stuck behind slow trucks.

The military currently hauls materials, equipment, and supplies, including ammunition, from Kawaihae Harbor to Pōhakuloa Training Area (PTA) via Queen Ka‘ahumanu Highway, Waikoloa Road and DKI Highway (refer to ***Fig. S.1***). Located on the plateau saddle between Mauna Loa, Mauna Kea and the Hualālai volcanoes, the 109,000-acre PTA is the largest military installation in the state of Hawai‘i. It is used by up to 2,000 troops during a four to six-week training period in which a wide range of weapons can be used. Ammunition cargo is restricted through urban areas. As Waikoloa Village expands, the military may be precluded from using Waikoloa Road through the village area. There is a need to provide a direct, modern State Highway route that avoids urban areas to the extent feasible and accommodates both passenger vehicles and slow-moving cross-island truck traffic and military traffic.

Purpose of Project

The overarching, primary purpose of the proposed project is to provide a modern State Highway link connecting Māmalahoa Highway (SR 190) and Queen Ka‘ahumanu Highway (SR 19) for motorists traveling between Hilo and coastal South Kohala/Kona on the Daniel K. Inouye Highway (SR 200). Secondary and supporting purposes to this primary goal are to:

- Improve the general efficiency and operational level of traffic movement between East Hawai‘i and West Hawai‘i;
- Support special traffic needs, including commercial truck traffic and military traffic between Kawaihae and the Pōhakuloa Training Area (PTA); and
- Improve safety for all users.

S.2 ALTERNATIVES

S.2.1 Alternatives Considered

A number of preliminary alternatives were conceptualized by the FHWA and HDOT based on at least some potential to satisfy the Project’s purpose and need, including:

- Transportation Systems Management/Travel Demand Management (TSM/TDM)
- Mass Transit
- No Action Alternative
- Eleven alternative highway alignments

S.2.2 Screening Process

The alternatives were analyzed during an initial screening process for potential to satisfy the Project’s purpose and need. Those alternatives which after initial screening appeared to have little such potential, along with others that would involve inordinate costs or severe environmental impacts, were dismissed from further analysis. A second screening carried forward those alternatives that had better potential to satisfy purpose and need. They were evaluated on a range of criteria involving purpose and need, environmental effects, and operational characteristics.

S.2.2.1 Initial Screening

The initial screening focused on the alternative's potential to satisfy basic criteria of the Project's purpose and need in a reasonable manner.

Transportation Systems Management/Travel Demand Management (TSM/TDM)

This alternative includes restrictions or enhancements to road use such as work- and school-time staggering, car-pool incentives, High Occupancy Vehicle (HOV) lanes, optimizing signalization or utilizing roadway shoulders for auxiliary lanes. These measures are not capable of providing better connections between rural regions with sparse road networks. As the TSM/TDM Alternative could not meet the purpose and need criteria, it was dismissed from further consideration.

Mass Transit

The public transportation system consists of a County bus system, a vanpool system and a rideshare program. A fleet of 25 buses serves several dozen routes around the island. Several routes serve the South Kohala area and are well used for getting workers to their jobs in resort centers. Relatively few riders other than workers use the South Kohala buses. The majority of motor vehicle traffic utilizing project area highways is derived from other sources. Visitor travel (including rental cars and tour buses), business travel, cargo and service trucks, shopping, and recreation are important sources of traffic for consideration in this analysis. There is little potential to substitute mass transit for these components, which require flexibility, multiple stops, cargo capacity, and out-of-the-way destinations. Mass transit cannot provide more efficient connections between rural regions with sparse road networks nor meet the growing demands of commercial and military users of the road. Mass transit would benefit from a new highway in the project region, but it cannot substitute for the Project. As the Mass Transit Alternative could not meet the purpose and need criteria, it was dismissed from further consideration.

Related Projects/Improvements to Existing Corridors

The alternatives of widening portions of existing roads and/or reliance on another planned highway project in the region were evaluated. Currently unplanned but feasible are projects that could substantially widen all or portions of the Māmalahoa Highway (SR 190) and Kawaihae Road (SR 19). Vehicles that make non-stop trips along this route add to the congestion in central Waimea. Widening one or both of these highways would provide more highway capacity through Waimea. However, both routes through Waimea have relatively narrow rights-of-way and a concentration of businesses, community facilities, scenic tree corridors, and historic buildings. Widening of these Waimea roads within town would cause extreme disruption to businesses and traffic, and would seriously impact the rural character of the town. Widening would be more practical in the open ranch lands outside Waimea, but substantial segments of both roads would require large-scale realignment to meet modern State highway design standards, with major disruption of native forests, rural towns, recreational uses and existing traffic. The disadvantages of these potential projects far outweigh any advantage from being able to utilize existing State Highways right-of-way for parts of the highways. Based on the inability of widening existing roads to meet any aspect of the purpose and need of the Project without substantial community and environmental disruption, this alternative was dismissed from further consideration for the purposes of this EIS.

The Kawaihae Road Mini-Bypass (refer to ***Fig. S.1*** for location) is a project proposed by HDOT in 2016 that would route traffic bound between Kawaihae and Māmalahoa Highway (SR 19 and SR 190) around central Waimea. It would reduce congestion through Waimea without the extreme disruption of widening existing highways. It would also address part of the Saddle Road Extension's project purpose and need by providing a more efficient route for general East Hawaiʻi-West Hawaiʻi traffic through at least a portion of central Waimea. However, the Mini-Bypass would not efficiently accommodate motorists using the DKI Highway to access their destinations. The Kawaihae Road Mini-Bypass could not substitute in key purpose and need respects for the proposed Project and was dismissed from further consideration for the purposes of this EIS. Because of its independent utility, the Kawaihae Road Mini-Bypass is being considered in a separate EIS currently in planning by HDOT.

Widening all or a portion of Waikoloa Road to include additional lanes would also involve substantial re-routing to meet modern State highway standards. However, it would at least partially meet the purpose and need of the Project by accommodating DKI Highway traffic as well as providing more lanes for East Hawaiʻi-West Hawaiʻi traffic and a State Highway for special needs traffic. Because of the potential to meet the Project's purpose and need, three variants of this approach were advanced for consideration in the second screening of the Alternatives Analysis.

Alternative Alignments

Each of an array of eleven initial alternative alignments would involve construction of a new highway beginning at the proposed Saddle Road terminus along the Māmalahoa Highway and ending at a point somewhere on the Queen Kaʻahumanu Highway. ***Figure 2.1*** of Chapter 2 of this EIS depicts these alternatives, all of which were carried forward in the initial screening.

No Action

The No Action Alternative assumes that no new highway corridor would be built and that no major improvements to existing transportation corridors other than those already planned and discussed above under *Related Projects/Improvements to Existing Corridors*, would occur. Minor widening and signalization projects, particularly on Waikoloa Road, would likely be undertaken in response to increasing congestion. The No Action Alternative does not satisfy any of the purpose and need criteria. However, it provides a baseline for comparing how new transportation modifications or improvements would accomplish the Project's purposes, and also provides a reference base to measure environmental impacts, both beneficial and adverse. The No Action Alternative was therefore advanced for study in the EIS.

S.2.2.2 Second Screening

The next phase of alternative evaluation consisted of developing and rating the remaining action alternatives (eleven highway alignments) on important selection criteria, including specific environmental resources and design considerations. The following criteria were utilized and evaluated on a semi-quantitative basis:

A. Conformance with State and Regional Plan/Consistency with State System
B. Effects to Zoned/Entitled Lands
C. Safety Improvement and Meeting Design Standards
D. Special Needs Traffic
E. Minimizing Drainage Crossing
F. Native Flora/Fauna
G. Geologic Hazards/Features
H. Historic and Cultural Resources
I. Socioeconomic Impacts
J. Public Hunting Area Impacts
K. Probable Construction Costs
L. Minimization of Total Travel Distances
M. Agricultural Lands of Importance to the State of Hawaiʻi Taken

S.2.3 Alternatives Advanced for Detailed Analysis in Draft EIS

Based on the evaluation contained in this analysis, the following alternatives (in addition to the No Action Alternative) are being proposed for further advancement to consideration in the Draft EIS:

- Alternative 4
- Alternative 5
- Alternative 6

The rationale for their advancement is that: 1) each ranked highly in the suitability analysis, while other alternatives generally ranked low on many or most criteria; and 2) considered together, they offer a diverse range of routes that are also efficient for field analysis. They are illustrated above in Figure S.2.

Design Standards

All Build Alternatives have the following design standards:

- Right-of-way width: 120-foot minimum, variable up to 240 feet
- Pavement width: Two 12-foot travelway lanes and 8-foot shoulders (minimum total pavement width of 40 feet, plus climbing lanes as required)
- Design speed: 60 MPH
- Minimum radius curve: 1,200 feet

- Maximum super-elevation: 8 percent
- Maximum grade: 7 percent
- Typical intersection: Turn lanes, acceleration and deceleration lanes for all approaches
- Redesign of Daniel K. Inouye Highway terminus: To provide adequate intersection at Māmalahoa Highway (2 design options, at-grade and grade-separated)

Project Schedule and Costs

The Project would cost between approximately $63 and $74 million, depending on the combination of Alternative and Design Option that is selected, as shown below.

Estimated Project Costs by Alternative and Design Option

Alternative 4, At-Grade Intersection	$63 million
Alternative 4, Grade-Separated Intersection	$67 million
Alternative 5, At-Grade Intersection	$70 million
Alternative 5, Grade-Separated Intersection	$74 million
Alternative 6, At-Grade Intersection	$64 million
Alternative 6, Grade-Separated Intersection	$68 million

Cost is in 2018 dollars

This total includes right-of-way acquisition, design and construction. Because of its shorter length and fewer intersections, Alternative 4 is the least costly alternative. For all alternatives, the grade-separated interchange design option at Māmalahoa Highway would add approximately $4 million to the cost. It is expected that the State of Hawaiʻi would be responsible for 20 percent of funding and the federal government would fund the remaining 80 percent. The Project is included in the FY2018 to FY2020 Statewide Transportation Improvement Projects (STIP) list. If approvals are obtained in a timely manner, the EIS completion, project design and construction would proceed according to the following estimated timetable:

Record of Decision Issued:	Late 2017
Award Design Contract:	Late 2017
Complete Design:	Early 2018
Award Construction Contract:	Early 2018
Complete Construction:	Late 2020

S.3 AFFECTED ENVIRONMENT, ENVIRONMENTAL CONSEQUENCES, AND MITIGATION MEASURES

Sections S.3.1 through S.3.19 briefly summarize existing conditions, impacts, and mitigation measures on a resource-by-resource basis. Appendix J of this EIS contains a complete list of all avoidance, mitigation and minimizations measures.

S.3.1 Land Use and Related Governmental Plans and Policies

Land Use

The land including and surrounding the project corridors consists of large properties owned by a few major private landowners and used for quarrying or ranching, as well as the State of Hawaiʻi's Puʻuanahulu Game Management Area (GMA). The lands in the project corridor are marginal for grazing because of low rainfall and rockiness, and cattle densities are very low. Although no homes currently exist, the large private properties may each eventually include a single-family residence as a farm dwelling and additional farm housing as appropriate, and/or undergo further subdivision for similar agricultural uses. With rezoning and in some cases more extensive land use approvals, urban uses may someday be possible.

Across Māmalahoa Highway from the eastern project terminus is the Keʻāmuku section of the Pōhakuloa Training Area (PTA), which is traversed by the Daniel K. Inouye Highway. This multi-service training complex is operated by the U.S. Army Garrison, Hawaiʻi.

The only current residential uses within several miles of the project corridors are in Waikoloa Village, as close as two miles to the north. Waikoloa Village is a diverse and growing community with a 2010 Census population listed at 6,362 and a variety of businesses and civic facilities including an elementary school and middle school and fire station. The Waikoloa Beach Resort is present *makai* of the western project terminus. This collection of hotels and resort residential, recreational and commercial uses constitutes a major core of the visitor industry on the Island of Hawaiʻi.

Public utility uses in the project area are associated with electric transmission lines and poles, electricity substations, and telephone and fiber optic cables. The West Hawaiʻi Sanitary Landfill is located 1.4 miles south of the western project terminus. A rock quarry operated by West Hawaii Concrete is present in the *makai* portion of the project area between the Alternative 4 and 5 project corridors.

Environmental Consequences for Land Use

Construction would have short-term impacts on land uses adjacent to the selected alternative project corridor only. These impacts would come from temporary access issues and construction noise and dust, but there are very few active land uses in areas that would be so affected.

Operationally, the Project would result in acquisition of about 330 acres of property from mostly private owners in areas used for extensive grazing. Construction in Alternative 4 would involve a permanent loss of about 0.5 square miles of State hunting land along a 2.5-mile long segment, due to both direct highway use and 50-yard standoff areas from highways. This area in the heart of the Kanikū lava flow is extremely rocky, with almost no vegetation and minimal hunting use, although some goats are present. Conversely, the Project would increase hunter accessibility to the area, particularly if Alternative 4 were implemented.

Consistency with Governmental Plans and Policies

The proposed Saddle Road Extension project complies with appropriate State and County land use policies, plans, goals, objectives and controls. It would facilitate implementation of the State Plan and Transportation Functional Plan through accommodating both existing and future cross-island traffic in a safe and efficient manner, and by linking existing residential, governmental and service centers in East Hawaiʻi and major job centers and economic development opportunities of West Hawaiʻi. *The Federal-Aid Highways 2035 Transportation Plan for the District of Hawaii* (2014) and the 2015-2018 Statewide Transportation Improvement Program (STIP) explicitly justify and call for a new two-lane road between the "western terminus of the Saddle Road realignment" and Queen Kaʻahumanu Highway as one of 19 "Potential Long-Range Capacity Solutions."

The Project is consistent with goals, objectives, and standards in local land use plans, including the County of Hawaiʻi General Plan, the Kona and South Kohala Community Development Plans, in that (1) the Project is specifically identified for implementation and (2), it would provide a modern, safe, efficient and scenic highway that fulfills County land use, access and circulation objectives while maintaining environmental quality. The Project is also consistent with permitted uses in the districts regulated through the State Land Use Law and the Hawaiʻi County Zoning Code, and no reclassification of land use district or change of zone would be required.

Mitigation Measures

Construction contract conditions will require access to properties to be available at all times during construction, although temporary interruptions will be allowed. If Alternative 4 is selected, FHWA and HDOT will coordinate with the DLNR to determine access points that could be used to promote hunting access in the Puʻuanahulu GMA.

S.3.2 Farmland and Ranching

No farmland or farms are present, but the *mauka* half of the project area is leased for grazing, with very sparse stocking rates because of rocky and dry conditions. Short-term, construction-related impacts to ranching would be nearly identical among the alternatives. All would involve use of grazing land, although this would likely be minor because of the very low density of cattle in the area. Depending on the pastures that cattle happen to be placed in during the construction period, there is some potential that cattle may need to be relocated temporarily.

Each of the alternative project corridors would involve removal of a total of about 200 acres of grazing land. In the context of the hundreds of thousands of acres of grazing land in the region, there would be no impacts to the cattle industry. The highway would also divide pasture areas, causing logistical issues for grazing. Ranching infrastructure such as fences, gates and paddocks would be affected. Mitigation including the installation of fencing, gates and cattle crossings will be required to retain the ability to move grazing animals from one part of the property to another. No property would be reduced in size such that grazing is no longer practical, but grazing might be marginally more difficult because of the need to cross the highway.

A Farmland Conversion Impact Rating assessment of the Build Alternatives under consideration was completed in 2014 pursuant to the Federal Farmland Protection Policy Act. The first step in the process is to determine if farmlands considered important are present in the area. For Hawaiʻi, the U.S. Natural Resources Conservation Service (NRCS) evaluates farmlands as important if they are classified within the Agricultural Lands of Importance to the State of Hawaiʻi (ALISH) system as Prime, Unique or Other Important Lands. In the case of the Saddle Road Extension Build Alternatives, NRCS determined that no such lands are present in any alternative alignment, and that there was hence no need for further evaluation.

No mitigation is necessary or planned for impacts to farmland used for crops, as none is present in the corridor. In terms of grazing operations, HDOT will be responsible for the following actions for all affected grazing land:

- Provide funding for temporary relocation of cattle during construction, if determined to be necessary during coordination with land managers and ranchers.
- Construct (non-barbed wire) fencing along the right-of-way of the highway for access control and cattle control, and be responsible to maintain the fence.
- Provide for access on both sides of the highway to properties used for grazing that are divided by the highway.
- Re-fence existing paddocks and corrals.
- Right-of-way will be acquired in conformance with the Uniform Relocation and Real Property Acquisition Policies Act of 1970.

S.3.3 Socioeconomic

Hawaiʻi County's population has grown from 61,333 in 1960 to 196,428 in 2015, with an average annual growth rate of 2.2 percent. Although East Hawaiʻi still claims most of the island's residents, much of this growth has been concentrated in drier, sunnier West Hawaiʻi, where most tourist resorts and hotels are located. Moreover, on any given day, visitors account for more than 5 percent of the de facto population – and most are in West Hawaiʻi.

The context of the proposed highway's project area is an essentially unpopulated corridor of land near the junction of the major highways of East Hawaiʻi and West Hawaiʻi (refer to ***Fig. S.1***). The DKI Highway is the link to East Hawaiʻi and the island's main city of Hilo, as well as Pōhakuloa Training Area and the recreational and scientific destinations on Mauna Kea and Mauna Loa. Māmalahoa Highway links Waimea and Kailua, Queen Kaʻahumanu Highway leads to Kailua and Kawaihae, and Waikoloa Road leads to Waikoloa Village and the Waikoloa Beach and other resort areas. The closest residential or resort areas are Waikoloa Beach Resort (a collection of hotels, resort retail and resort residential properties, primarily timeshare; 0.2 miles from the western terminus); Waikoloa Village (2010 pop. 6,362; 2.5 miles from the proposed tie-in point between Alternatives 5/6 and Waikoloa Road), Waikiʻi, (pop. not recorded in 2010 census; an agricultural subdivision of about 120 lots, 4.5 miles from the eastern terminus); Puakō (2010 pop. 710; 6 miles from the western terminus); and Puʻuanahulu (a small village of about 100 properties; 7 miles from the eastern terminus).

The purposes of cross-island travel include recreation, shopping, business, and commuting. Astronomers, support staff, and suppliers with bases in Hilo or Waimea require access to Mauna Kea, and the military, hunters, hikers, and recreationalists also access Mauna Kea, Mauna Loa and Saddle area between them.

The new link in the State highway system represented by the Saddle Road Extension would widen travel choices of both residents and visitors by offering shorter routes to destinations that State and County agencies expect to continue growing. The new highway link would not, however, provide any fundamental change in the economic activity in any location it accesses, nor is it likely to attract people to the island, affecting the total resident population. Because of existing State land use classification, County zoning, General Plan designation, infrastructure constraints, and market demand, the highway is unlikely to induce growth in the corridor or land surrounding it, nor otherwise directly affect or redirect settlement patterns or population growth.

The new highway would not be located directly adjacent to any communities and would not affect existing communities in ways that would tend to change socioeconomic measures. In creating a new link that saves times and fuel costs and improves travel safety and convenience, it would improve everyday life for residents who travel cross-island for work, recreation, or other reasons. Optimizing cross-island transport would help to slow increasing congestion in urban areas along Queen Ka‘ahumanu Highway and other SR 19 segments, benefitting even residents who are not traveling cross island. Shorter travel times would allow residents more time at their homes, work and other destinations.

Consistent with Title VI of the federal 1964 Civil Rights Act and Executive Order 12898 on Environmental Justice, all program and project actions and decisions must ensure that minority and low-income populations do not experience disproportionately high and adverse human health or environmental effects and activities. No direct impacts such as construction-phase impacts, right-of-way taking, barrier impacts or noise and air quality effects would be experienced by *any* community or home as a result of the Project. The most prominent social-related effects of the proposed highway would be to reduce traffic in communities such as Waikoloa and to provide a safer and faster path for low-income workers commuting East Hawai‘i to West Hawai‘i for work. Minority and low-income populations would not suffer disproportionately high and adverse impacts from construction, ROW-acquisition, noise and air quality, or other direct, indirect or cumulative impacts from the implementation of the Project.

In general, very little infrastructure related to public facilities or utilities would be affected, because there is almost none present in areas affected by highway construction or operation. No police, fire, emergency medical, educational, water, wastewater, stormwater or solid waste infrastructure would be affected. Electric lines and poles may require relocation and/or new lines and poles may be needed to accommodate the highway with sufficient clearance for the crossing lines. Police, fire and emergency medical services would be required to service an additional 11 miles of highway, adding to their responsibility for several thousand miles of roads and highways across the island. But estimated time savings for many destinations of between 5 and 6.6 minutes would decrease response times for emergency services. The modest amount of solid waste generated by construction could easily be accommodated at the adjacent West Hawai‘i Sanitary Landfill.

On the northwest side of the Island of Hawaiʻi that is the site of the proposed project, many jobs are related in some way to the visitor industry. Five resorts are among the top 10 employers in the County, with each employing at least 450 workers. The Project would substantially benefit workers by shortening commute times and reducing commuting fuel costs. Construction of the Saddle Road Extension would involve labor over a period of about two years and would cost between $63 and $74 million. The required workforce of a maximum of approximately 335 workers is a small portion (about 4%) of the County's construction workforce, an increase that puts the total workforce well within the historical range of variation. Additional jobs added by indirect and induced means would be distributed throughout the State and County. Because of the scale and diffuse nature, they would not be expected to induce labor shortages.

The County and State of Hawaiʻi depend on several types of taxes for revenue to support public programs and facilities. Major sources of government income are real property tax for the County and income and excise taxes for the State. Revenues for State highway construction and maintenance come from the State Highways Fund and federal sources. For the State of Hawaiʻi, the sum of excise and personal and corporate income taxes from building the Project would be roughly $5 million dollars – which may be less than the State's share of the Project's construction costs, depending on how the Project is funded. The Saddle Road Extension would shorten travel time by up to 6.6 minutes for many motorists' trips, and would also lessen congestion. These savings will result in lower fuel consumption and thus lower fuel tax revenues for the County of Hawaiʻi, over the lifetime of the Project. Such fiscal impacts are difficult to quantify, because decreased fuel expenditures for commuting can be offset by increased use of motor vehicles for leisure purposes. Moreover, the increase in jobs and wages and the decreased fuel cost will tend to induce other expenditures that will increase County revenues, including property tax and the County share of transient accommodation tax (TAT). Safer, wider and more efficiently connected roadways can also benefit the County by reducing the frequency and increasing the efficiency of responses to accidents and fires.

The Project is predicted to cause some proportion of some types of traffic to bypass Waikoloa Village, which would vary depending on the selected alternative. Waikoloa Village has one major shopping center, with several small stores and restaurants located outside this core. The center is currently anchored by a supermarket and has over a dozen smaller tenants including a gas station, several restaurants, retail operations, and service businesses. Customers are dominated by local residents, as well as visitors staying in condominiums in Waikoloa Village or in the resorts below who specifically come to Waikoloa Village to shop or dine. Pass-through traffic from motorists bound from/to Waimea or Hilo and Kona is a smaller but not insignificant customer base. Over the course of 20 years, Waikoloa Village and the resorts are forecasted to continue growing. Even with construction of the Saddle Road Extension, traffic on Waikoloa Road will continue to increase (albeit at a lower rate). There should therefore be an increase, rather than a decrease, in both the customer base and expenditures at local businesses. Some business loss could result from drivers being unaware of the proximity of needed goods or services. In order to mitigate for any initial loss of business, FHWA and HDOT will work with the County of Hawaiʻi and Waikoloa Village merchants to install standard signage on the Saddle Road Extension indicating the availability of goods and services in Waikoloa.

S.3.4 Traffic, Right-of-Way and Pedestrian/Bicycle Use

Motor Vehicle Traffic

As the Daniel K. Inouye (DKI) Highway increases in importance as a primary cross-island connector, detailed travel demand model forecasts prepared as part of the *Federal-Aid Highways 2035 Transportation Plan for the District of Hawaii* indicate that traffic demand between the DKI Highway/Māmalahoa Highway terminus and Queen Kaʻahumanu Highway is forecast to increase. This will challenge the ability of the existing roadway network to accommodate demand. In the last 40 years, Queen Kaʻahumanu Highway has become the primary north-south roadway for the region. Although HDOT continues to maintain and improve Māmalahoa Highway, its alignment and overall roadway cross-section makes it less desirable to handle regional traffic. Similarly, increased routing of regional traffic through Waikoloa Road along with local traffic growth will stress the intersections in Waikoloa Village.

The main effect of all of the Saddle Road Extension Build Alternatives would be to provide a highway of appropriate functional classification for regional traffic between the existing DKI Highway and Queen Kaʻahumanu Highway. It would reduce the impact of projected regional traffic increases on roadways less capable of handling regional traffic due to design constraints or functional intent. Motorists would be able to access their destinations between 5 and 6.6 minutes faster, depending on destination and origin, saving not only time but also fuel and its cost. Various secondary benefits accrue to the SRX Build Alternatives in the form of reduced requirements for intersection and roadway segment improvements on Māmalahoa Highway, Waikoloa Road, and Queen Kaʻahumanu Highway. In general, the high level of expected regional traffic growth would cause the Level of Service (an ordinal scale of traffic flow conditions, ranging from A [best] to F [worst]) under any alternative to decline from the Year 2014 baseline LOS B/C range to LOS C/E. Unlike the No Action Alternative, however, only the Waikoloa Road/Queen Kaʻahumanu Highway intersection would have less than acceptable service. All other intersections would have improved operations relative to the No Action Alternative.

The main benefit of Alternative 4, which does not directly connect to Waikoloa Road, is that it would divide the traffic turning movement demands between the intersections of Waikoloa Road and Waikoloa Beach Drive with Queen Kaʻahumanu Highway. This would decrease turn movements at the existing Queen Kaʻahumanu/Waikoloa Road intersection, thereby improving projected intersection operations there. It would also reduce turn movements and improve intersection operations at the Māmalahoa Highway intersections at Waikoloa Road and DKI Highway, in turn reducing the magnitude of improvements needed on Māmalahoa Highway between DKI Highway and Waikoloa Road.

Alternative 5 preserves the benefit achieved by Alternative 4 of dividing turning movement demands between the Waikoloa Road and Waikoloa Beach Drive intersections on Queen Kaʻahumanu Highway. It has the added benefit of reducing the turning movement demand at the Māmalahoa Highway/Waikoloa Road intersection, since the connection to Waikoloa Road would attract a large proportion of Waikoloa Village and surrounding area-related DKI Highway traffic directly to the SRX instead of the lower portion of Waikoloa Road. This would further reduce turning movements on Māmalahoa Highway at Waikoloa Road and DKI Highway, improving operations.

Alternative 6 would utilize the existing Waikoloa Road alignment to a point fairly close (0.7 miles) to Queen Kaʻahumanu Highway, achieving some of the same of the benefits of Alternative 5 by dividing turning movement demands between Waikoloa Road and Waikoloa Beach Drive intersections on Queen Kaʻahumanu Highway. But due to the proximity to Queen Kaʻahumanu Highway, certain types of traffic would be more likely to continue to use Waikoloa Road rather than SRX in order to save time and distance. In particular, motorists on the SRX bound to destinations found north along Queen Kaʻahumanu Highway, such as Puako or the Mauna Lani Resort, would likely take the shortcut and turn right on Waikoloa Road and its intersection rather than utilize the SRX. This would create capacity issues similar to the No Action Alternative at the Queen Kaʻahumanu Highway/Waikoloa Road intersection.

Design Option 1 involves having the SRX/Māmalahoa Highway intersection remain at-grade and signalized. The future traffic levels at this intersection will require four through-traffic lanes for the DKI/SRX approaches (two in each direction). The additional lanes would be needed only in the influence area of the intersection and would be transitioned in and out per standard lane add and lane drop designs.

Design Option 2 includes a grade-separated intersection of the single-point urban interchange (SPUI) type. All on- and off-ramps converge at a single intersection as opposed to two closely-spaced intersections on a typical "diamond" interchange. In the SPUI, all right turns for all approaches can make their movements with curved off-ramps and no signals. For the dominant highway, all through movements can move through with no traffic signal. One traffic signal under the bridge of the intersection handles all left-turns for all approaches, as well as the through movements for the non-dominant highway. Implementing the interchange would eliminate the need for additional lanes for the Saddle Road/SRX through movement and would also significantly improve the intersection Level of Service relative to an at-grade intersection. The narrow design would also limit the extent and width of right-of-way acquisition for the adjacent properties.

All necessary operational traffic mitigation measures, such as channelized turn movements, traffic signals, etc., have been incorporated into the highway design.

Right-of-Way Acquisition

Construction of the Saddle Road Extension on any of the alternative alignments would involve acquisition of about 10.0 to 10.5 miles of ROW. The width of the ROW will be determined along the entire length of the selected alternative during final design and is expected to vary from 120 to 240 feet. The Project would also involve use and expansion of right-of-way on Māmalahoa Highway and Queen Kaʻahumanu Highway, and potentially, Waikoloa Road. About half of the ROW area would experience actual ground disturbance. No relocations of homes, businesses or any structures would be required. The Project would require property acquisition of up to a maximum of 334 acres from eight State or private land from up to eight properties that vary between 800 and 1,700 acres. FHWA-CFLHD and HDOT have begun preliminary discussions with landowners in order to ensure that issues of access and remnant parcels can be resolved during the right-of-way negotiation process.

The following mitigation measures will be incorporated into the Project:

- The acquisition of property necessitated by the Project will be completed in accordance with the Federal Uniform Relocation and Real Property Acquisition Policies Act of 1970 (P.L. 91-646), as amended, and applicable State regulations.

Pedestrian and Bicycle Facilities and Use

In general, bicycle and pedestrian use are minimal on the project area roads. The inadequate nature of the facilities plays a role in the low usage rate, but other important reasons include long distances between population centers that are a source of users, steep grades, and hot and dry conditions. Queen Kaʻahumanu Highway attracts bicycles (and some runners) because it is relatively flat, with wide paved shoulders. The primary use is for training, as this is the course for the annual, world-famous Kona Ironman World Championship race. Lacking adequate shoulders for bicycles, Waikoloa Road has a far lesser rate of use, even though it connects Waikoloa Village and the Waikoloa Beach Resort over a distance of only six miles. Very few bicycles use Māmalahoa Highway, with its high speeds and narrow shoulders and long distances between towns. Most relevant in terms of future bicycle use on the Saddle Road Extension is the Daniel K. Inouye Highway, which the new proposed highway would resemble in terms of cross-section and directly connect to. Prior to the sequence of Saddle Road Improvement construction projects starting in 2003, the Saddle Road was narrow and curvy, with areas of narrow, irregular, eroded or non-existing shoulders, highly unsuitable for bicycles. Although not signed as a shared roadway, the eight-foot shoulders on the DKI Highway separated from the roadway by a rumble strip safely accommodate bicycles and attract some use training and touring use.

During early phases of project development, several community members requested consideration of a separated, paved shared-use trail with graded shoulders for safety that would run roughly parallel to the highway approximately 50 to 200 feet away, weaving along the slope through a series of switchbacks that allowed a more reasonable grade than the 4-7% slope of the proposed highway. FHWA and HDOT determined that the proposed highway shoulder cross-section could meet the transportation function for the nature and quantity of bicycles and pedestrians that would be expected on this highway, without the high costs and impacts of acquiring at least 50 acres of right-of-way, preparing the land surface, and constructing the paved trail.

Construction activities often present obstacles to pedestrians and bicyclists crossing the highway, and can temporarily prevent use of the road for walking or biking in the immediate vicinity of construction work. Because of the location of the construction on a (primarily) new alignment on private land with no intersecting streets, very little interference is expected. Some issues may occur at the termini at Queen Kaʻahumanu Highway and Māmalahoa Highway, as well as at connections with Waikoloa Road under Alternatives 5 and 6. Construction related impacts would be short term and temporary in nature.

The design parameters for the proposed Project would be a marked improvement over existing area roadways. The typical section includes, from inside to outside, a 12-foot travel lane, a travel lane edge stripe, a 4-inch gap, then a rumble strip, and then a 6’8” wide shoulder. The rumble strip millings are 12 inches wide by 7 inches long and spaced 12 inches apart. These extend for 47 feet with a 13-foot gap, and then resume again.

The wide, paved shoulders would minimize the hazards to pedestrians and bicyclists using the Saddle Road Extension. With the proposed construction of wider travelways and paved shoulders along the entire corridor, use of Saddle Road Extension by bicyclists may increase. While recreational ridership may increase, the steep grades and hot, dry weather are daunting, and much of the increased ridership would likely be from expert riders training for races and competitions. This type of facility has proven to adequately accommodate bicycle traffic on the Daniel K. Inouye Highway. In addition, the following mitigation will be implemented:

1. Signage will be emplaced indicating a signed, shared bicycle route.
2. Project construction will include provisions for safe pedestrian and bicycle crossings of Saddle Road during construction periods.

S.3.5 Climate and Air Quality

The project area spans elevations between 100 feet and 2,600 feet above sea level. The annual rainfall area varies from 9.5 to 25 inches. Temperatures show definite but moderate seasonal variability. Near the coast the average daily high is about 82 degrees F. and the low is about 72 degrees. Temperatures in the higher elevations are 4 to 7 degrees cooler. In South Kohala, high winds are normal, causing excellent dispersion but also posing potential dust problems. Northeast trade winds often blow at speeds exceeding 25 miles per hour, with slower speed upslope winds also occurring. Regionally, trade winds from an east to northeast direction are present on up to 90 percent of summer days and 50 percent of winter days.

Air quality is generally excellent, as combustion-derived air pollution in the entire State of Hawai‘i is minimal. Hawai‘i Island, like the rest of the state, meets the standards set by the Clean Air Act (CAA) and State of Hawai‘i law (HRS Chapter 342B), and is within an attainment area. Volcanic emissions of sulfur dioxide convert into particulate sulfate that causes a volcanic haze (vog) that primarily affects Kona, but also drifts north into South Kohala.

An emissions burden study, also called a mesoscale analysis, was conducted for the project, along with a microscale air quality analysis for critical on-ground locations at five different intersections. A qualitative assessment of mobile source air toxics was also prepared. In general, the air quality impacts of all Build Alternatives were either slightly less adverse or the same as the No Build Alternative. No increases of criteria pollutants above national or State of Hawai‘i standards would occur. In the future, substantial decreases in emissions will occur despite the projected large increase in traffic volumes, due to the expected significant reduction in average tailpipe emissions over time as older, more polluting vehicles are retired, as well as more efficient highway operations.

Mitigation related to dust control and construction equipment emissions will be necessary during the construction phase of the project.

S.3.6 Noise

A noise analysis considered noise-sensitive areas within a distance capable of being impacted – residences, businesses, schools, hospitals, and similar developed uses, as well as parks. The analysis measured existing noise and predicted future noise using A-weighted decibels (dBA), which accounts for human hearing. Ambient sound levels along the existing corridor are generally low and derived from natural sources such as wind and birdsong, except near the project termini where highways are present. The closest noise-sensitive uses are 1,600 feet from all alternatives, where sound levels will remain low and will not exceed values that would indicate an impact. Therefore, no operational noise impacts as defined by FHWA and HDOT standards would be expected to occur. Temporary construction noise impacts would primarily affect passing motorists and bicyclists. The construction contractor will be required to obtain a Hawai‘i Department of Health (DOH) noise permit that will limit the times at which high-volume construction can take place. After reviewing the application, DOH may require noise mitigation to be incorporated into construction plans, for example, maintenance and proper muffling of construction equipment and onsite vehicles that exhaust gas or air. DOH may also require the contractor to conduct noise monitoring.

S.3.7 Geology, Geologic Hazards and Soils

West Hawai‘i is the product of Pleistocene and Holocene lava flows and pyroclastic deposits from four volcanoes: Kohala, Mauna Kea, Mauna Loa, and Hualālai. The southern half of the project area consists mostly of ‘a‘a (clinkery) and pahoehoe (smooth or ropy) lava from eruptions of Mauna Loa. The northern half is mostly Mauna Kea lava flows of various ages, in places discontinuously mantled by pyroclastic, windblown or colluvial deposits. A few scoria cones from Mauna Kea are also present, as well as some Hualālai lava inclusions never completely covered by Mauna Loa flows. The topography is generally moderately sloped and irregularly rolling, with a few incipient, poorly developed drainage channels. Lava tubes, which are the long cavities left behind by underground channels of lava, are common on pahoehoe lava flows in the area. Some of the lava tubes are large enough and have openings for human entry, and may thus be classified as caves. Lava tubes and other caves in Hawai‘i often have value because they may contain native species, valuable subfossil remains, unique geological features, Hawaiian burials, and valuable and sensitive artifacts that for cultural reasons are preserved in place. One of the objectives that guided project design was avoidance to the greatest practical extent of lava tubes.

The USGS has classified the island into Lava Hazard Zones 1 through 9, in order of decreasing risk. The northern portion of the Waikoloa area is rated by the USGS as Zone 8 on a scale of ascending risk 9 to 1, and the southern portion is Zone 3. Zone 8 areas have had only a few percent of their surfaces covered by lava within the past 10,000 years. As such, there is little risk of lava inundation over relatively short time scales. Zone 3 includes areas in which lava flows have covered about 15-25 percent of the surface in the last 750 years, and risk is accordingly greater over the short-term. Hawai‘i experiences thousands of earthquakes each year, with some strong enough to be felt and a few causing minor to moderate damage. Seismic hazard in the Waikoloa area of northwest Hawai‘i can be expressed by the estimation that the earthquake peak ground acceleration that has a 2% chance of being exceeded in 50 years has a value between 0.60-0.80% g (the acceleration of gravity, or 9.8 m/s^2). This value is less in the eastern and southern parts of the island of Hawai‘i, but greater than values found in all the other Hawaiian Islands. Northwest Hawai‘i Island experiences earthquakes that can be damaging, especially to structures that are poorly designed or built, as demonstrated by the 6.7-magnitude quake of October 15, 2006. That earthquake damaged roadway structures and particularly cut slopes.

Soil types within the project area consist primarily of little-weathered pahoehoe and ‘a‘a lava flows, as well as Rock Land and Very Stony Land, where soil pockets develop in limited locations on pahoehoe and ‘a‘a flows, respectively. At the extreme eastern end are a few well-drained soil types called Pu‘u Pa and Punalu‘u. The first is an extremely stony very fine sandy loam formed in volcanic ash, and the latter a thin organic soil over pahoehoe lava. Runoff on the soils varies from medium to slow, and neither soil is highly erodible. The engineering properties of all these soils are reasonably adaptable to highway construction. Where inadequacy exists, specific solutions are most appropriately addressed in highway design and engineering work.

Road construction would have varying impacts on the topography and natural landforms because of excavation and fill necessary to meet design standards for grades, curves, sight distance and speeds. Substantial earthwork would be required in several locations, with fill slopes ranging from 5 to 40 feet, and cut slopes ranging from 5 to 30 feet. However, little noticeable alteration of natural landforms would occur because of the existing hummocky topography associated with lava flows. No difference exists with respect to topographic alteration between the alternatives, which in all cases would be minor to moderate. Alternatives 5 and 6 cross above slightly more lava tube caves. Any roadway that serves the Island of Hawai‘i is subject to at least some lava flow hazard and seismic hazard. Aside from avoidance of geologically hazardous areas, there is no practical mitigation for lava flow hazard. The proposed project facilitates an overall risk-spreading strategy by providing additional alternative cross-island routes around the island, in case particular routes become blocked because of lava flows.

The following mitigation measures will be incorporated into the Project:

- If a significant cave or lava tube is inadvertently encountered during construction, all construction activity will cease immediately at the location in question and the Project Engineer will be notified. Consultation will be conducted with appropriate resource or regulatory personnel to ensure that unique biological, cultural, or geological cave resources are investigated and documented, and, if warranted, protected.
- Construction specifications will be incorporated to minimize potential hazards of caves to construction workers.
- During the rainy season, following completion of construction, slopes and denuded areas will be allowed to revegetate with natural seed sources, such as kikuyu grass and ‘a‘ali‘i, in order to minimize soil erosion.

S.3.8 Water Resources

The project area is dry, and almost all rainfall tends to percolate rapidly into the ground, especially on recent lava flows. Streams slowly develop in such conditions, and no perennial or even continuous ephemeral streams are crossed by any the project corridors. Rather than drainage features, the project area's gullies are essentially the creases between lava flow hillocks that carry water short distances in very heavy rains. None of the drainages flow more than a few days a year, and no streams, ponds, lakes or other surface water resources are present.

All project corridors traverse an uninhabited and undeveloped area used lightly for pasture in the *mauka* half and for no active land uses in the *makai* half. Because of this, the area has not been studied for floodplain determination by the Federal Emergency Management Agency (FEMA), the County, or the State. No streams are present and the project corridors all lie entirely within Zone X, with no known areas of flood hazard. Nonetheless, overland flow occurs in minor gullies, in which culverts sized for the 50-year storm will be emplaced in order to avoid impacts such as drainage patterns disruption, channeling of flow and subsequent flooding, or ponding of drainage on roadways.

Waters of the United States is a regulatory term referring to surface waters that are under the jurisdiction of the U.S. Army Corps of Engineers (USACE). Research conducted for the EIS and coordination with the USACE led to a jurisdictional determination (JD) of May 22, 2012, that no waters of the U.S. were present. As this is valid for only five years, until May 22, 2017, another determination will be necessary based on the conditions and laws and regulations that exist at that time.

Owing to the lack of streams in the project area, precipitation that does not end up evapotranspiring drains rapidly into the ground. It then percolates slowly between 50 and 2,500 feet downwards to the basal aquifer perched just above sea level as a basal groundwater lens. The deep percolation of water through aerated rock achieves extensive natural filtration. The Pacific Ocean and its bays, inlets and ponds are located between one and twelve miles from the project corridors, with no surface waterway connection. These waters are classified as AA, with the highest level of water quality goals.

The proposed Project would have no direct impacts to surface water bodies such as lakes, streams, ponds or coastal waters, as none are present in or near the project corridors. Construction might have limited, short-term effects on the surface water quality of runoff to drainages, particularly an increase in suspended sediments in runoff. The new highway would permanently increase the extent of impermeable road surface, slightly increasing surface water runoff and concentrating stormwater runoff. Potential sources of pollution from highway operation include solids, heavy metals, and organics from fuels and motor oils.

In order to comply with the Clean Water Act, measures will be implemented both during and after construction to prevent pollutants, including sediment and hazardous chemicals, from degrading the quality of stormwater runoff. As required by EPA and State DOH regulations on stormwater discharges, stormwater pollution prevention measures called Best Management

Practices (BMPs) would be required both during and after construction. An extensive array of BMPs are proposed, which are listed in Section 3.8.1.3 of this EIS.

About 55,000 gallons per day water would be needed during construction for dust control. With a 2-year construction schedule, this would involve up to 10 trucks per work day each way using a contractor-selected source, most likely in Waimea. The source of water in Waimea are wells in the West Mauna Kea Aquifer Sector, which has a sustainable yield of 24 million gallons per day (mgd) and usage of less than 7 mgd. The temporary withdrawal of a maximum of roughly 0.055 mgd in the context of existing uses and sustainable yields is minor, at less than 0.8% of existing use. No stress on the aquifer system or wells would occur.

S.3.9 Botanical Resources

Project botanists reviewed available scientific and technical botanical literature as well as geospatial data, aerial photographs, and topographic maps to inventory botanical resources. They conducted a 100 percent, visual survey of a 250 foot-wide, staked survey corridor for each alternative. Attention was also directed outside the staked corridor to any nearby conspicuous plant or topographic feature. Vegetation descriptions were recorded in all plant communities encountered along the corridors, and all plant species found were recorded. Special attention was given to listed or proposed threatened or endangered species and critical habitat, and the U.S. Fish and Wildlife Service (USFWS) was consulted.

Once vegetated in dry forest, the area has been profoundly altered by wildfire; grazing by domestic cattle, feral sheep and goats; alien insect pests; and especially invasion by fountain grass (*Cenchrus setaceus*), an aggressive alien. The entire area is now a dry grassland, varying from sparse to dense cover, sometimes with scattered trees. A total of 35 different vascular plant species were tallied. Three were endemic (native to only Hawaiʻi and found only in Hawaiʻi), four were indigenous (native to Hawaiʻi and other places), and 28 were introduced. No rare plants or listed or proposed threatened or endangered plants were present. One *wiliwili* (*Erythrina sandwicensis*), a valuable native tree that is becoming less common, was present in Segment 5/6.

A corner of a land unit proposed by USFWS as critical habitat for three endangered plants is also traversed by Segment 5/6. This 1,779-acre unit is occupied in limited areas by the tree *Mezoneuron kavaiense* within and near the Waikoloa Dry Forest Preserve and includes – at least in some spots – the mixed herbland and shrubland, the moisture regime, and canopy, subcanopy, and understory native plant species identified as physical or biological features in the lowland dry ecosystem. The unit is not currently occupied by *Bidens micrantha* ssp. *ctenophylla* or *Isodendrion pyrifolium*, which may or may not have been historically present. The 1,350-foot length (consisting of 7.6 acres) of the unit within the Segment 5/6 project corridor is completely dominated by invasive species and does not appear to be a suitable site for the three species. The USFWS is currently considering withdrawing this biologically less suitable area from proposed critical habitat. FHWA is coordinating with USFWS concerning determination of effects to critical habitat, which is expected to be finalized prior to the publication of the Final EIS.

A number of mitigation measures for botanical resources related to restricting the spread of invasive weed species, wildfire prevention, and relocation of the one *wiliwili* tree, are proposed.

S.3.10 Fauna

Faunal surveys were undertaken on transects within the 250-foot wide project corridor of each alternative alignment, once during the dry season and once during the wet season. Attention was also directed outside the staked corridor to any visible or audible fauna. Zoologists also investigated land well beyond the corridor that could potentially experience invasion by non-native species or wildfire, altering faunal habitat. Special attention was given to listed or proposed threatened or endangered species and critical habitat and the U.S. Fish and Wildlife Service (USFWS) was consulted.

In an effort to detect the presence of endangered Hawaiian hoary bats (*Lasiurus cinereus semotus*), two stationary remote bat census stations were deployed over four nights. In addition, visual scans were made for bats during dawn and dusk on four separate evenings and mornings. Likely due to the lack of tree or shrub cover, no bats were detected, although they probably overfly the project corridors at least occasionally. Several non-native mammals that lack conservation value were detected. A total of 20 bird species was recorded, including one native migratory bird, Golden Plover or *kolea* (*Pluvialis fulva*). Two listed endangered birds, the Hawaiian Goose or *nēnē* (*Branta sandvicensis*) and the Hawaiian Stilt or *a‘eo* (*Himantopus mexicanus knudseni*), were also seen. The remaining birds were all non-native, although some are classified as migratory birds. Avian diversity and densities were extremely low, matching surveys in other fountain grass-dominated lowlands, which do not provide the resources needed for the sustenance or nesting of native birds. Although undetected during this survey, some threatened or endangered seabirds (Hawaiian Petrels (*Pterodroma sandwichensis* or ‘*ua‘u*); Band-rumped Storm-Petrels (*Oceanodroma castro*); and Newell’s Shearwaters (*Puffinus auricularis newelli*)), may overfly area between the months of June and October. These pelagic seabird species nest high in the mountains in burrows, and there is no suitable nesting habitat for them within or near the project corridors.

In general, native invertebrate species, and particularly threatened or endangered species, are not associated with areas dominated by non-native vegetation such as the project corridors. There is one important exception, the endangered Blackburn’s sphinx moth (*Manduca blackburnii*). The caterpillar of this species sometimes feeds on the leaves of plants in the nightshade family, including some introduced ones such as tree tobacco (*Nicotiana glauca*), a roadside weed in the project area.

Animal habitat would be affected in both permanent and temporary ways by the Project. These effects are generally not highly adverse because the habitat consists mainly of non-native vegetation that supports mostly common, widespread and non-native animals and animal habitat. No animal critical habitat is located within or near any of the project corridors.

The Project incorporates mitigation measures to avoid or minimize impact to listed species, including woody vegetation removal timing restrictions for Hawaiian hoary bats; preconstruction searches for Blackburn’s sphinx moth and potential relocation of larva; lighting restrictions for passing seabirds; and construction-phase measures to avoid attraction of *nēnē*. Mitigation measures related to habitat change derived from alien species invasion and wildfire are also proposed.

S.3.11 Wildfire Hazard

In addition to the damage wildfire can inflict on urban areas and ranches in dry parts of Hawai‘i, fire poses a grave threat to Hawaiian ecosystems by converting native habitats into grasslands dominated by non-native species. Wildfires in Hawai‘i are usually caused by human activity. The entire northwest side of the Big Island between Ka‘ūpulehu in the south and Hawi in the north is subject to extensive wildfires. Pu‘uanahulu is “ground zero” for many fires in the last 50 years, which have also affected the eastern end of the project corridors.

Responsibility for fighting wildfires rests with the Hawai‘i DLNR and the Hawai‘i Fire Department (HFD). The HFD has stations near the project area in Waimea, Waikoloa and on Queen Ka‘ahumanu Highway. DLNR has offices in Hilo and Waimea. A firefighting unit from the U.S. Army’s Pōhakuloa Training Area is responsible within the military base but also assists on fires that affect adjacent State and private lands. In addition to fighting wildfires after they ignite, County, State and federal agencies have worked with non-profits such as the Hawai‘i Wildfire Management Organization and local communities to prevent and adapt to wildfire. Strategies include substitution of fire-resistant for fire prone vegetation around homes, fuel breaks and firebreaks, alternate emergency road egresses, and new sources of firefighting including fire dip tanks for helicopters.

Any new highway between Māmalahoa Highway and Queen Ka‘ahumanu Highway near the southern border of South Kohala will extend through fire prone areas in the grasslands found on the *mauka* third to half of such a route. Wildfire maps for the area indicate that highways often act as barriers to fire movement, but that ignition points are frequently on road verges, as expected in area with infrequent sources of natural ignition. The Saddle Road Extension would have the adverse effect of being a new source of ignition for regional wildfires, but its wide cross section would also serve as a critical firebreak between the private, grazed lands of Waikoloa and the State lands of Pu‘uanahulu to the south. Furthermore, it would provide a new route for emergency evacuation during nearby fires, allow faster times for emergency fire response within and through the region, and offer a staging area for fire operations. The Daniel K. Inouye Highway has served this invaluable purpose several times since its opening in September 2013. In addition to operational issues, construction equipment used during grading and paving as well as careless construction workers can cause fires. Construction fires can largely be controlled by proper management.

Design measures incorporated into the Project’s Typical Section would mitigate for wildfire. The expanded Typical Section for the roadway would both reduce the likelihood of accidental ignition from unintentional road sources (car fires, catalytic converters, cigarettes, etc.) and assist in creating a firebreak and fuelbreak. Mitigation during construction includes a wildfire prevention and response plan, restriction of all construction activity to the clearly delineated

ROW, entry and exit into the ROW by all construction personnel and equipment at previously identified and marked non-sensitive areas, and strict no-smoking enforcement.

S.3.12 Wild and Scenic Rivers

The Wild and Scenic Rivers Act, 15 U.S.C. 1271-1287, makes it the national policy that certain rivers of the U.S which, along with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in free-flowing condition. There are no designated Wild and Scenic Rivers in the State of Hawaiʻi at this time. Consequently, construction and operation of any Build Alternative of the Saddle Road Extension would not lead to any impacts to Wild and Scenic Rivers.

S.3.13 Coastal Barriers Resources Act Error! Bookmark not defined. and Coastal Zone Management Act

The Coastal Barrier Resources Act, 16 U.S.C. 3501, designated various undeveloped coastal barrier islands, depicted by specific maps, for inclusion in the Coastal Barrier Resources System. No coastal barriers are present in the State of Hawaiʻi, and construction and operation of any Build Alternative of the Saddle Road Extension would not affect any resources protected by the Coastal Barriers Resource Act.

All federal projects require a determination to ensure that the proposed project is consistent with the objectives and policies of the CZM Program. With implementation of mitigation measures, the Project is expected be consistent with the objectives and policies of the CZM Program. FHWA and HDOT have determined that there are no differences between the use of any of the alternatives with respect to consistency with the Coastal Zone Management Act. This will be confirmed through review of the new corridor by the Hawaiʻi CZM program, which was supplied a copy of the Draft EIS.

S.3.14 Archaeological and Historic Resources

An archaeological inventory survey (AIS) of the project area was conducted in conformance with Section 106 of the National Historic Preservation Act (NHPA) that involved documentary research, field studies and consultation with Native Hawaiian Organizations (NHOs), native Hawaiian individuals and others highly familiar with the history of the area.

The project area lies primarily within Waikoloa Ahupuaʻa, South Kohala District, with a small segment of the project area in Puʻuanahulu Ahupuaʻa, North Kona District. This situates the project area in the traditional *pili* zone, well outside major agricultural and habitation areas during the pre-Western Contact era. The *pili* zone is named for the grass that was used for traditional thatching and once grew abundantly in this lava-covered, arid region prior to invasion by alien species. Abrader rock quarries, temporary habitation and shelter structures and trails were left behind, some of which remain today. Later uses were primarily for ranching, especially at higher elevations, and for military training during World War II. Corrals, boundary markers, walls, fences and roads indicate these uses.

Archaeologists conducted fieldwork in closely spaced intervals observing the surface of the Area of Potential Effect (APE), a 250-foot wide corridor surrounding each alternative. They also surveyed areas around all potential intersections, and to ensure full coverage, they surveyed many areas outside the APE as well. Archaeologists attempted to locate all lava tube caves below or in close proximity to the APE and also inspected them.

Fifty archaeological sites were recorded during the inventory survey process, 28 of them fully or partially within the APE. The remaining 22 sites are located outside of the boundaries of the APE and will not be impacted by project construction activities. Most sites are in the western, *makai* portion of the project area. These lower elevation sites were likely visited more often because they were closer to habitation areas along the coast. The sites are clustered around an area of level pāhoehoe containing both lava tubes and friable surface lava used to make abraders. Several small caves, a larger refuge cave, numerous pāhoehoe excavations and a trail network are present. The central and upland sites are fewer and mainly consisted of boundary markers. All of the archaeological sites were assessed as significant under criterion D for the information they contain. A total of 20 historic sites are present within the APE of the project corridor for Alternative 4; 16 sites are present for Alternative 5; and 12 sites are present for Alternative 6. Some sites are shared by one or more alternatives. Although road construction would not necessarily impact every site in the selected alternative because the full 250-foot width would be cleared only in a few locations, most of these sites would undergo data recovery prior to construction of the highway. In addition, a full-time archaeological monitor would be provided during clearing, grubbing, and excavation operations on the proposed project.

S.3.15 Cultural Resources and Practices

Cultural resources and practices were considered in a broad context of the land use practices and care embodied in the *ahupua'a* land use system, which stresses the *mauka-makai* connection on both a physical and a spiritual level. Archaeological and cultural specialists conducted documentary research as well as interviews with local residents and cultural experts in various phases of the Project from 2000 to 2014. The interviews produced information on ranch activity, historical use of the project area and surrounding region, and perceptions of legends and traditional history.

The absence of water here severely restricted agriculture, although many resources were widely gathered. To Western eyes, such a landscape might appear bereft of utility, much less beauty, but traditional Hawaiian culture regarded it as abundant with resources such as rock, grass and bird eggs. This arid region was affectionately regarded by its residents, who developed an ingenious and sustainable set of fishing, dryland farming, and pond aquaculture technologies adapted to the difficult setting. The origin story for the settlements in the region, which derive names from legendary beings, provide insights into island-wide movements and local interactions. They also illuminate valued cultural places and landscapes that continue to have meaning.

Examples of Hawaiian cultural practices and sites include: gathering of subsistence items; loci of recreation, habitation, and agriculture; use of pathways to resources; and places where religions and spiritual customs are conducted. Aside from gathering, archaeological sites can be culturally significant when they offer a dynamic link between the vital culture of the present and events of the past. Certain archaeological sites such as ceremonial places and burial locations warrant special consideration and protection, or provide information on and cultural practices and beliefs. Places within this region that are revered for their historical associations and past events, such as residential compounds or the *heiau* where religious and spiritual customs are conducted, are situated beyond, and not within, the project area. Archaeological survey did not locate any *iwi kupuna* (Hawaiian burials) within the area that would be affected directly or indirectly by construction of any alternative of the Project.

The sources consulted during the research conducted for this project said that the typical resource gathering that may have once existed in the past has not been conducted in the project area for generations. This is in part due to the fact that villages along the coast, which relied on the use of upland resources, are no longer present. Consequently, there are no gatherers of birds and bird feathers, nor of *pili* grass, a resource now barely present in the project area. Other natural resources that the archaeological data indicate were taken from the project area in ancient times, such as scoriaceous stone to produce abrading tools, have not been collected for such purposes within the project area for many generations. The *mauka* third of the project area is within fenced cattle pastures that are not open to the general public, although they could be accessed by cultural practitioners. Because of the lack of most types of valuable resources in this area, and the presence of public lands of equal or superior resource value nearby (e.g., with the State lands of Puʻuanahulu), there appears to be little or no gathering occurring in this area.

Although the area is implicitly imbued with cultural importance, the Project would not impact any specific sites of cultural significance. Even if no cultural resources or practices specific to the land have been identified, there are more general cultural concerns about the use of any natural Hawaiian landscape, including this one. Some residents of Puʻuanahulu expressed concern about the crossing of the Kanikū lava flow, a storied landscape. However, the Kanikū lava flow is such an extensive feature – about 30 miles long and 3 miles wide, occupying a large area of North Kona and South Kohala – that it has been unavoidable for any highways that connect West Hawaiʻi communities, such as Māmalahoa Highway, Waikoloa Road, and Queen Kaʻahumanu Highway, as well as the Waikoloa Beach and Mauna Lani resorts. Members of the Hawaiʻi Island Burial Council noted that one alternative for the highway could cross the North Kona-South Kohala *moku* (district) boundary in two places. They expressed that these are traditional boundaries that are culturally and historically important to Hawaiians. Other concerns related to rare Hawaiian plants.

The only substantial differences among alternatives related to the cultural concerns are that Alternative 4 involves more use of the Kanikū Lava Flow and crosses the North Kona/South Kohala *moku* boundary twice, while Alternatives 5 and 6 remain inside South Kohala and cross less land in the Kanikū Lava Flow. However, use of either Alternative 5 or 6 would involve the loss of one *wiliwili* tree, while none are present in Alternative 4.

Mitigation measures derived primarily from the suggestions of those consulted during interviews and meetings include proper cultural protocol to release and sanctify or bless the construction project; cultural monitors during ground disturbing activities; signage marking crossing of the *moku* boundaries that will honor these cultural divisions of space and also educate the public;

and partnering with the University of Hawaiʻi at Hilo to provide funding for students to assist in an effort to collect information from the archaeological sites and the cultural landscape.

As the Draft EIS will undergo review by the consulted parties as well as others who may not have been reached during the first phases of Section 106 consultation, refined and/or additional mitigation may be suggested that may then be adopted in the Final EIS and Record of Decision.

S.3.16 Hazardous Materials and Toxic Substances and Ordnance and Explosives

The project corridors traverse areas that have undergone no modern land use except for scattered grazing and two utility lines. No roads or buildings are present, and no extractive activities such as mining or logging have occurred nearby. Therefore, no Phase I Site Assessment was conducted to systematically investigate potential hazards such as hazardous material sites, petroleum hydrocarbon sites, or above ground or underground storage tank (AST or UST) locations. State DOH hazardous material databases indicate no active or former Underground Storage Tanks, Leaking Underground Storage Tanks, or generators of hazardous materials along the project corridors. Discussions with County Fire, Police and Civil Defense along with visual reconnaissance of the survey corridor have revealed no evidence (aside from the potential for ordnance and explosives, discussed below) of hazardous materials, toxic substances or other conditions of concern. If Project construction uncovers previously unidentified hazardous substances or toxic materials indicating an existing release, a past release, or a material threat of a release of any hazardous substance into the project corridor of the selected alternative, work will cease at that location and appropriate regulatory or resource personnel will be contacted.

The entire area traversed by all project corridors is part of the former Waikoloa Maneuver Area (WMA), a 91,000-acre area in Parker Ranch licensed for use by the U.S. Navy at the outset of World War II. It was used as an artillery firing range for a variety of weapons and for troop maneuvers. From 1943 through 1945 nearly the entire WMA was in constant use. A 467-acre military cantonment called Camp Tarawa in honor of the first successful amphibious land invasion of the Pacific War was also established just outside Waimea town. A program under the direction of the U.S. Army Corps of Engineers (USACE) is the latest of several efforts to address the remnant ordnance and explosives (OE). The USACE has divided the WMA and adjacent areas into sectors based on past military usage, current and future land uses and other factors. Visual reconnaissance surveys, surface clearance, geophysical mapping, visual surface searches, anomaly investigation, and intrusive OE sampling have all been conducted in order to characterize the areas. OE clearance has been underway since 2005, and the total effort is expected to cost more than a billion dollars.

Although the entire former WMA has been investigated at some level, no part of the project corridors has yet been systematically swept and cleared of OE. FHWA and HDOT are unaware of any discoveries of hazardous OE in or near the corridors, although material that is presumed to be scrap (inert and nonhazardous) has been observed during field surveys. There are currently no indications that construction in any portion of the project corridors would encounter substantial quantities of OE that would prevent use of the area for a highway or involve extraordinary efforts and expense to remediate. As with most major construction within the former WMA, coordination with the USACE will be necessary to determine the level of surveys and clearance required. It is likely that OE survey and disposal will precede construction activities in areas to be determined as part of the consultation.

S.3.17 Scenic Character

Dramatic terrain spanning elevations between 60 and 2,500 feet above sea level coupled with open vegetation provides panoramic vistas with interesting landscape features. A foreground of rolling ridges and broad valleys, along with more distant vistas of cone-shaped *pu‘u* (hills), towering shield volcanoes and the Pacific Ocean, provide scenic interest. Natural features such as rock outcrops of basaltic lava, native shrublands, and grasslands that change hue from brown to green in times of rain are visible along all project corridors. There are only subtle cultural modifications of the natural landscapes, such as a few rough unpaved roads, powerlines, fence lines, and water tanks and troughs.

The Project could result in minor and temporary visual impacts during the construction period as a result of dust, temporary vegetation removal, the presence of heavy equipment, lighting associated with night-time construction activities (although this is currently not anticipated), the presence of additional vehicles traveling throughout construction areas, and detour roads and traffic control facilities.

After construction, there would be a substantial change in visual character due to the introduction of a paved highway to the existing pastoral or lava wilderness setting. The highway would to some degree lower the existing visual quality of the foreground area, based not only on the appearance of the paved surface, but also on cut and fill slopes. Over its length, fill slopes would range from 5 to 40 feet, and cut slopes would range from 5 to 30 feet, although eventual vegetation of these slope faces would minimize the change in visual quality and character.

Although this change in visual character is unavoidable, one of the most frequent comments heard from drivers on the improved Daniel K. Inouye Highway, which in its western end completely relocated the highway to a new route within pastures and lava flows, was the beauty of the scenery that the new highway revealed. The scale and appearance of that highway in general matches its surroundings. As with the Daniel K. Inouye Highway, the Saddle Road Extension would traverse areas of which there are currently very few views. The most important visual effect of the proposed highway would be the substantial number of new scenic vistas that would be available to motorists who have never seen them before. The Project would not interfere with existing vistas of the Pacific Ocean, Mauna Kea, Mauna Loa, Hualālai, or the Kohala Mountains, the major scenic resources in the area, regardless of viewer location.

While there are no substantial differences between the scenic resources or impacts of the three alternatives, Alternative 4 is more distant from existing highways and urban development than Alternatives 5 and 6. This marginally increases the wilderness character of this corridor. However, it closely follows an existing 138-kv electrical transmission line/access road, which actually lessens the route’s existing visual quality.

Proposed mitigation includes minimization of the amount of cut and fill slopes, revegetation of disturbed areas, and blending any proposed improvements into the surrounding landscape, in order to reduce the contrast between the proposed improvements and the existing landscape.

S.3.18 Energy and Climate Change

Energy would be consumed for construction, for new traffic signals and streetlights, and operation of vehicles once the highway opens. Beyond cost implications of energy, the earth is warming due to manmade increases in greenhouse gases in the atmosphere, which are primarily derived from combustion of fossil fuels. An EIS must consider: 1) the potential effects of a proposed action on climate change as indicated by assessing greenhouse gas emissions in a qualitative, or if reasonable, quantitative way; and, 2) the effects of climate change on a proposed action and its environmental impacts.

In terms of operational energy use after construction, the Project is not expected to increase total vehicle miles travelled on the Island of Hawaiʻi. Instead, it will offer a new and more efficient route between the termini at Māmalahoa Highway and Queen Kaʻahumanu Highway, with savings of up to 6.6 minutes per one-way trip. The more efficient highway will also foster fuel conservation by lowering congestion, reducing curves and grades, providing safe opportunities for passing, and allowing more steady highway speeds. Automobiles are up to 15 percent more fuel efficient, and produce 15 percent less CO_2, when traveling at 55 MPH rather than 35 MPH. Trucks experience even greater efficiency. Any alternative of the Project would substantially enable more efficient speeds and eliminate start-and-stop driving on Māmalahoa Highway and Queen Kaʻahumanu Highway. Although it is not feasible to calculate projected energy savings because of a lack of data on precise trip origins and destinations, as well as uncertainty about levels of fuel consumption in passenger vehicles or trucks that might utilize the Saddle Road Extension, savings will likely be substantial.

The project corridors are located from 130 to 2,500 feet above sea level, and are not vulnerable to sea level rise during the next century. Precipitation scenarios for leeward parts of the Hawaiian Islands under various climate models are quite variable, with some predicting wetter conditions and others drier. Under any scenario, extreme events such as tropical storms and droughts may become more frequent. The Project would include drainage structures designed based the 50-year storm, which improves on alternative local roads. The uncertain nature of the risk of substantially greater future rainfall and the long time scenario indicates that it is prudent to construct the Project as planned and realize its benefits for a period of up to many decades rather than fail to implement it or design it for currently unknowable, extreme contingencies.

S.3.19 List of Required Permits and Approvals

The following required permits and approvals must be met to implement the proposed project:

Federal

- Section 106 Consultation (National Historic Preservation Act [NHPA]), Hawaiʻi Department of Land and Natural Resources (DLNR) State Historic Preservation Officer (SHPO)
- Section 7 Consultation (Endangered Species Act [ESA]), U.S. Fish and Wildlife Service (USFWS);
- Department of the Army Approved Jurisdictional Determination Update (Section 10 of the Rivers and Harbors Act and/or Section 404 of the Clean Water Act [CWA]), U.S. Army Corps of Engineers (USACE)
- Section 4(f) (U.S. DOT Act), Federal Highway Administration (FHWA)

State

- National Pollutant Discharge Elimination System (NPDES) Permit, DOH
- Coastal Zone Management Act (CZMA) Federal Consistency Review, Hawaiʻi Department of Business, Economic Development, and Tourism Office of Planning
- Historic Preservation Review (HRS Chapter 6E), DLNR State Historic Preservation Division (SHPD)
- Americans with Disabilities Act Review (HRS §103-50), DOH Disability and Communication Access Board
- Occupancy and Use of State Highway Right-of-Way Permit, HDOT
- Community Noise Permit/Variance, DOH

County

- Grading, Grubbing and Stockpiling Permits; Permit for Work in County Right-of-way, Hawaiʻi County Department of Public Works

S.4 CUMULATIVE IMPACTS

Cumulative impacts encompass the total effect on a natural resource, ecosystem, or human community due to past, present, and future activities or actions of federal, non-federal, public, and private entities. The cumulative impact analysis approach undertaken in the EIS was based on guidance from the USEPA, Caltrans, and the Council on Environmental Quality (CEQ). The analysis for identifying and assessing cumulative impacts applied here consists of seven steps:

1. Identification of resources in consultation with agencies, groups, individuals and reliable information sources.
2. Identification of the direct and indirect impacts of the proposed project that might contribute to a cumulative impact on the identified resources.
3. For all resources that have a potential to be impacted by the Project, definition of a geographic boundary or Resource Study Area (RSA) for each resource to be addressed.
4. Description of the current health and the historical context of each resource.
5. Identification of the set of other current and reasonably foreseeable future actions or projects and their associated environmental impacts to include in the cumulative impact analysis.

6. Assessment of the potential cumulative impacts.
7. Assessment of the need for mitigation and the potential to avoid, minimize, rectify or compensate for impacts.

As a result of analyses in Steps 1 and 2, the following resources were found to be impacted by the Project in a more than insubstantial way:

Drainage Features: Project would increase drainage quantities in several local swales.
Threatened and Endangered (T&E) Plant Species: Plant critical habitat (but no T&E plants) and T&E animals are present in or near the corridors. Potential for impact due to highway construction and operation.
Wildfire: Fire-prone vegetation is present in all project corridors, with potential for impact due to highway construction and operation.
Recreational Areas: Project would involve loss of 0.5 sq. mi. of marginal hunting land within a 65 sq. mi. hunting unit, but may assist in better access to hunting land.
Historic Properties: 28 archaeological sites from pre-Western and historic era in all project corridors, significant primarily for information content, many of which would be removed to make way for the highway.
Areas for Practice of Traditional Culture: No gathering or other cultural areas identified in area on or near any project corridors, and thus no impacts to specific resources, but general degradation of natural-cultural landscape.
Scenic Character: Project would insert a built landscape in area currently without structures, with the potential for degradation of regional scenic resources.

In Step 3, a Resource Study Area (RSA) was defined and mapped for each resource for which the Project had an adverse impact that might accumulate with impacts from other projects. The RSAs provided a logical unit for analysis of the existing state of a resource and effects to it. The next step in the cumulative impact analysis consisted of describing the current health, condition, or status of each affected resource within its respective RSA, including historical and recent trends. The drainage features, wildfire prevention/suppression, recreational resources, historic properties, areas for practice of traditional culture, scenic resources were in a healthy or sustainable state. The health of the threatened and endangered plant populations that remain within the RSA is relatively good, although this must be interpreted within a context of two centuries of shrinking and degraded habitat that has rendered these plants very restricted in range and endangered.

Next, the cumulative impact analysis identified current and reasonably foreseeable transportation and non-transportation projects within the RSA for each resource. These included widening of Queen Kaʻahumanu Highway, various infrastructure and housing projects in and around Waikoloa Village, an agricultural subdivision, a public gun shooting range, and new or expanded solid waste facilities. The analysis then summarized the manner in impacts from the proposed Saddle Road Extension project would combine and interact with those of other projects, along with identification of potential mitigation measures, whether the Project is capable of providing for this or not.

Drainage Areas: The Project would add minor quantities of 50-year storm runoff from impermeable road surface to local drainages that currently have flows between 31 and 4,628 cfs. All additional runoff is expected to be within the capacity of existing drainages, and there are no risks to flooding or other resources when combined with drainage from the very few other past, present and future actions within the RSA. No drainage would reach waters of the U.S. or drainage sensitive uses. There are no adverse cumulative impacts that require mitigation.

Threatened and Endangered Species: The Project would take place outside areas with known T&E plant species and would avoid most indirect effects. Surveys for Blackburn’s sphinx moth will be necessary in order to avoid impact. The Project may impinge on unoccupied critical habitat. Introduced plant species may be slightly more invasive, but the effect is not substantial. There are no known actions nearby that would contribute to any further direct harm to T&E species. Establishment of Unit 32 of Critical Habitat and/or continued maintenance of the Waikoloa Dry Forest Preserve and upland Army preserves will actually improve the quality and resiliency of the resource. The major cumulative risk is wildfire (see below).

Wildfire: The Project represents an additional ignition source, but also a fuel break and staging area for firefighting. Mixed adverse and beneficial impacts will continue to occur with each new instance of developed infrastructure. Most would incorporate mitigation measures to prevent, adapt to, or combat wildfire, with community-government partnership actions playing a critical role. The mitigation for cumulative risk for wildfire relies on continuation of ongoing government and private actions, the most noteworthy being the Waikoloa Firewise Program, the gradual implementation of the Pōhakuloa Training Area’s *Integrated Wildland Fire Management Plan*, and the island-wide efforts of the Hawai‘i Wildfire Management Organization.

Recreational Areas. Alternative 4 traverses the multi-use 65-square mile Pu‘uanahulu GMA, which supports mammal hunting. This would lead to a permanent loss of 0.5 square miles of hunting area (direct highway use/50-yard standoff areas), but would also improve access for hunters to remaining 99% of the unit. Impacts to hunting conditions from other past, present and future actions within the RSA would be neutral to slightly beneficial; other recreational facilities will expand with population, outstripping additional growth in demand due to modern County policies imposing improvements upon developers. No mitigation for cumulative impacts should be required.

Historic Properties: The Project would lead to the destruction of some fraction of the 28 sites inventoried, with prior data recovery for any affected sites of the 24 eligible for data recovery. The best representatives of the pre-Contact and ranching history in the RSA will remain preserved. Historic preservation laws enforced prior to development will limit the potential for future actions to damage significant sites. Other foreseeable development will first inventory and then destroy some non-preservation quality sites and preserve many additional higher quality sites. There will be no substantial adverse cumulative impact.

Areas for Practice of Traditional Culture: The SRX project would insert another built element into a landscape that has been radically transformed but retains undeveloped character. There would be no loss of gathering resources, but it would be another intrusion into the massive Kanikū lava flow, which has traditional associations. Future actions will continue to alter the character of the land and change the context for cultural relationships. Although no gathering resources or ceremonial sites will be jeopardized, the Project would combine with other projects in the region and the State to reduce the undeveloped character of the landscape. This changes the context in which other traditional activities that might not in themselves be threatened occur. Development changes landscapes and views and introduces new people who may not understand or appreciate the Hawaiian worldview, in which the connections among the natural and spiritual world, the present and the past, are seamless. There may be no complete mitigation for this effect, other than ceasing development altogether. The tradition of the Saddle Road project, which was guided by the long-serving citizens of the Saddle Road Task Force and is being continued in the Saddle Road Extension project, has been to sincerely and humbly request the blessings of a traditional practitioner upon the Project. This has been done with the knowledge that project represents development that has both positive and negative aspects for traditional culture. Familiar landscapes are altered, but landscapes lost for centuries are newly rediscovered around each curve of the highway. New and sometimes disharmonious development may ensue, but so does a deepening of ties among families scattered around the island, who now may travel easily and safely.

Although beyond the power of FHWA and HDOT to implement, mitigation measures proposed for the Saddle Road Extension may also be adopted by other development and County road projects that cumulatively alter the natural landscape and can create a feeling of alienation among those with deep cultural roots. These include conducting proper cultural protocol to release and sanctify or bless the construction project; utilizing cultural monitors during ground disturbing activities to ensure that significant cultural resources that may have not been documented during the EIS are recognized and dealt with appropriately; marking for entering and exiting travelers the moku boundaries, which are highly significant. These measures, as modified and enhanced by public input during the EIS process, can serve as models and lessons for future projects that entail the scale of landscape transformation that is inherent in highway construction.

Scenic Character. The Project would insert a built element into the environment, changing the vistas. A new set of unique and highly scenic views for the driving public would be provided, similar to those associated with the Daniel K. Inouye Highway. Other foreseeable future actions include small-scale, agricultural-lot development will insert scattered structures, and urban development will transform at least some vistas from rural or wilderness to urban. Cumulatively, the scenic vistas that are currently enjoyed from Waikoloa Village and existing viewpoints will not change. Views from most of the existing highways will not be altered significantly. Views for drivers in a limited area near the junctions with Māmalahoa Highway will be altered to include elements of a more urban character because of the SRX. New vistas will continue to develop. Preservation of these views associated with cumulative development can be maintained through design controls available to local governments, which have planning mechanisms to prescribe protection in regulations associated with change of zone and other permits.

S.5 EIS FINDINGS

Probable Unavoidable Adverse Environmental Effects

If a Build Alternative is selected, the Project will create limited adverse environmental impacts that cannot be fully mitigated by the planned mitigation measures. Unavoidable short-term impacts even with mitigation involve very minor, temporary increases in soil erosion and sedimentation, traffic congestion, vehicle emissions and dust, visual impacts, and noise.

Unavoidable long term impacts include modifications to soils, topography, vegetation and views; destruction of some archaeological sites that have been determined significant for information content; and conversion of approximately 200 acres of sparsely grazed pasture to highway uses, as well as division of pastures. Depending on the alternative selection and the final rule by the U.S. Fish and Wildlife Service, the Project may impinge on a corner of a critical habitat unit for three endangered plants, although the area is unoccupied.

Relationship Between Short-Term Use of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

Over the life of the project, the construction phase would likely represent the period of most concentrated impact to the natural, biological, and social environment. Construction-related impacts, such as soil erosion and sedimentation, the generation of air pollutants and dust, traffic congestion due to detours and delays, and noise from construction equipment, would be considered temporary and would not be expected to affect the area's long-term productivity.

The conversion of existing land uses, the direct loss or displacement of limited numbers of native plants and replacement by aliens, the degradation of historic properties, and the modification of the visual environment would occur immediately; these impacts would not be retrievable for the long-term productivity of the area. No plant or wildlife species are expected to become extinct as a direct result of project activities.

Economic benefits associated with the construction efforts would occur immediately upon initiation of the Project. Those economic benefits associated with time-savings for cross-island traffic would begin following the construction period and would be expected to increase over time, contributing to the long-term productivity of the area.

Mitigation measures committed for the Project would be initiated and maintained over time as appropriate, many of which contribute to the maintenance and enhancement of the region's long-term productivity.

Proposed improvements would enhance safety and reduce travel time for many cross-island motorists. The short-term use of project area resources represents an efficient means to achieve a primary transportation goal.

Irreversible and Irretrievable Commitments of Resources

Irreversible and irretrievable commitment of resources for the Project include conversion of pasture to highway uses, scenic resources disturbance, and project materials such as aggregate for at least the life of the project, as well as archaeological sites, soil, and energy on a permanent basis.

Unresolved Issues

An unresolved issue exists concerning whether the highway will intrude into critical habitat after the current proposed critical habitat for *Isodendrion pyrifolium*, *uhiuhi* (*Mezoneuron kavaiense*), and *Bidens micrantha* ssp. *ctenophylla* is finally designated, as discussed in detail in Section 3.9.1.3 of this EIS. The USFWS is considering excluding from critical habitat the 1,758 acres that are owned or managed by the Waikoloa Village Association, including the land that would be utilized by Segments 5/6, because of significant ongoing conservation efforts of the landowner. If USFWS does remove this area, there would be no use of any type of critical habitat by any Build Alternative of the Project. The proposed critical habitat rule has yet to be finalized. It is expected that this issue will become resolved in 2017. Irrespective of its resolution, the Project would not substantially affect the ability to recover these species within Unit 32. There is no rationale for delaying a decision concerning the Project pending resolution of this issue.

S.7 SECTION 4(F) ANALYSIS

The purpose of 49 U.S.C. Section 103, generally known as Section 4(f), is to ensure that the U.S. DOT makes special efforts to protect public parks and recreation lands, wildlife and waterfowl refuges, and historic properties. The law states that the Secretary of Transportation shall approve a project which requires the use of publicly owned land from a public park, recreation area, wildlife or waterfowl refuge, or from an historic property of significance only if; (1) there is no prudent and feasible alternative to such use, and (2) the project includes all possible planning to minimize harm to the resource being affected by use.

In the case of the Saddle Road Extension project, 28 NRHP eligible archaeological sites are present, with a maximum of 20 sites affected, depending upon the selected alternative; none of the sites warrant preservation in place. There are no public parks or recreational lands or wildlife or waterfowl refuges as defined by the statute. The FHWA has consulted with the appropriate jurisdictional entities in determining whether and how these properties will be affected. The FHWA has concluded that no use of 4(f) properties will occur as a result of the Project.

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1 PROJECT LOCATION AND PURPOSE AND NEED

1.1 Project Location, Background and Historical Perspective

Project Location

The Hawai‘i State Department of Transportation (HDOT) and the Federal Highway Administration (FHWA) propose an arterial connector highway between Māmalahoa Highway, (State Route [SR] 190), and Queen Ka‘ahumanu Highway (SR 19) (***Figure 1.1***). The Project is referred to as the Saddle Road Extension.

The proposed Saddle Road Extension is envisioned as an integral element of the surface transportation system of the Island of Hawai‘i. In overview, the major destinations spurring cross-island traffic on the island of Hawai‘i include airports (Kona International Airport and Hilo International Airport), State harbors (Kawaihae and Hilo), beaches and resorts (South Kohala and Kona), and population centers (Hilo, Waimea, Waikoloa Village and Kailua). This capacity is currently met by SR 19 along the Hamakua Coast and through Honoka‘a and Waimea; by the Saddle Road (SR 200) (now known as Daniel K. Inouye or DKI Highway) in combination with Waikoloa Road and Māmalahoa Highway across the center of the island; and by the longer and less-used route around the southern end of the island through the Ka‘ū and Kona Districts on SR 11 (refer to ***Fig. 1.1***).

The project termini for the Saddle Road Extension were set based on accommodating the critical area of expected traffic growth. The eastern or *mauka* project limit was anticipated to be Māmalahoa Highway at or near the realigned Saddle Road terminus. This limit was selected because it is the outlet for the growing volume of Daniel K. Inouye (DKI) Highway traffic and thus the logical future focus point of traffic between East and West Hawai’i. The western or *makai* terminus is the Queen Ka’ahumanu Highway (SR 19) at the southern leg of Waikoloa Beach Drive, because this provides the shortest route from the DKI Highway to SR 19, at a point that has been planned for decades to be the major intersection in this segment of SR 19.

The project study area is a corridor extending in an east-west direction for approximately 10.5 miles within the districts of South Kohala and North Kona. This area corridor is open land that is lightly grazed on the *mauka* portion and mostly unused on the lower portion (***Figure 1.2***). Limited goat hunting occurs on the nearly bare ‘a‘a flows on the State land at the extreme south of the corridor.

Background and Historic Perspective

The Environmental Impact Statement (EIS) process for the Project was originally started in 1999, with a federal Notice of Intent (NOI) to Prepare an EIS published in the *Federal Register* on July 13, 1999, and a State of Hawai‘i EIS Preparation Notice (EISPN) released on August 8, 1999. An alternatives study that generated three alternative alignments was completed, and fieldwork was accomplished over the next two years. Subsequently, in November 2003, the U.S. Army began an EIS for the *Army Transformation of the 2nd Brigade, 25th Infantry Division (Light) to a Stryker Brigade Combat Team (SBCT)* project. The EIS covered purchase and use for military training of Parker Ranch's Ke'āmuku Parcel, through which the western portion of the realigned Saddle Road had been planned. The EIS process for the military training concluded in April 2008. Shortly thereafter, the U.S. Army determined that FHWA and HDOT would need to move the planned western portion of the Saddle Road south in order to reasonably accommodate training activities in the newly acquired Ke'āmuku Parcel.

With the need to shift the highway to the south to the southern end of the Ke'āmuku Parcel, HDOT and FHWA put the Saddle Road Extension project on hold to focus on a revised Saddle Road realignment alternative (termed W-7) that would represent the best logical terminus for the Saddle Road intersection with Mamālahoa Highway. This major change necessitated preparation of a Supplemental EIS (SEIS) for the Saddle Road. The SEIS was subsequently issued, and a Record of Decision (ROD) was completed in 2010. The selected W-7 alignment alternative has since been built, with a western terminus relocated about a half-mile south of that presented in the original 1999 EIS.

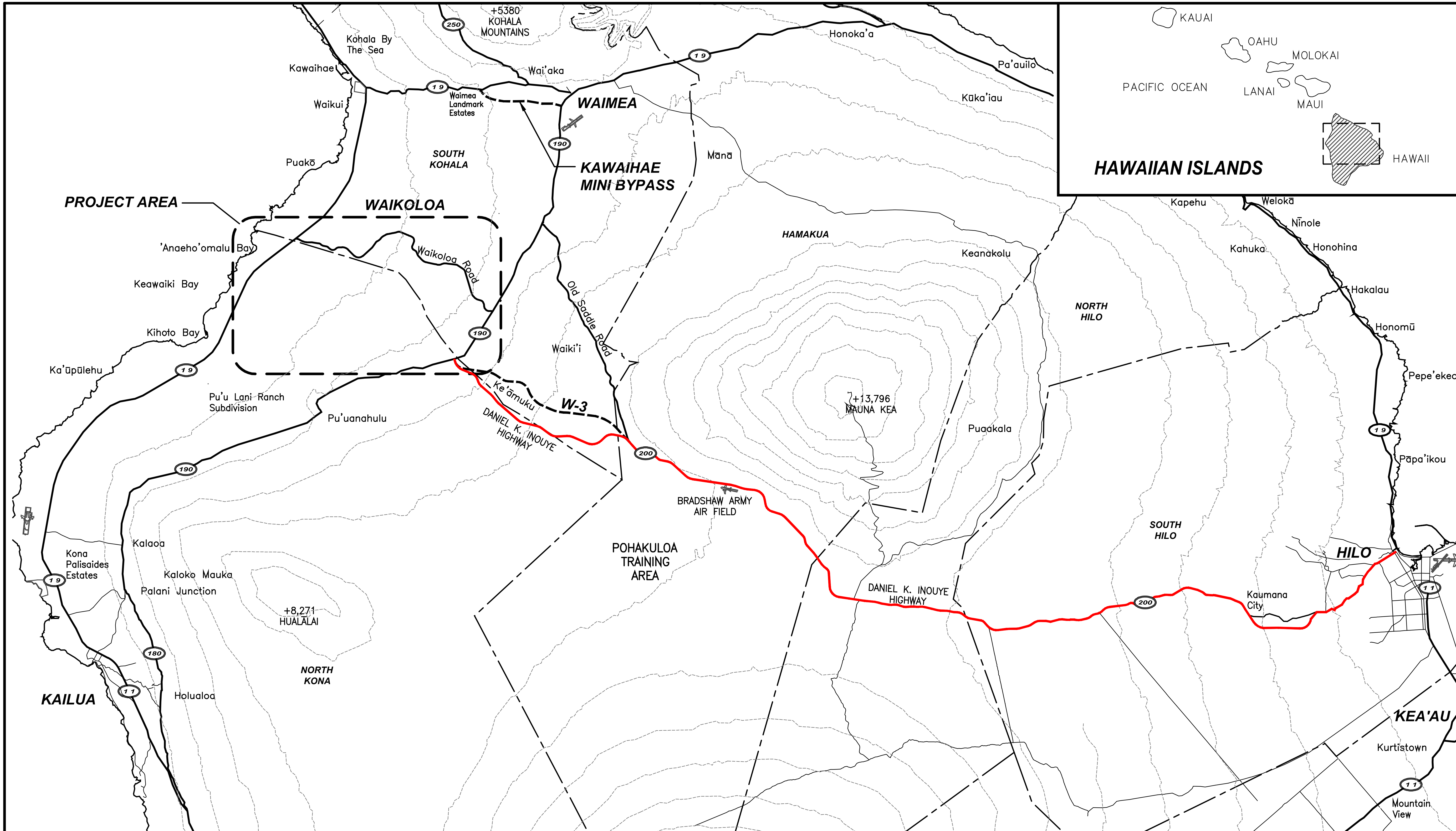
The Saddle Road Extension project had thus been on hold from 2003 to 2010. Following completion of environmental and engineering analyses for the Saddle Road realignment, HDOT and FHWA resumed efforts on preliminary design and environmental studies for the Saddle Road Extension project. The EIS process for the Saddle Road Extension was resumed in late 2011. A revised State of Hawai'i EISPN was issued in May 2012, and a National Environmental Policy Act (NEPA) Revised NOI was issued on March 11, 2014 (see ***Appendix A1***).

1.2 Lead Agencies and Environmental Impact Statement Process

An Environmental Impact Statement (EIS) identifies and assesses alternatives for a project, including the "No Action" alternative. The purpose of this EIS is to investigate the impacts to the physical, biological, social and cultural environment that would result from construction of the proposed Project and to devise mitigation measures to minimize potential adverse impacts. This EIS is intended to fulfill both State of Hawai'i EIS laws (Chapter 343, HRS) and NEPA[1].

FHWA and HDOT are serving as joint lead agencies to prepare this EIS. The Governor of the State of Hawai'i is the accepting authority for the EIS, under Chapter 343, HRS. The approving official for the EIS under NEPA is the Division Director for the FHWA, Central Federal Lands Highway Division (CFLHD). Additional federal requirements include the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU); Moving Ahead for Progress in the 21st Century Act (MAP-21); Fixing America's Surface Transportation Act (FAST Act); the National Historic Preservation Act; the Endangered Species Act; the Memorandum of Understanding (MOU) pertaining to coordination of the Clean Water Act Section 404 requirements (e.g., wetlands protection); and various others. SAFETEA-LU (signed into law on August 10, 2005) and subsequent revisions in MAP-21 (signed into law on July 6, 2012) include several new provisions intended to streamline the planning and environmental

[1]Chapter 343, Hawai'i Revised Statutes, and Hawai'i Administrative Rules, Chapter 200, §11; National Environmental Policy Act (NEPA) 42 U.S.C 4332; Council on Environmental Quality (CEQ) Regulations for Implementing NEPA (40 CFR 1500-1508); and Federal Highway Administration's Environmental Impact and Related Procedures (23 CFR 771).



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SADDLE ROAD EXTENSION

FIGURE 1.1 ~ PROJECT AREA

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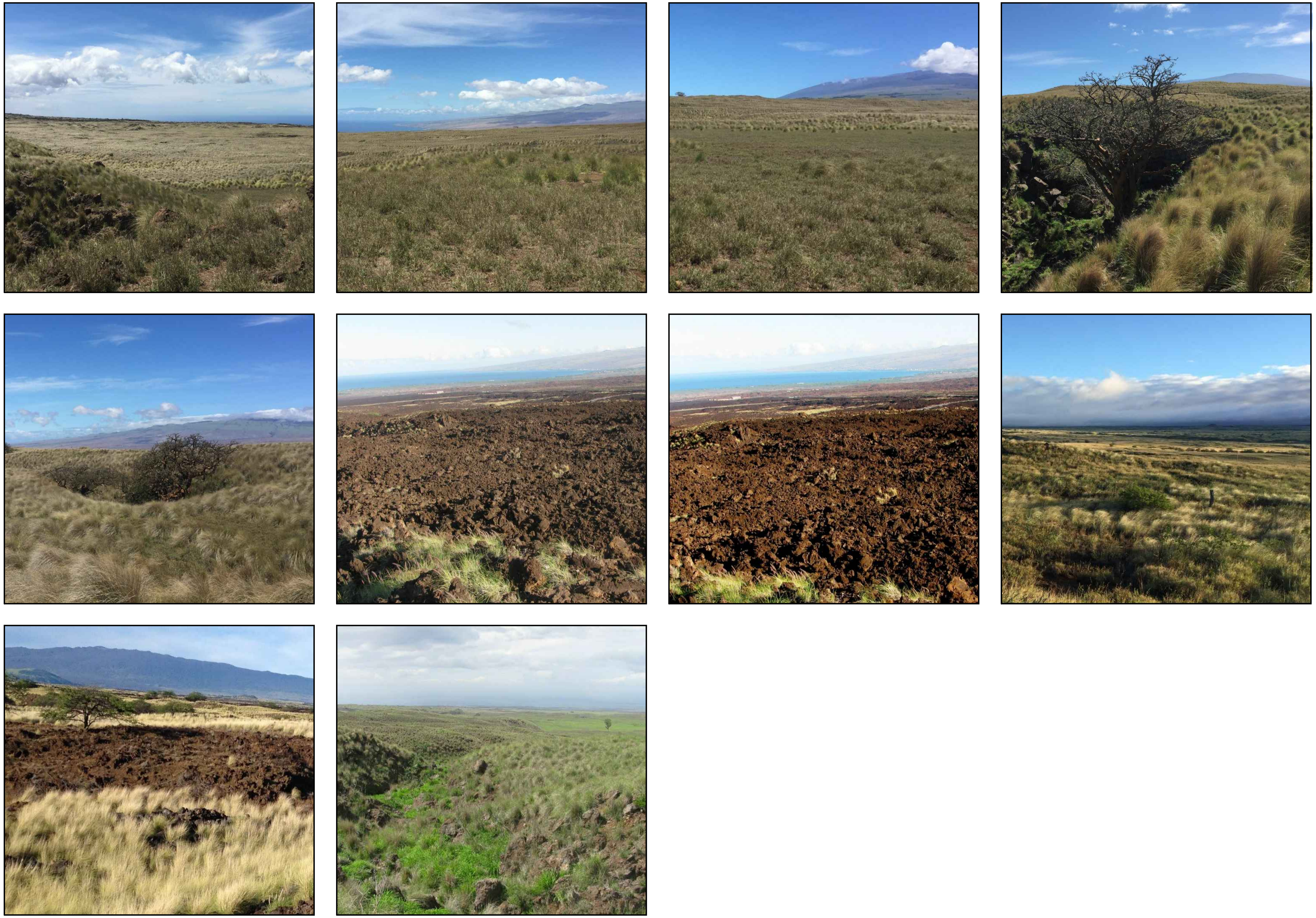

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SADDLE ROAD EXTENSION

FIGURE 1.2 ~ PROJECT AREA PHOTOGRAPHS

FILE: 99011-190 QUEEN K\Figures\FIG-1.2.DWG

review of highway projects[1]. Among the new procedures is the development early in the planning process of a Coordination Plan (CP) addressing how coordination and communication with agencies and the public will occur throughout the NEPA process. Goals of the CP include delivering an environmental document enabling sound decisions that:

- Address the concerns of local government entities and resource/regulatory agencies;
- Satisfy the mandates of the agencies with jurisdiction, while still meeting the purposes and needs of the Project; and
- Keep project planning on schedule and within budget.

The CP process includes inviting agencies to assist in the EIS process by serving as cooperating or participating agencies. A cooperating agency is any federal agency (or in special cases a State or local agency), other than a lead agency, that has jurisdiction or special expertise with respect to any environmental impact involved in the proposed project. Participating agencies include those “federal, State, tribal, regional, and local government agencies that have an interest in the Project and that have agreed to participate in the NEPA and scoping processes.” Cooperating and participating agencies are expected to play a critical role in defining the project, the project’s purposes and needs, the alternatives to be addressed, and methodologies to be employed. The agencies’ participation in the planning process is intended to improve the quality of roadway planning while fulfilling the mission of the agency.

The initial version of the CP was developed in May 2014. Thirty-seven federal, State and County agencies were invited to be involved in the Project as cooperating or participating agencies. The U.S. Army Corps of Engineers, Honolulu District (USACE) accepted cooperating agency status, and a number of agencies accepted as participating agencies. A CP meeting was held at State DOT-Highways Division offices in Hilo and Honolulu, Hawaiʻi on June 26, 2014. Seven agencies attended and provided input into the project purpose and need, alternatives and potential project elements (see ***Appendix A3*** for meeting materials, letters and other CP-related documents). At various points in the EIS process, additional consultation and/or meetings with participating and cooperating agencies will occur.

1.3 Purpose and NeedError! Bookmark not defined.

The Need for the Project is based on existing inefficiencies of the highway system. This includes circuitous routes that lead to additional vehicle miles traveled and thus increased fuel costs, vehicle emissions and time lost to driving that could be spent in work, social and recreational activities, as well as use of County roads for purposes more suited to State Highways. The following sections describe existing and future needs.

1 Details are contained in 23 United States Code (U.S.C.) Section 139, “Efficient Environmental Reviews for Project Decision-Making.” More information on the U.S. DOT environmental review process can be found on the FHWA website at http://www.fhwa.dot.gov/safetealu/index.htm.

1.3.1 Need for Improved Arterial Connection to State Route 19 from Daniel K. Inouye Highway (SR 200)

There is currently a long gap in the modern State Highway access between East Hawaiʻi and the coastal South Kohala/Kona area for motorists on the Daniel K. Inouye Highway (SR 200) (refer to ***Fig. 1.1***). Both the western terminus of the Old Saddle Road and the new, realigned western terminus of the Daniel K. Inouye Highway are located in the middle of pasture lands on Māmalahoa Highway (SR 190), far from most motorists' destinations. Presently, two options are available to access the center of Kailua town and points south in Kona. The first is via Māmalahoa Highway, which provides a relatively direct (36.7 miles) but winding and narrow route through upper Kona. This route lacks adequately wide shoulders for most of its length south of Waikoloa Road, and traverses a populated corridor with numerous streets and driveways for the last 8.7 miles. The other option is via Waikoloa Road (a long detour to the northwest along a County road that passes through a growing urban community) to SR 19, Queen Kaʻahumanu Highway, for a total distance of 42.8 miles. The route between the end of the Daniel K. Inouye Highway and the major intersection on Queen Kaʻahumanu Highway, Waikoloa Beach Drive, extends nearly 16 miles, although the straight-line distance is only 11 miles.

As part of six sequential construction efforts between 2002 and 2017, the FHWA and HDOT have made major improvements to segments of the Saddle Road (SR 200). This has resulted in a much shorter and faster route between East and West Hawaiʻi than either the old Saddle Road or the alternative SR 11 and SR 19 routes (refer to ***Fig. 1.1***). These improvements transformed the twisty, potholed, narrow Saddler Road into a modern State highway with a robust pavement structure, fewer and less severe minimal horizontal and vertical curves, good sight distance, wide shoulders, and passing lanes for uphill grades. In consultation with the citizen-led Saddle Road Task Force and neighborhood associations, the realignment was designed to bypass and reduce traffic for the ranching-residential community of Waikiʻi. A similar bypass was designed for the easternmost 5.5 miles of the Saddle Road through the Upper Kaumana neighborhood. This segment is currently under construction and is expected to be finished in late 2017, which will complete the Saddle Road Improvements project. While there have been major safety and operational improvements, an efficient connection from the Daniel K. Inouye Highway and the South Kohala/Kona coastal area is thus still lacking.

As each increment of the Saddle Road Improvements project has been completed, traffic volumes on Saddle Road/Daniel K. Inouye Highway have increased (***Table 1.1.1***). Although data are not always directly comparable because of differences in day of week surveyed, number of days surveyed, and precise location on the highway, counts by HDOT and FHWA show volumes consistently rising from an average daily traffic (ADT) of 843 in 1999 to 1,036 by 2004 to over 2,000 prior to opening the new western section of the highway in September 2013. Since April of 2014, permanent counting stations show ADT volumes of between about 2,750 and 4,000, varying by the month surveyed. As discussed in detail in Section 3.4.1 of this EIS, with or without the proposed Saddle Road Extension, a traffic model developed for the Project predicts a continuing, steady increase in traffic volumes at the western terminus of the Daniel K. Inouye Highway over the next 20 years. By the year 2035, an estimated 19,400 vehicles per day (vpd) will utilize the Daniel K. Inouye Highway. License plate counts conducted in the region indicate that a little over half the traffic on the Daniel K. Inouye Highway is between Hilo (and/or DKI destinations) and Kona, about a quarter is between Hilo and Waikoloa Village or the South Kohala resorts, and about 20 percent is between Hilo and Waimea. The need for the Saddle Road Extension existed at the Project's inception in 1999, but has become even more evident as traffic volumes on both the Daniel K. Inouye Highway and Queen Kaʻahumanu Highway continue to increase over time.

The predicted increase in Hilo-Kona/South Kohala traffic using the newly improved Daniel K. Inouye Highway emphasizes the need for an efficient, direct State Highway connection that is currently lacking.

Table 1.1 Average Daily Traffic Growth on Saddle Road

Month/year	ADT	Source
February 1994	843	1
2004	1036	2
March 2008	1728	3
November 2008	1327	3
December 2009	1626	3
November 2010	1648	3
April 2013	2168	3
March 2014	3096	4
April 2014	3012	4
May 2014	3015	4
June 2014	3038	4
July 2014	3119	4
August 2014	2983	4
September 2014	2475	4
October 2014	2569	4
January 2015	3365	4
April 2015	3415	4
July 2015	3592	4
October 2015	3663	4
January-September 2016 average	3952	4

1: 1994 Rust traffic study prep. for FHWA-CFLHD
2: HDOT traffic counts
3: FHWA-CFLHD traffic counts
4: Permanent station E. of SR 200/Old Saddle Road junction; ADT reduced 15% to estimate SR 200-only component

1.3.2 Need to Meet General Cross-Island Traffic Demand

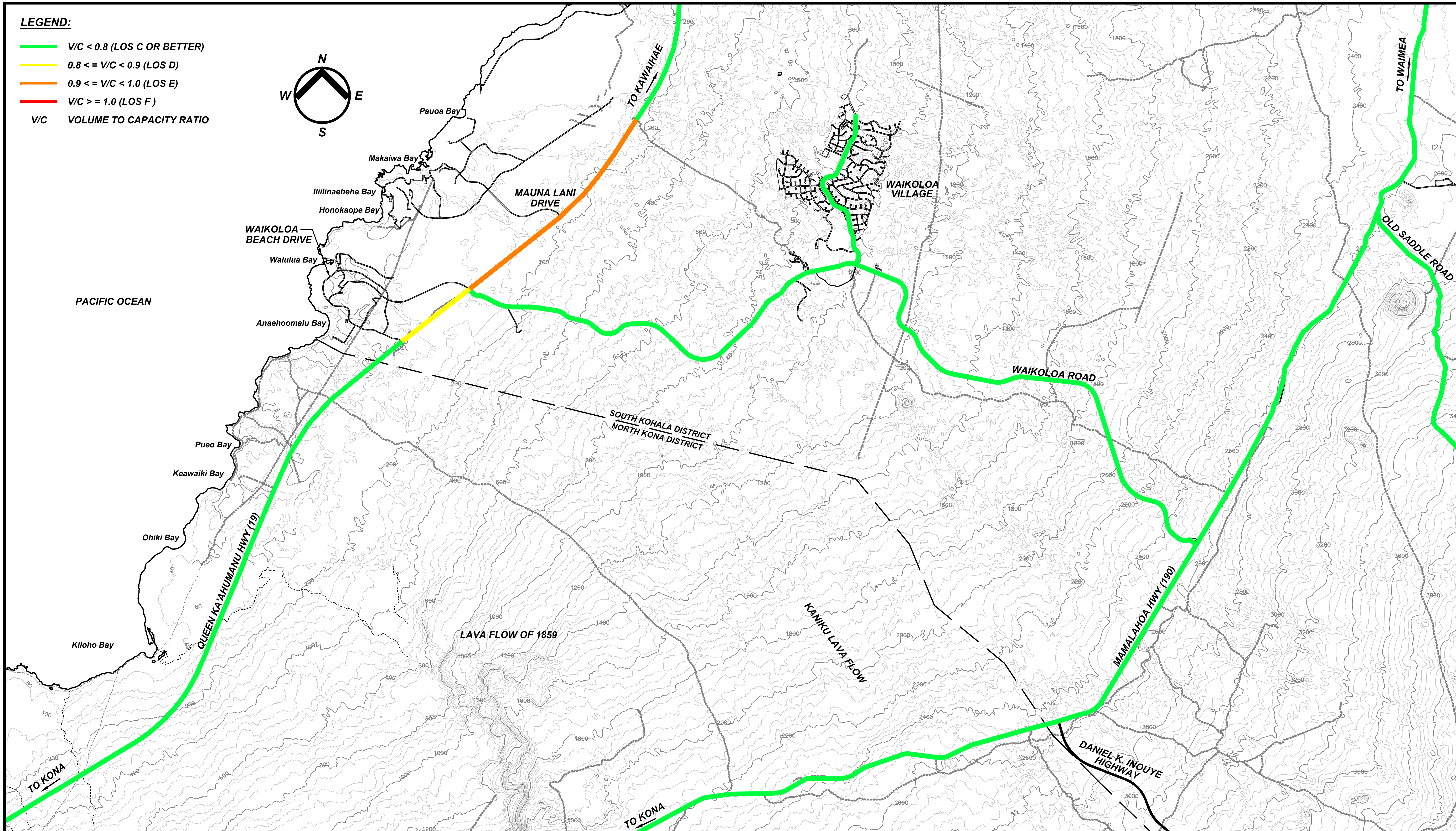
A closely related but distinct issue is the increase in the general volume of traffic in the South Kohala area, including motorists traveling between East and West Hawaiʻi. As discussed in Section 1.1, traffic generators include population centers (in particular, Hilo, Puna, Kona, Waimea and Waikoloa), job clusters (the Kohala and Kona coast resorts, the island's major government center in Hilo), educational facilities (UH Hilo and UH Center at West Hawaiʻi), a military base (Pōhakuloa Training Area), scientific facilities at Mauna Kea and Mauna Loa, and transportation infrastructure hubs (Hilo and Kona International Airports; Hilo and Kawaihae Harbors). This demand is met by the Daniel K. Inouye Highway (SR 200), by SR 11 (which takes a long route around the southern end of the island) and SR 19, transiting the Hamakua coast. SR 19, which provides a relatively direct and safe route between the three major population centers, services the large majority of this traffic, in particular commercial truck traffic, which contributes to the daily traffic congestion in Waimea during AM and PM peak hours.

The long-range *Federal-Aid Highways 2035 Transportation Plan for the District of Hawaii* (HDOT 2014) incorporated technical input and community values to guide decision makers in setting funding priorities and recommending multimodal transportation solutions. As part of the analysis, it examined growth trends in various parts of the Island of Hawaiʻi. Population, household, and employment information were grouped into geographical traffic analysis zones (TAZs). TAZs provide a general picture of where people live and work on the island. Forecasted socioeconomic data are important because they show where growth is programmed to occur, and where the transportation system could experience an increase in demand.

As discussed in detail in Section 3.3, population island-wide is forecast by HDOT to increase nearly 70 percent from 2014 to 2035 (HDOT 2014). The projected average growth rate of 2.5 % is slightly higher than the average rate of 1.6% projected by the Hawaiʻi Department of Business, Economic Development and Tourism (DBEDT) in their latest, 2012 projections for the State of Hawaiʻi (http://dbedt.hawaii.gov/economic/economic-forecast/2040-long-range-forecast/ accessed February 2017). From the standpoint of ensuring adequate highway capacity, the HDOT forecast may be considered conservative. The most significant growth is expected in the Puna District south of Hilo, where households and population may more than double. On the west side of the island, South Kohala and certain areas of Kona are also expected to experience significant population growth.

Traffic operations can be described by volume-to capacity (V/C) ratios and Level of Service (LOS). The V/C measurement compares the actual vehicle demand versus the capacity of a facility. The capacity of a facility depends on a variety of factors including the number of lanes, the operating speed, and the number of driveways or intersections on a roadway. A V/C ratio of 1.0 indicates that vehicle demand is equal to the capacity of the facility, and ratios above that correlate to LOS F. The LOS generally describes operating conditions in 6 letter-grade categories. LOS A typically represents conditions with little or no delay, while LOS F indicates poor operations with long wait times or extreme congestion.

In 2007, near the Kona International Airport, traffic volumes on Queen Kaʻahumanu Highway (SR 19) were around 21,000 vpd, which increased going north to around 23,000 per day near the Kohala Coast resorts. Traffic on SR 19 then showed a reduction in the vicinity of Waimea and Honokaʻa. As shown in ***Figure 1.3b***, this level of traffic involved approach to capacity that resulted in LOS E north of Waikoloa Road. Waikoloa Road, Māmalahoa Highway, and the old Saddle Road all had good volume to capacity ratios.



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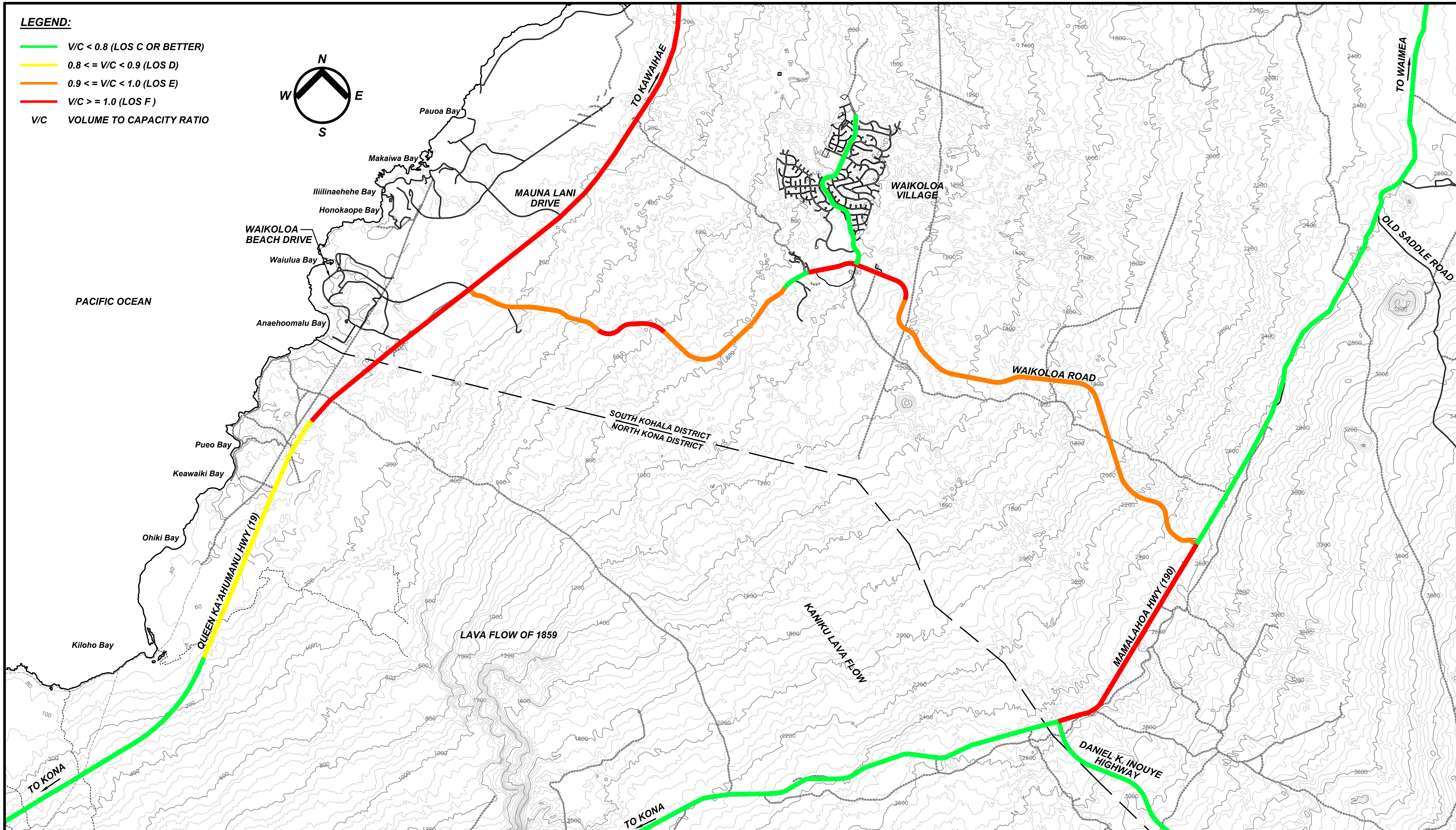
GRAPHIC SCALE IN FEET

SADDLE ROAD EXTENSION

FIGURE 1.3A ~ CAPACITY DEFICIENCIES IN PROJECT AREA HIGHWAY SYSTEM 2007

Source: Bike Plan Hawaii, Hawaii Department of Transportation (2003)

FILE: 99011-190 QUEEN K\Figures\FIG-1.3A.DWG



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SADDLE ROAD EXTENSION

FIGURE 1.3B ~ CAPACITY DEFICIENCIES IN PROJECT AREA HIGHWAY SYSTEM 2035

Source: Bike Plan Hawaii, Hawaii Department of Transportation (2003)

FILE: 99011-190 QUEEN K\Figures\FIG-1.3B.DWG

In the future, traffic is expected to increase due to larger population, more jobs, and new developments. By 2035, volumes on Queen Kaʻahumanu Highway (SR 19) are forecast to increase to the point where volume exceeds capacity, leading to LOS F or worse, from Kawaihae to Waikoloa Beach Drive (refer to ***Fig. 1.3b***). All roads near Waimea will be at or near capacity, and all of Waikoloa Road and the portion of Māmalahoa Highway (SR 190) between the Daniel K. Inouye Highway (SR 200) and Waikoloa Road will be at or over capacity. The Daniel K. Inouye Highway itself was projected to still have V/C ratios well below 1.0 and good LOS.

The Daniel K. Inouye Highway offers an important alternative route for much of the future traffic that is forecast to cause congestion on SR 19 route from Hilo to Honokaʻa, and on to Waimea, Kawaihae and Waikoloa. This is particularly true for automobiles, light trucks, and light or empty cargo trucks. Research conducted for the Saddle Road Improvements EIS (U.S. DOT 1999, Volume V) included traffic studies and trip purpose surveys. Military trips made up only 2 to 4 percent of all Saddle Road traffic in the 1990s. Residents used the highway to drive between the east and west sides of the island for recreation, shopping, business trips and limited commuting. Business and recreation were cited by local survey respondents as the most common trip purpose. In addition, about a quarter of visitors surveyed indicated that they used the Saddle Road either to access attractions located in the Saddle or for cross-island travel. Although traffic volumes have changes, and visitor use has increased with the lifting of rental car prohibitions on this highway, the general pattern of use remains similar.

It is important to note that regardless of traffic growth on the Daniel K. Inouye Highway, traffic volumes are still forecasted to rise on SR 19, as Waimea and the South Kohala coastal resort areas continue to grow. Although the Saddle Road Extension could assist in accommodating some of the expected growth in traffic volumes, there is an independent need for additional capacity in the SR 19 system. These are expected to be met by improvements that are currently being proposed in the Waimea area, such as the Kawaihae Road Mini-Bypass (refer to ***Fig. 1.1***). The Saddle Road Extension and the Kawaihae Road Mini-Bypass are complementary projects that will jointly accommodate increased volumes on appropriately designed highways that reduce stress and congestion on local roads and communities.

The growing volume of cross-island traffic creates a need for a system of highway improvements that increases cross-island capacity by offering efficient, safe alternative routes. Such a route will be critical for major traffic crashes, fires, floods and landslides that close SR 19.

1.3.3 Commercial and Military Traffic Need

Ports at Kawaihae and Hilo (refer to ***Fig. 1.1***), airports at Kona and Hilo, and commercial, manufacturing and civic centers generate substantial commercial truck traffic between East Hawaiʻi and West Hawaiʻi. Freight mobility is critical to the economic vitality of the island. Currently, Hilo Harbor handles annually 1.7 million tons, or approximately 144,800 20-foot cargo container equivalent units (TEUs), of cargo. Kawaihae Harbor handles 1.0 million tons, or roughly 85,800 TEUs of cargo. Kona and Hilo International Airports accommodate 22,300 tons and 24,100 tons respectively. Freight vehicles use arterial and local roadways to distribute goods to communities around the island, potentially adding to congestion due to the lack of parallel or alternative routes along much of the island (HDOT 2014).

As the economy grows, cargo volumes both into and out of the island are expected to increase. By 2035, highway borne freight is expected to increase by 47 percent. The airports are anticipated to handle nearly 70,000 tons of cargo, while the commercial harbors would process over 4 million tons (or approximately 339,600 TEUs) of cargo by 2035. Compared to current conditions, a significant number of additional freight vehicles would be on the roadway system to deliver goods in the future. This increase in freight operations will likely worsen congestion on highways near the airports and harbors, and traffic operations need to be improved in order to avoid costly delays and adverse impacts to the economy.

In West Hawaiʻi, highway freight volume is expected to grow in the next 20 years as the economy continues to expand and the Daniel K. Inouye Highway and other highway improvements provide more efficient routes. The sustained seven percent grades and a summit 6,500 feet above sea level make the Daniel K. Inouye Highway unsuitable for certain trucks and loads. However, since completion of the western leg of the Saddle Road in September 2013, truck traffic has increased in volume at a greater proportion than automobile traffic. In addition to serving Daniel K. Inouye Highway traffic, the proposed Saddle Road Extension could also provide an effective route for cargo between Hilo and the Kohala Resorts and Kailua and other parts of Kona (refer to ***Fig. 1.1***). This could include solid waste (as well as its useful byproducts) destined for the Puʻuanahulu Sanitary Landfill, located near the eastern terminus of the proposed Saddle Road Extension, or other sites. Use of the Saddle Road Extension could remove a large volume of truck traffic from Waikoloa Road, where the geometry and lack of passing lanes cause delays for other motor vehicles stuck behind slow trucks.

The military currently hauls materials, equipment, and supplies, including ammunition, from Kawaihae Harbor to Pōhakuloa Training Area (PTA) via Queen Kaʻahumanu Highway, Waikoloa Road and Daniel K. Inouye Highway (refer to ***Fig. 1.1***). Located on the plateau saddle between Mauna Loa, Mauna Kea and the Hualālai volcanoes, the 109,000-acre PTA is the largest military installation in the state of Hawaiʻi. It was developed during World War II and now has barracks to accommodate more than 2,000 troops. It includes Bradshaw Army Airfield with its 3,700-foot long runway that accommodates smaller aircraft, an impact area used for bombing and gunnery practice, over 30,000 acres for large maneuvers. The 25th Infantry Division of the U.S. Army and the 3rd Marine Regiment often use the base for four to six-week training period, during which a wide range of weapons can be used. Ammunition cargo is restricted through urban areas. As Waikoloa Village expands, the military may be precluded from using Waikoloa Road through the village area. If the Kawaihae Road Mini-Bypass is constructed, it will provide an alternative route avoiding urban areas; however, it will require travel along a portion of Māmalahoa Highway, which is narrow and winding. A more appropriate and direct route where land use directly adjacent to the highway could be regulated is thus desirable.

There is a need to provide a direct, modern State Highway route that avoids urban areas to the extent feasible and accommodates both passenger vehicles and slow-moving cross-island truck traffic and military traffic.

1.3.4 Need to Improve Safety

The present routes between the Māmalahoa Highway (SR 190) and Queen Kaʻahumanu Highway (SR 19) between Kawaihae and Kailua – which include Māmalahoa Highway itself, Waikoloa Road, and Kawaihae Road (SR 19) – are not built to modern, inter-regional highway standards. Kawaihae Road experiences heavy truck traffic associated with freight hauling to and from Kawaihae Harbor, exacerbating safety concerns. The present courses of the Māmalahoa Highway and Kawaihae Road pre-date the 1960s. Waikoloa Road, designated as a Secondary Arterial in the *County of Hawaiʻi General Plan* Facilities Map, was built privately and accepted by the County on July 1, 1972 (Māmalahoa Highway to Paniolo Avenue) and on December 19, 1975 (Paniolo Avenue to Queen Kaʻahumanu Highway). In many areas, curves reduce the safe speed to 45 MPH or less, which drivers are sometimes unprepared for. Wide shoulders are not present for emergencies and vehicle correction. Although each of these roads is safe for driving when drivers recognize facility limitations, with increasing traffic, accidents on all these highways can be expected to rise.

There is a need to provide a route serving regional traffic that to the greatest extent practicable optimizes safety by conforming to State highway standards for curves, grades, pavement and shoulders.

1.3.5 Purpose of Project

While the Need for the Project describes existing deficiencies, the Project Purpose defines the problem to be solved. Defining the Purpose is necessary to determine the range of alternatives to be considered; each alternative must meet the Purpose and address the identified Need to be considered a viable solution.

The overarching, primary purpose of the proposed project is to provide a modern State Highway link connecting Māmalahoa Highway (SR 190) and Queen Kaʻahumanu Highway (SR 19) for motorists traveling between Hilo and coastal South Kohala/Kona on the Daniel K. Inouye Highway (SR 200) (refer to ***Fig. 1.1***). Secondary and supporting purposes to this primary goal are to:

- Improve the general efficiency and operational level of traffic movement between East Hawaiʻi and West Hawaiʻi;
- Support special traffic needs, including commercial truck traffic and military traffic between Kawaihae and the Pōhakuloa Training Area (PTA); and
- Improve safety for all users.

Public input concerning the purpose and need was solicited via the May 23, 2012. State of Hawaiʻi EIS Preparation Notice and the 30-day public comment period that ensued, during which a public meeting was held at Waikoloa Elementary and Middle School on June 14, 2012 (see ***Appendix A5*** for meeting materials and notes).

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2 ALTERNATIVES

2.1 Alternatives Considered

A number of preliminary alternatives were conceptualized by the FHWA and HDOT based on at least some potential to satisfy the Project's purpose and need, which is described above in Section 1.3. The alternatives studied included:

- Eleven alternative highway alignments
- Transportation Systems Management/Travel Demand Management (TSM/TDM)
- Mass Transit
- No Action Alternative

2.2 Screening Process

The alternatives were analyzed during an initial screening process for their potential to satisfy the Project's purpose and need. Those alternatives which after the initial screening appeared to have little such potential, along with others that would involve inordinate costs or severe environmental impacts, were dismissed from further analysis. A second screening carried forward those alternatives that had better potential to satisfy purpose and need. They were evaluated on a range of criteria involving purpose and need, environmental effects, and operational characteristics.

2.2.1 Initial Screening

The initial screening focused on the alternative's potential to satisfy several basic criteria of the Project's purpose and need in a reasonable manner; i.e., provide a modern State Highway link for cross-island traffic utilizing the Daniel K. Inouye Highway, as well as improve the general operational level of all cross-island traffic, improve safety, and support special commercial truck military traffic needs.

Notwithstanding the specific purpose and need, the alternatives analysis included thinking broadly about the transportation issue involved. It investigated several non-highway solutions that could address the purpose and need in indirect but potentially meaningful ways. In some transportation projects, for example, the majority of motorists might be workers commuting to and from very specific locations. In such cases, car-pooling or mass transit might reasonably satisfy the overall purpose and need without the need for any new construction. Furthermore, for the highway alignment alternatives, the analysis did not precisely define the western terminus at the outset in order to avoid undue constraints on alternative selection that might too narrowly address the purpose and need and miss a route that could partially address this project's purpose and need and also have a broader overall benefit with fewer environmental impacts.

Each alternative considered is described and evaluated below.

2.2.1.1 Transportation Systems Management/Travel Demand Management (TSM/TDM)

This alternative includes such modifications as restrictions involving road use, including work- and school-time staggering, car-pool incentives, High Occupancy Vehicle (HOV) lanes and minor changes to existing roads, such as optimizing signalization or utilizing roadway shoulders for auxiliary lanes. These strategies can be highly effective in avoiding new highway construction in urban areas, which often entails high costs and major community disruption. However, such measures are not capable of providing better connections between rural regions with sparse road networks, as is the case here.

Several hundred residents of North and East Hawaiʻi who work at Kohala Coast hotels already practice car-pooling or utilize special buses (see Section 2.2.1.2, below). HOV lanes, which are dedicated lanes where travel is permitted only by vehicles carrying over a specified number of occupants (typically 2 or 3), would be feasible in the project area only on Queen Kaʻahumanu Highway (SR 19), where sufficient right-of-way exists. Such lanes would be more difficult and expensive to establish along Waikoloa Road and the major paths from Hamakua and Waimea (SR 19 and 190), where sufficient right-of-way does not currently exist. There are also major topographic or environmental obstacles such as archaeological sites and hedgerows of scenic trees, as well as homes and other structures. High levels of community disruption and expense would be needed to provide such rights-of-way. In any case, the transportation problem underlying the purpose and need for this project is not so much peak-hour congestion, which HOV lanes may be effective at solving, but the lack of a direct connection between the Saddle Road/Waimea and the South Kohala coastal resorts and Kona. TSM/TDM could also involve other, “minor” changes to roads, including use of existing shoulders for through or travel lanes and better signalization or intersection configuration to optimize queuing. Aside from the fact that few traffic signals exist and there are very few segments with wide shoulders that can be converted, these approaches would not confront the basic problem of an indirect connection.

Since the TSM/TDM Alternative could not meet the purpose and need criteria of improving safety for all users, the efficiency and operational level of traffic movement, and the ability to accommodate special needs traffic, it was dismissed from further consideration.

2.2.1.2 Mass Transit

The public transportation system on the island of Hawaiʻi consists of a County bus system, a vanpool system and a rideshare program that involves a database matching drivers and passengers. A fleet of 25 buses serves several dozen routes around the island. Several routes serve the South Kohala area. According to discussions with the Hawaiʻi County Mass Transit Agency over the last 15 years, the buses have usually run at 80 percent occupancy. Surveys indicate that the majority of riders are workers commuting between East Hawaiʻi and Waimea and the West Hawaiʻi resort areas, and the system is effective for getting workers to their jobs, which are concentrated in one location. Relatively few riders other than workers use the five South Kohala buses. It is expected that the bus and rideshare system will continue to expand to meet this important demand – the resort industry in South Kohala supports between 1,000 and 2,000 jobs.

However, the majority of motor vehicle traffic utilizing project area highways is derived from other sources. Visitor travel (including rental cars and tour buses), business travel, cargo and service trucks, shopping, and recreation are important sources of traffic for consideration in this analysis. According to discussions with Mass Transit Agency officials, there appears to be little potential to substitute mass transit for these components, which require flexibility, multiple stops, cargo capacity, and out-of-the-way destinations. And just as with the TSM/TDM strategy, mass transit does not provide more efficient connections between rural regions with sparse road networks, as is the case here. Furthermore, mass transit cannot meet the growing demands of commercial and military users of the road. Mass transit will benefit from a new highway in the project region, but it cannot substitute for the Project.

As the Mass Transit Alternative could not meet the purpose and need criteria of improving safety for all users, the efficiency and operational level of traffic movement, and the ability to accommodate special needs traffic, it was dismissed from further consideration.

2.2.1.3 Related Projects/Improvements to Existing Corridors

The alternative of widening portions of existing roads and/or reliance on another planned highway project in the region was evaluated for its ability to address the Project purpose and need.

Currently unplanned but feasible are projects that could substantially widen all or portions of the Māmalahoa Highway (SR 190) and Kawaihae Road (SR 19). As many as 18,000 vehicles per day may be present in central Waimea. Vehicles that make non-stop trips along this route add to the congestion in central Waimea that results from in-town trips and regional trips with Waimea stops. Widening one or both of these highways would accomplish, albeit with substantial difficulty, expense and community disruption, more highway capacity through Waimea. However, both routes through Waimea have relatively narrow rights-of-way and a concentration of businesses, community facilities, scenic tree corridors, and historic buildings. Widening of these Waimea roads within town would cause extreme disruption to businesses and traffic, and would seriously impact the rural character of the town. Widening would be more practical in the open ranch lands between Waimea and Waikoloa Road, and on Kawaihae Road west of Kohala View Estates, but substantial segments of both roads would require large-scale realignment to meet modern State highway standards. For Māmalahoa Highway, this would cause community disruption in Puʻu Anahulu, degradation of native forest in Puʻu Waʻawaʻa and Kaʻūpulehu, and would require acquisition of public hunting areas. For Kawaihae Road, some existing roadside residences and businesses would be displaced, and there would be substantial costs for earthwork and drainage structures because of the steep, gullied topography that contains jurisdictional waters of the U.S. Furthermore, the construction period would be disruptive for existing traffic. The disadvantages of these potential projects far outweigh any advantage of utilizing existing State Highways right-of-way for segments of the Project.

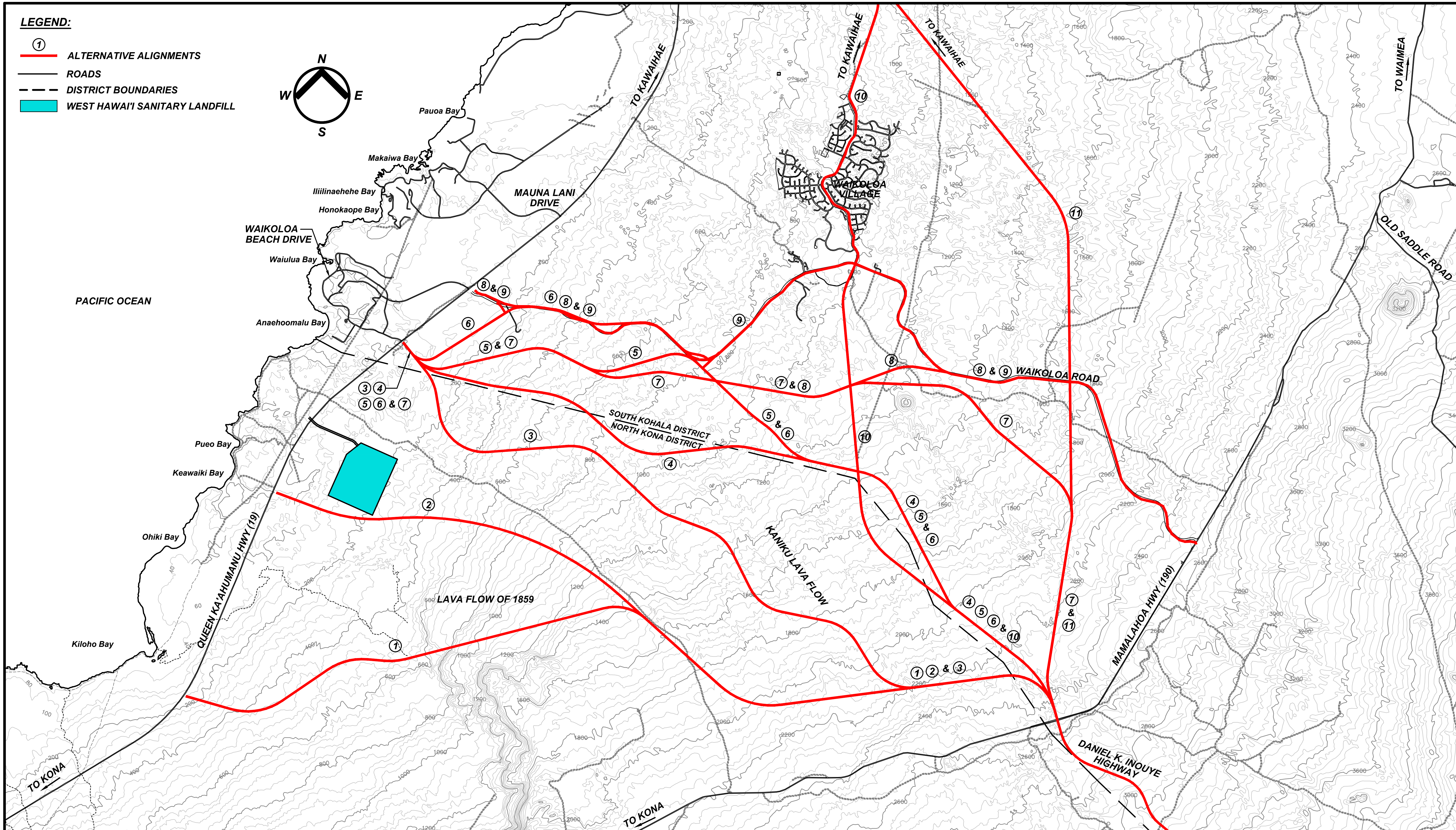
Since widening existing roads would not meet any aspect of the purpose and need of the project without substantial community and environmental disruption, this alternative was dismissed from further consideration for the purposes of this EIS.

The Kawaihae Road Mini-Bypass (refer to ***Fig. 1.1*** for location) is a project proposed by HDOT in 2016 that would route traffic bound between Kawaihae and Māmalahoa Highway (SR 19 and SR 190) in Waimea around the Lindsey Road/Kawaihae Road portion of central and western Waimea Town. The Project is expected to be included in the FY2018 to FY2020 Statewide Transportation Improvement Projects (STIP) list. This project would reduce congestion through Waimea without the extreme disruption of widening the highways discussed in the previous paragraph. It would also address part of the Saddle Road Extension's project purpose and need by providing a more efficient route for general East Hawaiʻi-West Hawaiʻi traffic through at least a portion of central Waimea. The Kawaihae Road Mini-Bypass was advanced for study after a longer bypass project (known as the Kawaihae Road Bypass) that extended all the way to Kawaihae Harbor was withdrawn by HDOT. The reasons for cancelling the longer project were total costs (which were over $300 million) and unavoidable impacts on highly significant historic properties. HDOT has determined that much of the benefit of the Kawaihae Bypass could be accomplished by a much shorter and less expensive project that minimizes environmental impact. The planned replacement of Waiaka Bridge, and perhaps other projects involving minor realignment, passing lanes and/or shoulder widening on the lower portion of Kawaihae Road, would also benefit the Kawaihae Road corridor. The forecast traffic congestion between Kawaihae and the Waimea/Hamakua area, as well as that within central Waimea, indicates that these improvements are required independently of the proposed Saddle Road Extension project. This proposed Mini-Bypass also offers and efficient route to conduct military traffic between Kawaihae Harbor and Māmalahoa Highway. However, as the great majority of DKI Highway traffic involves motorists bound between Hilo and the Waikoloa/Kona areas, the Mini-Bypass would not efficiently accommodate motorists using the DKI Highway to access their destinations. *The Kawaihae Road Mini-Bypass could not substitute in key purpose and need respects for the proposed Project, and it was thus dismissed from further consideration for the purposes of this EIS. Because of its independent utility, the Kawaihae Road Mini-Bypass is being considered in a separate EIS currently in planning by HDOT.*

Widening of all or a portion of Waikoloa Road to include additional lanes would also involve substantial re-routing to meet modern State highway standards. However, this approach has the advantage of at least partially meeting the purpose and need of the Project, because it would provide an outlet for DKI Highway traffic, additional lanes for East Hawaiʻi-West Hawaiʻi traffic, and a State Highway for special needs traffic. *Because of the potential to meet the Project's purpose and need, three variants of this approach were advanced for consideration in the second screening of the Alternatives Analysis as Build Alternatives 6, 8 and 9, discussed in the next section.*

2.2.1.4 Alternative Highway Alignments

All alternative alignments would involve construction of a new highway beginning at the Daniel K. Inouye Highway terminus along the Māmalahoa Highway and ending at a point somewhere on the Queen Kaʻahumanu Highway. ***Figure 2.1*** depicts these alternatives, which are described below.



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SADDLE ROAD EXTENSION

FIGURE 2.1 ~ OVERVIEW OF PRELIMINARY ALTERNATIVE HIGHWAY ALIGNMENTS

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Alternatives 1 and 2 angle south towards Kailua, reducing the distance for the major traffic stream traveling the Saddle Road. Alternative 1 terminates approximately 5.8 miles south of Waikoloa Beach Drive. Alternative 2 terminates near the West Hawaiʻi Sanitary Landfill at Puʻuanahulu, which is approximately 1.8 miles south of Waikoloa Beach Drive. A part of each route occupies State land used for hunting.

The top quarter of Alternative 3 follows Alternatives 1 and 2. Alternative 3 then turns north and terminates at the southern leg of Waikoloa Beach Drive. The majority of Alternative 3 is located within State hunting lands. Alternatives 4, 5 and 7 are located on pasture land to the south of the existing Waikoloa Road and remain on private land, with the exception of a short segment of Alternative 4 that enters slightly into the State land to avoid a rock quarry. The *mauka* [upper elevation] portion of Alternative 7 swings farther north from Alternatives 1-6 and affords an opportunity for a future connection along the *mauka* section of Waikoloa Road.

Alternative 6 is similar to Alternatives 4 and 5 but would rebuild and add additional traffic lanes to the bottom quarter of the existing Waikoloa Road, instead of building an entire new highway in that location.

Alternatives 8 and 9 would involve the redesign and reconstruction of portions of Waikoloa Road to meet modern standards as well as the addition of two travel lanes. Alternative 9 closely follows the existing Waikoloa Road right-of-way. Alternative 8 diverges from Waikoloa Road and Alternative 9 in the vicinity of Puʻu Hinai and reconnects to them approximately 3.2 miles to the west, thus avoiding the Waikoloa Village area. Alternatives 8 and 9 also include the addition of two travel lanes to the existing Māmalahoa Highway from the proposed Saddle Road terminus to the existing Waikoloa Road.

Alternatives 10 and 11 reverse the regional focus of traffic movement assumed in the others by proceeding from the DKI Highway terminus to Kawaihae, benefiting harbor-bound traffic. Alternative 10 uses a portion of the interior roads of Waikoloa Village, and Alternative 11 builds an entirely new highway *mauka* of the village. These Alternatives are consistent with at least one element of the Hawaiʻi County General Plan, which calls for a Secondary Arterial connection between Waikoloa and Kawaihae.

2.2.1.5 No Action

The No Action Alternative assumes that no new highway corridor would be built and that no major improvements to existing transportation corridors other than those listed in Section 2.2.1.3 (*Related Projects/Improvements to Existing Corridors*) would occur. Minor widening and signalization projects, particularly on Waikoloa Road, would likely be undertaken in response to increasing congestion.

The No Action Alternative does not satisfy any of the purpose and need criteria. Traffic exiting the DKI Highway would continue to lack a direct connection to its major destinations of Kona and other important destinations in the South Kohala resort areas and Waikoloa Village. Traffic bound to and from these destinations would still be required to use Māmalahoa Highway (SR 190) through *mauka* Kona, or Māmalahoa Highway to Waikoloa Road, stressing the capacity of these roads, which are not built to modern State Highway standards. Commercial truck and PTA-Kawaihae military traffic would continue to lack a route with passing lanes that allow them to climb between Queen Ka‘ahumanu Highway and Māmalahoa Highway, avoiding Waikoloa Village. Bicycle traffic from the DKI Highway bound for Queen Ka‘ahumanu Highway would continue to make the transition from wide shoulders that are well-separated from the motor-vehicle traffic lanes to roads with shoulders that are minimal to non-existent.

However, the No Action Alternative provides a baseline for comparing how new transportation modifications or improvements would accomplish the purposes related to increasing capacity, improving circulation efficiency, improving traffic safety, and satisfying special needs. It also provides a reference base to measure impacts to the social and physical environment, both beneficial and adverse. The No Action Alternative was therefore advanced for study in the EIS.

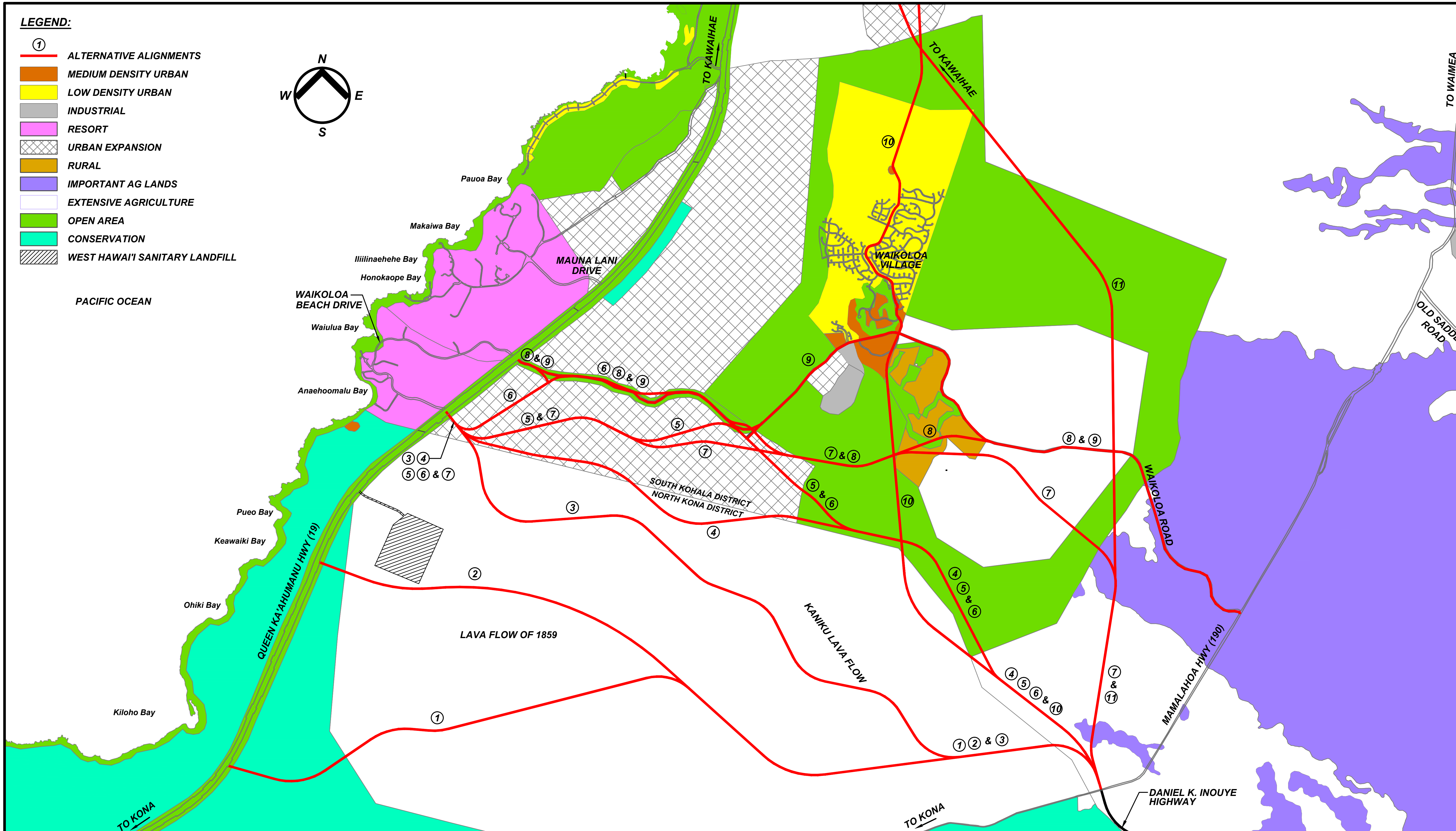
2.2.2 Second Screening

The next phase of alternative evaluation consisted of developing and rating the remaining action alternatives (eleven highway alignments) on important selection criteria, including specific environmental resources and design considerations. The following summarizes the findings for each criterion, followed by a table that provides an overall rating for each alternative.

Conformance with State and Regional Plans/Consistency with State Highway System

A number of State and County plans specify policies, goals, and objectives related to the location and design of highways. The most applicable plans to the proposed project are the *County of Hawai‘i General Plan* (Hawai‘i County Planning Department 2005), the *Kona Community Development Plan* and the *South Kohala Community Development Plan* (CDP) (Hawai‘i County Planning Department 2008a and 2008b), and the *Hawai‘i Long Range Land Transportation Plan* (HDOT 1998), which specifically consider transportation and/or socioeconomic factors. An extension of Saddle Road extending between the proposed (at the time) Saddle Road western terminus and Queen Kaahumanu Highway in the vicinity of the Waikoloa Resort is illustrated in all of these documents.

Alternatives 1 through 6 best conform with the recommendations of these plans. They directly carry traffic from the Saddle Road terminus to the principal current and projected destinations (Kona and the West Hawai‘i resort areas). Alternative 7 veers north and is slightly longer and therefore slightly less efficient because it increases travel time. Alternatives 8 and 9 provide for improved connections between Māmalahoa Highway and Queen Ka‘ahumanu Highway, but do not provide convenient connections to the Saddle Road terminus. Alternatives 10 and 11 access Kawaihae Harbor but do not provide convenient connections to the Kona region as recommended by the Hawai‘i County General Plan Facilities Map.



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SADDLE ROAD EXTENSION

FIGURE 2.2A ~ GENERAL PLAN LAND USE DESIGNATIONS

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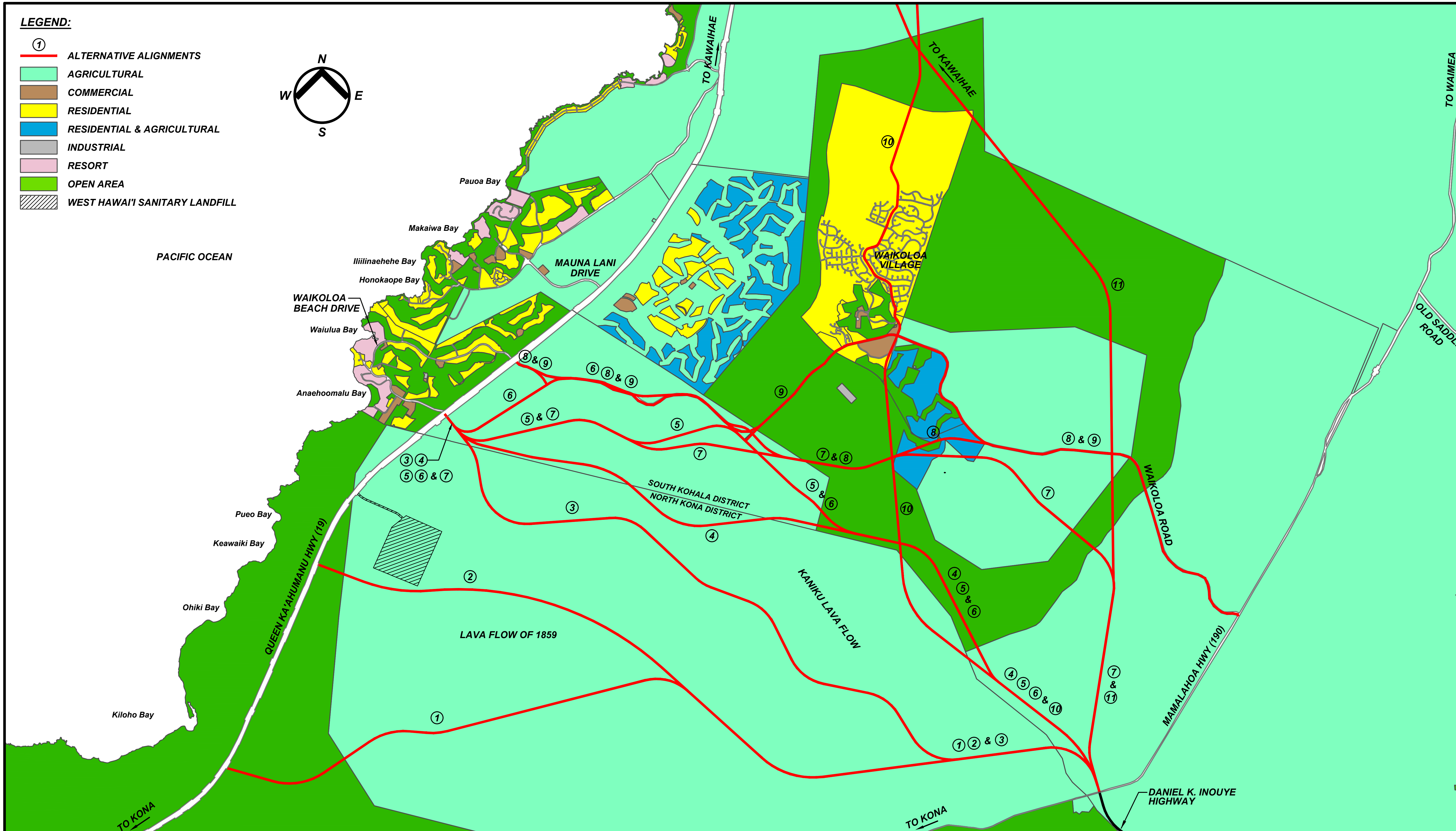

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SADDLE ROAD EXTENSION

FIGURE 2.2B ~ COUNTY ZONING MAP

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Impacts on Zoned/Entitled Lands

The 2005 General Plan's Land Use Pattern Allocation Guide Map (LUPAG) established the preferred basic urban and non-urban form for the County, with the Waikoloa Village Conceptual Plan, part of the South Kohala CDP, focusing in on this portion of South Kohala (refer to ***Fig. 2.2a***). These reflect desired growth patterns, while County zoning represents current land use entitlements. There are several broad patterns for the area between Māmalahoa Highway and Queen Ka'ahumanu Highway from Kawaihae south to roughly Kiholo Bay. All land within the Kona portion of this area is designated Extensive Agriculture or Conservation. South Kohala *mauka* of Waikoloa Village is designated Extensive Agriculture or Important Agricultural Land. Land in South Kohala within and immediately surrounding Waikoloa Village is designated Low Density Urban, and land *makai* of Waikoloa Village has a mixture of designations, including Urban Expansion and Extensive Agriculture. This is the primary portion of the project area where expansion of urban land uses was planned in 2005. Current County zoning for these areas is mostly Agriculture or Open, aside from the urban core of Waikoloa Village and some urban zoning *makai*. County zoning for most of the land area designated in the LUPAG as Urban Expansion remains Open or Agriculture.

Generally speaking, new State highways may serve planned development by providing needed access, but they can also adversely affect plans for future development through noise and visual impacts or by imposing a dividing barrier. State highways meant to efficiently conduct inter-regional traffic are also less effective if they have too many accesses. As for the proposed Saddle Road Extension, preliminary Alternatives 1, 2 and 3 completely avoid any lands that are planned or entitled for further development, with routes that mainly stay on land designated for Extensive Agriculture. Alternative 1 encroaches on land designated Conservation in the LUPAG. Alternatives 4, 5 and 6 pass through areas currently zoned for agriculture and open space, with certain portions also designated in the General Plan, if not the South Kohala CDP, for Urban Expansion. Alternatives 7, 8, 9, and 11 are similar, but also touch on at least some areas zoned and designated in both the General Plan and the CDP for urban development. Alternative 10 passes through the heart of the existing and future designated urban areas.

Safety Improvement and Meeting Design Standards

Because of differences in length, topography, orientation at major intersections and use of existing highways, the highway alternatives vary somewhat in their potential to efficiently meet the design parameters recommended by HDOT for a rural major arterial highway. The design parameters are as follows: minimizing grade, minimizing super-elevation on horizontal curves, minimizing access points, providing for an appropriate angle of intersection at major intersections, installing uphill passing lanes as well as truck escape ramps as needed to increase safety and to improve the Level of Service, accommodating adequate recovery zones for errant vehicles, and providing adequate shoulders for bicycle and pedestrian traffic. Engineers determined that preliminary Alternatives 3, 4 and 5 best met these criteria, while Alternatives 1, 2, 8 and 9 were least consistent. Alternatives 6, 7, 10 and 11 were intermediate.

Special Needs Traffic

Both commercial traffic and military traffic have special needs. Cargo originates from the ports in Hilo and Kawaihae, the airports in Hilo and Kona, and the major warehousing and wholesale operations in Hilo and Kailua. Important destinations include the urban centers of Hilo, Kailua, Waimea, and Waikoloa, as well as the resorts of West Hawaiʻi. Commercial traffic benefits from routes that offer the minimum distance between the most traveled origins and destinations, minimum elevational change and steep grades, and minimum conflict with other traffic.

The most important military use of area roads involves the transport of material, including ammunition, between Kawaihae Harbor and the Pōhakuloa Training Area (PTA) in the saddle between Mauna Loa and Mauna Kea. Federal regulations restrict transport of this ammunition through urban areas. Therefore, Waikoloa Road, with limited existing urban development directly fronting the highway, has become an important ammunition shipping route. As Waikoloa Road develops more urban uses, this route will become increasingly unsuited for the transport of ammunition.

Preliminary Alternatives 3, 4, 5, 6 and 7 were efficient for both trucks and military traffic; Alternatives 8, 9 10 and 11, were least consistent with serving these sectors. Alternatives 1 and 2 were intermediate.

Minimizing Drainage/Stream Crossing

The slopes of the project area are drained by highly intermittent streams or drainages, which are especially well-developed on the northern (Mauna Kea) half. During heavy rainfall, certain drainages can carry up to 13,000 cubic feet per second of water and sediment. One intermittent drainage, Kamakoa Stream, has caused extensive flooding in Waikoloa Village on several occasions. No native aquatic organisms are known to utilize the drainages in the project area, and no native riparian vegetation is present, and thus none of the drainages has any function in freshwater aquatic ecology. However, prevention of excess sediment delivery through such drainages to nearshore waters is an important consideration during and after roadway construction, and erosion and sedimentation controls can substantially raise highway construction and maintenance costs. Stream bridges are also an expensive component of highway construction and maintenance. Therefore, the alternative screening focused on evaluating the number and scope of stream crossings. Preliminary Alternatives 1-6 do not cross any streams that exhibit identifiable channels and exit to the sea, and minor drainage-crossing structures for these alternatives would be minimal. Alternative 7 involves a triple crossing of the Auwaiakeakua/Popoʻo system. Alternative 9 involves an expansion of the existing crossing of this same system, and Alternative 8 involves a new crossing. Alternatives 10 and 11 run nearly parallel along the slope for about 12 miles, intersecting all major drainages and jurisdictional waters of the U.S. in the area, thus requiring a number of substantial culvert structures or bridges.

Native Flora and Fauna

The native vegetation and faunal habitat over much of the project area and the surrounding region has been heavily degraded by domestic and feral animal grazing, invasion by alien plants such as fountain grass, and wildfire. Remnants of intact native vegetation or populations of rare or endangered species are, in general, highly localized.

A few individuals of the endangered species , including the tree halapepe (*Pleomele hawaiiensis*), were formerly present near Māmalahoa Highway, and at least one is still present. There are several populations of the endangered *uhiuhi* (*Mezoneuron kavaiense*) at the Waikoloa Dry Forest Preserve and at Puʻuanahulu. A scattering of the increasingly rare *wiliwili* (*Erythrina sandwicensis*) is present in Waikoloa.

A number of listed threatened or endangered bird species (and one bat species) overfly or forage in portions of Northwest Hawaiʻi, but because of the lack of suitable habitat in the project area, there is only a minor potential for impacts. The most important consideration is the Nēnē or Hawaiian Goose (*Branta sandvicensis*), which is a listed endangered species. Golf courses have become significant attractants for Nēnē. They are often observed near the Big Island Country Club in Puʻuanahulu and also within the Waikoloa Village Golf Course. As proposed routes approach these golf courses, the probability of potential impacts to Nēnē increases.

The only designated critical habitat nearby is for Blackburn's sphinx moth (*Manduca blackburnii*), which is present at the extreme south of the project area at elevations about 1,000 feet in Puʻuwaʻawaʻa (***Figure 2.3***). No alternative would intrude within or approach this critical habitat. However, plant species within the Solanaceae plant family, particularly the very common non-native tree tobacco (*Nicotiana glauca*), may serve as host plants for this endangered moth. This weedy shrub is locally abundant throughout the entire project area, especially on disturbed surfaces such as recently graded lava and highway shoulders.

Proposed critical habitat for three endangered plant species – *Mezoneuron kavaiense*, *Isodendrion pyrifolium*, and *Bidens micrantha* var. *ctenophylla* – is present adjacent to Waikoloa Village (refer to ***Fig. 2.3***). As mentioned above, only the first of these plants is present in the area. The latter two are not present and have never been recorded in this vicinity. Several of the alternatives pass directly through the current version of the proposed critical habitat.

Wildfire originating within the project area and spreading to biologically sensitive communities is a major biological consideration. The fire-adapted alien grasses that have come to dominate the vegetation of these areas provide the fuel for such fires. The most sensitive ecosystems are those *mauka* of the Māmalahoa Highway, outside the project area, which could be affected by a runaway fire from the proposed highway. Heavy fuel loads are present in much of the project area except where recent lava flows dominate. The most sensitive upslope communities are found generally in the south in Puʻuanahulu at Kipuka Kalawamauna, although isolated populations of endangered plants vulnerable to fires originating in Waikoloa are also present at cinder cones such as Puʻu Nohonaohae, which is near the existing Saddle Road junction with Māmalahoa Highway (refer to ***Fig. 2.3***).

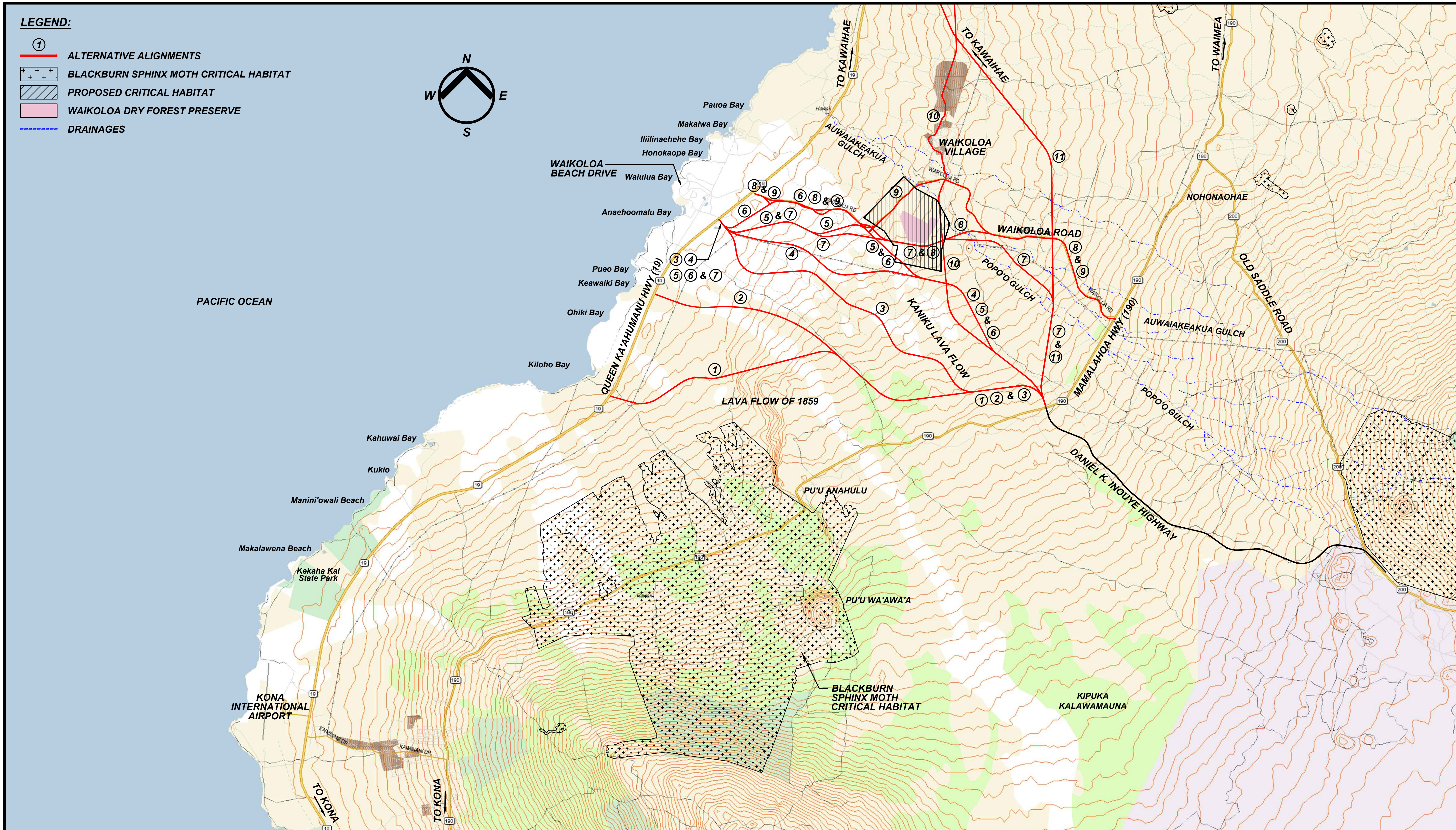
Potential biological impacts for the preliminary alternatives were evaluated with all these factors in mind. In general, the probability of encountering rare or endangered plant species in the project area is quite low, and alignments could generally be modified to avoid sensitive individuals or populations if they were encountered during initial biological survey. As a general rule, the grazed lands of Waikoloa have far fewer sensitive species and much lower fuel loads than the adjacent Puʻuanahulu lands. Therefore, all other considerations being equal, it would be preferable to locate routes outside the Puʻuanahulu lands; if these lands are to be crossed, lower elevations are preferable. Alternatives 1, 2 and 3 pose the greatest risk of being the source of wildfires that may threaten upslope ecosystems. The fire-adapted alien grasses that have come to dominate the vegetation of these areas provide the fuel for such fires. The most sensitive ecosystems are those *mauka* of the Māmalahoa Highway, outside the actual study corridor, which could be affected by a runaway fire from the proposed highway. However, in terms of Nēnē, Waikoloa Village is more sensitive, and Alternative 10 passes through Waikoloa Village Golf Course, and Alternatives 7, 8 and 9 are close to Waikoloa Village and also to an area for a future proposed golf course. Although no alternatives would intrude into designated critical habitat for Blackburn's sphinx moth, the tree tobacco weed that is a critical host of the current resurging population will be an issue for all alternatives, prior to construction, during construction (as it grows rapidly in disturbed areas, and after construction, as it rapidly spreads along and away from roadway corridors. The alternatives that most substantially intrude into proposed critical habitat for the three endangered plants discussed above are Alternatives 7, 8, 9 and 10. Alternative 5 and 6 touch a corner of the proposed unit, while Alternatives 1, 2, 3, 4 and 11 do not approach or enter the unit.

Geologic Hazards/Features

Lava hazard varies from moderate, where alternatives cross Mauna Loa; to moderately low, where they cross Hualālai; to low, on Mauna Kea substrates, (see Section 3.1.1 for detailed discussion of lava flow hazard). All preliminary alternatives except 10 and 11 (which are mostly on Mauna Kea flows) traverse Mauna Loa lava flows for most of their lengths. Alternative 1 is located partly on Hualālai, and substantial lengths of Alternatives 8 and 9 are on Mauna Kea. Geologic resources in the area include: 1) lava tube skylights and caves, which may contain burials, and may also offer geological, recreational, historical and biological value; 2) the Puʻu Anahulu lava flow (crossed only by Alternative 1), which is of scenic value; and 3) rock quarries, which provide an economic resource.

Historic and Cultural Resources

Only relatively small areas within the project area have been previously surveyed for historic properties. No sites on the National or State Registers of Historic Places are present. Archaeological features at upper elevations in the project area are known to include trails, temporary habitations, and post-Contact features such as walls and cattle-related structures. At lower elevations, the frequency of pre-Contact sites such as utilized lava tubes, shrines, burials, and rock quarries increases. An archaeological preserve has been proposed near the existing rock quarry along Waikoloa Road in order to protect a cluster of historic site resources. Because of isolation and a paucity of resources, little or no traditional gathering or other resource use has been reported from the area. Although detailed investigations of any alignments advanced for further study would be required, in general, preliminary Alternatives 3, 5, 6, 8 and 9 appear to have a lesser probability of encountering significant historic or cultural sites, and Alternatives 1, 2 and 4 have a greater such probability.



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SADDLE ROAD EXTENSION

FIGURE 2.3 ~ CRITICAL HABITAT FOR ENDANGERED SPECIES

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Socioeconomic Impacts

Waikoloa Village is the only urban settlement between Māmalahoa Highway and Queen Ka‘ahumanu Highway within the alternatives study corridor. The profile of Waikoloa Village provided in the South Kohala Community Development Plan (CDP) shows a new and rapidly growing community of single family homes and condominium units, with a population of over 4,000 that supports a K-8 public school and a fire station. A shopping center includes a grocery store, gas station, and small shops and restaurants. According to the Hawai‘i County General Plan, because it is a young, expanding community, Waikoloa Village still lacks much infrastructure such as a hospital or medical clinic, community center, and major commercial centers. Given the steady increase in residential units at Waikoloa, additional public facilities and centers for retail and service businesses are needed. Other land uses within the project area consist of pasture and undeveloped land used for hunting, the Waikoloa Dry Forest Preserve, two rock quarries and the West Hawai‘i Sanitary Landfill.

Six of the ten largest employers on the Island of Hawai‘i are the resort hotels located between the Mauna Kea Beach Hotel near Kawaihae and the Four Seasons Resort in Hualālai. Together, they account for over 4,000 jobs, more than the number two and number three island employers (County of Hawai‘i and U.S. Government) combined. Expansion of resort residential land use is expected over the next 20 years. The South Kohala Community Development Plan forecast a doubling of population from 2007 to by 2020 as well, based both on resort housing but largely on servicing the growing economy associated with the visitor industry. This will require public services, including schools, fire, police, medical, and various social services, as well as more infrastructure, including roads, sewer, water, and electricity.

For the purposes of preliminary alternative route evaluation, socioeconomic impacts are defined as: 1) temporary disruption of the community and businesses during construction; 2) permanent alteration of community by traffic; and/or 3) permanent adverse effects to local business. Temporary construction-related disruption would be substantial only with routes involving long segments of existing highways; i.e., Alternatives 6, 8, 9, 11, and particularly 10. In terms of permanent impacts, as any highway provides both desired business customers and undesired street traffic, these criteria are somewhat inversely related. For the proposed project, those alternatives that do not necessitate – but easily allow – traffic through Waikoloa Village provide the best blend of minimum community disruption and minimum loss of business activity.

Public Hunting Area Impacts

Hunting is a cherished tradition on the island of Hawai‘i, where over 3,000 residents hunt for meat and recreation. Pigs, sheep, goats and a variety of gamebirds are hunted by rifle or archery in some three dozen units largely concentrated in the central portion of the island. Impacts to hunting from individual projects must be carefully analyzed in the context of the cumulative loss of thousands of acres of public hunting area over the last few decades.

Public hunting occurs on the State land south of the North Kona/South Kohala district boundary. The area supports a sparse population of goats and is of modest value for hunting. The West

Hawaiʻi Shooting Range was being planned by DLNR and the non-profit On Target Inc. for an approximately one square mile area between the West Hawaiʻi Sanitary Landfill and the South Kohala/North Kona district boundary (refer to ***Fig. 2.1***). The current status of this proposal is uncertain, but no alternative would impact the last proposed layout.

Estimated Construction Costs

Estimating construction costs for preliminary highway alignments is often difficult due to the many factors that contribute to the overall expense for new roadway construction. In general, it appeared that Alternatives 1, 2, 3, 4, 5 and 6 would be lowest in cost, while Alternatives 10 and 11 would be about 50 percent higher. Alternatives 7, 8 and 9 would be intermediate in cost.

Minimization of Total Travel Distances to Major Destinations

Travel patterns for all motor vehicles in the project area reflect trips related to jobs, education, shopping and social purposes between major population centers in Hilo, Kona, and South Kohala; visitor accommodation/attraction areas such as the coastal areas of West Hawaiʻi and Hawaiʻi Volcanoes National Park; and the commercial traffic discussed above. A two-day traffic license plate survey conducted for the Saddle Road EIS in 1998 determined that about 50 percent of the traffic entering or exiting the Saddle Road was associated with Kona, about 30 percent with Waimea, and 20 percent with Waikoloa. This basic distribution appeared to continue after opening of the western section of the Saddle Road Improvements project in September 2013. The routes that provide the minimum distances to fulfill these trips are preliminary Alternatives 1, 2, 4, 5, 6 and 7, while Alternatives 10 and 11 are least suitable.

Impacts to Agricultural Lands of Importance to the State of Hawaiʻi (ALISH)

The agricultural utility of land in Hawaiʻi was assessed in the 1970s by the U.S. Soil Conservation Service and mapped as part of the Agricultural Lands of Importance to the State of Hawaiʻi (ALISH) map series. Three categories of valuable agricultural land are identified: Prime, Unique, and Other. Prime Land "has the soil quality, growing season, and moisture supply needed to produce sustained high yields of crops economically when treated and managed... according to modern farming methods". Island-wide, Prime Lands constitute about 4 percent of the surface, Unique Lands less than 1 percent, Other Important Lands about 18 percent, and Unclassified the remaining 78 percent. No Prime or Unique Agricultural Land is present in the project area, but soil and rainfall combine in certain areas to produce satisfactory grazing lands, which are classified under Other Important Lands. The only alternatives that would convert more than a negligible number of acres of classified lands to roadway are Alternatives 7, 8, 9 and 11.

2.2.3 Overall Evaluation

Table 2.2.1 summarizes the second screening ratings of the alternative alignments for the Saddle Road Extension project on various design and environmental factors, on a scale of -2 to +2 from least favorable to most favorable. In order to provide a summary comparison of the alternatives, their scores on these factors have been totaled. *It is important to note that while all factors are* *important, they are not of equal significance in decision-making. Totals should be regarded as a rough guide rather than a precise quantification of suitability.*

A low rating overall and/or on various factors for an alternative indicated that it might not be suitable for further consideration. Both the alternative's overall rating and its particular context were considered in the evaluation and recommendations to dismiss or retain alternatives.

Preliminary Alternatives 10 and 11 rate low on many factors related to purpose and need, such as minimization of travel distances, satisfaction of special needs traffic, and conformance with State and regional highway and land use plans. Although they do fulfill the function of conducting traffic between Waikoloa and Kawaihae, which could accommodate Pōhakuloa Training Area military traffic, they run from southeast to northwest, "across the grain" of the major deficiency in capacity for the majority of motorists, which is from Waimea/Saddle Road in the northeast to Kona in the southwest. A connection between Waikoloa and Kawaihae, which is specified in the Hawai'i County General Plan, is likely to be built as part of private land development projects in the future. Based on these reasons, Alternatives 10 and 11 have been dismissed from further consideration for this project.

Alternatives 8 and 9 also rate fairly low, for reasons of mediocre satisfaction of purpose and need and for some environmental concerns as well. Both would involve construction-phase impacts to the traffic on the existing Waikoloa Road. Alternative 8 bypasses the urbanizing Waikoloa Village area, avoiding community disruption and increasing the inter-regional function of the highway, but it must cross a major drainage twice, traverses proposed critical habitat for three endangered plants, and is very near a rare plant preserve. In addition to potential community disruption and the proposed critical habitat crossing, Alternative 9 is also poorly suited for special needs truck/military traffic. For these reasons, Alternatives 8 and 9 were dismissed from further consideration for this project.

Alternatives 1 and 2 satisfy purpose and need factors fairly well, and also involve few impacts to developed lands, although they would also fail to provide convenient additional access for planned development. However, they involve impacts to a number of environmental resources, including hunting lands and native biota, and potentially historic resources, because of longer routes. Since alternatives with similar qualities and fewer environmental disadvantages are available, Alternatives 1 and 2 were dismissed from further consideration for this project.

Alternatives 3 and 7 had intermediate suitability rankings. Alternative 3 scored fairly high on most factors in the suitability analysis. Otherwise it had no real advantages over Alternatives 4, 5 and 6 and would involve higher biological impacts than the other three that probably outweigh its advantages. Similarly, Alternative 7 cuts across lava tubes and drainages, approaches the Waikoloa Dry Forest Preserve, and makes a substantial crossing into proposed critical habitat. It did not offer any advantages over similar routes without these problems. For these reasons, Alternatives 3 and 7 were dismissed from further consideration for this project.

In general, ***Table 2.2.1*** reveals that Alternatives 4, 5 and 6 all ranked high. Each of them ranked fairly highly on Conformance with Plans, Consistency with State Highway System, Safety, Cost and ALISH Lands.

Table 1.2.1 Build Alternative Alignments Rankings

FACTORS	ALTERNATIVE ALIGNMENTS										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
A. Conformance with State and Regional Plan/Consistency with State System	1	2	2	2	2	2	1	0	0	0	0
B. Effects to Zoned/Entitled Lands	0	0	0	1	1	1	2	2	2	-1	1
C. Safety Improvement and Meeting Design Standards	0	0	2	2	2	1	1	0	0	1	1
D. Special Needs Traffic	1	1	2	2	2	2	2	0	-2	-1	0
E. Minimizing Drainage Crossing	2	2	2	2	2	2	0	1	1	-1	-1
F. Native Flora/Fauna	-2	-1	-1	2	1	1	-1	0	1	-1	1
G. Geologic Hazards/Features	-2	1	-1	0	0	1	-1	2	2	0	-1
H. Historic and Cultural Resources	-1	-1	0	0	0	1	-1	-1	2	-1	-2
I. Socioeconomic Impacts	1	1	1	1	2	2	1	-1	-1	-2	1
J. Public Hunting Area Impacts	-1	-1	-2	0	2	2	2	2	2	2	2
K. Probable Construction Costs	1	1	2	2	2	1	0	-1	-1	-2	-2
L. Minimization of Total Travel Distances	1	1	2	1	1	1	1	0	0	-1	-1
M. ALISH Lands Taken	1	2	2	2	2	2	0	0	0	2	0
TOTAL RANKING	**2**	**8**	**11**	**17**	**19**	**19**	**7**	**4**	**6**	**-5**	**-1**

Note: each alternative is scored on each factor on a scale of -2 to +2 from least favorable to most favorable

2.3 Alternatives Advanced for Detailed Analysis in Draft EIS

Based on the evaluation contained in this analysis, the following alternatives (in addition to the No Action Alternative) were proposed for further advancement to consideration in the Draft EIS:

- Alternative 4
- Alternative 5
- Alternative 6

The rationale for their advancement was that: 1) each ranked highly in the suitability analysis, and 2) considered together, they offer a diverse range of routes that are also efficient for field analysis. In proposing just these three alternatives for study, it is recognized that various options for the configuration and use of the road were foreclosed. The alternate paths in the upper elevations offered by Alternative Groups 1-2-3, 7, 8-9, and 10-11 will not be available. Nor will the options of a more direct connection to Kailua offered by Alternatives 1 and 2, or a direct connection to Kawaihae as provided by Alternatives 10 and 11. In addition, the opportunity to use substantial lengths of existing right-of-way associated with Alternatives 8 and 9 will be precluded. However, since there are more disadvantages than advantages associated with each of these opportunities, it is sensible to drop them from further consideration. The remaining three alternatives that have been advanced for consideration have been subjected in this EIS to detailed analysis of design, cost and environmental factors.

Public input concerning the range of alternatives studied was solicited via the May 23, 2012 State of Hawaiʻi EIS Preparation Notice and the 30-day public comment period that ensued, during which a public meeting was held at Waikoloa Elementary and Middle School on June 14, 2012 (see ***Appendix A5*** for meeting materials and notes).

2.3.1 No Action Alternative

As discussed in Section 2.2.1.5, although the No Action Alternative does not satisfy any of the purpose and need criteria, it provides a baseline for comparing the benefits and disadvantages of the Build Alternatives in terms of transportation goals and impacts to social and physical environment. The No Action was therefore advanced for study in the EIS.

2.3.2 Build Alternatives

As discussed above in Section 2.2.2, the screening process resulted in three Build Alternatives, Alternatives 4, 5 and 6, being advanced for consideration. They are described in detail below and mapped on ***Figure 2.4***.

2.3.2.1 Design Standards

All Build Alternatives have the following design standards (***Figure 2.5***).

Right-of-way width:	120-foot minimum, variable up to 240 feet
Pavement width:	Two 12-foot travelway lanes and 8-foot shoulders (minimum total pavement width of 40 feet, plus climbing lanes as required)
Design speed:	60 MPH
Minimum radius curve:	1,200 feet
Maximum super-elevation:	8 percent
Maximum grade:	7 percent
Typical intersection:	Turn lanes, acceleration and deceleration lanes for all approaches
Redesign of Daniel K. Inouye Highway terminus:	To provide adequate intersection at Māmalahoa Highway (2 design options, at-grade and grade-separated)

2.3.2.2 Construction Operations

Construction of the highway and appurtenant infrastructure such as intersections and drainage culverts would involve typical roadway and bridge construction activities, including the following:

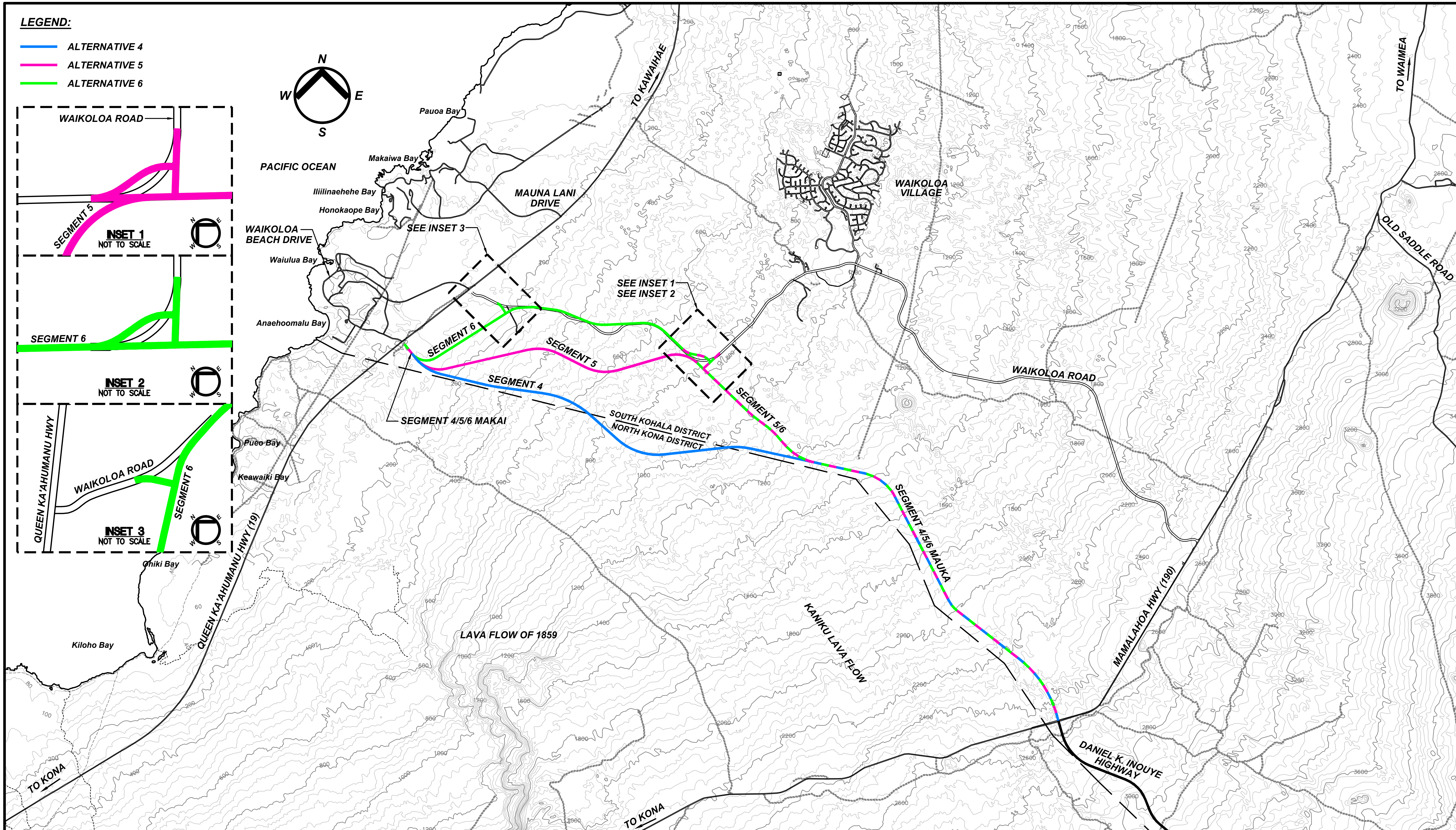
- Grubbing and initial grading of the highway alignments, slope easements and staging areas
- Grading and excavation involving cut and fill of slopes to obtain appropriate roadway sub-base
- Import from a quarry of base fill material
- Paving of highway structures
- Installing temporary roadways and bridges
- Installing runaway truck ramp(s)
- Pouring concrete and/or and installation of culvert pipes for drainage structures
- Installing temporary and permanent erosion control devices
- Installing highway appurtenances such as signing, roadside barriers, and pavement markings

Construction equipment anticipated to be used in the construction of the highway and appurtenant infrastructure include the following:

- Bulldozers
- Excavators/Backhoe
- Scraper
- Motor Grader
- Roller
- Cranes
- Dump trucks
- Hydraulic rams
- Boring Rig
- Pile Driver
- Water and Dewatering pumps and hoses
- Rock Crusher
- Paver
- Sweeper
- Concrete Mixer

Additional equipment would be used as necessary. The majority of the construction materials would likely come from the Kona and Hilo vicinities, both within 65 miles of the site. Materials for certain structures may come via barge from Honolulu.

The proposed project would build the highway in several stages. While mobilizing equipment to the project site, the contractor's surveyor will begin surveying and stakeout of the proposed features of the project (grading limits, drainage features, etc.). With the limits of the project work



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SADDLE ROAD EXTENSION

FIGURE 2.4 ~ ALTERNATIVES ADVANCED FOR STUDY TO THE DRAFT EIS

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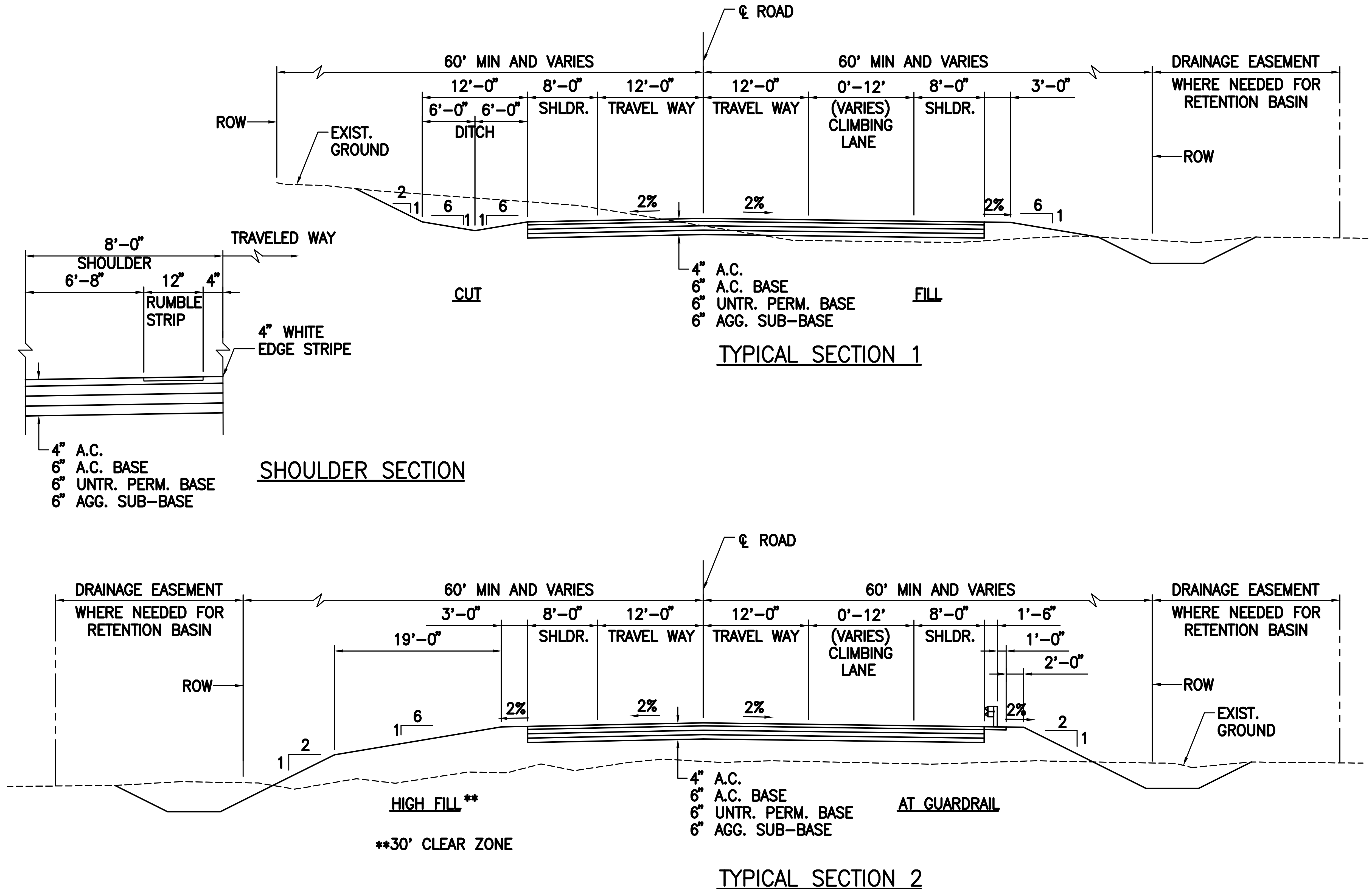

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SADDLE ROAD EXTENSION

FIGURE 2.5 ~ TYPICAL HIGHWAY SECTION

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SADDLE ROAD EXTENSION

FIGURE 2.6 ~ DESIGN OPTION FOR GRADE-SEPARATED INTERSECTION AT DANIEL K. INOUYE HIGHWAY

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defined, traffic management signage is installed, and clearing and grubbing of the area through which the road must pass of trees, stumps, brush, boulders, and other debris is completed. The next step is the grading operations and the construction of structure foundations, the placement of cross-drain pipes, and culverts. The grading operations are carried out by the equipment operators until the subgrade is completed. In fill areas, the grading is brought up in layers and compacted. In cuts, the excavation is carried out until the subgrade elevation is reached, and then the earth is compacted. After the subgrade is completed, equipment operators place aggregate base material on the subgrade. With the base material in place, paving operations are completed and final pavement markings and signage are installed.

2.3.2.3 Detailed Characteristics of Build Alternatives

Alternatives 4, 5 and 6 begin at the Māmalahoa Highway (SR 190) terminus of the Saddle Road (SR 200), and end at the junction of Waikoloa Beach Drive and Queen Ka‘ahumanu Highway (SR 19). Although they share the same termini and certain common segments, they have important differences that offer various options and constraints (refer to ***Fig. 2.4***).

For 4.91 miles west of the Māmalahoa Highway terminus, Alternatives 4, 5 and 6 have a common path for what is called “Segment 4/5/6 *mauka*” throughout the EIS. Below this point, Alternative 4 diverges from the “Segment 5/6” and proceeds 5.50 miles west/southwest through the lands of Waikoloa, detouring around a quarry into State lands in Pu‘uanahulu, before rejoining Alternatives 5 and 6 near the Queen Ka‘ahumanu Highway terminus (“Segment 4/5/6 *makai*”). Meanwhile, Segment 5/6 proceeds west/northwest for 1.92 miles before diverging. Alternative 5 remains south of Waikoloa Road and travels 3.93 miles before joining the other alternatives near the Queen Ka‘ahumanu Highway terminus. Alternative 6 jogs over to Waikoloa Road (a segment of which the Project would improve and replace if Alternative 6 were selected) and roughly follows its right-of-way until about a half-mile *mauka* of Waikoloa Road’s intersection with Queen Ka‘ahumanu Highway. From this point, Alternative 6 heads south and joins the other alternatives near the Queen Ka‘ahumanu Highway terminus within Segment 4/5/6 *makai*. The total length of the unique section of Alternative 6 is 4.12 miles. Small connector roads to provide perpendicular intersection between Waikoloa Road and Alternatives 5 and 6 are also proposed, as illustrated on ***Figure 2.4***.

The total lengths of the alternatives, including the common segments, are as follows:

Alternative 4	10.18 miles
Alternative 5	10.49 miles
Alternative 6	10.71 miles

As shown in ***Figure 2.4,*** Alternative 4 involves only two intersections, at Queen Ka‘ahumanu Highway (SR 19) and Māmalahoa Highway (SR 19). As noted above, both Alternatives 5 and 6 have additional intersections connecting them to Waikoloa Road.

A design option for all three Build Alternatives involves the intersection at the Daniel K. Inouye Highway. Under Design Option 1, the intersection would remain at-grade, controlled by STOP-signs or traffic signals, as determined during a signal warrant analysis and safety study that will occur prior to final engineering. Under Design Option 2, a grade-separated intersection would be built, in which flyover ramps would conduct some of the turn movements, as shown in ***Figure 2.6***.

2.3.3 Project Schedule and Costs

The Project would cost between approximately $63 and $74 million, depending on the combination of Alternative and Design Option that is selected, as shown below in Table 2.3.1.

Table 2.3.1 Estimated Project Costs by Alternative and Design Option

Alternative 4, At-Grade Intersection	$63 million
Alternative 4, Grade-Separated Intersection	$67 million
Alternative 5, At-Grade Intersection	$70 million
Alternative 5, Grade-Separated Intersection	$74 million
Alternative 6, At-Grade Intersection	$64 million
Alternative 6, Grade-Separated Intersection	$68 million

Cost is in 2018 dollars

This total includes right-of-way acquisition, design and construction. Because of its shorter length and fewer intersections, Alternative 4 is the least costly alternative. For all alternatives, the grade-separated interchange design option at Māmalahoa Highway would add approximately $4 million to the cost. It is expected that the State of Hawaiʻi would be responsible for 20 percent of funding and the federal government would fund the remaining 80 percent. The Project is included in the FY2015 to FY2018 Statewide Transportation Improvement Projects (STIP) list. If approvals are obtained in a timely manner, the EIS completion, project design and construction would proceed according to the following estimated timetable:

Record of Decision Issued:	Late 2017
Award Design Contract:	Late 2017
Complete Design:	Early 2018
Award Construction Contract:	Early 2018
Complete Construction:	Mid 2020

3 AFFECTED ENVIRONMENT, ENVIRONMENTAL CONSEQUENCES, AND MITIGATION MEASURES

On a resource by resource basis, this chapter describes the existing social, economic, cultural, and environmental conditions in the project area, analyzes the probable direct and indirect environmental effects of the proposed action, and then specifies mitigation measures designed to eliminate, minimize or compensate for adverse environmental impacts.

The project area is located in Waikoloa, South Kohala District, and Puʻuanahulu, North Kona District, on the island of Hawaiʻi (***Figure 3.1.1***). The term *project area* indicates the land between Māmalahoa Highway and Queen Kaʻahumanu Highway that is within, between or near the Build Alternatives that have been selected for advancement (Alternatives 4, 5 and 6). The term *project corridor(s)* refers to a 250-foot width around the center of each alternative alignment that was intensely surveyed by field scientists. The selected project corridor will be the focus of land disturbance and construction if the Project is constructed. As mapped in ***Figure 3.1.1***, the alternative project corridors share various segments, named to reflect which alternatives are sharing the common segments. From *mauka* to *makai* (east to west, in this case) Segment 4/5/6 *mauka* is common to all three alternatives. At roughly the 1,200-foot elevation, Alternative 4 diverges to the south, and Segment 5/6 continues towards Waikoloa Road. Near Waikoloa Road, Alternatives 5 and 6 diverge. Just mauka of SR 19, all three alternatives converge into a common path – Segment 4/5/6 *makai* – where they meet with Waikoloa Beach Drive intersection.

For the purpose of impact assessment, the term *region of influence (ROI)* is defined on a resource by resource basis to ensure that the full zone of impacts is adequately defined and described. It is meant to provide context for resources and impacts under discussion in and near the areas affected directly or indirectly by highway construction and use. For many environmental variables, the impacts of the proposed action will be restricted to the project corridors and immediately surrounding land within the project area. Some impacts such as air quality and traffic extend further off site. The ROI will thus vary according to the resource under discussion, usually including certain portions of surrounding properties. For certain social and economic impacts, the ROI will encompass a region as broad as all of West Hawaiʻi or even the island of Hawaiʻi.

3.1 LAND USE AND RELATED GOVERNMENTAL PLANS AND POLICIES

3.1.1 Land Use and Land Ownership

3.1.1.1 Affected Environment

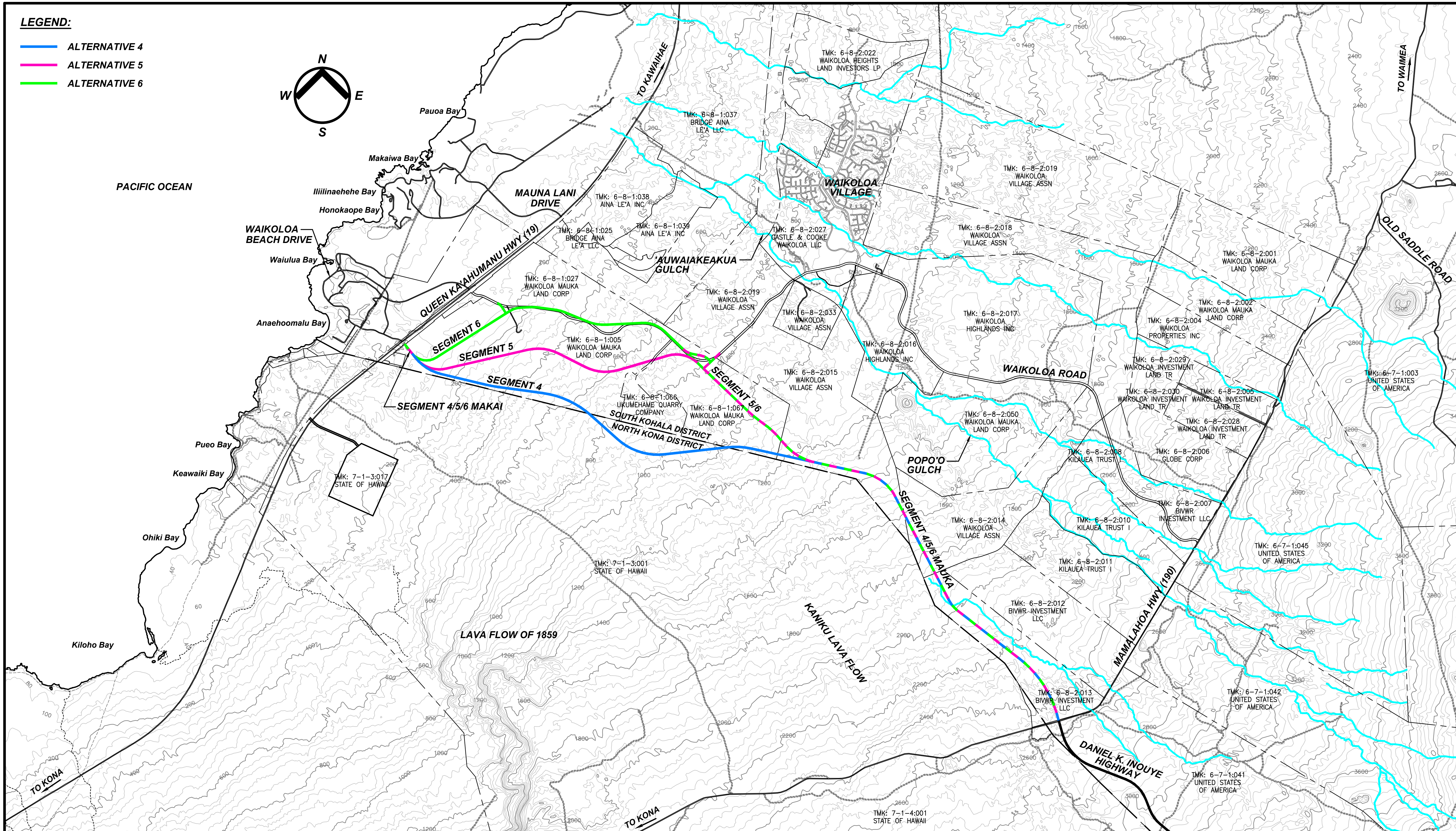
As shown in ***Figure 3.1.1***, the land including and surrounding the project corridors is owned by only a few major landowners. These include the Waikoloa Village Association (TMKs 3-6-8-002:005, 014, 015, 016, 019, 023), Waikoloa Mauka LLC (Hawai‘i County Real Property Tax Map Keys 3-6-8-001:005 & 027; 3-6-8-02:050), Ukumehame Quarry (TMKs 3-6-8-001:066), BIVWR Investment LLC (TMK 3-6-8-002:013), and the State of Hawai‘i (TMK 3-7-1-003:001). In addition, right-of-way associated with Māmalahoa Highway and Queen Ka‘ahumanu Highway (owned by the State of Hawai‘i) and Waikoloa Road (County of Hawai‘i) would be involved. Intersection improvements may extend *mauka* of Māmalahoa Highway into land owned by the U.S. Army (TMKs 3-6-7-001:041), and/or *makai* of Queen Ka‘ahumanu Highway into land owned by Waikoloa Development Company (TMKs 3-6-9-008:009 & 013; and 3-6-9-008:007, the right-of-way of Waikoloa Beach Drive).

Surrounding properties are as follows: to the south is the State of Hawai‘i’s Pu‘uanahulu Game Management Area; to the north are large properties currently dedicated to ranching, with some area planned for eventual large-lot agricultural subdivisions or other uses; to the west is the Waikoloa Beach Resort node; and to the east is the Ke‘āmuku section of the U.S. Army’s Pōhakuloa Training Area (PTA).

3.1.1.1.1 Ranching

Ranching activities in the broader project area include grazing on private lands accessed from Waikoloa Road and from Māmalahoa Highway. The lands in the project corridor are marginal for grazing because of low rainfall and rockiness, and cattle densities are very low. The main access into the grazing lands is from a gate off of Māmalahoa Highway, 0.6 miles south of the Saddle Road Extension eastern terminus. Ranching lands that are more intensively used are found about ten miles to the north, on land belonging to Parker Ranch, where better soils and higher rainfall are present.

Segment 4/5/6 *mauka* passes through the southernmost property of the Waikoloa Ranch Lots, which include about a dozen properties that front Māmalahoa Highway and range in size from roughly 150 to 1,200 acres (refer to ***Figure 3.1.2***). These are used for agricultural purposes and may each eventually include a single-family residence as a farm dwelling and additional farm housing as appropriate, and/or undergo further subdivision for similar agricultural uses.



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GRAPHIC SCALE IN FEET

SADDLE ROAD EXTENSION

FIGURE 3.1.1 ~ ALTERNATIVES 4/5/6

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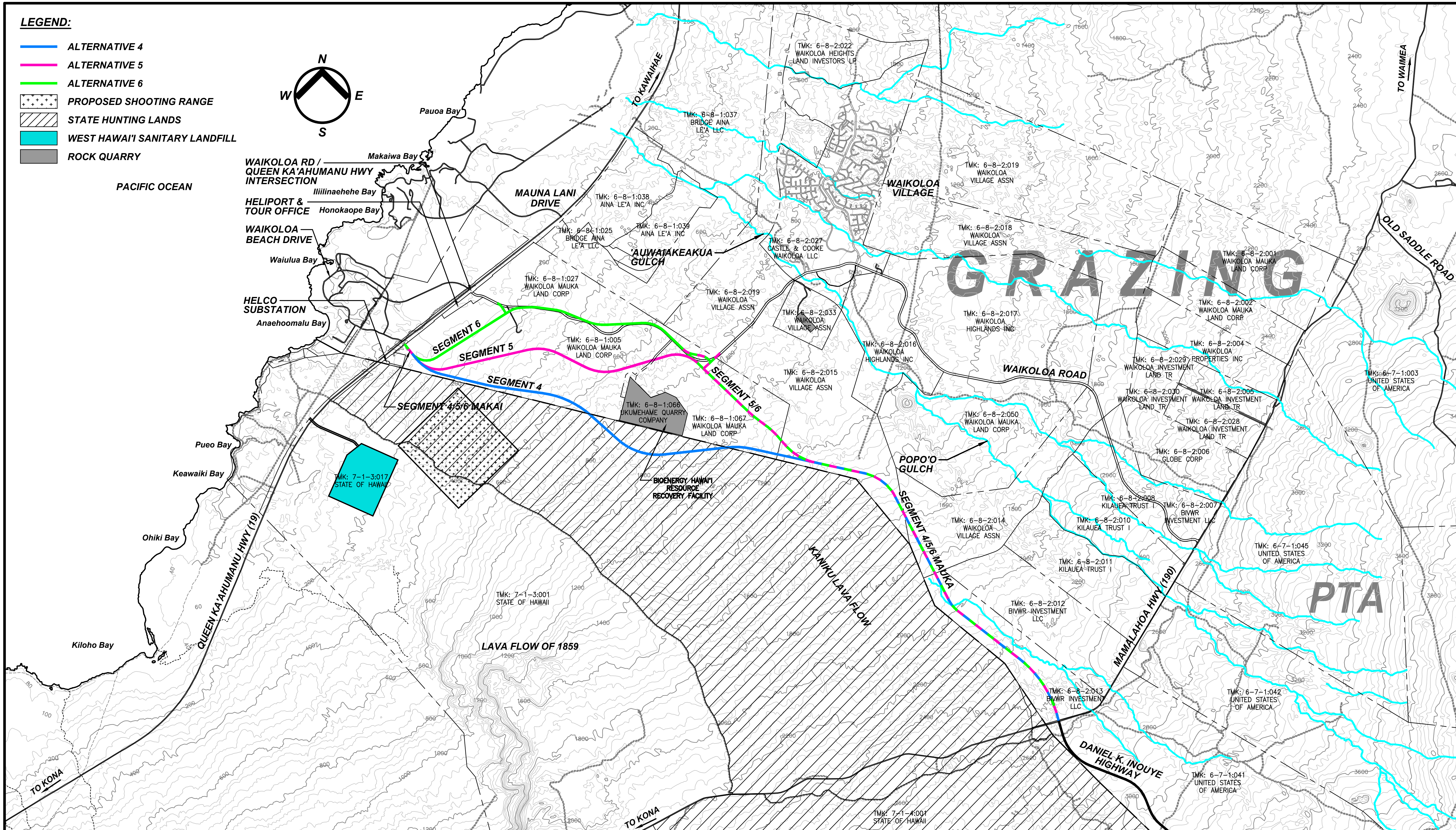

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GRAPHIC SCALE IN FEET

SADDLE ROAD EXTENSION

FIGURE 3.1.2 ~ LAND USE IN PROJECT AREA

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3.1.1.1.2 Military

Military land use within the project area occurs (across Māmalahoa Highway from the eastern project terminus) within the Pōhakuloa Training Area (PTA), a multi-service training complex operated by the U.S. Army Garrison, Hawai‘i (refer to ***Fig. 3.1.2***). PTA consists of approximately 132,950 acres of land, including the Ke‘āmuku parcel, centered in the plateau between Mauna Kea and Mauna Loa. The Daniel K. Inouye Highway traverses PTA over a distance of approximately 22 miles from Milepost (MP) 30 to MP 52.

PTA provides a safe, modernized, major training area for the U.S. Army Pacific (USARPAC) and other Pacific Command Units. All branches of the armed services located in the Pacific theater utilize PTA, including the Army, Army Reserves, Marines, Air Force, Navy, and the National Guard, as well as local law enforcement agencies and foreign allied forces. PTA provides space for field training exercises and annual service practice. PTA is capable of supporting coordinated live firing of all assigned crew-served weapons of the infantry company and battalion and artillery, in conjunction with live air support. The ranges and firing points at PTA accommodate employment of all the conventional weapons in the Pacific Region. PTA is the only training area in the Pacific that affords training units the opportunity to employ their weapon systems at their maximum standoff range. More than 15,000 military personnel receive training at PTA each year.

A summary of major PTA facilities follows:

Live-Fire Ranges and Maneuver Areas. PTA contains 14 operational fixed live-fire ranges, two rotary wing forward arming and/or refueling ranges, unlimited artillery firing points, 24 motor points, six drop zones, a helicopter and fighter/bomber gunnery range, strategic aircraft bombing range, and almost 23,000 contiguous acres for maneuver training (not counting Ke‘āmuku).

Bradshaw Army Airfield. Bradshaw Army Airfield is used primarily by Army and Marine helicopters, though it also supports limited fixed wing operations. A project to lengthen the runway from its existing length of 3,700 to 6,000 feet is currently under review by the Army. The longer runway would allow fully loaded C-130 aircraft and C-17 aircraft operating at 80 percent capacity to utilize the airfield.

Cantonment Area. PTA can support a training deployment of up to 2,400 personnel. The base camp includes 154 buildings, including three fully equipped with dining facilities, two motor pools, 2.1 million gallons of water storage, a rations warehouse, a bulk fuel facility, a chapel, a theater, a recreation club including game courts, and a medical facility.

Infrastructure. PTA is in the process of upgrading its water system. Water was formerly supplied from a spring, but the demand is now met principally by water hauled to PTA by truck. The University of Hawai‘i conducted research concerning the hydrology of the center of the island that could identify potentially useable aquifers (University of Hawai‘i, Hawai‘i Institute of Geophysics and Planetology 2014), and a water well is planned.

Training in Keʻāmuku. The Army has incorporated Keʻāmuku (directly across Māmalahoa Highway from the proposed Saddle Road Extension) within PTA and is preparing to use it for military training involving all maneuver elements of Army, Marine, and Reserve Component units. Training resources used by these elements include non-live-fire maneuver training facilities and rudimentary bivouac areas. Live-fire exercises are not undertaken on the Keʻāmuku parcel.

3.1.1.1.3 Residential, Commercial and Resort Uses

The only current residential uses within several miles of the project corridors are in Waikoloa Village, as close as two miles to the north. Waikoloa Village is a diverse and growing community with a 2010 Census population listed at 6,362 and a variety of businesses and civic facilities including an elementary school and middle school and fire station (refer to ***Fig. 3.1.2***).

The Waikoloa Beach Resort is present *makai* of the western project terminus. This collection of hotels and resort residential, recreational and commercial uses constitutes a major core of the visitor industry on the Island of Hawaiʻi. There are more than 2,000 hotel rooms and over 1,000 other lodging units in nine separate resort residential complexes, as well as two shopping centers with several dozen retail and restaurant operations (refer to ***Fig. 3.1.2***). The only other commercial uses in close proximity to the project corridors are found at the junction of Queen Kaʻahumanu Highway with Waikoloa Road, where there is a tour helicopter business office and heliport (refer to ***Fig. 3.1.2***).

3.1.1.1.4 Public Lands/Facilities and Public Utilities

State Forest Reserve lands designated as a Game Management Area (GMA) are found to the south of (and for a 2.5-mile long segment of Alternative 4, within) the project corridors in the Kona lands of Puʻuanahulu (refer to ***Fig. 3.1.2***). The approximately 65-square mile Puʻuanahulu GMA is used for goat hunting but because of its extremely rugged terrain, there is relatively little use in the area near the project corridors. The West Hawaiʻi Shooting Range was being planned by DLNR and the non-profit On Target Inc. for an approximately one square mile area between the West Hawaiʻi Sanitary Landfill and the South Kohala/North Kona district boundary. The current status of this proposal is uncertain, but no alternative would impact the last proposed layout (refer to ***Fig. 3.1.2***)

Public utility uses in the project area are associated with electric transmission lines and poles (refer to ***Fig. 3.1.2***), electricity substations, and telephone and fiber optic cables. Details about existing utilities and effects to them are contained in Section 3.3.5, below.

3.1.1.1.5 Mining

A rock quarry operated by West Hawaii Concrete is present in the *makai* portion of the project area on TMK 3-6-8-001:066, between the Alternative 4 and 5 project corridors (refer to ***Fig. 3.1.2***). Over the last several decades, this quarry has supplied several hundred thousand tons per year of crushed rock required for concrete and road base uses throughout West Hawaiʻi. The quarry property is also the site of a proposal by BioEnergy Hawaiʻi, LLC to construct and operate a facility to divert municipal solid waste from the County's landfills. Recyclable materials would be recovered and collected for offsite sales, with organic materials diverted to an anaerobic digester and use for thermal conversion to natural gas using a gasifier or pyrolysis unit. The renewable natural gas would be used to power the waste collection fleet and also sold to offsite consumers to displace fossil fuels.

3.1.1.2 Environmental Consequences

Land use impacts that would result from construction of the Saddle Road Extension include temporary construction-related impacts, impacts associated with use of private land zoned but not currently utilized for agriculture other than grazing, and impacts to State land managed for game hunting (under Alternative 4). Several specific categories of impacts are dealt with in depth in other sections of this EIS, as referenced below.

Construction activities would result in short-term impacts on land uses adjacent to the selected alternative project corridor only. These impacts would come from temporary access issues and construction noise and dust, but there are very few active land uses in areas that would be so affected. Some grazing might be affected, with cattle needing to be relocated temporarily, as discussed in Section 3.2.

The Project would require acquisition of property from private owners and (with Alternative 4) from the State Department of Land and Natural Resources (DLNR) in areas used for extensive grazing and hunting. As depicted in ***Figure 3.1.1***, the six properties traversed range in size from 733 to 1,871 acres. Impacts related to acquisition of real property and the issue of relocation are discussed below in Section 3.4.2.

If other conditions including water infrastructure and appropriate zoning were met, a new highway providing new access frontage could result in increased opportunities for development. This could vary from simple agricultural subdivisions to urban land uses. The subject of potential growth induction is discussed in detail in Section 3.3.1.2.

Some adverse land use impacts would occur through reduction of land available for current uses, including grazing and hunting (Section 3.2 deals more specifically with the issue of impacts to farming and ranching). Alternative 4 encroaches within the approximately 65-square mile Pu‘uanahulu GMA (refer to ***Fig. 3.1.2***), which supports mammal hunting. For Alternative 4 only, there would be a permanent loss of about 0.5 square miles of hunting area (due to both direct highway use and 50-yard safety standoff areas from highways) adjacent to the Hawai‘i Electric Light power line at about the 1,000-foot elevation. This particular area in the heart of the Kanikū lava flow is extremely rocky, with almost no vegetation and minimal use for hunting, although some goats are present. Conversely, the Project would also increase hunter accessibility to the area, particularly if Alternative 4 were implemented. FHWA and HDOT are consulting with the DLNR through the EIS and permitting processes to explore access points that could be used to promote hunting access (as well as conservation activities) if Alternative 4 is selected. The opinions of hunters and hunting organizations concerning adverse and beneficial impacts of Alternative 4 are being solicited as part of the EIS process.

Differences in Impacts Between Alternatives 4, 5 and 6 and Intersection Design Options

Short-term, construction-related land use impacts would be nearly identical between Alternatives 5 and 6, and would involve a temporary accommodation for the road access for Waikoloa Quarry, which currently has access from Waikoloa Road. Alternative 4 would involve impacts to goat hunting in the area of the Puʻuanahulu GMA into which Alternative 4 passes.

Long-term, the use of Alternative 4 would involve the permanent loss of approximately 0.5 square miles of hunting area in the Puʻuanahulu GMA for not only right-of-way but also the hunting standoff areas required around highways. Alternatives 5 and 6 would require permanent relocation of the road access for Waikoloa Quarry.

Design Option 1, in which the Saddle Road Extension intersection with Māmalahoa Highway would remain at-grade, would have less effect on grazing in the *mauka* half of the project corridors, because less land would be used. The grade-separated intersection under Design Option 2 would require more acreage and thus greater displacement of grazing land.

Impacts of the No Action Alternative

The No Action Alternative would have no effect on existing land uses.

3.1.1.3 Mitigation Measures

1. Construction contract conditions will require access to properties and public use and recreation areas to be available at all times during construction, although temporary interruptions will be allowed.
2. If Alternative 4 is selected, FHWA and HDOT will coordinate with the DLNR to determine access points that could be used to promote hunting access in the Puʻuanahulu Game Management Area.

3.1.2 Consistency with Governmental Plans, Policies, and Land Use Regulations

3.1.2.1 Existing Plans

3.1.2.1.1 Hawaiʻi State Plan

The Hawaiʻi State Plan (State Plan) was adopted in 1978 and revised in 1986 and again in 1991 as Chapter 226, Hawaiʻi Revised Statutes (HRS). The plan establishes a set of goals, objectives and policies that are meant to guide the State's long-term growth and development.

Relevant sections of the Hawaiʻi State Plan include the following from Section 226-17, HRS, relating to Transportation:

Objective a.1: An integrated multi-modal transportation system that serves statewide needs and promotes the efficient, economical, safe and convenient movement of people and goods.

Objective a.2: A statewide transportation system consistent with planned growth objectives throughout the State.

Policy b.1: Design, program, and develop a multi-modal system in conformance with the desired growth and physical development as stated in this chapter.

Policy b.6: Encourage transportation systems that serve to accommodate present and future development needs of communities.

Policy b.9: Encourage the development of transportation systems and programs which would assist statewide economic growth and diversification.

Policy b.10: Encourage the design and development of transportation systems sensitive to the needs of affected communities and the quality of Hawai‘i’s natural environment.

The proposed Project is consistent with the transportation policies and objectives of the State Plan. The highway would accommodate both existing and future cross-island traffic in a safe and efficient manner. It would improve the link between existing residential, governmental and service centers in East Hawai‘i and major job centers and economic development opportunities of West Hawai‘i.

3.1.2.1.2 Hawai‘i State Functional Plans

The State Plan contains twelve separate Functional Plans addressing specific areas of concern. The 1991 revision of the Functional Plan for Transportation has several objectives, policies and implementing actions that are relevant to this project including the following:

Objective IA: Expansion of the Transportation System.

Policy I.A.2: Improve regional mobility in areas of the State experiencing rapid urban growth and road congestion.

Objective I.E: Planning and designing State highways to enhance inter-regional mobility.

Policy I.E.1: Design highways with controlled accesses, grade separated crossings, and minimum four-lane divided standards where applicable. Encourage counties to develop local road networks for local travel and access.

Objective II.A: Development of a transportation infrastructure that supports economic development initiatives.

Policy II.A.1: Support State economic development initiatives.

Policy II.A.2: Support tourism and economic development.

The proposed Project is consistent with the Objectives and Policies of the Transportation Functional Plan. The new highway would accommodate both existing and future cross-island traffic in a safe and efficient manner. It would link the existing residential, governmental and service centers in East Hawaiʻi with the major job centers and economic development opportunities in West Hawaiʻi.

3.1.2.1.3 Federal-Aid Highways 2035 Transportation Plan for the District of Hawaii and Statewide Transportation Improvement Program (STIP)

The long-range *Federal-Aid Highways 2035 Transportation Plan for the District of Hawaii* (HDOT 2014) is an update of the existing Hawaii Long-Range Land Transportation Plan developed in 1998. It incorporates technical input and community values and serves to guide decision makers in setting funding priorities. By defining goals and needs and recommending multimodal solutions specific to the Hawaiʻi District, it sets the direction for land transportation system improvements for which priorities and funding can be developed.

The Plan integrates with the overarching Statewide Federal-Aid Highways 2035 Transportation Plan. These planning documents also fulfill federal and state requirements to formulate long-range transportation plans for the development of a multimodal transportation system within the state through a continuing, cooperative, and comprehensive statewide multimodal transportation planning process. This Plan only applies to the federal-aid highways on the Island of Hawaiʻi. The federal-aid highways are the National Highway System and all other public roads, except those federally classified as local roads or rural minor collectors. The Plan has the following goals:

- Improve capacity and system efficiency by addressing congestion
- Maintain and improve safety for all modes
- Expand and increase Hawaiʻi District's economic vitality
- Preserve and maintain the existing transportation system
- Provide modal integration and improve transit service
- Support evacuation and emergency access/egress during incidents

As previously discussed in Chapter 1, the Plan included an analysis of growth trends in various parts of the Island of Hawaiʻi. Population, household, and employment information were grouped into geographical traffic analysis zones (TAZs). TAZs provide a general picture of where people live and work on the island. Forecasted socioeconomic data are important because they show where growth is programmed to occur, and where the transportation system could experience an increase in demand.

Based on forecast population growth island-wide, HDOT determined that traffic volumes will eventually exceed capacity on the principal roads and highways in the project area. By 2035, volumes on Queen Kaʻahumanu Highway are forecast to increase to the point where volume exceeds capacity, leading to Level of Service (LOS) F or worse, for the stretch from Kawaihae to

Waikoloa Beach Drive (refer to ***Fig. 1.3b*** – as explained in Section 1.3.2, Level of Service or LOS is a measure of how well traffic flows, from well in LOS A to poorly in LOS F). All roads near urban Waimea will be at or near capacity, and all of Waikoloa Road and the portion of Māmalahoa Highway between the Daniel K. Inouye Highway and Waikoloa Road will be at or over capacity during peak periods. The Daniel K. Inouye Highway itself was projected to still have acceptable LOS.

HDOT identified the Saddle Road Extension as one of 19 "Potential Long-Range Capacity Solutions" (HDOT 2014: Exhibit 4-4). Specifically, the Plan called for a new two-lane road between the "western terminus of the Saddle Road realignment" and Queen Kaʻahumanu Highway, with an expected cost of $180,000,000.

The State Transportation Improvement Program (STIP) is a set of identified improvements that can be reasonably expected to be completed with available funds over a four-year period. It is one mechanism for implementing the long-range plan. The current Fiscal Year 2015-2018 STIP identifies the Daniel K. Inouye Highway (Saddle Road) Extension as Project No. HS24 (https://hidot.hawaii.gov/highways/files/2016/06/160615-15-18-R6-PROCESSED.pdf - accessed March 2017).

3.1.2.1.4 County of Hawaiʻi General Plan

The *General Plan* for the County of Hawaiʻi is a policy document expressing the broad goals and policies for the long-range development of the Island of Hawaiʻi. The plan was adopted by ordinance in 2005 (Hawaiʻi County Planning Department). The *General Plan* itself is organized into thirteen elements, with policies, objectives, standards, and principles for each. There are also discussions of the specific applicability of each element to the nine judicial districts comprising the County of Hawaiʻi. Most relevant to the proposed project are the following Goals, Policies, and Standards:

TRANSPORTATION – GOALS

- Provide a transportation system whereby people and goods can move efficiently, safely, comfortably and economically.
- Make available a variety of modes of transportation that best meets the needs of the County.

TRANSPORTATION – POLICIES

- A framework of transportation facilities that will promote and influence desired land use shall be established by concerned agencies.
- The agencies concerned with transportation systems shall provide for present traffic and future demands, including the programmed development of mass transit programs for high growth areas by both the private and public sectors.
- The improvement of transportation service shall be encouraged.

- Consider the provision of adequate transportation systems to enhance the economic viability of a given area.
- Develop a comprehensive, islandwide multi-modal transportation plan that identifies the location and operation of automobile, mass transit, bicycle and pedestrian systems, in coordination with appropriate Federal and State agencies.

TRANSPORTATION – STANDARDS

- Transportation systems shall meet the requirements of the U.S. Department of Transportation, State Department of Transportation and the County of Hawaiʻi.
- Transportation systems shall conform with design guidelines established by the American Association of State Highway and Transportation Officials (AASHTO).

ROADWAYS – GOALS

- Provide a system of roadways for the safe, efficient and comfortable movement of people and goods.
- Provide an integrated State and County transportation system so that new major routes will complement and encourage proposed land policies.

ROADWAYS – POLICIES

- Encourage the programmed improvement of existing roadways by both public and private sectors.
- Investigate various methods of funding road improvements, including private sector participation, to meet the growing transportation needs of the island.
- Encourage the State to establish a continuous State highway system connecting the County's major airports and harbors.
- Support the development of programs to identify and improve hazardous and substandard sections of roadway and drainage problems.
- Coordinate with appropriate Federal and State agencies for the funding of transportation projects for areas of anticipated growth.
- There shall be coordinated planning of Federal, State, and County street systems to meet program goals of the other elements such as historic, recreational, environmental quality, and land use.
- Encourage the State Department of Transportation to establish special scenic routes within and between communities.
- Support the development of an efficient transit route between east and west Hawaii.
- Develop short and long range capital improvement programs and plans for transportation that are consistent with the General Plan.

ROADWAYS – STANDARD

- Primary Arterial: Includes major highways, parkways, and primary arterials that move vehicles in large volumes and at higher speeds from one geographic area to another; highest traffic volume corridor. Designed as a limited access roadway. Primary arterials shall have a minimum right-of-way of 120 feet.

PUBLIC LANDS – GOALS

- Utilize publicly owned lands in the best public interest and to the maximum benefit.
- Acquire lands for public use to implement policies and programs contained in the General Plan.

PUBLIC LANDS – POLICY

- State and County Capital Improvement Programs should continue to be coordinated.

PUBLIC LANDS – STANDARD

- Public lands with unique recreational and natural resources shall be maintained for public use.

The Project is completely consistent with these goals, objectives, and standards, because it provides a modern, safe, efficient and scenic highway that fulfills County land use, access and circulation objectives while maintaining environmental quality.

3.1.2.1.5 General Plan Land Use Pattern Allocation Guide Map and Facilities Map

The *Hawai'i County General Plan Land Use Pattern Allocation Guide* (LUPAG) is the map component of the General Plan and a graphic representation of the Plan's goals, policies, and standards as well as of the physical relationship between land uses (***Figure 3.1.3***). It also establishes the basic urban and non-urban form for areas within the planned public and cultural facilities, public utilities and safety features, and transportation corridors.

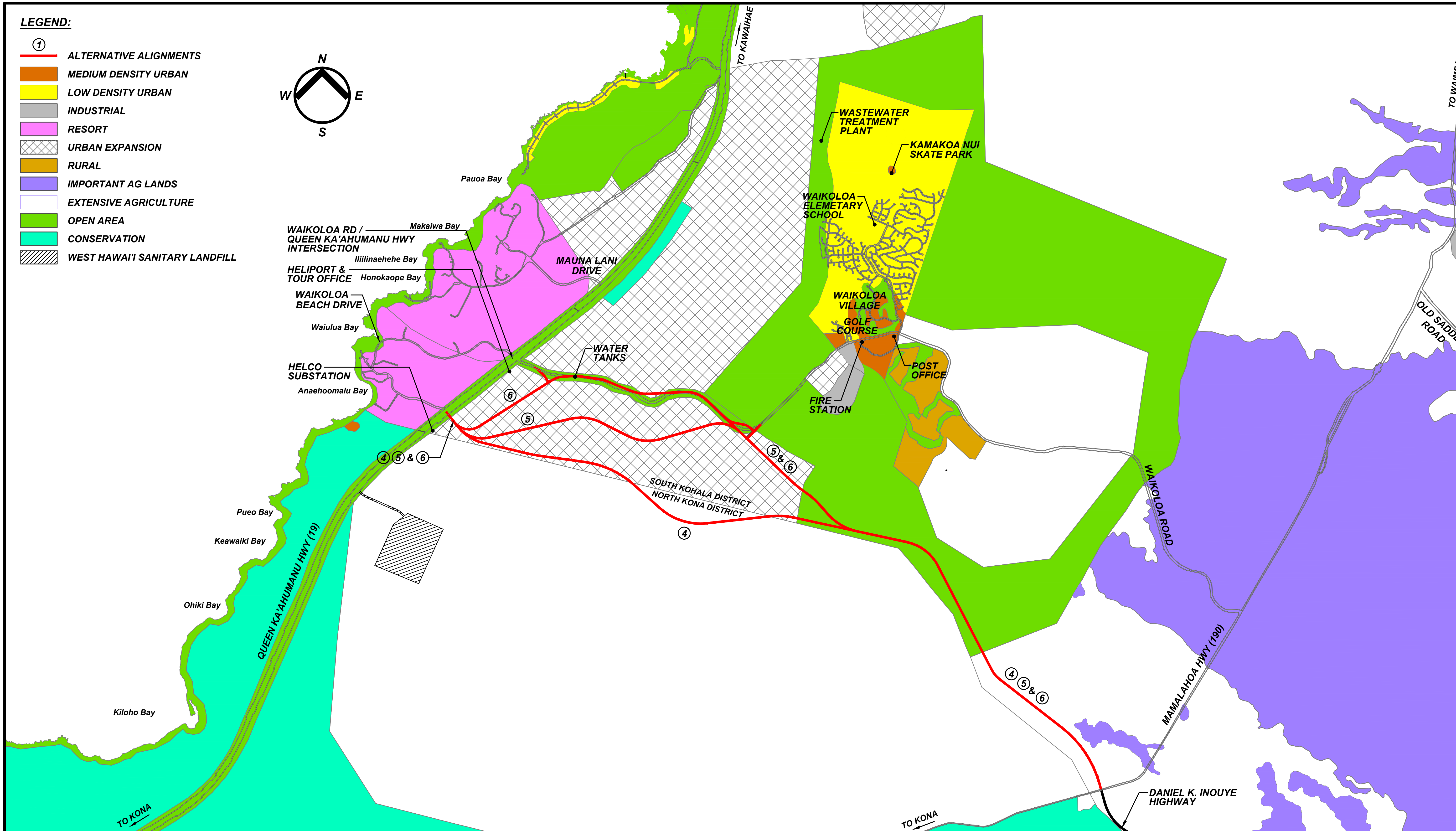
The *mauka* half of the project corridors extends through areas designated as Open (defined as parks and other recreational areas, historic sites, and open shoreline areas), while the *makai* half is designated for Urban Expansion. The segment of Alternative 4 that extends into the North Kona District is designated Extensive Agriculture (defined as agricultural lands not classified as Important Agricultural Land in the General Plan). Use for a public highway is consistent with each of these designations. Furthermore, the Transportation Facilities Map of the *Hawai'i County General Plan* shows a proposed future arterial highway extending from the terminus of the future (in 2005) Saddle Road to Queen Ka'ahumanu Highway. The proposed project is highly consistent with the LUPAG and Facilities components of the General Plan.

3.1.2.1.6 Land Use Regulations for State Land Use Districts

All land within the State of Hawaiʻi is classified into one of four State land use districts (SLU): Urban, Rural, Agricultural, or Conservation (***Figure 3.1.4***). Chapter 205, HRS, establishes the criteria and objectives for the land use and assigns responsibility for the regulation of these districts. Chapter 205, HRS and Chapter 15-15, Hawaiʻi Administrative Rules (HAR) provide for the classification and regulation of the districts as follows:

> *Urban District*. This district shall include land characterized by "city-like" concentrations of people, structures, streets, urban level of services, and other related land uses. Urban districts shall include activities or uses as provided by ordinances or regulations of the County within which the urban district is situated.
>
> *Rural District*. This district shall include areas of land composed primarily of small farms mixed with very low density residential lots, which may be shown by a minimum density of no more than one house per half-acre and a minimum lot size. Rural districts shall include activities or uses as characterized by low density residential lots of not more than one dwelling house per half-acre.
>
> *Agricultural District*. This district shall include areas of land with a high capacity for agriculture production. It may also include lands surrounded by or contiguous to agricultural lands which are not suited for agricultural production by reason of topography, soils and other related characteristics. Agricultural districts shall include activities or uses as characterized by the cultivation of crops, orchards, forage and forests, farming activities, open area recreational uses, and related activities.
>
> *Conservation District*. This district shall include areas necessary for protecting watersheds and water sources; preserving scenic and historic areas; providing park lands, wilderness, and beach reserves; conserving indigenous or endemic plants, fish, and wildlife, including those which are threatened or endangered; preventing floods and soil erosion; forestry; open space areas where existing openness, natural condition, or present state of use, if retained, would enhance the present or potential value of abutting or surrounding communities, or would maintain or enhance the conservation of natural or scenic resources; areas of value for recreation purposes; and other related activities. Activities within the Conservation district shall be established by the State of Hawaiʻi Board of Land and Natural Resources.

All land in and near all of the project corridors is classified within the State Land Use Agricultural District (see ***Fig. 3.1.4***). If intersection improvements are required *makai* of the existing Queen Kaʻahumanu Highway, they would involve land in the State Land Use Urban District. Transportation systems are allowable uses in all State Land Use Districts, and the Project would be consistent with State Land Use District regulations.



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SADDLE ROAD EXTENSION

FIGURE 3.1.3 ~ GENERAL PLAN LAND USE DESIGNATIONS AND FACILITIES MAP

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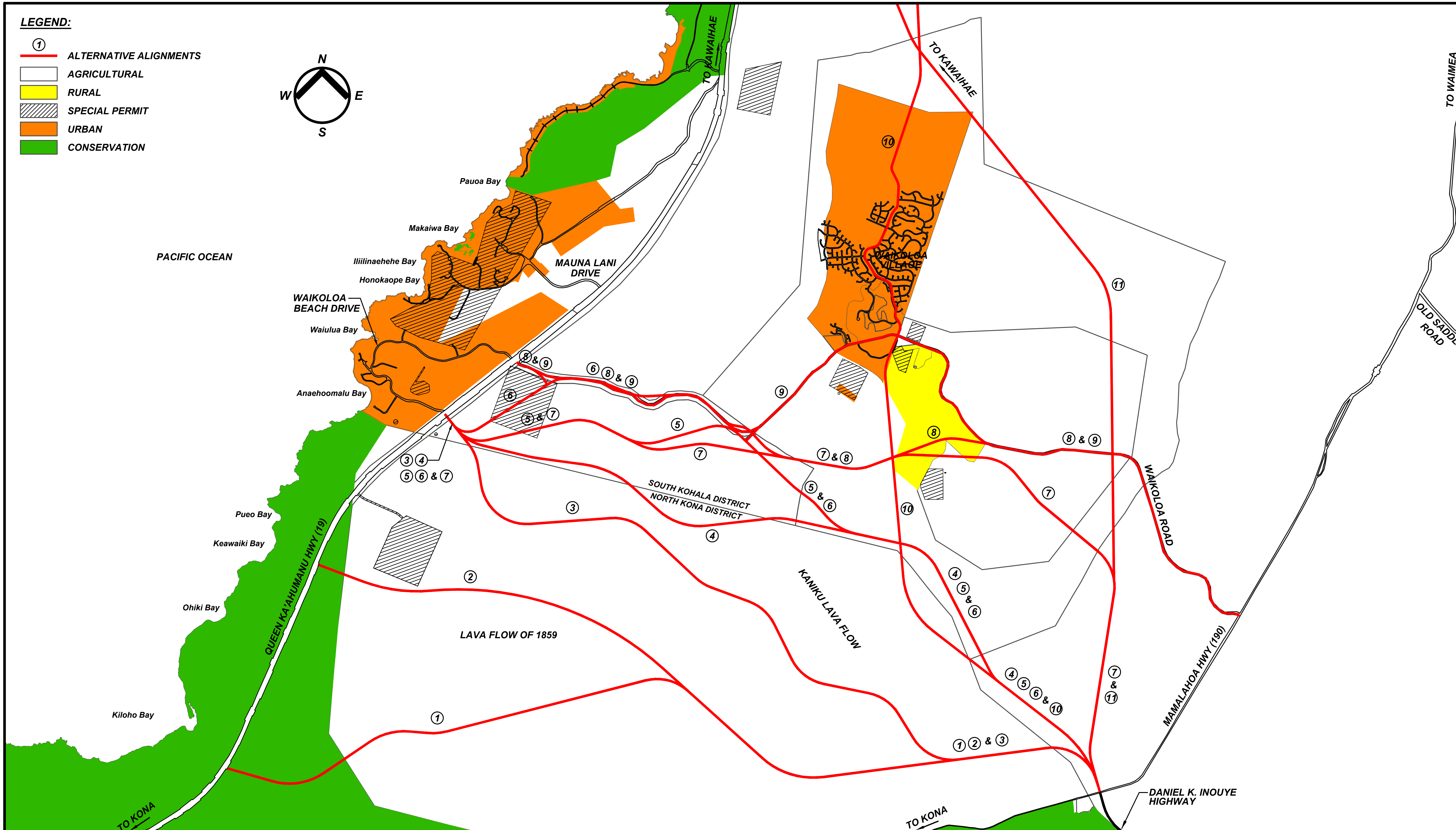

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GRAPHIC SCALE IN FEET

SADDLE ROAD EXTENSION

FIGURE 3.1.4 ~ STATE LAND USE DISTRICT AND COUNTY ZONING

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3.1.2.1.7 Hawai‘i County Zoning Code

The Hawai‘i County Zoning Code, as contained in Chapter 25 of the Hawai‘i County Code, is the legal instrument that regulates the use of land within the SLU Urban, Agricultural and Rural Districts (but not the Conservation District, which is under the control of the State Department of Land and Natural Resources). The land in the *mauka* portion of the project corridor, in Segment 4/5/6 *mauka*, is zoned Open. Zoning in all other locations is A-5a (Agricultural, minimum lot size 5 acres) (refer to ***Fig. 3.1.4***). The proposed project is consistent with uses permitted within these County zoning districts.

3.1.2.1.8 Kona and South Kohala Community Development Plans

The South Kohala and Kona Community Development Plans (CDP) pertain to the judicial districts of South Kohala, and North and South Kona, respectively. They were developed under the framework of the February 2005 County of Hawai‘i General Plan. Community Development Plans are intended to translate broad General Plan Goals, Policies, and Standards into implementation actions as they apply to specific geographical regions around the County. They are also intended to serve as a forum for community input into land-use, delivery of government services and any other matters relating to the planning area. The General Plan now requires that a Community Development Plan shall be adopted by the County Council as an “ordinance,” giving the CDP the force of law. This is in contrast to former CDPs that were adopted by “resolution” and served only as guidelines or reference documents for decision-makers.

The Hawai‘i County Council adopted the Kona CDP in September 2008 and the South Kohala CDP in November 2008. The plans have many elements and wide-ranging implications, but there are several major strategies that embody the guiding principles related to land use, housing, public facilities, infrastructure and services, and transportation.

The Saddle Road Extension project is consistent with plans related to road improvements in the two CDPs. Specifically, Section 4.1.2, “Overall Strategy,” of the Kona CDP notes that “Widening, improving and extending major arterials, as well as increasing connectivity between and within existing and future development are necessary to enhance mobility in Kona.” The South Kohala CDP contains a map figure entitled Waikoloa Village Conceptual Plan that depicts the “Possible Saddle Road Extension” as a conceptual alignment on the South Kohala side of the border with North Kona, in roughly the same area traversed by the project corridors of Alternatives 4, 5 and 6.

The Project is also consistent and/or not inconsistent with other goals, objectives and policies of the CDPs, in particular with the policies or principles that seek to guide planning for the districts.

3.1.2.2 Summary of Consistency of Alternatives with Existing Plans and Policies

The proposed Saddle Road Extension project complies with appropriate State and County land use policies, plans, goals, objectives and controls. It would facilitate implementation of the State Plan, the Transportation Functional Plan, the Federal-Aid Highways 2035 Transportation Plan for the District of Hawaii, the Statewide Transportation Improvement Program (STIP), the County of Hawaiʻi General Plan, the Kona and South Kohala Community Development Plans, and the land use controls and regulations established pursuant to the State Land Use Law and the Hawaiʻi County Zoning Code.

Table 3.2.1, *Consistency with Land Use Plans and Policies*, summarizes the Project's conformance with previously described land use plans and policies.

Differences in Impacts Between Alternatives 4, 5 and 6 and Intersection Design Options

There are no notable differences in consistency with existing plans and policies between Alternatives 4, 5 and 6, or Design Options 1 or 2, as each is equally consistent.

Impacts of the No Action Alternative

The No Action Alternative would not be inconsistent with any existing land use designations. However, it would not promote implementation of the goals, policies, objectives, and proposed actions of the State Plan, the Transportation Functional Plan, the Federal-Aid Highways 2035 Transportation Plan for the District of Hawaii and Statewide Transportation Improvement Program (STIP), the County of Hawaiʻi General Plan, and the Kona and South Kohala Community Development Plans specifically related to promoting better transportation facilities to serve the communities of the Island of Hawaiʻi.

3.1.2.3 Environmental Consequences and Mitigation

The proposed project is consistent with all land use plans and policies, and no additional approvals such as State Land Use District boundary amendment, County change of zone, or other action is required.

3.2 FARMLAND AND RANCHING

For Farmland and Ranching, the region of influence is the area of the project corridors as well as the landholdings of which they are a part, as these are the lands where farming or ranching could potentially be affected (refer to ***Fig. 3.1.1*** for property maps).

3.2.1 Affected Environment

No farmland or farms are present, but the *mauka* half of the project area traversed by the project corridors is leased for grazing, with very sparse stocking rates because of the rocky and dry conditions and lack of valuable pasture grasses (refer to photos in ***Fig. 1.2***).

Table 3.2.1 Consistency with Land Use Plans and Policies

Agency	Name	Year	Plan Purpose or Description	Plan or Policy Conformance
State of Hawai‘i	Hawai‘i State Plan	1991	Establishes broad goals, objectives and policies to guide the overall development of the State.	Consistent with State goals on economy/transportation.
State of Hawai‘i	Hawai‘i Long Range Land Transp. Plan, Federal-Aid Highways 2035 Transp. Plan for the District of Hawaii, and 2015-2018 Statewide Transportation Improvement Program (STIP) Plan	2014 and 2016	Identifies and prioritizes major highway system improvements necessary to accommodate future traffic demands.	Consistent with recommendation for the Saddle Road Extension.
State of Hawai‘i	Hawai‘i State Transportation Functional Plan	1998	Establishes guidelines for implementation of the State Plan with respect to transportation.	Consistent with Plan on regional mobility, land use, economic development.
State of Hawai‘i	Hawai‘i State Land Use Law	1962	Establishes the legal uses within the State Land Use Urban, Rural, Agricultural, and Conservation Districts.	Consistent with State Land Use District regulations.
County of Hawai‘i	County of Hawai‘i General Plan	2005	Long-Range Comprehensive Plan guiding the overall development of the County.	Consistent with Transportation Goals of the General Plan, and all other policies.
County of Hawai‘i	General Plan LUPAG and Facilities Map	2005	Maps show general location of land uses and roadway networks in relationship to each other.	Project is consistent with maps which call for Saddle Road Extension. LUPAG designations for all project corridors consistent with highway use.
County of Hawai‘i	County of Hawai‘i Zoning	No date	Establishes zoning districts.	Zoning designations for all project corridors consistent with highway use.
County of Hawai‘i	Kona and South Kohala and Kona Community Development Plans	2008	Long-Range Comprehensive Plan guiding the overall development of the Kohala and Kona Districts.	Project is consistent with maps which call for Saddle Road Extension, and all other policies.

3.2.2 Environmental Consequences

Cattle Ranching Impacts

Short-term, construction-related impacts to ranching would be nearly identical among the alternatives. All would involve use of grazing land, although this would likely be minor because of the very low density of cattle in the area. Depending on the pastures that cattle happen to be placed in during the construction period, there is some potential that with cattle may need to be relocated temporarily during this period.

Although the project area is only sparsely grazed, each of the alternative project corridors would involve removal of a total of about 200 acres of grazing land. In the context of the hundreds of thousands of acres of grazing land in the region, there would be no impacts to the cattle industry. The highway would also divide pasture areas, causing logistical issues for grazing. Ranching infrastructure such as fences, gates and paddocks will be affected. Without mitigation such as the installation of fencing, gates and cattle crossings, the ability to move grazing animals from one part of the property to another will be impeded. No property will be reduced in size such that grazing is no longer practical, but grazing may be marginally more difficult because of the need to cross the highway.

Farmland Protection Policy Act (FPPA) Compliance

Federal agencies must identify and consider the adverse effects of their programs on the preservation of important farmland, under the Farmland Protection Policy Act (FPPA). Agencies must consider alternative actions that could reduce adverse effects and ensure that their programs, to the extent practicable, are compatible with State, local government and private programs and policies to protect farmland. As part of FPPA compliance, the U.S. Natural Resources Conservation Service (NRCS), formerly known as the Soil Conservation Service, was consulted to determine the soil and agricultural resources present in the project corridors and vicinity, in conformance with FHWA regulations related to the FPPA, at 7 CFR 658.4(a). FHWA prepared a Farmland Conversion Impact Rating (FCIR) form and provided it along with maps of the corridor to NRCS. The assessment is done to evaluate a highway project’s relative impact on farmland in a region, county and state. It takes into account the acreage of farmland directly converted, the potential to indirectly convert agricultural land to non-agricultural uses, impacts to individual farms, and the relative size and importance of the farms affected. The evaluation process derives an impact rating that varies from 0 to 260 points. The first step in the process is to determine if farmlands considered important are present in the area. For Hawaiʻi, NRCS evaluates farmlands as important if they are classified within the Agricultural Lands of Importance to the State of Hawaiʻi (ALISH) system as Prime, Unique or Other Important Lands. In the case of the Saddle Road Extension Build Alternatives, NRCS determined that no such lands are present in Alternatives 4, 5 or 6, and that there was thus no need for further evaluation. ***Appendix A4*** contains Form AD-1006 and correspondence dated December 5, 2014 from NRCS.

Differences in Impacts Between Alternatives 4, 5 and 6 and Intersection Design Options

Because ranching is confined to the *mauka* portion of the project area, where the project corridor is shared by Alternatives 4, 5 and 6, there is no difference between the alternatives in terms of effects to cattle grazing, which is the only potential effect to farmlands and ranching. Approximately 200 acres would be removed from grazing and converted to highway uses under any Build Alternative.

Design Option 1, in which the Saddle Road Extension intersection with Māmalahoa Highway would remain at-grade, would have lesser effects on grazing in the *mauka* half of the project corridors, because less land would be used. The grade-separated intersection under Design Option 2 would require more acreage and thus greater displacement of grazing.

Impacts of the No Action Alternative

The No Action Alternative would have no effect to farmland or ranching.

3.2.3 Mitigation Measures

No mitigation is necessary or planned for impacts to farmland used for crops, as none is present in the corridor. In terms of grazing operations, HDOT will be responsible for the following actions for all affected grazing land:

1. Provide funding for temporary relocation of cattle during construction, if determined to be necessary during coordination with land managers and ranchers.
2. Construct (non-barbed wire) fencing along the right-of-way of the highway for access control and cattle control, and be responsible to maintain the fence.
3. Provide for access on both sides of the highway to properties used for grazing that are divided by the highway.
4. Re-fence existing paddocks and corrals.
5. Right-of-way will be acquired in conformance with the Uniform Relocation and Real Property Acquisition Policies Act of 1970. (Cross-reference Section 3.4.2)

3.3 SOCIOECONOMIC

The project area is an essentially unpopulated extent of land near the junction of the major highways of East Hawaiʻi and West Hawaiʻi (refer to ***Fig. 1.1)***. The Daniel K. Inouye Highway is the link to island's main city of Hilo (2010 population 43,623) and the rest of East Hawaiʻi as well as Pōhakuloa Training Area, and the recreational and scientific destinations on Mauna Kea and Mauna Loa. Māmalahoa Highway (SR 190) links to Waimea and Kailua, Queen Kaʻahumanu Highway (SR 19) leads to Kailua and Kawaihae, and Waikoloa Road leads to Waikoloa Village and the Waikoloa and other resort areas. The purposes of cross-island travel include recreation, shopping, business, and commuting. Astronomers, support staff, and suppliers with bases in Hilo or Waimea require access to Mauna Kea. Thirteen observatories are currently present. Several existing observatories are likely to be decommissioned or upgraded within the next ten years. Depending on the schedule of activity, between dozens and hundreds of trips per day are associated with astronomy, and an at least equal number occurs related to astronomy and mountain tourism. Hunters, hikers, and recreationalists also access the Saddle area between Mauna Loa and Mauna Kea in the heart of the island.

Several towns and villages and some major resort centers are located within about seven miles of some part of the project corridors.

- Waikoloa Beach Resort and Mauna Lani Resort, 0.2 to 2.5 miles from the western (*makai*) terminus;
- Waikoloa Village (2010 pop. 6,362), about 2.5 miles from the tie-in point between Alternatives 5/6 and Waikoloa Road;
- Waikiʻi, (pop. not recorded in 2010 census) an agricultural subdivision of about 120 lots, about 4.5 miles from the eastern (*mauka*) terminus;
- Puakō (2010 pop. 710), about 6 miles from the western (*makai*) terminus; and
- Puʻuanahulu (pop. not recorded in 2010 census), a small village of about 100 properties located 7 miles from the eastern (*mauka*) terminus.

Other population and commercial centers that are farther away and less directly affected are Waimea (2010 pop. 9,212; about 12 miles north of the eastern terminus), and Kailua (2010 pop. 11,975; about 25 miles south of both the eastern and western termini). These towns are centers of population and employment in the diverse economic sectors of the island, including agriculture, construction, government and particularly the visitor industry. As the Project involves streamlining of cross-island traffic, to some extent the entire island of Hawaiʻi is affected. The level of information in Section 3.3 is geared to reflect this hierarchy of effects.

This section of the EIS discusses the interaction of the Project with socioeconomic factors. Section 3.3.1 begins with a discussion of historical and projected population growth on the island and in the project area, and the relationship of the Project to this growth. Section 3.3.2 discusses the economy, the visitor industry and employment, and particularly the issue of how the new proposed highway relates to employment and tourism, including the effect on local businesses in Waikoloa Village. This section also deals with fiscal impacts for County and State government. Section 3.3.3 looks at measures of social welfare and whether there are aspects of the Project that may affect these in a positive or negative way. Section 3.3.4 discusses whether there are minority and low-income populations that may be disproportionately adversely impacted, a matter of environmental justice. Finally, Section 3.3.5 examines existing public facilities, services and utilities and potential impacts to these.

For socioeconomic impacts, the region of influence is defined as the Island of Hawaiʻi, although the communities that are nearer the project corridors – Waimea, Kailua, Puʻuanahulu and particularly Waikoloa Village – will experience a greater level of beneficial and adverse effects. They are thus examined more closely.

3.3.1 Population

3.3.1.1 Affected Environment

Hawaiʻi County has experienced continuing population growth over the last half-century. From 1960 to 2015 the population grew from 61,333 to 196,428, representing an average annual growth rate of 2.2 percent (U.S. Census Bureau 2016). Population growth has not been evenly distributed. Although East Hawaiʻi still claims most of the island's residents in South Hilo and adjacent districts, much of the growth over the last 25 years has been concentrated in drier, sunnier West Hawaiʻi, where most tourist resorts and hotels are located, and growth rates of over 4 percent per year have been common. Moreover, on any given day, visitors account for more than 5 percent of the de facto population – and most are in West Hawaiʻi. However, East Hawaiʻi's Puna District, where there is affordable housing and good access to the services and jobs of Hilo, has also experienced high population growth. Outlying areas in East Hawaiʻi – Hamakua, eastern Kaʻū and North Hilo – have seen little population growth.

In 2012, the State Department of Business, Economic Development and Tourism (DBEDT) released a new series of long-range projections. These projections recognized that despite the economic recession of 2008, the Island of Hawaiʻi experienced the fastest population growth in the State (***Table 3.3.1***). DBEDT anticipated population and job growth continuing at higher rates than the visitor count. They accordingly suggest two economic trends: successful targeting of high-income visitors and diversification of the local economy. The former trend supports high employment in the visitor industry. As the local economy grows, it can support a larger share of its own commercial infrastructure, lessening dependence on Oʻahu.

Table 3.3.1
Hawaiʻi DBEDT 2040 Series Population Projections for Hawaiʻi County

Year	Residents	Total Job Count	Visitor Units	Average Visitor Census
2010	185,406	93,927	11,595	24,749
2020	220,880	112,230	11,600	29,260
2030	258,510	131,430	12,120	32,700
2040	296,320	151,690	13,460	36,320

Source: Population and Economic Projections for the State of Hawaiʻi to 2040: DBEDT 2040 Series. Honolulu, 2012. http://dbedt.hawaii.gov/economic/economic-forecast/2040-long-range-forecast/ (accessed March 2017)

As discussed in Section 3.2 above, the long-range *Federal-Aid Highways 2035 Transportation Plan for the District of Hawaii* (HDOT 2014) sets the direction for land transportation system improvements for which priorities and federal funding can be developed. HDOT forecasted population data as a key variable for predicting motor-vehicle travel patterns and traffic volumes to the year 2035. The land use and socioeconomic forecast data came from the 2008 version of the Hawaiʻi State DBEDT *Long Range Projections*, which are done on an island by island basis. For a finer geographic scale, HDOT utilized the County of Hawaiʻi General Plan's 2005 projections of the *proportion* of population that would reside in each district in the year 2020, and then projected this forward to 2035. ***Table 3.3.2*** shows these estimates. The forecast predicted an average annual growth rate of 1.74% for the County of Hawaiʻi as a whole, and 3.03% for South Kohala, a rate that would double the population within 24 years.

Table 3.3.2. Population Forecasts in Hawaiʻi County by District, 2007 to 2035

District	Population			Population Change (Year 2007 to Year 2020)		Population Change (Year 2007 to Year 2035)	
	2007	2020	2035	Difference	% Difference	Difference	% Difference
North Kohala	5,600	9,310	13,440	3,710	66%	7,840	140%
South Kohala	16,790	25,320	38,840	8,530	51%	18,050	108%
Hāmākua	6,090	6,810	7,710	720	12%	1,620	27%
North Hilo	1,910	1,990	2,080	80	4%	170	9%
South Hilo	47,620	49,790	50,540	2,170	5%	2,920	6%
Puna	42,380	62,170	84,460	19,790	47%	42,080	99%
Kaʻū	7,900	9,960	11,720	2,060	26%	3,820	48%
North Kona	35,780	46,470	57,510	10,690	30%	21,730	61%
South Kona	8,970	17,750	17,750	4,480	50%	8,780	98%
TOTAL	**173,040**	**225,270**	**280,050**	**52,230**	**30%**	**107,010**	**62%**

Source: Hawaiʻi State DOT 2014 (Population based on forecasts from DBEDT, with district allocations based on growth rates provided in Hawaiʻi County General Plan.

3.3.1.2 Environmental Consequences

New highways have the potential to influence population patterns and growth through several means. Construction of a highway in a region where the construction labor force is insufficient to provide labor may draw in temporary or permanent new residents. A new highway may revolutionize the economic prospects of a region and start new economic generators that cause significant growth or alteration of existing settlement patterns. Finally, a new highway may enable land development on its margins that induces population growth. Each of these potential sources of population growth is examined below.

As discussed in detail in Section 3.3.2, below, the labor force on the Island of Hawaiʻi is generally sufficient to absorb the additional labor requirements of a project on the scale of the Saddle Road Extension. This has been evident through the phased construction from 2002 to 2016 of the Saddle Road Improvements project over the last 14 years, which provides evidence of a skilled and ready workforce for road construction projects. Some workers may be brought to the island from elsewhere in Hawaiʻi or even the U.S. mainland, depending on the contractor who wins the award for construction, but the scale is small. The total required labor is about 4 percent of the existing workforce, well within the historical range of variation. Accordingly, while construction of new Saddle Road segments could attract workers other than current Hawaiʻi County residents if unemployment dips significantly from its current high level before construction, the short-term increase does not amount to a significant change.

The new link in the State highway system represented by the Saddle Road Extension would widen travel choices of both residents and visitors by offering shorter routes to destinations that State and County agencies expect to continue growing. There are two important commonly-traveled routes that would benefit from the time savings that the Project would enable:

Route 1. The terminus of the Daniel K. Inouye Highway to/from Waikoloa Beach Drive at Queen Kaʻahumanu Highway, and from there on to Kona International Airport; and

Route 2. The terminus of the Daniel K. Inouye Highway to/from Waikoloa Road at Queen Kaʻahumanu Highway, and from there north to Puako and Kawaihae.

Utilizing the maximum legal speed per existing and expected speed limits for various parts of the routes, the estimated time savings of using the Saddle Road Extension for Route 1 is 6.6 minutes, and for Route 2, 5.0 minutes. The differences between alternatives are insignificant fractions of a minute. Although the savings in time, fuel and emissions for each individual trip are small, the cumulative savings considering up to 10,000 trips a day, 365 days per years, are substantial.

The new highway link would not, however, provide any fundamental change in the economic activity in any location it accesses. The more efficient link is not likely to attract people to the island, affecting the total resident population, once construction is finished, or otherwise directly affect or redirect settlement patterns or population growth.

Growth-inducing impacts are related to the potential for a project to induce or accelerate currently planned or unplanned project area development, encourage shifts in growth from other areas in the region, or intensify growth beyond the levels anticipated and planned for without the Project. It is important to examine potential growth in the context of growth policies and development constraints.

As shown in ***Figures 3.1.3*** and ***3.1.4*** above (CROSS REFERENCE Section 3.1), most of the corridor area is ultimately envisioned for Urban Expansion by the County of Hawaiʻi General Plan, except for the *mauka* (eastern) quarter near Māmalahoa Highway. However, none of the land currently is within the State Land Use Urban District, and none is zoned by the County for urban uses. The procedure to designate the land for urban uses is extensive and considers a wide variety of factors. In the last several decades, only one property, Aina Leʻa, has been able to achieve such entitlements, and it has not yet been developed. Although there is an abundant inventory of thousands of acres of urban zoned land in this area, most with at least some of the road and water infrastructure necessary to develop it, only a small percent has been developed and absorbed by the market in the last 30 years. All of this has been either part of the resort complex *makai* of Queen Kaʻahumanu Highway or directly adjacent to Waikoloa Village, where every one of the key variables is in place: zoning, road access, water and wastewater entitlements, and electricity infrastructure. The great majority of urban zoned land with existing ready access to Waikoloa Road or Queen Kaʻahumanu Highway fails to be developed. In addition to a lack of appropriate State and County zoning and apparent market demand, the areas surrounding the project corridors lack water infrastructure, a critical issue in this area with no surface fresh waters and very limited aquifers. Because of these reasons, the potential for significant additional urban development in this area for the foreseeable future would appear marginal at best.

Development into large "agricultural" lots would be more feasible in the near future, as it is consistent with the Open and Agricultural, 5-acre minimum lot size land use designations and does not require a series of discretionary permits. In the *mauka* area, where grazing is currently being conducted, one agricultural subdivision into about fifteen 80-acre lots is currently in planning. The proposed highway would not benefit access, which already exists, and may actually create remnant property that reduces possible density. Aside from this project, there is abundant agriculturally zoned land in the project area in areas that lack soil and water. At least 20,000 acres of such land have the potential for subdivision into lots as small as five acres. The market for such lots is not agriculture per se but single-family homes on large lots reasonably near resorts. Despite the large inventory for such land, very little of it has been subdivided or has current plans for subdivision. Even where the factors promoting subdivision are most favorable – available water, highway access, and reasonable proximity to resort beaches – almost no subdivision has occurred. The potential for short or medium term agricultural subdivision development would appear to be low, and no aspect of the proposed project would provide the critical element needed to induce subdivision.

In the long term of 30 to 100 years, however, it is possible that global market or energy conditions may change such that urban development or agricultural subdivisions would be more feasible. While the existence of a new State highway in the area would be helpful for development, it is not a critical need, as other access on Waikoloa Road and/or Māmalahoa Highway and/or Queen Ka‘ahumanu Highway already exists. Furthermore, the nature and timing of growth would largely be at the discretion of the State and County governments, which through zoning, land use district and other approvals exercise considerable influence on growth. Government decisions must balance concerns over excessive urban development with the need for additional housing stock and demands for the quality of life afforded by development in this area. Consequently, while the development of the Saddle Road Extension could facilitate planned development approved by County and State plans for the Waikoloa area, it would not in itself modify the planned land use patterns or accelerate growth. Considering all these factors, there is no rational argument to be made that the new highway would induce development or population growth.

Differences in Impacts Between Alternatives 4, 5 and 6 and Intersection Design Options

No differences with respect to worker influx, alteration of settlement patterns or induction of population growth exist between the alternatives or the design options. The time savings differences between alternatives are insignificant fractions of a minute.

Impacts of the No Action Alternative

There is no difference with respect to settlement patterns or population growth between any of the Build Alternatives and the No Action Alternative.

3.3.1.3 Mitigation Measures

No mitigation measures are required for changes to settlement patterns or population growth, as neither are expected as a consequence of the proposed project.

3.3.2 Employment, Visitor Industry and Fiscal Impacts

3.3.2.1 Affected Environment

Employment

Over the last half-century, Hawai‘i County has seen major changes in its economic base. Plantation agriculture, the mainstay of the island economy for over a century, ended in the 1990s. Although the South Hilo and Puna Districts were steadied by having the center of government and commerce located in Hilo, the communities in North Kohala, Hamakua, North Hilo and Ka‘ū were left with few local jobs. The foundational role of the plantations was gradually replaced in the later 20th century by services and retail associated with tourism. Employment on the Island of Hawai‘i is now centered principally on the government sector (including education), trade, and services, with construction fluctuating significantly depending on the economy (***Table 3.3.3***).

Table 3.3.3. Job Count by Industry and Sector, County of Hawai‘i

Industry	**2010-2013 estimate**	**2008-2010 estimate**
Civilian employed population 16 years and over	80,208	85,320
Agriculture, forestry, fishing and hunting, and mining	5.0%	4.8%
Construction	6.5%	11.0%
Manufacturing	2.4%	2.7%
Wholesale trade	2.0%	2.9%
Retail trade	13.0%	12.6%
Transportation and warehousing, and utilities	5.5%	4.5%
Information	1.4%	1.0%
Finance and insurance, and real estate and rental and leasing	4.5%	5.2%
Professional, scientific, and management, and administrative and waste management services	12.2%	9.0%
Educational services, and health care and social assistance	19.1%	19.0%
Arts, entertainment, and recreation, and accommodation and food services	17.4%	17.9%
Other services, except public administration	5.3%	4.1%
Sector		**Proportion of Employment**
Private Sector		71.4%
Government		28.6%
Federal		2.3%
State		14.0%
Education (DOE & UH)		8.1%
Local		4.2%

Source: Sectors http://dbedt.hawaii.gov/economic/databook/db2012/ Industry: http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_3YR_CP03&prodType=table (accessed March 2017)

Hawai‘i County has seen steady growth in the number of jobs over recent decades, but unemployment rates have fluctuated from nearly 3% to 12% in that time. As of November 2016, the County unemployment rate was 3.4% (not seasonally adjusted), which has held steady for about a year. Meanwhile, the State as a whole had an unemployment rate of 2.8 (not seasonally adjusted) (Hawai‘i State Department of Labor and Industrial Relations: https://www.hiwi.org/gsipub/index.asp?docid=417 , accessed March 2017).

On the northwest side of the Island of Hawai‘i that is the site of the proposed project, many jobs are related in some way to the visitor industry. Five resorts are among the top 10 employers in the County, with each employing at least 450 workers. The Hilton Waikoloa Village resort accounted for 935 by itself (Hawai‘i County Department of Research and Development, http://records.co.hawaii.hi.us/WebLink8/DocView.aspx?id=63496&dbid=1; accessed March 2017). Workers commute from offsite, primarily from North and South Kohala and North Kona, but there are some workers from each district in the island, including Puna and Ka‘ū. Hundreds of workers commute daily from a central meeting point for East Hawai‘i residents in downtown Hilo. All of the resort complexes are accessed along a stretch of Queen Ka‘ahumanu Highway that is anchored on the western terminus of the proposed Saddle Road Extension.

Given the existing population structure and the decades-long trends in expansion of the visitor industry, as well as other economic activities including agriculture, high tech and energy, HDOT forecasted a strong continuing growth in employment (***Table 3.3.4***). Much of the growth will continue to be concentrated in the visitor industry and will generate job-related traffic on project area highways.

Table 3.3.4 Employment Forecasts in Hawai‘i County by District, 2007 to 2035

District	Population			Employment Change (Year 2007 to Year 2020)		Employment Change (Year 2007 to Year 2035)	
	2007	2020	2035	Difference	% Difference	Difference	% Difference
North Kohala	780	920	1,100	140	18%	320	41%
South Kohala	10,600	12,350	14,770	1,750	17%	4,170	39%
Hamakua	1,010	1,300	1,580	290	29%	570	56%
North Hilo	160	210	250	50	31%	90	56%
South Hilo	27,050	34,540	41,450	7,490	28%	14,400	53%
Puna	4,350	4,860	5,750	510	12%	1,400	32%
Kau	920	1,160	1,410	240	26%	490	53%
North Kona	21,340	26,940	32,640	5,600	26%	11,300	53%
South Kona	2,140	3,050	3,760	910	43%	1,620	76%
Total	68,350	85,330	102,710	16,980	25%	34,360	50%

Source: Hawai‘i State DOT, 2014 (Employment based on forecasts from DBEDT, with district allocations based on existing employment rates.

Visitor Industry

The visitor industry in the State of Hawai‘i is significant for its effects on land use, employment and business, and traffic. Total visitors to the Hawaiian Islands grew from about 17,000 in 1927 to about 46,000 by 1950, and skyrocketed to 296,000 in 1960 and 6.9 million in 2010 (DBEDT: http://dbedt.hawaii.gov/visitor/ accessed March 2017).

The Island of Hawai‘i shared a modest portion of this growth, but it wasn’t until the late 1980s that the annual visitor count hit one million. Through the mid-19th century tourism was concentrated in the major population center of Hilo, leading to the lengthening of runaways at the small airport to accommodate large non-stop jet aircraft from the mainland in 1965. Soon after, however, it became apparent that visitors were increasingly drawn to the sunny side of the island. Hotels were built in Kailua and then other locations in Kona and Kohala, and the region quickly began to dominate the industry, necessitating a modern airport at Keahole in 1970. Queen Kaʻahumanu Highway was built in the early 1970s in part to link resort nodes and promote tourism and jobs in growing West Hawaiʻi.

The Hawaiʻi Tourism Authority (HTA) calculates that on any given day, over 39,000 visitors are present on the island of Hawaiʻi, with the great majority on the west side (HTA 2014, http://www.hawaiitourismauthority.org/research/reports/annual-visitor-research/; accessed March 2017). Four major resort complexes, stretching from Kaʻūpulehu in the south to the Mauna Kea Resorts in the north, now contain the majority of the 6,564 hotel rooms on the island. Also significant are the condominium hotels, apartments, bed and breakfasts, hostels, and particularly vacation rentals and timeshares. The majority are located in Kohala or Kona, altogether accounting in 2015 for another 4,521 units (HTA http://www.hawaiitourismauthority.org/default/assets/File/reports/accommodations/2015%20VISITOR%20PLANT%20INVENTORY%20REPORT.pdf; accessed March 2017).

The visitor industry continues to grow, although more modestly than the boom decades of the late 1900s. In the latest DBEDT forecast released on May 18, 2016, both visitor arrivals and visitor days are expected to increase by over 2 percent in 2016 (Hawaiʻi DBEDT 2016: http://dbedt.hawaii.gov/visitor/tourism-forecast/; accessed March 2017). For 2017, the growth rates of visitor arrivals, visitor days, and visitor expenditures are now expected to be 1.8 percent, 2.0 percent, and 4.1 percent, respectively. The Island of Hawaiʻi's airports are forecast to accommodate approximately 5.3 million passengers in the year 2020 and 6.1 million passengers in 2035 (HDOT 2014). This equates to an approximate 8.1 percent increase of passengers by 2020, and 24.0 percent increase by 2035.

Local Businesses in Waikoloa Village

The Project is predicted to cause some proportion of some types of traffic to bypass Waikoloa Village, which would vary depending on the selected alternative. Therefore, it is important to note those businesses that may experience a decline in regional traffic drive-by business. Waikoloa Village has one major shopping center – Waikoloa Highlands Center – located along Waikoloa Road, with several small stores or restaurants located outside this core. The center is currently anchored by a supermarket and has over a dozen smaller tenants including a gas station, several restaurants, retail operations, and service businesses. Discussions with businesses owners at community meetings indicate that customers are dominated by local residents, as well as visitors staying in condominiums in Waikoloa Village or in the resorts below who specifically come to Waikoloa Village to shop or dine. Pass-through traffic from motorists bound from/to Waimea or Hilo and Kona is a smaller but not insignificant customer base.

Fiscal Setting

The County and State of Hawaiʻi depend on several types of taxes for revenue to support public programs and facilities. Major sources of government income are real property tax for the

County and income and excise taxes for the State. Revenues for State highway construction and maintenance come from the State Highways Fund and federal sources.

3.3.2.2 Environmental Consequences

Employment

Construction of the Saddle Road Extension would involve construction labor over a period of about two years and would cost between approximately $63 to 74 million in 2018 dollars, depending on the Alternative and Design Option selected (see ***Table 2.3.1***). The average size of the workforce can be estimated, as shown in ***Table 3.3.5***. On the average for a period of two years, approximately 305 to 335 workers would be employed. Direct jobs are created in the firms tasked with construction. Some may be located in offices and baseyards, not at the work site. The indirect and induced jobs shown in the table are created by the expenditure of capital in the regional economy. That spending would occur over a longer period than the anticipated two-year construction schedule, and over a wider area, not just in Hawaiʻi County. Construction costs could increase due to options such as grade-separated intersections at one or more locations, which could add $10 million or more to cited costs per intersection. Construction jobs and wages would increase in proportion to construction spending. Although maintenance of the highway would require labor, no new continuing jobs are anticipated as a result of the construction of the highway.

Table 3.3.5
Economic Impact of Saddle Road Extension Construction

Alternative	Construction Value	Regional Economic Output	Total Earnings	Total Jobs (Person Years of Employment)
Alternative 5, with grade-separated interchange (max)	$74.0	$122.84	$31.82	670
Alternative 4, at-grade interchange (min)	$63.0	$104.58	$27.09	570

Notes
(1) The Alternative and Design Option combination with the maximum construction cost based on project engineer estimates is compared with the combination with the minimum construction cost in this table.
(2) Economic output includes direct, indirect and induced jobs and earnings based on Politano and Roadifer (1989) model *Regional Economic Impact Model for Highway Systems (REIMHS)*, updated for 2018-20, which relates typical highway construction jobs to construction spending. Construction is expected to last for two years, so the annual job count is half the total.

Hawaiʻi County's construction workforce has contracted and grown through several cycles over the last thirty years, which is typical of this industry in the United States. The annual average construction job count in 1998 was 2,300, and it stands at over 9,000 today. The economic recession of 2008 caused high unemployment among this workforce, which has slowly grown again. As has occurred throughout the six phases of construction from 2002 to 2017 of improvements to the Saddle Road (renamed in 2013 the Daniel K. Inouye Highway), the local workforce would almost certainly prove large enough to supply the labor for the Saddle Road Extension. Since work has steadily progressed on other segments, an experienced workforce is at hand. If those workers are committed to other jobs, construction workers could be brought to the Big Island from elsewhere in Hawaiʻi or even the U.S. mainland. The precise split among local, Statewide and national labor will depend to some degree on the contractor who wins the award for construction and the labor situation at the time of construction. Although some contractors may employ almost totally local labor, others from out-of-State will bring varying proportions of their own workers. The required workforce of a maximum of approximately 335 workers is a small portion (about 4%) of the construction workforce, an increase that puts the total workforce well within the historical range of variation. Additional jobs added by indirect and induced means would be distributed throughout the State and County. Because of the scale and diffuse nature, they would not be expected to induce labor shortages.

Visitor Industry and Island Businesses and Residents

The Project would have a beneficial effect on the visitor industry by reducing travel times for visitors centered in West Hawaiʻi to access destinations by automobile, particularly East Hawaiʻi attractions such as Hilo and Hawaiʻi Volcanoes National Park. It would also offer a safer bike route, promoting bike tourism. New highways offering novel scenic vistas may attract more visitation, as has occurred with the Daniel K. Inouye Highway. With improvements to this highway, tourists with rental vehicles as well as tour companies have been able to use it to access previously restricted and remote interior areas to view expansive lava flows from the Mauna Kea and Mauna Loa volcanoes; coastal, ocean, and adjacent island panoramas; and unique inner-island vegetation. Broad coastal vistas and the island of Maui can be seen from higher elevations of the island interior. The completely dark night sky in the interior also attracts tourists for stargazing. The Saddle Road Extension would make the attraction of the Daniel K. Inouye Highway even more accessible. While difficult to estimate, these benefits would likely be modest but not negligible. Both the east and west side of the island can benefit from the tourists arriving on both sides, which would potentially contribute to increased spending by tourists in the County of Hawaiʻi of roughly 0.5 percent. Even this modest rise results in a total increase of $7.7 million visitor spending per year.

Many scientific agencies such as the National Science Foundation, National Aeronautics and Space Administration (NASA), National Oceanic and Atmospheric Administration, and the Smithsonian Institution have research facilities at the Mauna Kea and Mauna Loa Observatories. The Saddle Road Extension would help provide safe, reliable, and efficient access to these facilities and contribute to their economic generation capabilities. The improvements would provide a shorter, safer cross-island commute for workers.

The Saddle Road Extension would help provides access to unique environments found only on Mauna Kea and Mauna Loa. The Saddle Road Extension would allow for safer accessibility to these areas and allow for greater use of this incomparable living laboratory, which would generate additional research dollars and create more jobs for the scientific and educational communities. It would also decrease costs and increase accessibility related to mountain hunting and gathering, which have economic implications for local residents.

Effects to Local Businesses in Waikoloa Village

Adverse impacts to businesses can occur when highway bypasses are built around a community and traffic through a town is reduced. The economic literature concerning bypasses suggests that while adverse effects may often occur, many variables influence whether or not they occur and how severe they will be. It is also important to distinguish between short-term and long-term effects. Major studies have been concentrated in the Midwestern United States and Texas. Key findings include:

- In most communities, highway bypasses have little adverse impact on total economic activity (Leong and Weisbrod 1999). Volumes of sales, employment and population are usually not greatly affected (Thompson, Miller and Roenker 2001).
- Specific businesses and the overall business pattern in bypassed communities may be affected, at least in the short term. Travel-related businesses – notably restaurants, bars, motels, and service stations – on existing roads may lose revenue when a bypass opens (Burress 1996).
- Community size can make a difference. Towns with populations less than 2,500 in much of the U.S. tend to be declining with or without new highway construction. They have high commercial vacancy rates and an even mix of retail and service businesses. They have low ratios of customers to businesses. In medium and large towns, vacancy rates are much lower and most businesses, both in traditional downtowns and in outlying areas, are retail firms. The customer base for businesses tends to be higher than in small towns (Comer and Finchum 2001). In general, the smaller the town, the longer the bypass, and the easier it is to develop new commercial areas outside the bypassed town, the more likely are adverse economic impacts. During and after bypass construction, tax collections from medium and large towns generally continue to grow (Ibid).
- Even when business revenues decline, local communities may perceive their bypasses positively. Business leaders in small Texas towns, for example, saw decreases in traffic congestion as improving the quality of life in their towns (Andersen et al, 1990, as summarized in Comer and Finchum 2001).
- After a bypass opens, retail businesses are more likely than services to be found near the new road or intersection. However, this is usually due to new business openings rather than relocation from the downtown area (Thompson, Miller and Roenker 2001).
- Limited access along the bypass can be important. If land use controls prohibit the development of retail centers that would capture the business that once flowed to the town center, then the impact to merchants tends to increase (Collins and Weisbrod 2000).
- Adverse impacts can be limited by signage and road planning that make it easy for travelers to visit the bypassed town.

The new highway would bypass Waikoloa Village. A number of bypass roads have been built in Hawaiʻi, several of which have been in place long enough to separate out short- and long-term effects of the new traffic routes. Notable bypasses include Haleiwa on Oʻahu, and Honokaʻa, Keaʻau and Pāhoa on the Big Island. Review of traffic volume data and discussions with business owners and community leaders found different outcomes depending on the location. The Haleiwa bypass opened in 1995, during a slow period for Hawaiʻi tourism. After the

Haleiwa bypass was built, merchants saw a drop in visitor traffic. Since then, visitor traffic volumes have returned, and visitor spending as well. Currently, Haleiwa's stores are nearly all refurbished, and vacancies are very few. This example fits with the mainland trends that show while businesses dependent on through traffic are strongly affected at first, over time, visitor traffic and revenues return.

On the island of Hawaiʻi, bypasses of Honokaʻa (1960s), Pāhoa (1980s), and Keaʻau (1990s) may provide some lessons. Honokaʻa was in the 1960s a local center for a plantation-based economy, and has only recently became a tourist stop. Nor was Keaʻau a destination in its own right; its congestion was due to commuting to and from the lower Puna subdivisions rather than tourism or truck traffic. Local merchants report that business declined somewhat when the bypass opened, but it has since returned to earlier levels. Pāhoa was on a well-used tourist circuit until the Chain of Craters road was cut by lava in 1987. Only those tourists with plenty of time and the inclination to make a separate trip to lower Puna venture into Pāhoa — and within lower Puna, Pāhoa is the only source for any services, as well as an attraction in its own right. Businesses appear to be doing better now than before the bypass.

The Hawaiʻi cases have several features that distinguish them from those studies in the U.S. On the mainland, studies show retail – especially "travel-related" retail businesses – as potentially vulnerable, while service businesses are not affected by the opening of a bypass. However, none of the mainland studies reviewed commented on the volume of tourist traffic on the routes (probably because the towns were not major visitor draws), or on attempts by bypassed communities to attract visitors from the highway. Such measures have been common in Hawaiʻi. In Haleiwa, the North Shore Community Chamber of Commerce has actively marketed Haleiwa as the North Shore's surf town, and sponsored events to bring visitors to town. On the island of Hawaiʻi, development of the Hilo to Honokaʻa Historic Corridor and marketing of Puna (as the Volcanic Corridor) have promoted excursions into small towns for visitors motoring around the island. Festivals have followed, with the aim of bringing island residents, part-time residents and visitors to the small towns. In most cases these efforts have been highly successful.

In the case of the potential bypass of Waikoloa Village by the Saddle Road Extension, the town has one major shopping center with a grocery store, restaurants and other businesses located along Waikoloa Road. It draws most of its business from local residents and visitors who are staying in condominiums in Waikoloa Village or the resorts below and specifically come to Waikoloa Village to shop. Pass-through traffic from motorists bound from/to Waimea or Hilo and Kona is a relatively small component. As discussed in Section 3.4.1, current Average Daily Traffic (ADT) on Waikoloa Road is 3,400 vehicles per day (VPD) east of the village, and about 6,630 VPD west of the village, indicating a high degree of local generation rather than pass-through traffic. Given the fact that over the course of 20 years, Waikoloa is forecasted to continue to grow at a moderate pace, and there will also be growth the in the resorts, there should be an increase in the customer base, rather than a decrease. If the Saddle Road Extension is not built, the Year 2035 ADT is expected to triple to 18,850 VPD west of the village, and 18,950 VPD east of the village, reflecting a large increase in all traffic but especially pass-through traffic, as Daniel K. Inouye drivers use Waikoloa Road for origins/destinations in coastal Waikoloa and Kona. If the Saddle Road Extension is constructed, ADT would vary by alternative, from a low of about 9,000 VPD with Alternative 4 to a high about 12,000 VPD with either Alternative 5 or 6. Note that no matter the Alternative, traffic volumes would increase substantially relative to current volumes. With a lack of infrastructure and existing zoning of properties flanking any of the project corridors, new shopping centers centered on the Saddle Road Extension are unlikely to be approved or developed, at least for many decades, and therefore motorists on the Saddle Road Extension seeking services are still likely to enter Waikoloa Village, especially with Alternatives 5 and 6.

Fiscal Impacts

Highway projects may have impacts to County and State expenditures and revenues, known as fiscal impacts. These are separate from the costs of construction and maintenance, which are assumed to be compensated by the public worth of the Project. Although often not possible to quantify in advance, these impacts require consideration.

The Saddle Road Extension would shorten travel time and congestion. Motorists traveling between the Daniel K. Inouye Highway and various destinations accessed by Queen Kaʻahumanu Highway would save between 5.0 and 6.6 minutes on each trip. These savings will result in lower fuel consumption and thus lower fuel tax revenues over the lifetime of the Project. The cumulative values of this reduction is highly uncertain, since it depends on the volume of traffic, the distribution of trips among major origins/destinations (for westbound traffic, these are Kona, Waikoloa Beach Resort, Waikoloa Village, and Queen Kaʻahumanu Highway northbound), vehicle fuel economy, and the fuel types used by motorists on the Saddle Road Extension.

Estimates conducted for the Saddle Road Improvement Project's Supplemental EIS (FHWA-CFLHD 2010) made a variety of assumptions about the impact of building the western segment of Saddle Road and calculated reductions in fuel tax revenues of approximately $2.6 million to the State and $1.3 million (2008 dollars) to the County over a course of 20 years. The length of highway for the new Saddle Road segment was almost identical to the Saddle Road Extension, but the average time savings associated with the Saddle Road project was likely greater. These estimates provide a reasonable comparison. It should be noted that all such revenue losses are completely balanced by driver savings.

These impacts on State funds would be offset by State revenues derived from wage and excise taxes associated with construction of the Project, shown below in ***Table 3.3.6***.

Table 3.3.6
State Revenues Associated with Construction

	Alternative 5, with grade-separated intersection	Alternative 4, at-grade intersection
Construction cost	$74.0 million	$63 million
Worker earnings	$31.82 million	$27.09 million
Excise taxes on construction on workers' spending	 $2.96 million $0.78 million	 $2.52 million $0.66 million
Personal income tax	$1.53 million	$ 1.30 million
Corporate income tax	$74,000	$63,000
Total State revenues	$5.34 million	$4.54 million

Notes:

(1) Alternative and Design Option combination with maximum construction cost based on project engineer estimates is compared with that of minimum construction cost in this table.
(2) Estimated as 4% of construction cost
(3) Estimated as 4% of the share of workforce income subject to taxation. That share (61.6%) calculated from average spending data for Honolulu consumers per methods of FHWA-CFLHD 2010.
(4) Estimated at 4.8% of wages, based on State data incomes and income taxes, per methods of FHWA-CFLHD 2010.
(5) Estimated as 0.1% of corporate revenues (in this case, construction cost), from State data on corporate revenues and income taxes, per methods of FHWA-CFLHD 2010.

For the State of Hawai‘i, the net impact of building the Saddle Road Extension from the cash flows estimated here would be positive – although it could be less than the State's share of the Project's construction costs, depending on how the Project is funded. Assuming federal aid for the Project, the State's share of construction costs for the Saddle Road Extension will be 20 percent of construction costs.

For the County of Hawai‘i, reduced fuel consumption would likely result in lower fuel tax revenues. Such impacts are difficult to quantify, because decreased fuel expenditures for commuting can be offset by increased use of motor vehicles for leisure purposes, because of time savings. Even if this is not the case, the substantial economic benefit to jobs and wages and the decreased fuel cost will allow other expenditures that will increase County revenues, including property tax and the County share of transient accommodation tax (TAT). Safer roadways also benefit the County significantly by reducing the need to respond to accidents. The net benefit to wildfire reduction and firefighting demands will also reduce County costs.

It is also important to note that road improvements will allow vehicles to operate at optimum speeds, producing the lowest CO_2 emissions possible as described by the Center for Clean Air Policy. In the case of the Saddle Road Improvements project, it was calculated that the improvements and would save approximately 57,000 gallons of motor fuel per year upon project opening, which by 20 years later would increase to approximately 124,000 gallons per year.

Very similar savings would be expected with the Saddle Road Extension.

Overall Economic Benefit

Previous detailed research on costs and benefits of highway construction conducted for a very similar project – the completion of the western portion of the Saddle Road Improvements project, indicated that benefits of construction the road exceeded costs by a large factor (FHWA-CFLHD 2010). The resulting benefit-cost ratio in that instance was 2.56. Most of the benefit resulted from additional tourist spending, but time savings, accident reduction, fuel savings, and other factors contributed. The state of good repair leads to lower lifecycle cost and reduced maintenance; economic competitiveness results in increased tourist spending. Although less easy to quantify, livability and sustainability are additional benefits.

Differences in Impacts Between Alternatives 4, 5 and 6 and Intersection Design Options

As shown above in ***Table 3.3.5*** and ***Table 3.3.6***, the highest benefit in terms of direct and indirect economic impacts, including job numbers and worker earnings as well as revenues from excise tax, and income tax would occur with the costlier alternatives and design options; i.e., Alternative 5 with a grade-separated intersection at Māmalahoa Highway. The least would be with Alternative 4 and an at-grade intersection. The evaluation of the comparative benefits must also consider the context of the Project’s government funding, which is derived from State and federal taxpayers.

As discussed above, the “bypass” effect to local businesses would be most pronounced with Alternative 4, which provides no connection back to Waikoloa Village (refer to ***Fig. 3.1.1***). Alternatives 5 and 6 both provide a means for eastbound and westbound motorists to easily access Waikoloa Village with a two-mile trip. Motorists could then return to the Saddle Road Extension or utilize Waikoloa Road to access their destinations on Māmalahoa Highway or Queen Ka‘ahumanu Highway. But no matter the Alternative, by the Project Year 2035, traffic volumes passing through Waimea would have increased substantially relative to current volumes, negating any permanent bypass effect.

No differences with respect to economic impacts exist between the design options.

Impacts of the No Action Alternative

Under the No Action Alternative, jobs and income directly associated with project construction or with indirect economic activity would not be realized. There would be no “bypass” effect to local businesses in Waikoloa Village. The fiscal impacts, whether net negative or positive, would not occur.

3.3.2.3 Mitigation Measures

No mitigation measures related to employment and incomes are needed, as impacts would be beneficial.

Although the customer base of the businesses in Waikoloa Village would be expected to continue to grow with or without the Saddle Road Extension, signage on the new highway could reduce the loss of business revenues resulting from drivers being unaware of the proximity of needed goods or services. In order to offset any initial loss of business, the following mitigation measure will be incorporated into the Project:

1. FHWA and HDOT will work with the County of Hawaiʻi and Waikoloa Village merchants to install standard signage on the Saddle Road Extension indicating the availability of goods and services in Waikoloa.

Whether the fiscal impacts would be negative or positive would depend to a large degree on the funding source for the Project and how much federal aid would be involved. No mitigation is proposed. The analysis shows that State tax collections associated with construction would more than offset reduced revenues from fuel taxes. While no new revenues have been identified to offset County fuel tax revenues lost, the Saddle Road Extension improvements would offer Hawaiʻi Island residents greater mobility and savings in fuel, and hence contribute to the quality of life and economic activities that can generate County tax revenues by other means.

3.3.3 Socioeconomic Characteristics

New highways may affect certain social measures of a community in positive or negative ways. They may provide better access to social services and medical care, or reduce travel time that affords residents more time for other activities.

3.3.3.1 Affected Environment

Table 3.3.7 shows selected measures of the socioeconomic environment from the 2010 U.S. Census of Population and the American Community Survey for the County of Hawaiʻi and the communities of Waikoloa Village (at just less than two miles away, closest to the project corridors), Waimea and Kailua (15 to 25 miles away), and Hilo (50 miles away).

The compared census areas all display marked socioeconomic diversity, with no census-classified racial group representing the majority anywhere. All areas have some of the highest "Two or More Races" responses of anywhere in the U.S., at more than 20%. However, there are differences distinguishing the West Hawaiʻi communities from Hilo and Hawaiʻi County as a whole. West Hawaiʻi has a higher proportion of Whites (43.9% in Waikoloa versus 17.6% in Hilo, e.g.) and a lower proportion of Asians (16.1% in Waikoloa versus 34.2% in Hilo). Waimea is somewhat intermediate and also has the highest proportion of Native Hawaiians or Pacific Islanders, at 15.8%. Waikoloa and Kailua's socioeconomic characteristics are somewhat similar, and both reflect in their ethnic, educational attainment, median income and poverty rates the influx of older mainland residents drawn by the drier climate and attractive coastal waters of West Hawaiʻi. Somewhat paradoxically, however, there are more elderly in Hilo than in West Hawaiʻi, despite the latter's reputation for attracting retirees. This is explained by the fact that South Kohala and North Kona have a far greater proportion of their populations concentrated in the 25 to 54-year-old category (not shown in the table), as opposed to East Hawaiʻi, whose low population in this demographic has resulted from the outflow of young working age people to

Table 3.3.7
Selected Socioeconomic Measures for Hawai‘i County Communities

	Waikoloa Village	Waimea	Kailua	Hilo	Hawai‘i County
Population, 2010	6,362	9,212	11,975	43,263	185,079
Persons under 5 years, percent, 2013	7.1%	6.8%	6.7%	6.0%	6.3%
Persons under 18 years, percent, 2013	25.1%	27.5%	23.4%	21.3%	22.2%
Persons 65 years and over, percent, 2013	9.6%	12.3%	12.4%	18.0%	16.8%
Female persons, percent, 2013	49.9%	51.7%	49.8%	51.2%	49.9%
White alone, percent, 2013	47.1%	31.2%	36.7%	17.6%	34.4%
Black or African American alone, percent, 2013	0.7%	0.3%	0.4%	0.5%	0.8%
American Indian and Alaska Native alone, percent, 2013	0.8%	0.2%	0.6%	0.3%	0.6%
Asian alone, percent, 2013	16.1%	17.3%	18.1%	34.3%	22.1%
Native Hawaiian and Other Pacific Islander alone, percent, 2013	11.3%	15.8%	15.2%	14.2%	12.7%
Two or More Races, percent, 2013	21.6%	34.0%	25.2%	32.5%	29.5%
Hispanic or Latino, percent, 2013	10.2%	9.0%	12.2%	10.4%	12.2%
White alone, not Hispanic or Latino, percent, 2013	43.9%	29.4%	34.5%	15.9%	30.7%
Living in same house 1 year & over, percent, 2008-2012	83.7%	91.4%	80.3%	85.0%	86.2%
Foreign born persons, percent, 2008-2012	14.1%	9.8%	15.9%	8.0%	11.9%
Language other than English spoken at home, pct age 5+, 2008-2012	17.2%	17.4%	25.2%	15.8%	19.4%
High school graduate or higher, percent of persons age 25+, 2008-2012	96.9%	94.5%	87.8%	91.1%	90.6%
Bachelor's degree or higher, percent of persons age 25+, 2008-2012	26.2%	29.0%	19.1%	29.8%	25.6%
Mean travel time to work (minutes), workers age 16+, 2008-2012	27.3	27.8	18.8	18.5	25.4
Homeownership rate, 2008-2012	73.3%	63.0%	52.4%	63.6%	65.1%
Housing units in multi-unit structures, percent, 2008-2012	36.0%	11.5%	47.9%	23.3%	20.2%
Median value of owner-occupied housing units, 2008-2012	$410,800	$425,200	$373,600	$313,200	$326,900
Persons per household, 2008-2012	2.62	2.88	3.09	2.75	2.82
Per capita money income in past 12 months (2012 dollars), 2008-2012	$31,754	$28,213	$25,985	$25,416	$24,882
Median household income, 2008-2012	$72,364	$62,000	$60,965	$51,929	$52,098
Persons below poverty level, percent, 2008-2012	8.5%	10.4%	12.2%	16.9%	17.0%

Source U.S. Census Bureau: State and County QuickFacts. Data derived from Population Estimates, American Community Survey, Census of Population and Housing. https://www.census.gov/quickfacts/table/PST045216/15; accessed March 2017.

West Hawai‘i, Honolulu and the mainland. Another difference is the percent of housing for seasonal/vacation use, which reflects the importance of the visitor industry in West Hawai‘i.

3.3.3.2 Environmental Consequences

The new highway is not located directly adjacent to or even near any populated areas and would not affect existing communities in ways that would tend to change socioeconomic measures. In creating a new link that saves times and fuel costs and improves travel safety and convenience, it would improve everyday life for residents who travel cross-island for work, recreation, or other reasons. Optimizing cross-island transport would help to slow increasing congestion in urban areas along Queen Kaʻahumanu Highway and other SR 19 segments, benefitting even residents who are not traveling cross island. Shorter travel times would allow residents more time at their homes, work and other destinations.

Differences in Impacts Between Alternatives 4, 5 and 6 and Intersection Design Options

There is no difference with respect to impacts on socioeconomic measures between any of the alternatives or the design options.

Impacts of the No Action Alternative

The No Action Alternative would maintain the current indirect connections between residents and their destinations, causing residents to spend more time and money in auto travel, reducing the quality of life to a slight but not negligible degree.

3.3.4 Environmental Justice

3.3.4.1 Affected Environment

Consistent with Title VI of the federal 1964 Civil Rights Act and Executive Order 12898 on Environmental Justice, all program and project actions and decisions must ensure that minority and low-income populations do not experience disproportionately high and adverse human health or environmental effects and activities. Environmental justice is a term that refers to social inequity in bearing the burdens of adverse environmental impacts. Certain socioeconomic groups in the U.S., including ethnic minorities, the elderly, rural residents and others, have historically experienced a disproportionate share of undesirable side-effects from locally undesirable land uses such as toxic waste dumps, landfills, and freeway projects.

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations* directs agencies to address whether any minority or low-income groups are disproportionately impacted by a proposed project and identify mitigation measures to avoid or minimize any adverse social impacts.

The proposed highway would be located entirely within remote and uninhabited pastures and lava flows. There are no communities with permanent residents within about 1.6 miles of any portion of the corridors (although multi-family units of the Waikoloa Beach Resorts timeshare development are located as close as 1,500 feet from the western terminus, separated by Queen Kaʻahumanu Highway). Therefore, no residents are expected to experience many of the typical highway impacts, including noise, air pollution, displacement, barrier effects, etc. Nevertheless, the characteristics of the only nearby community, Waikoloa Village, was evaluated to determine if environmental justice populations were present.

As a measure of the extent of low-income populations, this EIS uses poverty rates as representative, because data on poverty are readily available. There are no County or State data concerning income levels or poverty rates in individual communities on the Island of Hawaiʻi. The most fine-scaled and recent data are contained in the U.S. Census's American Community Survey. These data are updated each year. Poverty status is determined by comparing annual income to a set of dollar values called poverty thresholds that vary by family size, number of children and age of householder. If a family's before-tax monetary income is less than the dollar value of their threshold, then that family and every individual in it are considered to be in poverty. For people not living in families, poverty status is determined by comparing the individual's income to his or her poverty threshold. For small populations and small sample sizes, high margins of error occur.

For the figure of 8.5% individuals in poverty in Waikoloa Village, there is a margin of error of 4.7%, meaning that there is a 90% confidence level that the true poverty rate is between 3.8% and 13.2%. Although this is a wide range, it is clear that the poverty rate in Waikoloa Village is less than that of Hawaiʻi County as a whole, which is 17.0% with an error margin of 1.2%. It can be said that there is a low-income population in Waikoloa Village.

Although the census data are currently five years old, they remain a reasonably reliable source of information for race identity for most areas of Hawaiʻi. In terms of major categories recognized by the U.S. Census, the largest group in the County of Hawaiʻi are White (30.7 percent), followed by Two or More Races (29.5%), Asian (22.1%), and Native Hawaiians and Pacific Islanders (12.7%). This breakdown, however, inadequately describes the ethnic makeup as perceived by Hawaiʻi residents, who distinguish among Native Hawaiians, Samoans, Japanese, Chinese, Koreans, Puerto Ricans, Portuguese and Filipinos. In addition, more than half of all births in Hawaiʻi since 1970 involve parents of different or mixed ethnic backgrounds, leading to often inconsistent identifications on census forms. Consequently, the conventional definition of ethnic affiliation is problematic in Hawaiʻi. Discussions of environmental justice in Hawaiʻi generally center on the Native Hawaiian population, which is usually recognized as disadvantaged in terms of income, health, home ownership, and many other measures of socioeconomic well-being.

As shown in ***Table 3.3.7***, above, the ethnic makeup of Waikoloa Village in 2010 was recorded as follows: White (43.9 percent), followed by Two or More Races (21.6%), Asian (16.1%), and Native Hawaiians and Pacific Islanders (11.3%). It therefore can be stated that minority populations are certainly present in Waikoloa Village.

Thus, it is clear that minority and low-income populations are present in the community nearest to the project corridors. It bears emphasis *none* of the project alternative corridors pass within nearly two miles of any homes and are generally confined to either vacant land or low-use, extensive cattle grazing pastures.

3.3.4.2 Environmental Consequences

No direct impacts such as construction-phase impacts, right-of-way taking, barrier impacts or noise and air quality effects would be experienced by *any* community or home as a result of the

Project, and the most prominent social-related effects of the proposed highway would be to reduce traffic in communities such as Waikoloa and to provide a safer and faster path for low-income workers commuting East Hawaiʻi to West Hawaiʻi for work. Minority and low-income populations would not suffer disproportionately high and adverse impacts from construction, ROW-acquisition, noise and air quality, or other direct, indirect or cumulative impacts from the implementation of the Project.

The public involvement process throughout project development has included efforts to outreach into the minority and low-income populations of the island, and especially West Hawaiʻi and Waikoloa. In addition to conventional newspaper announcements, there has been outreach to community leaders and meetings within neighborhood settings, including Waikoloa Elementary and Middle School and local centers, with the general public but also special groups such as hunters and Hawaiian culture organizations. Most importantly, the diverse, citizen-based Saddle Road Task Force has served as both outreach to publicize the project to various segments of the community and also a channel to provide feedback to the highway agencies. To encourage participation among low-income and minority populations in the Draft EIS public hearing for the project, the project team has utilized its website, provided releases to community bloggers for posting on social media, and posted flyers at non-traditional locations including community centers, union halls, Hawaiian Homes centers, and senior care facilities.

Differences in Impacts Between Alternatives 4, 5 and 6 and Intersection Design Options

There is no difference with respect to environmental justice impacts among any of the alternatives.

Impacts of the No Action Alternative

The No Action Alternative would have no environmental justice impacts.

The preliminary finding of FHWA, per EO 12898, is that no minority or low-income populations will be disproportionately adversely affected by the Saddle Road Extension. Input received in the Draft EIS comment period will be used to confirm this, or to identify and mitigate for impacts if any are identified.

3.3.4.3 Mitigation Measures

No mitigation measures are currently anticipated to be required for environmental justice impacts, which would not occur.

3.3.5 Public Facilities and Utilities

3.3.5.1 Affected Environment

Police, Fire and Emergency Services

The Hawaiʻi County Police Department (HCPD) has jurisdiction throughout the entire island of Hawaiʻi. Administrative personnel and police officers total over 500. Headquartered in Hilo, HCPD maintains a station in Waimea, with substations in Waikoloa and Puakō.

The Hawaiʻi Fire Department (HFD) has jurisdiction throughout the entire island of Hawaiʻi. Firefighters respond to emergency medical situations, hazardous conditions, rescues, building fires, brush and other outdoor fires, and vehicle fires. Fire stations generally have three 24-hour shifts. HFD currently has a force of over 300 working as administrative personnel or firefighters throughout the island, with stations within the project area at Waimea, Waikoloa and Puakō.

Educational Facilities

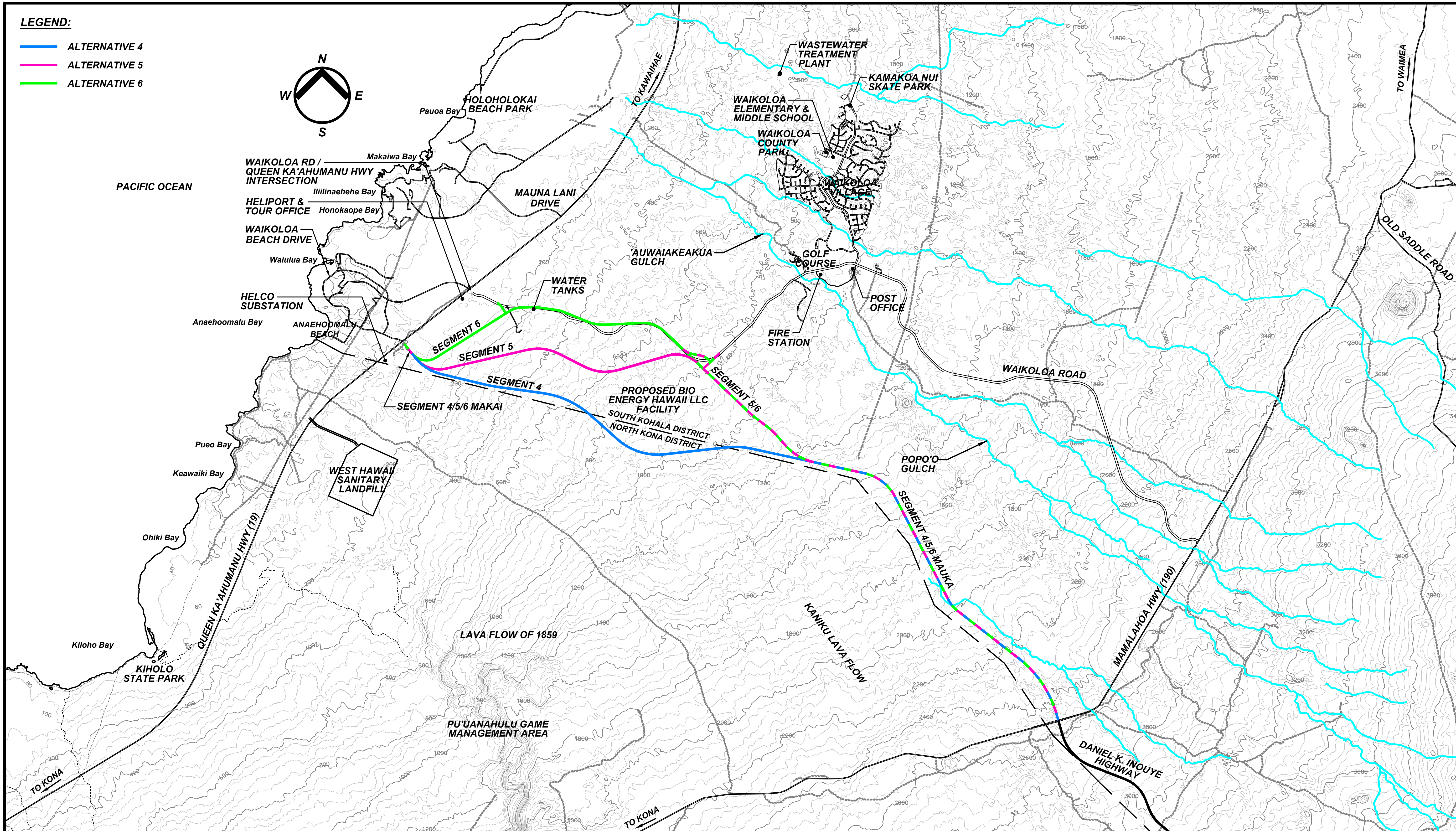
Seventy-two elementary, intermediate, secondary or combination schools – 41 public, 15 charter, and 16 private, with an enrollment of about 26,408 students – represent the educational facilities on the island of Hawaiʻi as of the start of the 2014-2015 school year (Hawaiʻi County Data Book: accessed March 2017; http://www.hisbdc.org/BusinessResearchLibrary/HawaiiCountyDataBook2015.aspx;). There are also a number of pre-schools, and several public and private colleges.

Students in the project area are primarily served by Waikoloa Elementary and Middle School (refer to ***Fig. 3.3.1***), and Kealakehe High School. The former is located on Paniolo Avenue within Waikoloa Village, and the latter is about 20 miles south in Kona. In addition, Waimea has a public charter school (PCS) at Kanu O Ka ʻAina PCS as well as three private schools: Parker School, Hawaiʻi Preparatory Academy, and Hawaiʻi Montessori School. The northern part of urban Kona has the West Hawaiʻi Explorations Academy PCS.

Recreational Facilities

A number of recreational areas and facilities are located throughout the island of Hawaiʻi, including beach parks, golf courses, district and neighborhood parks, and community centers. As of 2017, four national parks or historic sites making up 325,072 acres; 15 State parks, recreation areas, or historic sites with about 2,700 acres (not including about 380,000 acres of multiple purpose State forest units); and over 130 county parks totaling about 2,000 acres are present on the island of Hawaiʻi (Hawaiʻi County Data Book, accessed March 2017: http://www.hisbdc.org/BusinessResearchLibrary/ HawaiiCountyDataBook2015.aspx)

Recreational facilities in the project area include coastal, semi-public beach parks at ʻAnaehoʻomalu in Waikoloa and two County parks in Waikoloa. A State-designated hunting area is present at the Puʻuanahulu GMA, which would be traversed by a portion of Alternative 4 (CROSS REFERENCE Section 3.1.1 and refer to ***Fig. 3.3.1***).



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GRAPHIC SCALE IN FEET

SADDLE ROAD EXTENSION

FIGURE 3.3.1 ~ PUBLIC FACILITIES

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Utilities

Electrical power on the island of Hawai‘i is provided by Hawai‘i Electric Light, privately owned utility company regulated by the State Public Utilities Commission, via their island-wide distribution network. The utility has more than 60,000 residential customers and an additional 10,000+ General Load, Commercial Cooking and Heating, Large Power Service, and Street Lighting accounts. In 2010, over 1.15 gigawatt hours were sold to customers. The distribution system principally of overhead transmission lines, with limited underground lines. Hawai‘i Electric Light’s 138-kilovolt (kV) 8100 electrical transmission line extends south from Waikoloa Road to the North Kona/South Kohala district boundary, crossing the path of both Segment 5/6 and Alternative 4 before reaching the boundary (see ***Figure 3.3.1***). The 8100 transmission line then terminates and the 8200 transmission line runs west along the district boundary to the ‘Anaeho‘omalu Substation, which is located approximately 1,800 feet south of the southern intersection of Waikoloa Beach Drive with Queen Ka‘ahumanu Highway. Access to this substation is through an unpaved road extending south along the *mauka* side of the highway from this intersection. In addition, Hawai‘i Electric Light’s 69-kV 6800 transmission line runs on the *makai* side of the Māmalahoa Highway in the vicinity of the DKI Highway intersection.

Telephone and cable television services are available within most areas of the island. Telephone infrastructure is owned by Hawaiian Telcom (and, in some areas, Sandwich Isles Communications), and cable lines by Oceanic Time Warner Cable. Services are distributed via both underground and overhead lines following highways and roadways. In the project area, telephone lines and cable lines are present on the poles on Māmalahoa Highway and in the 8100 transmission line that extends south from Waikoloa Road to the North Kona/South Kohala district boundary (refer to ***Fig. 3.3.1*** for locations).

Potable water for most of the island of Hawai‘i is provided by the County of Hawai‘i Department of Water Supply (DWS), but the project area is primarily served instead by the Hawaii Water Service Company, a private water system. In the broader project area there are various wells, public and private water transmission and distribution lines, and reservoirs. However, no public or private water system infrastructure is located within or near the project corridors.

Sanitary sewer systems funneling wastewater to municipal treatment plants are present within both State and County roadway rights-of-way in certain areas of urban Hilo and Kailua, but are not widely distributed around the island. These are maintained by the Hawai‘i County Department of Environmental Management (DEM). Some private “package” plants and accompanying sewer lines are also present, mainly at resort complexes. Most of the island’s rural districts and many urban areas away from the core of Hilo and Kailua currently depend on cesspools and septic tanks. Wastewater treatment facilities in the broader project area consist of package sewage treatment plants at Waikoloa Village and the resort complexes of Waikoloa and Mauna Lani (refer to ***Fig. 3.3.1***). However, no public or private wastewater system infrastructure is located within the project corridors.

Stormwater conveyance systems, including culverts, inlets, catch-basins, stormwater drainage lines, and drywells, are present within or adjacent to some portions of State and County roadway rights-of-ways in the area. Many roads and highways in this dry area of the island lack substantial manmade drainage facilities because of the infrequency and low overall total of rainfall, which leads to generally low runoff levels. Natural drainage systems in the project area include gullies and streams, and various depressions in the pastures provide natural detention basins. No public or private stormwater system infrastructure is located within the project corridors.

Solid Waste

In the State of Hawaiʻi, solid waste disposal is the responsibility of the counties, with State and federal regulatory oversight. The County of Hawaiʻi revised its solid waste management policy in an update to its *Integrated Solid Waste Management Plan* (ISWMP – Hawaiʻi County DEM 2009). Among the main goals is an effort to increase recycling and solid waste diversion to protect the life of the West Hawaiʻi Sanitary Landfill (WHSL). This facility is located in Puʻuanahulu about one mile from the makai portion of the Alternative 4 project corridors (refer to ***Fig. 3.3.1***). The WHSL may eventually be the only operating County landfill, if the East Hawaiʻi Sanitary Landfill closes as expected within about five to ten years. To support the goal of recycling and diversion, the County is currently converting many of the rural transfer stations to facilities that include recycling centers. The closest transfer station is Waimea Transfer Station, located off Kawaihae Road on the western end of town. Other programs deal with organic materials including greenwaste, untreated lumber, food and other organic waste, which can be composted and resold by a County contractor. Another important goal is to develop extra capacity for the South Hilo Sanitary Landfill while remaining within its current footprint. Private parties are also exploring waste reduction technology facility that accepts mixed wastes and processes or transforms them to soil amendments. Under current projections, the WHSL is expected to have capacity until sometime between 2037 and 2049.

In addition to municipal solid waste facilities, there is currently a proposal by BioEnergy Hawaiʻi, LLC to construct and operate a facility at Waikoloa Quarry to divert municipal solid waste from the County's landfills (refer to ***Fig. 3.3.1***). Recyclable materials would be recovered and collected for offsite sales, with organic materials diverted to an anaerobic digester and use for thermal conversion to natural gas using a gasifier or pyrolysis unit. The renewable natural gas would be used to power the waste collection fleet and also sold to offsite consumers to displace fossil fuels.

3.3.5.2 Environmental Consequences

In general, very little infrastructure related to public facilities or utilities would be affected, because there is almost none present in the area that would be affected by highway construction or operation. No police, fire, emergency medical, educational, water, wastewater, stormwater or solid waste infrastructure (including the BioEnergy Hawaiʻi LLC site, if it is constructed) would be affected.

Construction of the Saddle Road Extension on any alternative alignment would affect Hawaiʻi Electric Light's 8100 and 6800 transmission lines. For the electric line that runs from Waikoloa Village to the North Kona/South Kohala boundary, poles may require relocation and/or new poles may be required to accommodate the highway with sufficient clearance for the crossing lines. At the crossing of the 8100 transmission along Māmalahoa Highway, several poles would require relocation to accommodate the highway. Construction of the *makai* terminus of the Saddle Road Extension at Queen Ka‘ahumanu Highway would affect access to Hawai‘i Electric Light’s ‘Anaeho‘omalu Substation, which is located off the highway to the south. The access might require a minor relocation. The project would not affect the substation itself, which is 1,800 feet to the south of the intersection. Telephone and cable lines are also present on the poles, which would be temporarily affected by utility pole relocations.

Public services related to these public facilities may be affected in several ways by a new highway. For example, police, fire and emergency medical services would be required to service an additional 11 miles of highway, adding to their responsibility for several thousand miles of roads and highways across the island. However, as discussed in Section 2.3.2, the Saddle Road Extension would provide estimated time savings for many destinations of between 5 and 6.6 minutes, as well as wider shoulders, climbing lanes, and fewer curves. This would allow faster response times for police, fire and emergency medical services for a number of areas.

Highway construction generates solid waste. During excavation, filling and grading on the Saddle Road Extension project, excavated materials would likely be used elsewhere in the highway area for fill. Engineers attempt to prepare final designs that balance cut and fill volumes to the extent feasible so that a minimum of excavated material needs to be disposed of outside the construction area and a minimum amount of fill needs to be imported. However, because crushed rock from local quarries rather than local soil would be required for some sections of the roadbed, there may be excess cut of native material. Road construction also generates solid waste in the form of packaging for building materials, detergents, paint, metals, solvents, and old concrete and asphalt paving from demolition of existing facilities at intersections. Improper stockpiling or disposal of such material can have adverse impacts on air and water quality.

As discussed above, solid waste generated in West Hawai‘i is disposed of at the West Hawai‘i Sanitary Landfill, a 300-acre facility that is situated approximately 1.8 miles from the project area in Pu‘uanahulu, North Kona. This landfill is expected to be able to serve the County’s needs well into the future, including the small expected amount of solid waste that would be generated by highway construction.

Differences in Impacts Between Alternatives 4, 5 and 6 and Intersection Design Options

There are no substantial differences between the alternatives or the design options relative to effects to public facilities and utilities.

Impacts of the No Action Alternative

The No Action Alternative would have no effect on any public facilities or utilities.

3.3.5.3 Mitigation Measures

1. HDOT will work with Hawai‘i Electric Light, Hawaiian Telcom, Sandwich Isles Communications and Oceanic Time Warner Cable to perform utility relocations,

including excavation and pole relocation, to ensure appropriate clearances and a minimum of disruption to electrical transmission and other utility services. Special Contract Requirements would specify that the contractor shall schedule construction so as to minimize the length of time utility customers are inconvenienced.
2. During construction, emergency spill treatment, storage, and disposal of all hazardous materials, both within construction limits and at staging areas will be handled in accordance with the most recent version of FHWA's *Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects*.

3.4 TRAFFIC, RIGHT-OF-WAY AND PEDESTRIAN/BICYCLE USE

For motor vehicle traffic and pedestrian/bicycle uses, the region of influence involves both the existing and proposed surface transportation system, including Māmalahoa Highway, Queen Ka'ahumanu Highway, Waikoloa Road, and the proposed Saddle Road Extension itself. The region of influence for right-of-way involves the project corridors and the properties they traverse, as both the usability of and access to these properties requires consideration (refer to ***Fig. 3.1.1*** for property boundaries).

3.4.1 Motor Vehicle Traffic

A traffic report covering all alternatives is contained in ***Appendix F*** and summarized in this section. The purpose of this study was to evaluate existing conditions and the operational traffic impacts of the three proposed Build Alternatives as well as the No Action Alternative of the Saddle Road Extension project, which will be abbreviated "SRX" throughout this section.

3.4.1.1 Existing Environment

Existing Road Network

As discussed in detail in Chapter 1, the improvements to the former Saddle Road (renamed Daniel K. Inouye [DKI] Highway in 2013 in honor of the late Senator) over the last 10 years have transformed a majority of its length from a sub-standard, rural roadway to a modern, high capacity roadway facility. As improvements have been completed, the DKI Highway has increasingly become a desirable alternative route to the existing Māmalahoa Highway (SR 19) along the Hamakua Coast between East and West Hawai'i.

Currently, the western end of the DKI Highway terminates at Māmalahoa Highway. From that intersection, westbound traffic must turn either north or south to travel to major destinations:

- South along Māmalahoa Highway to Kailua;
- North along Māmalahoa Highway to Waimea;
- North along Māmalahoa Highway then west on Waikoloa Road to Waikoloa Village and South Kohala resort areas; and
- North along Māmalahoa Highway, west on Waikoloa Road, then north on Queen Ka'ahumanu Highway to Kawaihae Harbor.

Therefore, the key roadways/intersections within the study area (depicted in ***Figure 3.4.1***) are:

- DKI Highway (and intersection with Māmalahoa Hwy.)
- Queen Ka‘ahumanu Highway (and intersections with Waikoloa Rd. and Waikoloa Beach Dr.)
- Māmalahoa Highway (and intersections with DKI Hwy, and Waikoloa Rd.)
- Waikoloa Road (and intersections with Queen Ka‘ahumanu Hwy. and Māmalahoa Hwy.)

<u>DKI Highway</u>

The Daniel K. Inouye Highway is a regional arterial roadway that provides cross-island mobility for the Big Island. It is mostly a two-lane, undivided roadway with paved shoulders along its improved segments. An additional eastbound climbing lane is provided from Māmalahoa Highway to the vicinity of the junction with the old Saddle Road segment. DKI Highway has been incrementally improved over the past decade and is now a high-type arterial roadway capable of handling significant traffic volume. It is posted at 55 to 60 MPH, with selected reduced speed segments posted at 45 and 35 MPH.

<u>Queen Ka‘ahumanu Highway</u>

Queen Ka‘ahumanu Highway is the primary regional north-south arterial highway handling traffic on the west side of the Big Island between Kailua and Kawaihae. It is mostly a two-lane, undivided highway with paved shoulders. HDOT has been incrementally widening Queen Ka‘ahumanu Highway to a four-lane, divided highway starting from Kailua. Widening is complete up to Kealakehe Parkway, and a project to widen all the way to the Kona Airport Access Road is underway and scheduled for completion in late 2017. Most of its length is posted with a 55 MPH speed limit with selected areas of reduced speed posted between 35 and 45 MPH. Within the study area, Queen Ka‘ahumanu Highway is posted at 45 MPH. Key intersections along its length are channelized with left-turn lanes and right-turn acceleration and deceleration lanes. Selected intersections are signalized. Within the study area, the intersections of Waikoloa Beach Drive and Waikoloa Road are both signalized.

<u>Māmalahoa Highway</u>

Māmalahoa Highway serves as the *mauka* north-south arterial highway on the west side of the Big Island. It is a two-lane, undivided highway with curvilinear horizontal and vertical alignment. It is posted primarily at 50 MPH with selected areas of reduced speed posted between 35 and 45 MPH. Within the study area, Māmalahoa Highway is posted at 50 MPH, with key intersections are at DKI Highway and Waikoloa Road. Both intersections are unsignalized with STOP-sign control on the DKI Highway and Waikoloa Road approaches.

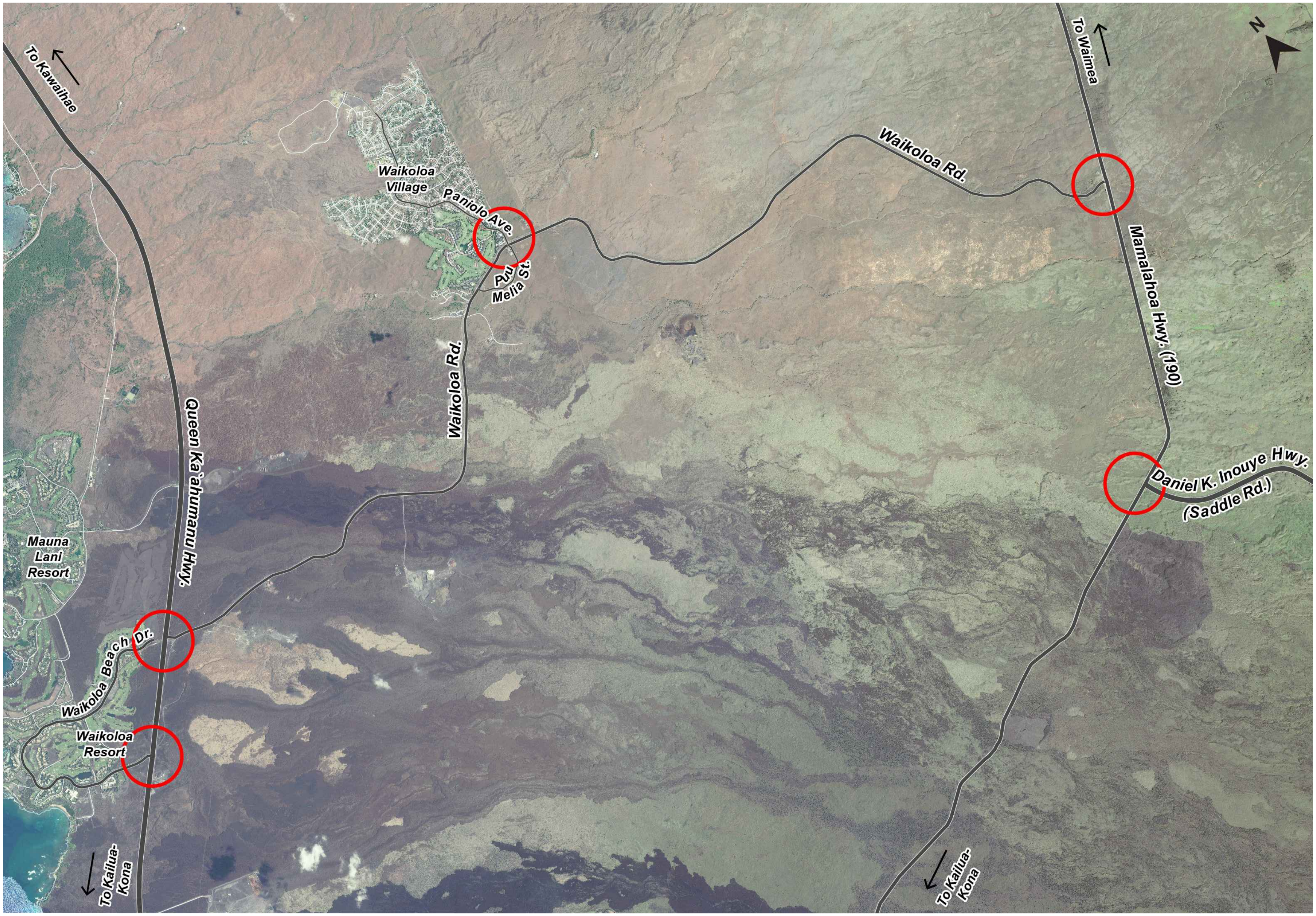

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FIGURE 3.4.1 ~ KEY HIGHWAYS AND INTERSECTIONS IN PROJECT AREA

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Waikoloa Road

Waikoloa Road is a major County collector roadway that provides access to the Waikoloa Village community and future development along its corridor. It also provides *mauka-makai* connectivity between Māmalahoa Highway and Queen Kaʻahumanu Highway. It is a two-lane, undivided roadway for most of its length. In the vicinity of Waikoloa Village, for approximately one half-mile of its length, it is a 4-lane, divided roadway with unsignalized intersections at Paniolo Avenue/Pua Melia Street (*mauka* leg), Pua Melia Street (*makai* leg), and Uluwehi Street.

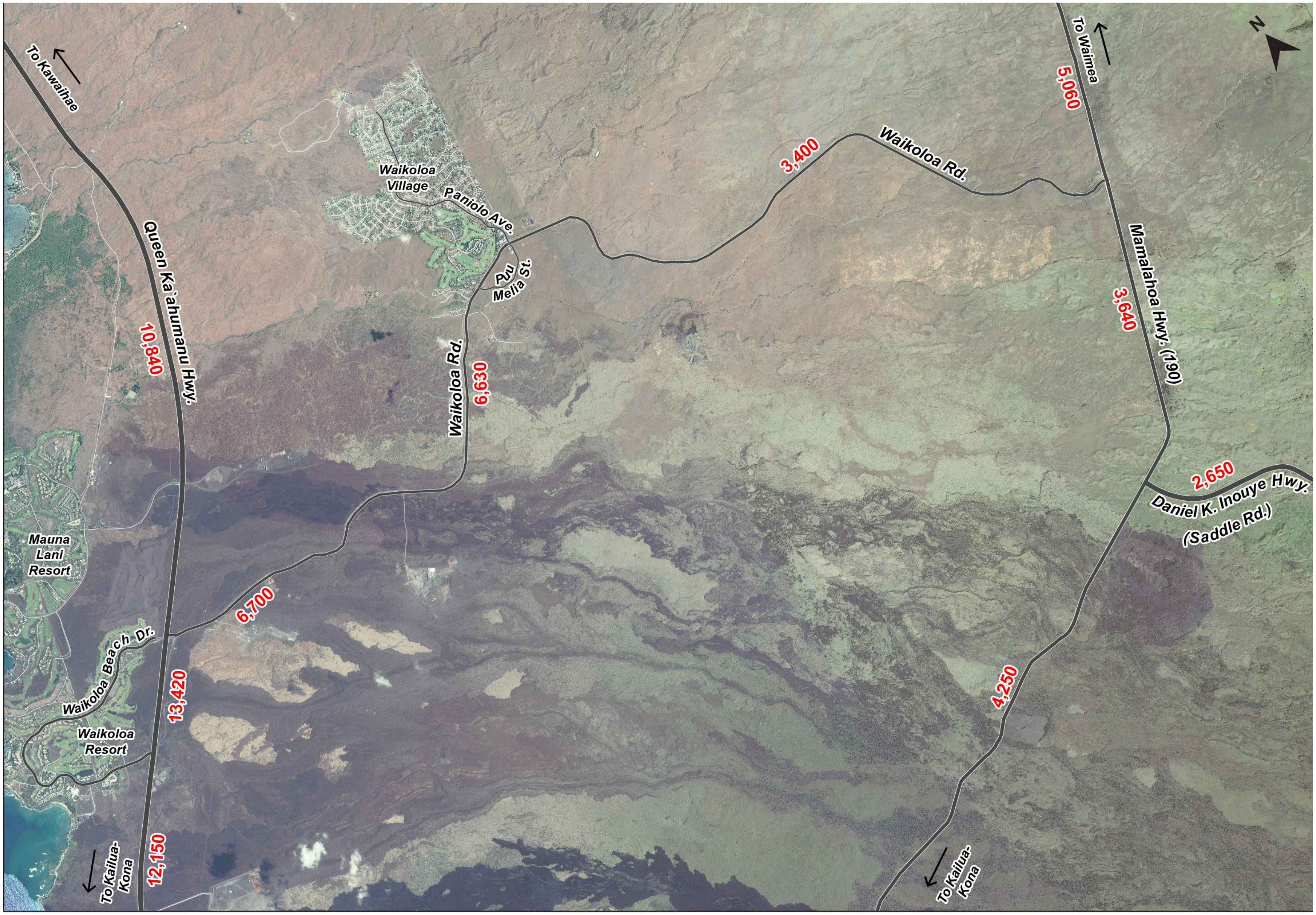
Waikoloa Village is a residential community with a golf course, a community shopping center and a post office, fire station, and community facilities. The Waikoloa Road/ Paniolo Avenue/Pua Melia Street (*mauka* leg) intersection provides primary access into Waikoloa Village, including the community shopping center and the golf course. The post office and a few stores and apartments are located along Pua Melia Street, with most of the existing development concentrated near the Paniolo Avenue intersection. Local vehicular traffic and pedestrians and bicycles frequently cross Waikoloa Road in travelling between land uses located on the north and south sides of Waikoloa Road at this intersection. Some traffic calming measures have been implemented to preserve traffic safety at this intersection. Waikoloa Road is posted at 45 to 55 MPH for most of its length with the segment in the vicinity of Waikoloa Village posted at 35 MPH.

Base Year Traffic Volumes and Intersection Operations

Base Year 2014 link traffic volumes were collected for the major roadways within the project area and peak hour traffic turning movement volumes were collected for key intersections. ***Figure 3.4.2*** illustrates the link volumes, while ***Figure 3.4.3*** illustrates peak hour turning movements for the Base Year 2014 time frame. The link traffic volumes were collected by HDOT and reflect traffic volumes on the major roadways for a 24-hour period. The turning movement traffic volumes were collected via turning movement counts conducted by a traffic engineer.

The key intersections were analyzed for the Base Year 2014 condition based on peak hour traffic turning movement volumes and the existing intersection configurations. The intersection capacity methods documented in the 2010 Highway Capacity Manual were applied using the Synchro/Sim Traffic software.

The standards of comparison for intersection operation are Delay and Level of Service (LOS) at the AM and PM peak hour of traffic volumes for any given intersection. Delay is a straightforward factor representing the average number of seconds that a motorist is required to wait at an intersection. Level of Service offers a qualitative estimate based on delay. There are six levels-of-service, A through F, which relate to the driving conditions from best to worst, respectively. In general, LOS A represents free-flow conditions with no congestion. LOS F, on the other hand, represents severe congestion with stop-and-go conditions. In general, LOS of D or better is considered an “acceptable level of service”. ***Table 3.4.1*** summarizes the results of the analyses.



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SADDLE ROAD EXTENSION

FIGURE 3.4.2 ~ BASE YEAR 2014 24-HOUR TRAFFIC VOLUMES

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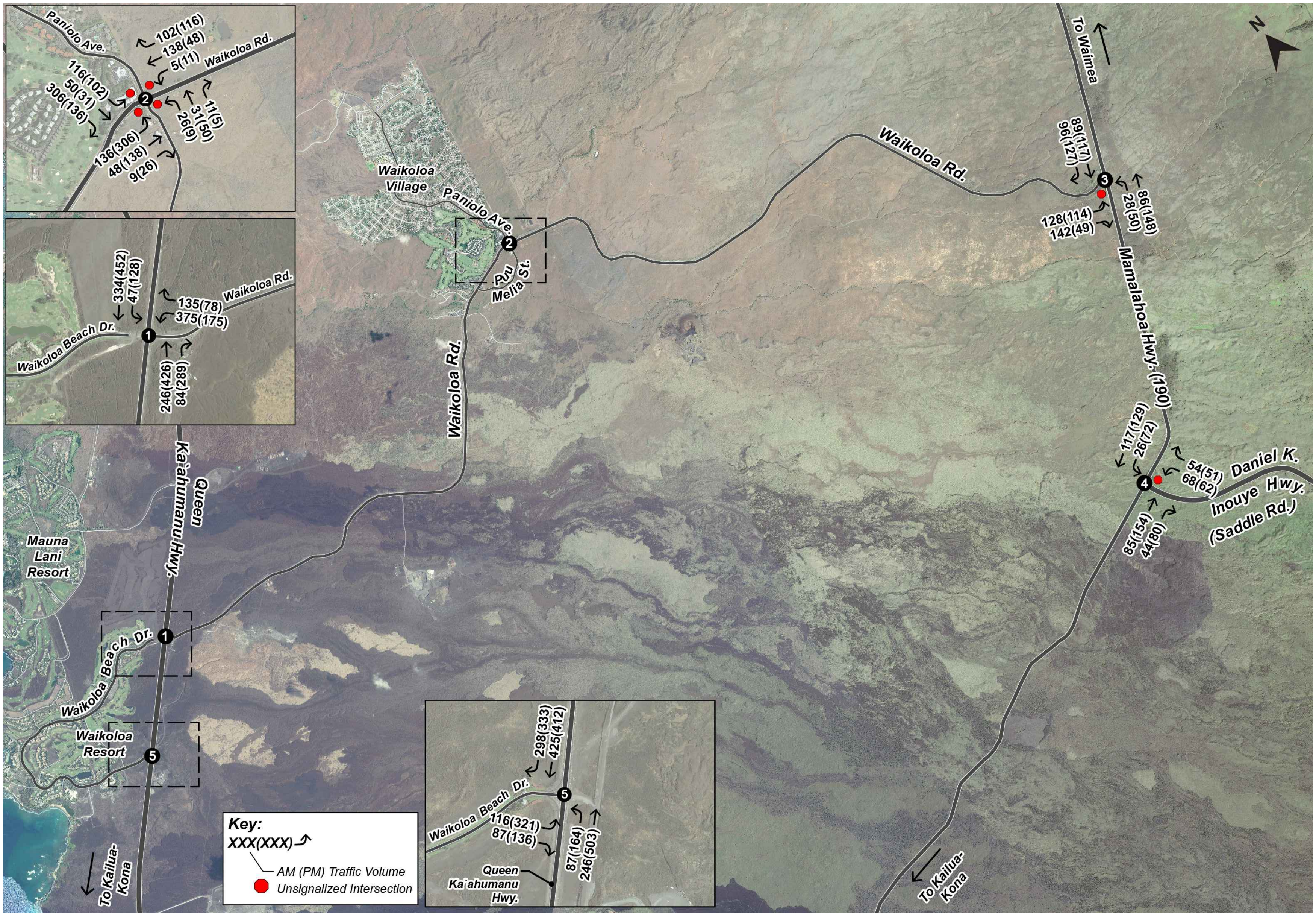

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FIGURE 3.4.3 ~ BASE YEAR 2014 PEAK HOUR TRAFFIC VOLUMES

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Table 3.4.1 Base Year Peak Hour Intersection Operations

Intersection	Control	AM Peak Hour		PM Peak Hour	
		Delay*	LOS	Delay*	LOS
Māmalahoa Hwy./DKI/SRX	2-way Unsig.	7.4/10.7/9.0	A/B/A	7.7/12.9/9.4	A/B/A
Māmalahoa Hwy./Waikoloa Rd.	2-way Unsig.	7.5/11.2/9.5	A/B/A	7.6/12.8/9.1	A/B/A
Queen Ka'ahumanu Hwy./Waikoloa Beach Rd.	Signalized	12.2	B	19.6	B
Queen Ka'ahumanu Hwy./Waikoloa Rd.	Signalized	14.9	B	14.4	B
Waikoloa Rd/Paniolo Ave./Pua Melia Rd.	All-way Unsig.	10.5/10.8/ 11.3/16.5	B/B/ B/C	16.5/10.5/ 10.8/11.3	C/B/B/B

* Delay in seconds

As shown, the key intersections operated acceptably to well for peak hour conditions for Base Year 2014, with LOS C and B operation. There are instances of vehicle queueing that occurred for selected movements, especially the left-turn movements. However, the observed queuing was for a fairly short duration and the overall operation was LOS C or better.

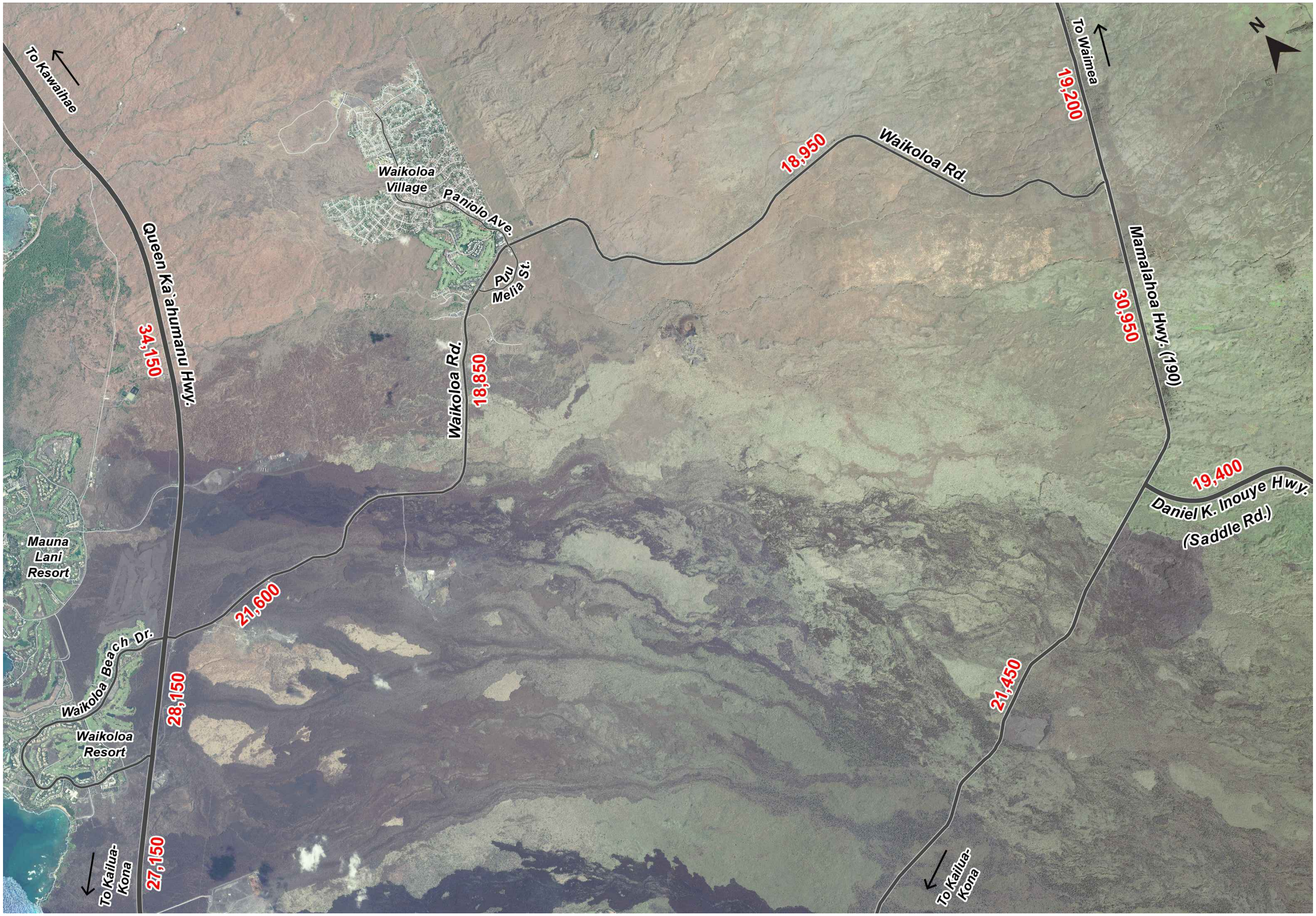
3.4.1.2 Environmental Consequences (Traffic Volumes and Intersection Operations)

Methods

As the DKI Highway increases in importance as a primary cross-island connector, traffic demand between the DKI Highway/Māmalahoa Highway terminus and Queen Ka'ahumanu Highway is forecast to increase. This increase will stress the existing roadway network in the northwestern portion of Hawai'i Island. While Māmalahoa Highway was once the primary roadway for travel between Kailua and Waimea, Kawaihae, and Kohala, construction of Queen Ka'ahumanu Highway 40 years ago as a new, modern standard roadway made Queen Ka'ahumanu Highway the primary north-south roadway in this area. Although HDOT continues to maintain and improve Māmalahoa Highway, its alignment and overall roadway cross-section makes it less desirable to handle regional traffic due to its older design constraints. Similarly, increased routing of regional traffic through Waikoloa Road is expected to stress the intersections in Waikoloa Village as they must meet both the expected increase in regional through traffic as well as local community traffic.

In order to quantify expected future conditions, a project year of 2035 was chosen for intersection analyses of the three Build Alternatives and the No Action Alternative. The year 2035 matches the year for which detailed travel demand model forecasts have already been prepared as part of the *Federal-Aid Highways 2035 Transportation Plan for the District of Hawaii* (HDOT 2014). These forecasted volumes were in the form of 24-hour and PM peak hour link volumes.

Figure 3.4.4 illustrates the forecasted 24-hour Average Daily Traffic (ADT) volumes for the Year 2035. As shown, ADT volumes on DKI Highway are projected to increase significantly from current levels. This is consistent with recent traffic volume counts that have documented rapid increases in traffic volume on DKI Highway since the most recent improvements (refer to ***Table 1.1.1***). Traffic volumes are also forecast to significantly increase system-wide within the



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SADDLE ROAD EXTENSION

FIGURE 3.4.4A ~ PROJECTED YEAR 2035 24-HOUR TRAFFIC VOLUMES - NO BUILD

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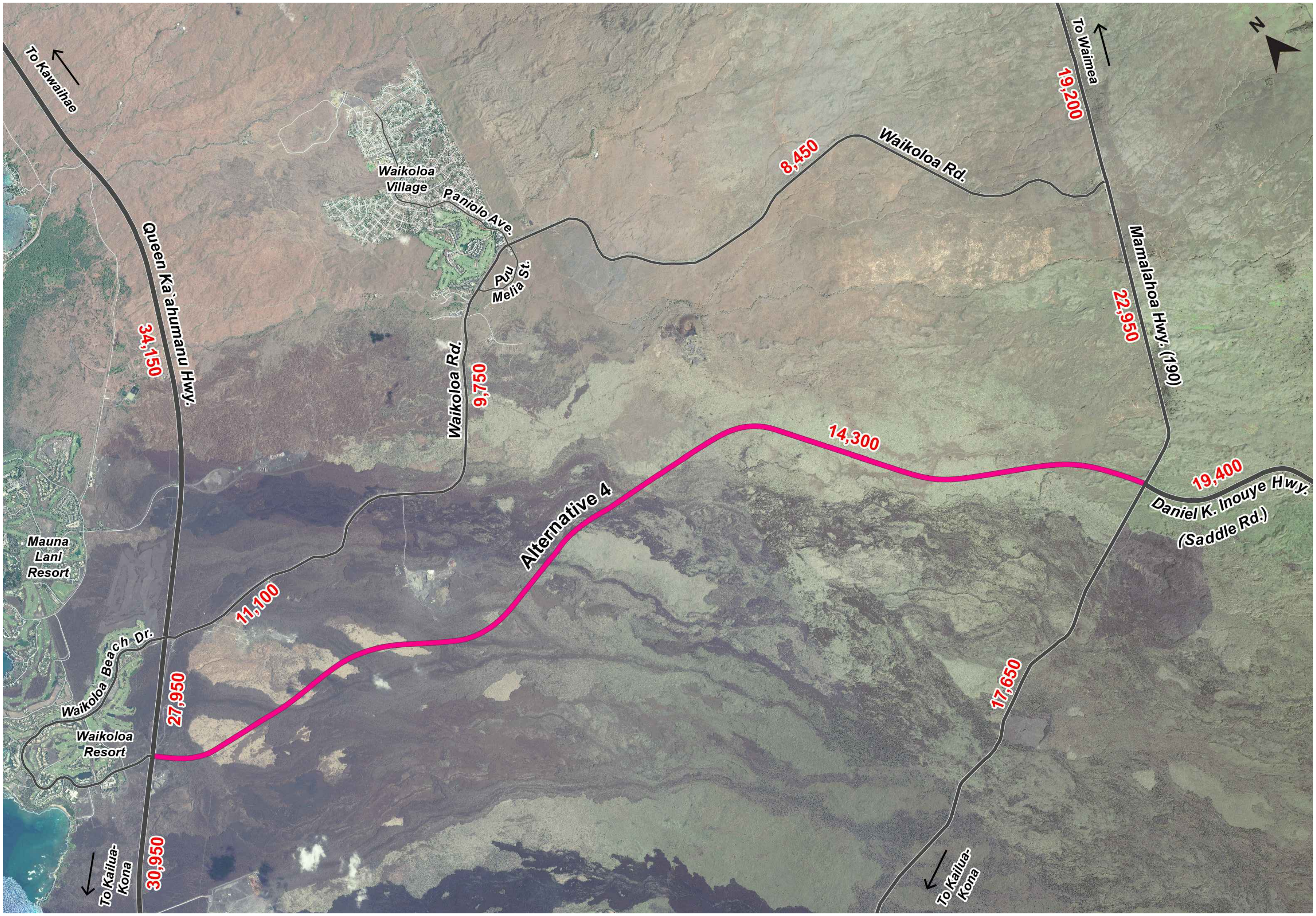

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SADDLE ROAD EXTENSION

FIGURE 3.4.4B ~ PROJECTED YEAR 2035 24-HOUR TRAFFIC VOLUMES - ALTERNATIVE 4

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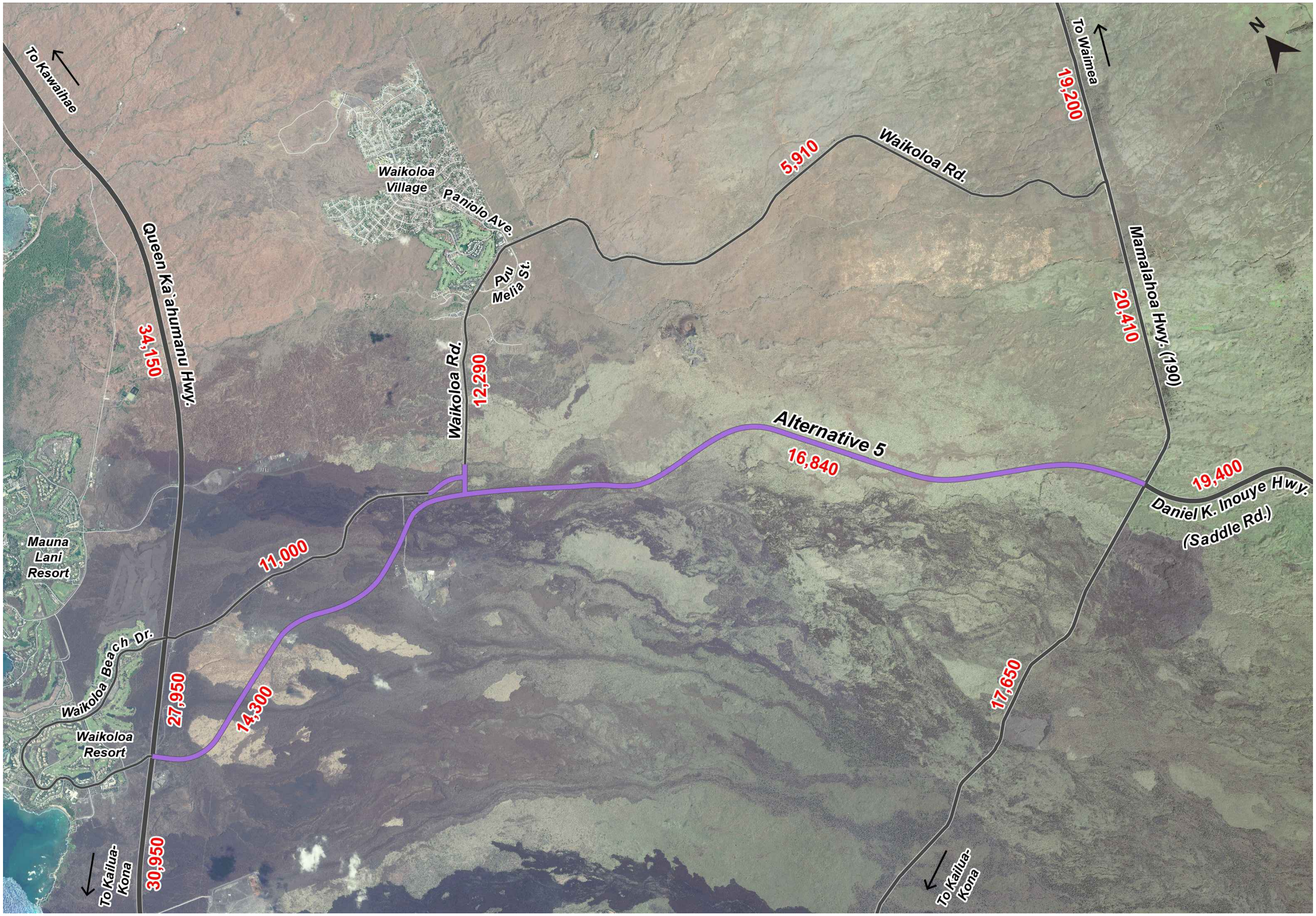

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SADDLE ROAD EXTENSION

FIGURE 3.4.4C ~ PROJECTED YEAR 2035 24-HOUR TRAFFIC VOLUMES - ALTERNATIVE 5

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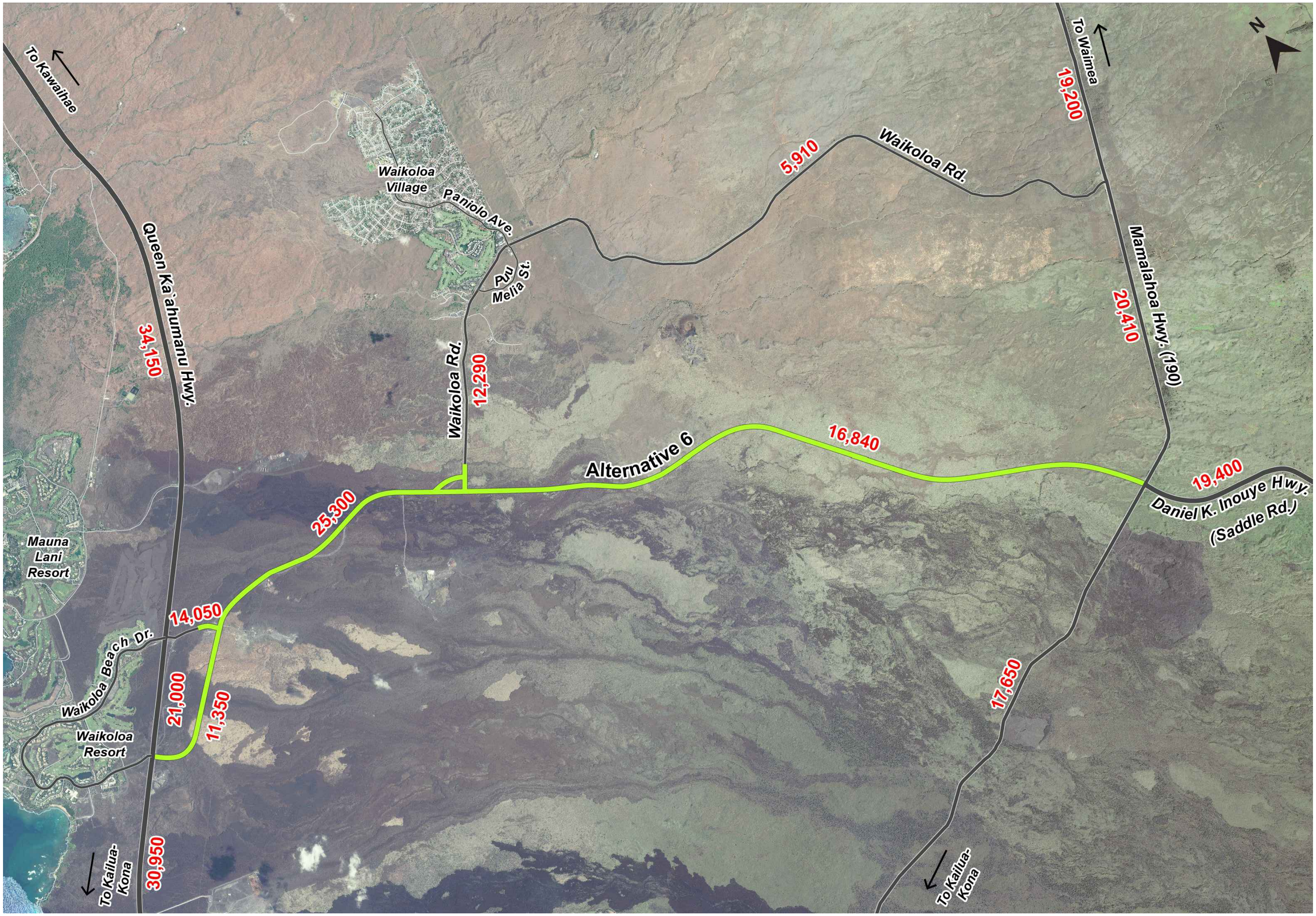

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SADDLE ROAD EXTENSION

FIGURE 3.4.4D ~ PROJECTED YEAR 2035 24-HOUR TRAFFIC VOLUMES - ALTERNATIVE 6

FILE: \99011-190 TO QUEEN K\Figures\Fig-3.4.4D.DWG study area, due to growth in both visitor activity and resident population. The most significant increases will occur on Queen Ka‘ahumanu Highway.

The forecasted link volumes were translated into intersection turning movements for all alternatives using pattern analysis and traffic volumes balancing, based on methods described in ***Appendix F***. The traffic study contains map figures and tables detailing volumes, delay and Level of Service for each turn movement for each alternative.

Differences in Impacts Between Alternatives

Because an understanding of traffic conditions that would occur if the Project is not implemented is essential to understanding the impacts of the Project, discussion of No Action Alternative impacts is integrated with the discussion of the Build Alternative in this section.

Table 3.4.2 summarizes the intersection operations under each of the alternatives at AM and PM peak hours. Owing to the expected high growth in resident population and visitor numbers, Level of Service would decline from the current LOS B/C range, no matter the alternative. The No Action Alternative would have an average LOS of below D, with no intersections operating above LOS C, and one at LOS F. Under any of the Build Alternatives, most intersections at either peak hour would operate at acceptable levels, with at least one at LOS B, even if some intersections would have unacceptable service of LOS E or F.

The main effect of all of the Saddle Road Extension Build Alternatives, regardless of the alignment that is selected, would be to provide a highway of appropriate functional classification for regional traffic between the existing DKI Highway and Queen Ka‘ahumanu Highway, the major regional roadway serving the west coast of the Island of Hawai‘i. In doing so, it would reduce the impact of projected regional traffic increases on roadways less capable of handling regional traffic due to design constraints or functional intent. Motorists would be able to access their destinations between 5 and 6.6 minutes faster, depending on destination and origin, saving not only time but also fuel and its cost. Various secondary benefits accrue to the SRX Build Alternatives in the form of reduced requirements for intersection and roadway segment improvements on Māmalahoa Highway, Waikoloa Road, and Queen Ka‘ahumanu Highway. The following summarizes the advantages and disadvantages of all alternatives under consideration, including the No Action.

<u>No Action Alternative</u>

The No Action Alternative analyses reflect conditions that would occur if no Saddle Road Extension were constructed. In this case, all traffic using the DKI Highway would use Māmalahoa Highway for at least part of their trip. This includes regional traffic destined for Kailua-Kona, North Kona and Kawaihae as well as the more local trips destined for Waikoloa Village, Waimea, and *mauka* areas of Kona along Māmalahoa Highway. Traffic destined for Queen Ka‘ahumanu Highway, the primary regional roadway on the west side of the island, would need to utilize Waikoloa Road, a collector type roadway meant to be used as access to

Table 3.4.2 Year 2035 Overall Intersection Operations by Alternative

Intersection	AM Peak hour		PM Peak hour	
	Delay*	LOS	Delay*	LOS
NO ACTION ALTERNATIVE				
Queen Ka‘ahumanu/Waikoloa Beach Rd/Waikoloa Rd	56.4	E	74.5	E
Māmalahoa Hwy/Waikoloa Rd	55.0	D	40.9	D
Māmalahoa Hwy/SRX/DKI	28.5	C	146.0	F
Queen Ka‘ahumanu/Waikoloa Beach Rd/SRX	36.7	D	23.6	C
Waikoloa Road/Paniolo Avenue/Pua Melia Street	20.7	C	18.4	B
ALTERNATIVE 4				
Queen Ka‘ahumanu/Waikoloa Beach Rd/Waikoloa Rd	45.4	D	53.7	D
Māmalahoa Hwy/Waikoloa Rd	19.5	B	33.6	C
Māmalahoa Hwy/SRX/DKI	41.6	D	86.7	F
Queen Ka‘ahumanu/Waikoloa Beach Rd/SRX	35.6	D	37.2	D
Waikoloa Road/Paniolo Avenue/Pua Melia Street	10.7	B	11.3	B
ALTERNATIVE 5				
Queen Ka‘ahumanu/Waikoloa Beach Rd/Waikoloa Rd	43.2	D	53.7	D
Māmalahoa Hwy/Waikoloa Rd	16.4	B	33.7	C
Māmalahoa Hwy/SRX/DKI	50.7	D	69.4	E
Queen Ka‘ahumanu/Waikoloa Beach Rd/SRX	50.8	D	37.2	D
Waikoloa Road/Paniolo Avenue/Pua Melia Street	20.4	C	28.0	C
ALTERNATIVE 6				
Queen Ka‘ahumanu/Waikoloa Beach Rd/Waikoloa Rd	52.0	D	77.1	E
Māmalahoa Hwy/Waikoloa Rd	16.4	B	22.7	C
Māmalahoa Hwy/SRX/DKI	50.7	D	69.4	E
Queen Ka‘ahumanu/Waikoloa Beach Rd/SRX	50.8	D	34.5	C
Waikoloa Road/Paniolo Avenue/Pua Melia Street	20.4	C	28.0	C

* Delay in seconds. Intersections of Māmalahoa Hwy/SRX/DKI assume at-grade intersection. Grade-separated conditions would yield substantially better LOS.

Waikoloa Village and future development in the surrounding areas. Regional traffic traveling between areas to the south such as Kailua-Kona and North Kona is projected to primarily utilize Māmalahoa Highway.

As the DKI Highway achieves its role as a primary cross-island arterial highway, regional traffic volumes are expected to challenge the ability of both Māmalahoa Highway and Waikoloa Road to acceptably handle the traffic volume demand. Projected regional traffic impacts to Waikoloa Road interfere with this minor arterial roadway’s primary purpose to provide access to the Waikoloa Village community and future development along its corridor. Additionally, the volume of projected 2035 average daily traffic using Māmalahoa Highway between the DKI Highway and Waikoloa Road without benefit of the Saddle Road Extension – 30,950 vehicles per day – would stress the intersections on the DKI Highway and at Waikoloa Road, due to the large number left-turn movements.

Level of Service would decline from the Base Year 2014 baseline LOS B/C range to LOS C/F. Operation would be less than acceptable at the Māmalahoa Highway/SRX/DKI intersection in the PM peak hour, and at both the AM and PM peak at the Queen Kaʻahumanu Highway intersection with Waikoloa Road and Waikoloa Beach Drive (i.e., where Waikoloa Road connects).

In the case of the DKI Highway intersection, the main stress is on the southbound to eastbound left-turn movement from Māmalahoa Highway to DKI Highway. At the Waikoloa Road intersection, it is on the northbound to westbound left-turn movement from Māmalahoa Highway to Waikoloa Road. Even with significant improvements to Māmalahoa Highway, these left-turn movements are projected to result in long vehicle queues that would require unreasonably long left-turn storage lanes. The amount of traffic signal time required to service these left-turns would also negatively impact the ability of Māmalahoa Highway to handle through traffic.

By the year 2035, long-range plans by HDOT call for Queen Kaʻahumanu Highway to be widened to 4 lanes in the Waikoloa area. As part of this widening, significant intersection geometry improvements would also be assumed to occur. These would help Queen Kaʻahumanu Highway fulfill its role as the primary regional roadway on the west side of the Big Island. Even so, without the SRX, all regional DKI Highway traffic desiring access to Queen Kaʻahumanu Highway would be obliged to connect via Waikoloa Road. This would funnel regional traffic as well as Waikoloa Village-generated traffic through the Queen Kaʻahumanu Highway/Waikoloa Road intersection, leading to difficulties in handling the large volume turning movements. Especially significant is the large southbound to eastbound left-turn from Queen Kaʻahumanu Highway to Waikoloa Road. Even a double left-turn configuration at this intersection would not mitigate the issues associated with this turn movement. As in the Māmalahoa Highway intersections, the traffic signal time required to service the large turn movements detract from the ability of Queen Kaʻahumanu Highway to handle through traffic.

Build Alternative 4

The main benefit of Alternative 4, which does not directly connect to Waikoloa Road, is that it would divide the traffic turning movement demands between the intersections of Waikoloa Road and Waikoloa Beach Drive with Queen Kaʻahumanu Highway. The SRX would allow regional DKI Highway traffic to access Queen Kaʻahumanu Highway directly, while Waikoloa Village and the surrounding area would continue to utilize Waikoloa Road. This would lessen the intensity of the turn movements at the existing Queen Kaʻahumanu/Waikoloa Road intersection, thereby improving projected intersection operations there. Similarly, the proposed SRX would reduce turn movements at the Māmalahoa Highway intersections at Waikoloa Road and DKI Highway, thereby improving projected intersection operations. This would, in turn, reduce the magnitude of improvements needed on Māmalahoa Highway between DKI Highway and Waikoloa Road.

Level of Service would, in general, decline only slightly from the Year 2014 baseline LOS B/C range to LOS B/D. All intersections except the Māmalahoa Highway intersection with the SRX and DKI Highway at the PM hour would operate at acceptable levels during both the AM or PM peak hours.

Build Alternative 5

Alternative 5 includes a connection between the SRX and Waikoloa Road that does not exist in Alternative 4. There would be a short connector roadway between Waikoloa Road and SRX, resulting in two relatively closely spaced intersections at Connector/SRX and Connector/ Waikoloa Road (see ***Figure. 2.4*** for intersection details).

Alternative 5 preserves the benefit achieved in by Alternative 4 of dividing turning movement demands between the Waikoloa Road and Waikoloa Beach Drive intersections on Queen Ka‘ahumanu Highway. It has the added benefit of reducing the turning movement demand at the Māmalahoa Highway/Waikoloa Road intersection, since it is projected that the connection to Waikoloa Road between Māmalahoa and Queen Ka‘ahumanu Highway would attract a large proportion of Waikoloa Village and surrounding area-related DKI Highway traffic directly to the SRX, instead of the lower portion of Waikoloa Road. This would further reduce turning movements on Māmalahoa Highway at Waikoloa Road and DKI Highway, improving operations. The result would be a further reduction in the extent of improvements needed on Māmalahoa Highway to accommodate projected traffic conditions.

The SRX-DKI Highway through-movement would increase in traffic volume relative to Alternative 4, because both not only regional traffic but also Waikoloa Village area traffic associated with DKI Highway could take advantage of the SRX. Consequently, the proposed roadway design provides substantial capacity for this through-movement, with four lanes (two in each direction). These are reduced to two lanes away from the Māmalahoa Highway/SRX intersection.

For various intersections in the system, the Level of Service under Alternative 5 would decline from the Year 2014 baseline LOS B/C range to LOS C/E. Unlike the No Action condition, however, only the Waikoloa Road/Queen Ka‘ahumanu Highway intersection would have less than acceptable service.

Build Alternative 6

Alternative 6 achieves some of the same benefits of Alternative 5 by dividing turning movement demands between Waikoloa Road and Waikoloa Beach Drive intersections on Queen Ka‘ahumanu Highway. The Alternative 6 alignment utilizes the existing Waikoloa Road alignment to a point fairly close (0.7 miles) to Queen Ka‘ahumanu Highway. For this reason, certain types of traffic would be more likely to continue to use Waikoloa Road rather than SRX in order to save time and distance. In particular, motorists on SRX bound to destinations found north along Queen Ka‘ahumanu Highway, such as Puako or the Mauna Lani Resort, whether they originated from Hilo or Waikoloa Village, would likely take the shortcut and turn right on Waikoloa Road and its intersection rather than utilize the SRX intersection. This would create capacity issues similar to the No Action Alternative at the Queen Ka‘ahumanu Highway/ Waikoloa Road intersection. However, since both regional and Waikoloa Village area traffic are projected to utilize SRX to its intersection at the southern leg of Waikoloa Beach Drive to and from Queen Ka‘ahumanu Highway south, the capacity issues at the Waikoloa Road/Queen

Kaʻahumanu Highway would not be as intense as in the No Action Alternative. For the Māmalahoa Highway intersections, the results would be similar to the Alternative 5 results.

The connection between Waikoloa Road and SRX would be simpler in Alternative 6 than in Alternative 5 (see ***Figure 2.4*** for intersection details). SRX would be the through roadway with Waikoloa Road intersecting it as the minor leg of a “T-intersection.” However, there would be an additional intersection on SRX where the remaining segment of Waikoloa Road would connect to Queen Kaʻahumanu Highway. This would be a longer segment than the connector road in Alternative 5.

Level of Service would decline from the Year 2014 baseline level LOS B/C range to LOS B/E. Operation would be less than acceptable (LOS E) at the Queen Kaʻahumanu Highway intersection with Waikoloa Road and Waikoloa Beach Drive (i.e., where Waikoloa Road connects) in the PM peak hours.

Differences in Impacts Between Intersection Design Options

Design Option 1 involves having the SRX/Māmalahoa Highway intersection remain at-grade and signalized. The future traffic levels at this intersection will require four through-traffic lanes for the DKI/SRX approaches (two in each direction). The additional lanes would be needed only in the influence area of the intersection and would be transitioned in and out per standard lane add and lane drop designs.

Design Option 2 includes a grade-separated intersection (see ***Figure 2.6***). The preliminary design consists of single-point urban interchange (SPUI). In this type of interchange, all on- and off-ramps converge at a single intersection as opposed to two closely-spaced intersections on a typical “diamond” interchange. In the SPUI, all right turns for all approaches can make their movements with curved off-ramps and no signals. For the dominant highway, all through movements can move through with no traffic signal. One traffic signal under the bridge of the intersection handles all left-turns for all approaches, as well as the through movements for the non-dominant highway. Implementing the interchange would eliminate the need for additional lanes for the Saddle Road/SRX through movement and would also significantly improve the intersection Level of Service relative to at-grade intersection. The narrow design would also limit the extent and width of right-of-way acquisition for the adjacent properties.

Short-term Impacts

Most construction work would take place in isolated areas with no existing road network, minimizing traffic disruption. For every Build Alternative, there would be traffic disruption at the intersections of Queen Kaʻahumanu Highway and Māmalahoa Highway. Alternatives 5 and 6 would involve disruption on Waikoloa Road near Mile Marker 3. For Alternative 6 only, a two-mile length of Waikoloa Road would be disrupted. For all these areas, construction of intersection and/or roadway improvements would temporarily congest traffic as the intersection and/or roadway is widened and areas are repaved, restriped, and fitted with traffic control structures. Alternative 4, with intersections at only Queen Kaʻahumanu Highway and Māmalahoa Highway, would involve the least amount of temporary traffic disruption.

Alternative 6, which involves realignment of a 2-mile segment of the existing Waikoloa Road, much of it involving existing paved roadway, would involve the greatest amount of temporary traffic disruption. Alternative 5 would be intermediate.

Full closure of Māmalahoa Highway may be needed for a very limited number of construction activities if the grade-separated design option is selected.

The No Action Alternative would have no traffic construction impacts.

3.4.1.3 Mitigation Measures

Operational (Long-term) Mitigation Measures

If a Build Alternative is selected, the following intersection improvements have been incorporated into the design to assist in reducing congestion:

1. Channelize turn movements at the Māmalahoa Highway/SRX/DKI Highway intersection through striping;
2. Implement double left-turn lanes both northbound and southbound Queen Kaʻahumanu Highway at both the Waikoloa Road and Waikoloa Beach Road/SRX intersections;
3. Implement double left-turn lanes on the Waikoloa Road, SRX, and Waikoloa Beach Drive approaches to Queen Kaʻahumanu Highway;
4. Build a grade-separated intersection or signalize an at-grade intersection on Māmalahoa Highway at DKI Highway/SRX
5. If Design Option 1 is selected (at-grade intersection), and either Alternative 5 or 6 is selected, provide two lanes in each direction for through traffic movements on the DKI Highway/SRX movement. After the intersection, the SRX and DKI Highways will be transitioned back to one lane in each direction away from this intersection.
6. If Alternative 5 or 6 is selected, signalize the connector intersections of Waikoloa Road/SRX at the time when traffic signal warrants are satisfied.

Construction (Short-term) Mitigation Measures

1. Temporary traffic control plans will be developed and implemented to keep all project area highways and roads open to road users. Two-way travel will be accommodated on the existing road or temporary roadways during construction to the greatest degree practical. Construction activities may periodically necessitate restricting the road to one lane of travel. In such cases, road use will be maintained by implementing an alternate one-way movement of travel through the construction area. Provisions will be made for this alternate one-way movement using such methods as flagger control, a flag transfer, a pilot car, or traffic control signals. Provisions will be made to restrict these alternate one-lane closures to a period of no more than several hours; no full, 24-hour alternate one-way movement would be implemented.
2. Full closure of Māmalahoa Highway may be needed for a very limited number of construction activities if a grade-separated design option is selected. Provisions will be made to restrict these full closures to when road use is minimal. Provisions will also be

made to restrict these full closures to a period of several hours, and no full, 24-hour closures are proposed. The public will be notified well in advance of all closures. Emergency and incident responders will be allowed access through the construction area at all times.

3. The project is located in a rural setting and there are limited bicycle and pedestrian facilities through the project area. The existing bicyclist usage is minimal, consisting of occasional touring and recreational cyclists, and pedestrian use is almost non-existent. Standard traffic control practices described in the Manual of Uniform Traffic Control Devices (MUTCD) would be proposed to accommodate bicyclists. Bicyclists will share the road and ride through the construction zone without impeding traffic, similar to the current conditions. Provisions to aid in lowering vehicular speeds through the construction zone would be implemented. The existing posted speed limit of 55 MPH is proposed to be lowered in 10 MPH increments through the construction zone (to a posted 25 MPH speed limit in areas of active construction). Bicyclists' needs will be met by maintaining a paved surface where feasible and removing temporary signs, debris, and other obstructions from the edge of the road after each day's work.

3.4.2 Right-of-Way and Relocation

3.4.2.1 Existing Environment

The only State highway right-of-way (ROW) currently present on any portion of the project corridors is at the eastern terminus on Māmalahoa Highway (70 feet in width) and at the western terminus on Queen Ka'ahumanu Highway (425 feet in width) (refer to ***Fig. 3.1.1***). A portion of the main segments of Alternatives 5 and 6 as well as associated connector roads touch on the ROW of Waikoloa Road near Milepost 3. This County facility has a 125-foot wide ROW in this area. All remaining land within the project corridors is owned by one of four landowners (including the State of Hawai'i), as shown in ***Figure 3.1.2***.

3.4.2.2 Environmental Consequences

Construction of the Saddle Road Extension on any of the alternative alignments would involve acquisition of about 10.0 to 10.5 miles of ROW. The width of the ROW will be determined along the entire length of the selected alternative during final design and is expected to vary from 120 to 240 feet. The Project would also involve use and expansion of right-of-way on Māmalahoa Highway and Queen Ka'ahumanu Highway, and potentially, Waikoloa Road. About half of the ROW area would experience actual ground disturbance. No relocations of homes, businesses or any structures would be required. The Project would require acquisition of up to a maximum of 334 acres from up to eight State or private land properties, each of which varies between 800 and 1,700 acres (***Table 3.4.3***).

Table 3.4.3. Estimated Maximum Right-of-Way Take, by Property

TMK No.	**Owner**	**Alternative 4 Area in Acres**	**Alternative 5 Area in Acres**	**Alternative 6 Area in Acres**
6-8-01:27	Waikoloa Mauka LLC	0	0	37.3
6-8-01:05	Waikoloa Mauka LLC	77.0	100.6	56.9
6-8-01:66	WQJ2008 Investment LLC	0	2.5	0.1
6-8-01:67	Waikoloa Mauka LLC	19.2	58.6	46.4
6-8-02:15	Waikoloa Village Assn.	55.6	56.9	56.8
6-8-02:14	Waikoloa Village Assn.	25.4	25.4	25.4
6-8-2:13	BIVWR Investments LLC	74.0	74.0	74.0
7-1-03:01	State of Hawai‘i	57.2	0	0
	County of Hawai‘i (Exist. Waikoloa Road)	0	0	27.6
Total Area		318.4	328.0	334.5

Even on large properties, construction of a highway can divide unified holdings and isolate portions of a property from other areas. This may lead to access problems and constrain future uses of the land, particularly if it is intended to be subdivided in the future. There may sometimes be issues involving uneconomical or inaccessible property remnants. Segment 4/5/6 *mauka* would divide one long and narrow 802.9-acre property lengthwise.

Differences in Impacts Between Alternatives 4, 5 and 6 and Intersection Design Options

The only major difference between the alternatives is that Alternative 4 would involve a lesser degree of acquisition of private land, as it traverses almost two miles of State land where approximately 30 acres of ROW would need to be transferred from the State Department of Land and Natural Resources to HDOT rather than acquired from private owners.

Design Option 2, involving a grade-separated intersection of the Saddle Road Extension with Māmalahoa Highway, would require more acquisition of private land (and an arrangement with the U.S. Government for additional land at Pōhakuloa Training Area) than Design Option 1, in which the intersection would remain at-grade.

Impacts of the No Action Alternative

No right-of-way acquisition or relocation would occur with the No Action Alternative.

3.4.2.3 Mitigation Measures

1. The acquisition of property necessitated by the Project would be conducted in accordance with Federal Uniform Relocation and Real Property Acquisition Policies Act of 1970 (P.L. 91-646), as amended, and applicable State regulations.

Since 1971, the acquisition of private land for government programs and projects has been subject to the Uniform Relocation Assistance and Real Property Acquisition Policies Act (URARPAPA) of 1970 (amended and updated by Congress in 1987). The URARPAPA provides for fair and equitable treatment of persons whose property would be acquired, or persons who would be displaced because of federally funded programs or projects.

The URARPAPA has three parts or Titles. Title I contains general provisions and definitions. Title II has provisions for relocation assistance for persons displaced because of federal and federally assisted programs. Title III, the Uniform Real Property Acquisition Policy, contains the provisions for consistent treatment of owners whose private property is acquired by the government. All federal, state and local public agencies, in addition to others receiving federal financial assistance for public programs and projects requiring the acquisition of real property, must comply with the policies and provisions set forth in the URARPAPA and its amendments.

The acquisition of private property does not need to be directly federally funded for the rules of URARPAPA to apply. If federal funds are used in any phase of the program or project, the URARPAPA applies. Its rules encourage acquiring agencies to negotiate with property owners in a prompt and amicable manner so that litigation can be avoided. FHWA-CFLHD and HDOT have begun preliminary discussions with landowners in order to ensure that issues of access and remnant parcels can be resolved during the right-of-way negotiation process.

3.4.3 Pedestrian and Bicycle Facilities and Use

3.4.3.1 Existing Environment

Bicycling is increasingly being viewed as not just a recreational activity but also a viable transportation mode. *Bike Plan Hawaii* (HDOT 1994, as supplemented) summarizes the multifaceted benefits of bicycling to transportation, health, economics, community, and the environment. The Island of Hawai‘i has nearly 27 miles of designated bicycle facilities, which are made up of three types: paths, bike lanes, and signed shared roadways (***Figure 3.4.5***). The American Association of State Highway and Transportation Officials (AASHTO) (1999) define these facilities as:

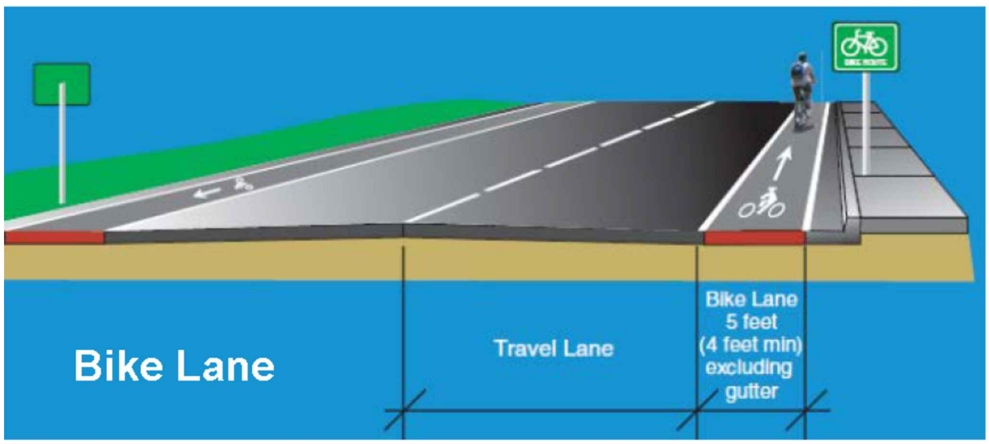
- Paths or Shared-use Paths – a bikeway that is physically separated from motorized vehicular traffic by an open space or barrier. Shared-use paths may also be used by pedestrians and other non-motorized users.
- Bike Lanes – a portion of a roadway that has been designated by striping, signing, and pavement markings for the preferential or exclusive use of bicyclists.
- Signed Shared Roadways – a shared roadway that has been designated by signing as a preferred route for bicycle use. This may be an existing roadway with wide curb lanes, or paved shoulders.

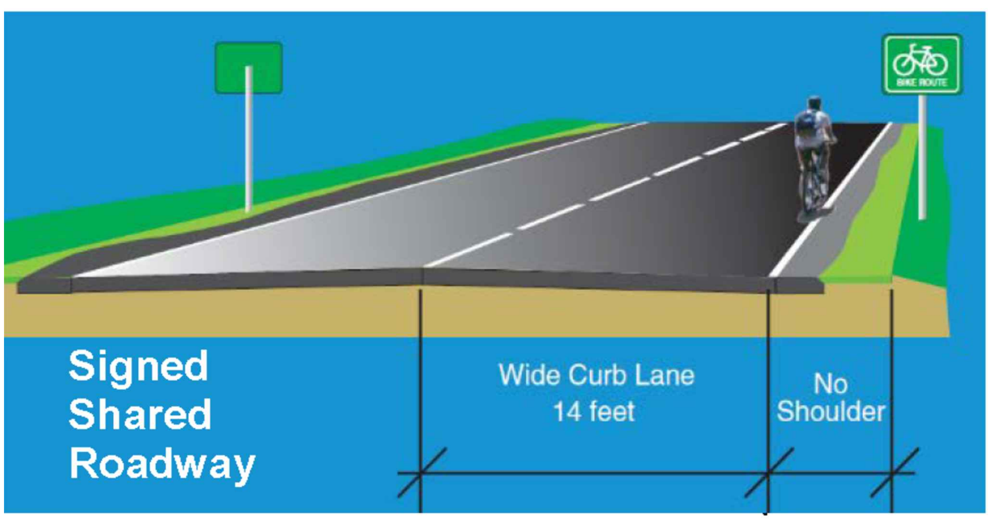
At the time of the 1994 plan, bicycle facilities in the area were minimal, but there were plans for signed, shared roadways on Māmalahoa Highway, (Old) Saddle Road, and Waikoloa Road (***Figure 3.4.6***). None have yet been implemented. There were also plans for a signed, shared roadway on, and a bike path adjacent to, Queen Kaʻahumanu Highway. The 12-foot wide shoulder of the highway accommodates bicycle use and there are “Share the Road” signs and lane-share markings at intersections. Otherwise, the highway is not marked as a bicycle facility.

To date, with the important exception of Queen Kaʻahumanu Highway and minor roads within Waikoloa Village and the Waikoloa Beach Resort, bicycle and pedestrian use are also minimal on the project area roads. The inadequate nature of the facilities plays a role in the low usage rate, but other important reasons include the large distances between population centers that would be a source of users, steep grades, and hot and dry conditions. Queen Kaʻahumanu Highway attracts bicycles (and some runners) because it is relatively flat, with wide paved shoulders. The primary use is for training, as this is the course for the world-famous Kona Ironman World Championship race in October of each year on the west side of the island. Lacking adequate shoulders for bicycles, Waikoloa Road has less bicycle or pedestrian use, even though it connects Waikoloa Village and the Waikoloa Beach Resort over a distance of only six miles. Very few bicycles use Māmalahoa Highway, with its high speeds and narrow shoulders and long distances between towns, although usage appears to be increasing (***Figure 3.4.7***).

Most relevant in terms of future bicycle use on the Saddle Road Extension is the Daniel K. Inouye Highway, which the new proposed highway would directly connect to and resemble in terms of cross-section and grade. Prior to the sequence of Saddle Road Improvement construction projects starting in 2003, the Saddle Road was narrow and curvy, with segments of narrow, irregular, eroded or non-existing shoulders, highly unsuitable for bicycles. Although not signed as a shared roadway, the eight-foot shoulders on the Daniel K. Inouye Highway separated from the roadway by a rumble strip safely accommodate bicycles and attract some use (***Figure 3.4.7***). A motorist on a typical trip across the Saddle will observe very few, if any, pedestrians, bicyclists, or equestrians on the western portion of the highway, although there is a fair amount of bicycle use in and around Mauna Kea Recreation Area, about 20 miles east of the proposed Saddle Road Extension’s eastern terminus. This park offers a good central staging point for relatively level recreational bicycle excursions as long as 10 miles one-way. Time-lapse camera bicycle counts taken over a period of 164 daylight hours on three occasions in February and April 2014 measured 10 cyclists, or one every 16.4 hours, at MP 45.2 in the western section of the DKI Highway. During events such as races or rallies there is a higher level of use. Since 2014, it appears from anecdotal observation that bicycle use on all area roads and highways has increased.

Several individuals and the organization Peoples Advocacy for Trails Hawaiʻi (PATH) commented during the scoping process that the Project should incorporate a recreational bicycle path (see meeting notes and letters in ***Appendix A2***). The suggestion was for a paved trail with graded shoulders for safety that would run roughly parallel to the highway approximately 50 to 200 feet away, weaving along the slope through a series of switchbacks that allowed a more reasonable grade than the 4-7% slope of the proposed highway. FHWA and HDOT considered the idea of adding a recreational bicycle trail to the Project but determined that the proposed



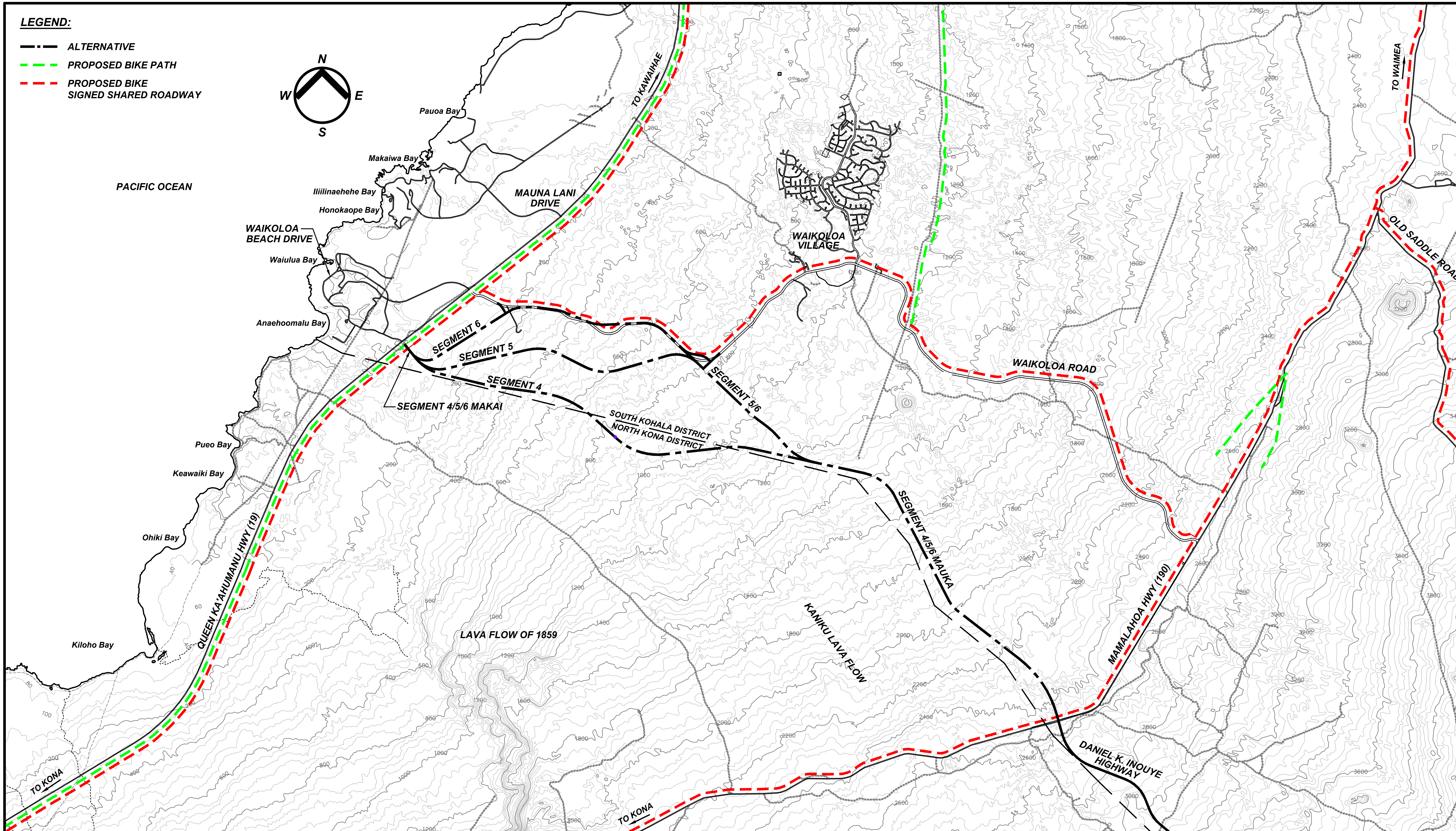


FA PROJECT NO. DP-HI-0200(5)

SADDLE ROAD EXTENSION

FIGURE 3.4.5 ~ TYPES OF BICYCLE FACILITIES

Source: Bike Plan Hawaii, Hawaii Department of Transportation (2003)



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GRAPHIC SCALE IN FEET

SADDLE ROAD EXTENSION

FIGURE 3.4.6 ~ BIKE PLAN HAWAII FACILITIES IN PROJECT AREA

Source: Bike Plan Hawaii, Hawaii Department of Transportation (2003)

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Figure 3.4.7
Shoulders of Māmalahoa Highway and Daniel K. Inouye Highway

Māmalahoa Highway **Daniel K. Inouye Highway**

highway shoulder cross-section could meet the transportation function for the nature and quantity of bicycles and pedestrians that would be expected on this highway. Furthermore, a recreational trail does not meet the purpose and need of the Project. It should be noted that acquiring at least 50 acres of right-of-way, preparing the land surface, and constructing a recreational trail would have significant costs. For a 6-foot wide paved trail, construction would involve acquisition of right-of-way, a minimum of 12,000 tons of 6-inch thick aggregate base and 4,300 tons of 2-inch thick asphalt concrete, which would cost approximately $945,000 at current values. The highest costs would be from clearing and grubbing a corridor on completely unaltered, steep terrain, and then conducting excavation/ embankment earthwork and fine grading. These costs could be as high as $6,000,000. In addition, it would add to the area of impact of the proposed highway.

In addition to guidance on bicycle and pedestrian facilities from Bike Plan Hawaiʻi, both the State and County of Hawaiʻi have existing or proposed laws and policies concerning complete streets. The County of Hawaiʻi General Plan is a policy document expressing the broad goals and polices for the long-range development of the Island of Hawaiʻi. The plan was originally adopted by ordinance in 1967, and was most recently amended in 2005. The General Plan is organized into thirteen elements, with goals, policies, standards and recommended courses of action for each. The Transportation Element of the General Plan establishes the following policy with regard to pedestrian and bicycle facilities:

> "Explore means and opportunities to enhance the shared use of the island's roadways by pedestrians and bicyclists, in coordination with appropriate government agencies and organizations."

The Complete Streets Act, Act 54, was passed by the 2009 Hawaiʻi State Legislature. In the language of the law:

> §286- Complete streets. (a) The department of transportation and the county transportation departments shall adopt a complete streets policy that seeks to reasonably accommodate convenient access and mobility for all users of the public highways within their respective jurisdictions as described under section 264-1, including pedestrians, bicyclists, transit users, motorists, and persons of all ages and abilities.
> (b) This section shall apply to new construction, reconstruction, and maintenance of highways, roads, streets, ways, and lanes located within urban, suburban, and rural areas, if appropriate for the application of complete streets.
> (c) This section shall not apply if:
> (1) use of a particular highway, road, street, way, or lane by bicyclists or pedestrians is prohibited by law, including within interstate highway corridors;
> (2) the costs would be excessively disproportionate to the need or probable use of the particular highway, road, street, way, or lane;
> (3) there exists a sparseness of population, or there exists other available means, or similar factors indicating an absence of a future need; or
> (4) the safety of vehicular, pedestrian, or bicycle traffic may be placed at unacceptable risk.

The Complete Streets approach has limited application on certain highways, as foreseen in Act 54. When the costs would be excessively disproportionate to the need or probable use of the particular highway, or when the sparseness of population indicates an absence of a future need, as is the case with Saddle Road Extension, many of the features envisioned for a "Complete Street" (particularly sidewalks) are not suitable or necessary. Through its provision of a wide, paved shoulder with rumble strips, the Saddle Road Extension would meet the needs of cross-island bicyclists.

3.4.3.2 Environmental Consequences

Construction activities often present obstacles to pedestrians and bicyclists crossing the highway, and can temporarily prevent use of the road for walking or biking in the immediate vicinity of construction work. Because of the location of the construction on a (primarily) new alignment on private land with no intersecting streets, very little interference is expected. Some issues may occur at the termini at Queen Kaʻahumanu Highway and Māmalahoa Highway, as well as at connections with Waikoloa Road under Alternatives 5 and 6. Construction related impacts would be short term and temporary in nature.

The design parameters and controls that would be implemented with the proposed Project would markedly improve safety characteristics compared to existing roadways in the area. The widened, paved shoulders proposed for the Project would minimize the hazards to pedestrians and bicyclists using the Saddle Road Extension, and would enhance safety. As shown in ***Figure 2.5***, the typical section includes, from inside to outside, a 12-foot travel lane, a travel lane edge stripe, a 4-inch gap, then a rumble strip, and then a 6'8"-wide shoulder. The rumble strip millings are 12 inches wide and spaced 12 inches apart. These extend for 47 feet with a 13-foot gap, and then resume again.

After construction, HDOT would provide standard signage denoting a shared, signed bike path. With the proposed construction of wider travelways and paved shoulders along the entire corridor, use of Saddle Road Extension by bicyclists may increase. While recreational ridership may increase, the steep grades and hot, dry weather are daunting, and much of the increased ridership would likely be from expert riders training for races and competitions. This type of facility has proven to adequately accommodate bicycle traffic on the Daniel K. Inouye Highway. It would represent a substantial improvement over Waikoloa Road and Kawaihae Road, the only other *mauka-makai* connections in the northwest Hawai‘i region, where shoulders as narrow as one foot are inadequate for bicycles.

Differences in Impacts Between Alternatives 4, 5 and 6 and Intersection Design Options

There would be no substantive differences in the level of facilities for pedestrian and bicycle use between the alternatives or design options. However, both Alternatives 5 and 6 offer a connection to Waikoloa Road, which would create an adequate bicycle route for at least a portion (three of the six total miles) of the route between Waikoloa Village and the Waikoloa Beach Resort. Selection of Alternative 4 would not directly link the Waikoloa Beach Resort with any communities. However, during construction, there would be greater impacts to pedestrians and bicycles utilizing Waikoloa Road with Alternative 6 (and to a much lesser extent with Alternative 5).

Impacts of the No Action Alternative

The No Action Alternative would not improve bicycle or pedestrian facilities in any way. It is expected that the signed-shared bicycle roadway that has been proposed for Waikoloa Road since 1994 would eventually be built, improving conditions for cyclists.

3.4.3.3 Mitigation Measures

Temporary (construction-phase) mitigation for bicycle and pedestrian passage is discussed above in Section 3.4.1.3. After construction, the Project design itself provides for a highway with a widened shoulder and rumble strips to connect Queen Ka‘ahumanu Highway and the Daniel K. Inouye Highway, which substantially improves existing conditions. The following mitigation will be implemented:

1. Signage will be emplaced indicating a signed, shared bicycle route.
2. Project construction will include provisions for safe pedestrian and bicycle crossings of affected roadways during construction periods.

3.5 CLIMATE AND AIR QUALITY

Impacts to air quality in the project area are covered in a report included as ***Appendix I*** and summarized below. For climate and air quality, the region of influence encompasses areas of different scale. As defined and discussed below, certain criteria pollutants from motor vehicles merit consideration on a mesoscale or regional basis; therefore, all of Northwest Hawaiʻi is considered. For others, such as carbon monoxide, it is more important to focus on the microscale, usually at intersections, which become hotspots as vehicles brake, idle and accelerate. During construction, dust can affect all areas surrounding the corridor within about 1,000 feet. Therefore, the region of influence will vary with the particular type of air quality impact being considered.

An emissions burden study, also called a mesoscale analysis, is an overall assessment of the potential impact of a roadway project. This was performed to provide estimates of existing and future air pollution emissions from traffic operating within the project corridor. A microscale air quality analysis, meant to study air quality impacts at critical on-ground locations, was conducted for five different intersections in the project area. A qualitative assessment of mobile source air toxics was also prepared.

3.5.1 Affected Environment

3.5.1.1 Climate

The project area spans elevations between 100 feet and 2,600 feet above sea level. The annual rainfall area varies from 9.5 to 25 inches (Giambelluca et al 2014). Temperatures show definite but moderate seasonal variability. Near the coast the average daily high is about 82 degrees F. and the low is about 72 degrees. Temperatures in the higher elevations are 4 to 7 degrees cooler.

Wind is important for its effect on dispersion or concentration of motor vehicle-generated pollutants and for its ability to generate fugitive dust emissions from construction. In South Kohala, high winds are normal, causing excellent dispersion but also posing potential dust problems. Northeast trade winds often blow at speeds exceeding 25 miles per hour, with slower speed upslope winds also occurring. Regionally, trade winds from an east to northeast direction are present on up to 90 percent of summer days and 50 percent of winter days.

Air quality is generally excellent, as combustion-derived air pollution in the entire State of Hawaiʻi is minimal. Hawaiʻi Island, like the rest of the state, meets the standards set by the Clean Air Act (CAA) and State of Hawaiʻi law (HRS Chapter 342B), and is within an attainment area. Volcanic emissions of sulfur dioxide convert into particulate sulfate that causes a volcanic haze (vog) that primarily affects Kona, but also drifts north into South Kohala.

3.5.1.2 Criteria Pollutants and Mobile Source Air Toxics

Regulatory Background

Ambient concentrations of air pollution are regulated by both federal and State of Hawaiʻi ambient air quality standards (AAQS). National air quality standards and regulations provide the basic scheme for project-level air quality analysis under the National Environmental Policy Act (NEPA). The Federal Clean Air Act (CAA), as amended, is the primary federal law that governs air quality, while the Hawaiʻi Air Pollution Control Act is its companion State law. These laws, and related regulations by the United States Environmental Protection Agency (EPA) and Hawaiʻi Department of Health (HDOH), Clean Air Branch, set standards for the concentration of pollutants in the air. At the federal level, these standards are called National Ambient Air Quality Standards (NAAQS). NAAQS and State ambient air quality standards have been established for six transportation-related criteria pollutants that have been linked to potential health concerns: carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM), which is broken down for regulatory purposes into particles of 10 micrometers or smaller (PM 10) and particles of 2.5 micrometers and smaller (PM 2.5), and sulfur dioxide (SO_2). The State has also set a standard for hydrogen sulfide. The NAAQS, as well as the State standards that are defined in Chapter 11-59 of the Hawaiʻi Administrative Rules are set at levels that protect public health with a margin of safety, and are subject to periodic review and revision. Table 1 of ***Appendix I*** contains all relevant federal and State of Hawaiʻi standards.

NAAQS are stated in terms of both primary and secondary standards for most of the regulated air pollutants. Primary standards are designed to protect public health with an “adequate margin of safety.”. Secondary standards, on the other hand, define levels of air quality necessary to protect the public welfare from “any known or anticipated adverse effects of a pollutant.” Secondary public welfare impacts may include such effects as decreased visibility, diminished comfort levels, or other potential injury to the natural or man-made environment, e.g., soiling of materials, damage to vegetation or other economic damage. In contrast to the NAAQS, Hawaiʻi State AAQS are given in terms of a single standard that is designed “to protect public health and welfare and to prevent the significant deterioration of air quality.”

Each of the regulated air pollutants has the potential to create or exacerbate some form of adverse health effect or to produce environmental degradation when present in sufficiently high concentration for prolonged periods of time. The AAQS specify a maximum allowable concentration for a given air pollutant for one or more averaging times to prevent harmful effects. Averaging times vary from one hour to one year depending on the pollutant and type of exposure necessary to cause adverse effects. In the case of the short-term (i.e., 1- to 24-hour) AAQS, both national and State standards allow a specified number of exceedances each year. The Hawaiʻi AAQS are in some cases considerably more stringent than the comparable NAAQS. In particular, the Hawaiʻi 1-hour AAQS for carbon monoxide is four times more stringent than the comparable national limit. On the other hand, the current Hawaiʻi AAQS for sulfur dioxide are less stringent than the national standards. ***Appendix I*** contains additional information concerning the AAQS.

Regional Air Quality in Relation to AAQS

The HDOH operates a network of air quality monitoring stations around the State, including one at Konawaena High School in Kealakekua, about 30 miles south of the project site. This is one of the areas of Kona most affected by vog. Systematic data are not available for most criteria pollutants in Kona except SO_2 and particulates (PM 2.5, or particulate matter less than 2.5 microns in diameter), which are of concern because of their association with vog. It is generally accepted that other criteria pollutants are well within standards, at least on a regional basis. The excellent air quality for pollutants other than particulates and SO_2 is owing to the isolation of the island from any outside sources of pollution. However, carbon monoxide concentrations may be exceeded on occasion near high-volume intersections during periods when traffic congestion and poor dispersion conditions coincide.

During the most recent 5-year period for which data have been reported (2011-2015), the HDOH operated an air quality monitoring site in Kealakekua for measuring sulfur dioxide and particulate matter (PM 2.5). Air quality data collected at this station are probably representative of regional conditions. Measurements of sulfur dioxide concentrations at this location during the 2011-2015 monitoring period were mostly low with annual average concentrations of 0.003 to 0.005 ppm, which represents about 10 to 17 percent of the State standard. During 2011 and 2012, there were a few incidents of higher 1-hour average sulfur dioxide concentrations that exceeded the level of the national standard. The highest annual "second highest" 3-hour and 24-hour concentrations (which are most relevant to the State standards) for these five years were 0.079 and 0.030 ppm, respectively; these are about 16 to 21 percent of the applicable standards. No exceedances of the State 3-hour and 24-hour AAQS for sulfur dioxide were recorded.

Mobile Source Air Toxics

In addition to the criteria air pollutants for which there are NAAQS, EPA also regulates air toxics. Most air toxics originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners) and stationary sources (e.g., factories or refineries). Mobile Source Air Toxics (MSATs) are a subset of the 188 air toxics defined by the Clean Air Act. The MSATs are compounds emitted from highway vehicles and non-road equipment. Some toxic compounds are present in fuel and are emitted to the air when the fuel evaporates or passes through the engine unburned. Other toxics are emitted from the incomplete combustion of fuels or as secondary combustion products. Metal air toxics also result from engine wear or from impurities in oil or gasoline.

3.5.2 Environmental Consequences

3.5.2.1 Construction Phase Impacts

Short-term direct and indirect impacts on air quality could potentially occur during project construction. For a project of this nature, there are two potential types of air pollution emissions that could directly result in short-term air quality impacts during construction: (1) fugitive dust from vehicle movement and soil excavation; and (2) exhaust emissions from onsite construction equipment. Indirectly, there also could be short-term impacts from slow-moving construction equipment traveling to and from the project site and from the disruption of traffic due to road construction.

Fugitive dust emissions may arise from grading and dirt-moving activities associated with land clearing and preparation work. The emission rate for fugitive dust emissions from construction activities is difficult to estimate accurately because of the diffuse and variable sources of emissions, and because the potential for its generation varies greatly depending upon the type of soil at the construction site, the amount and type of dirt-disturbing activity taking place, the moisture content of exposed soil in work areas, and the wind speed. The EPA has provided a rough estimate for uncontrolled fugitive dust emissions from construction activity of 1.2 tons per acre per month under conditions of "medium" activity, moderate soil silt content (30%), and precipitation/evaporation (P/E) index of 50. Uncontrolled fugitive dust emissions in the project area would likely be somewhere near this level. In any case, State of Hawaiʻi Air Pollution Control Regulations at Chapter 11-60, HAR, prohibit visible emissions of fugitive dust from construction activities at the project boundary, and thus an effective dust control plan for the project construction phase is essential.

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

On-site mobile and stationary construction equipment also will emit air pollutants from engine exhausts. The largest of this equipment is usually diesel-powered. Nitrogen oxides emissions from diesel engines can be relatively high compared to gasoline powered equipment, but the standard for nitrogen dioxide is set on an annual basis and is not likely to be violated by short-term construction equipment emissions. Also, the short-term (1- hour) standard for nitrogen dioxide is based on a three-year average; thus, it is unlikely that relatively short-term construction emissions would exceed the standard. Carbon monoxide emissions from diesel engines, on the other hand, are low and should be relatively insignificant compared to vehicular emissions on nearby roadways.

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

Section 3.5.3, most potential short-term air quality impacts from project construction can be mitigated.

3.5.2.2 Operational Impacts

Mesoscale Analysis

As detailed in ***Appendix*** I, the mesoscale analysis utilized data on vehicle efficiency (related to speed and queuing) and vehicle miles traveled (VMT) for all roadways in the area. The analysis assumed that the fleet mix, or the types and ages of vehicles, would be the same for each alternative. For the Project, the estimated daily VMT for all involved roadways for each scenario were as follows (it should be noted that these estimated VMTs are conservative and may not fully account for the "shortcut" effect offered by any Build Alternative):

Scenario	**VMT/day**
Existing	251,729
2035 No Action Alternative	929,725
2035 Alternative 4	943,345
2035 Alternative 5	943,613
2035 Alternative 6	931,793

As detailed in Tables 4-8 of ***Appendix I***, the analysis indicated that for existing conditions the estimated totals of emissions from traffic within the study area were 420 tons per year of carbon monoxide, 230 tons per year of nitrogen oxides and 20 tons per year of volatile organic compounds. Under the No Action Alternative project in the year 2035, it was estimated that carbon monoxide emissions would decrease by 9 percent, 4 volatile organic compounds emissions would decrease by 70 percent and nitrogen oxides emissions would decrease by 59 percent. These substantial decreases in emissions would occur despite the projected substantial increase in traffic volumes. This is due to the expected significant reduction in average tailpipe emissions over time as older, more polluting vehicles are retired. Importantly, with any Build Alternative in the year 2035, emissions of carbon monoxide, volatile organic compounds and nitrogen oxides **were estimated to decrease by about an additional 10 to 15 percent**, due to better vehicle efficiency on less congested roads.

Microscale Analysis

The microscale analysis performed for this project involved the use of computerized emission and atmospheric dispersion models to estimate existing and future (year 2035) worst-case 1-hour average ambient concentrations of carbon monoxide during peak travel hours at five intersections in the project study area involving Waikoloa Road, Daniel K. Inouye Highway, Mamālahoa Highway, and Queen Kaʻahumanu Highway. Tables 9 and 10 ***Appendix I*** provide data on these intersections. The highest worst-case carbon monoxide concentration for existing conditions occurs at the intersection of Waikoloa Road and Queen Kaʻahumanu Highway during the afternoon. The predicted 1-hour concentration at this location reached 1.4 parts per million (ppm), which is well within the State standard of 9 ppm and the national standard of 35 ppm.

The factors influencing future concentrations tended to cause both increases and decreases in microscale emissions. Increasing VMT increases emissions, but even with significantly more traffic and congestion by the year 2035, much of the excess emissions would be offset by the retirement of older vehicles with their less efficient emissions control systems. As far as future conditions under the No Action Alternative in 2035, the predicted highest worst-case 1-hour concentration in the project study area actually decreased (improved) to 0.9 ppm. In the year 2035 for any Build Alternative, worst-case concentrations were predicted to be either lower (better) or unchanged compared to the No Action Alternative.

Mobile Source Air Toxics

A quantitative assessment of the effects of air toxic emissions impacts on human health cannot be made at the project level. While available tools to reasonably predict relative emissions changes between alternatives for larger projects, the amount of MSAT emissions from each of the project alternatives and MSAT concentrations or exposures created by each of the project alternatives cannot be predicted with enough accuracy to be useful in estimating health impacts. The current emissions model is not capable of serving as a meaningful emissions analysis tool for smaller projects. Therefore, the relevance of the unavailable or incomplete information is that it is not possible to make a determination of whether any of the alternatives would have "significant adverse impacts on the human environment."

Even though reliable methods do not exist to accurately estimate the health impacts of MSATs at the project level, it is possible 30 to qualitatively assess the levels of future MSAT emissions under the project. Although a qualitative analysis cannot identify and measure health impacts from MSATs, it can give a basis for identifying and comparing the potential differences among MSAT emissions, if any, from the various alternatives. The qualitative assessment presented below is derived in part from a U.S. Department of Transportation, FHWA Memorandum dated December 6, 2012. For each project alternative, the amount of MSATs emitted can be expected to be proportional to the VMT.

As indicated above, the estimated VMT in 2035 without the project are substantially higher compared to the existing case, and the estimated VMT for the three with-project alternatives are very slightly higher (about 1 percent higher or less) compared to the No Action Alternative.

Any of the three Build Alternatives in 2035 would provide for slightly higher average travel speeds in the project area compared to the No Action Alternative. The relationship between travel speed and MSAT emission rates has not been well established, but for the criteria air pollutants, lower travel speeds generally result in higher emissions. If it is assumed that the average travel speed is not a factor, then on the basis of VMT alone, the expected slightly higher VMT in 2035 with the project would result in slightly higher MSAT emissions compared to the No Action Alternative. Regardless of the alternative chosen, however, emissions would likely be **lower than present levels** in the design year as a result of EPA's national control programs that are projected to reduce MSAT emissions by over 80 percent between 2010 and 2050. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in virtually all locations.

In sum, with the project in the design year, it is estimated that MSAT emissions in the immediate area of the project would increase slightly relative to the without-project alternative due to the fact that the project is expected to cause a small increase in the VMT. In comparing the project alternatives, MSAT levels could potentially be higher in some specific locations than others, but current tools and science are not adequate to quantify them. However, on a regional basis, EPA's vehicle and fuel regulations, coupled with fleet turnover, would over time cause substantial reductions that, in almost all cases, would cause region-wide MSAT levels to be significantly lower than today.

Dust

During operation of any highway, dust generated from offsite areas can reduce visibility on the highway and cause a safety hazard to motorists. Because of the geology (mostly recent lava) and current and expected types and intensities of adjacent land uses (vacant or low-intensity cattle grazing), there is only a minimal possibility for dust from adjacent uses to impact drivers on the Saddle Road Extension.

Differences in Impacts Between Alternatives 4, 5 and 6 and Intersection Design Options

For total emissions burden (mesoscale analysis, of the three build alternatives, Alternative 6 would likely yield the largest emission reductions, but the difference among the three alternatives is slight. Insofar as the microscale analysis is concerned, there is no significant difference among the three Build Alternatives studied. Alternatives 4, 5 or 6 could result in slightly higher MSAT emissions compared to the without-project alternative based solely on vehicle miles of travel estimates. However, it is probable that MSAT emissions will decrease in the future compared to existing emissions, with or without the project, due to fleet turnover and as new vehicle and fuel regulations are implemented. Design Option 2 and its grade-separated intersections would be most efficient and least polluting.

Impacts of the No Action Alternative

As stated above, the proposed roadway improvements would likely have either a slight net positive impact or no impact on both the mesoscale and microscale long-term air quality of the area, primarily because of the shorter travel distances and more efficient engine operation. The No Action Alternative, therefore, would have slightly negative to neutral effects relative to any action alternatives. small.

Conformity

In addition to this environmental analysis, a parallel "Conformity" requirement under the CAA requires mention. Under the conformity provisions of the CAA, regionally significant and federally funded projects located in designated non-attainment or "maintenance" areas (former nonattainment) must demonstrate conformity to State Implementation and Maintenance Plans.

Since 1977, federal agencies and Metropolitan Planning Organizations (MPO) have been required by Section 176c of the Clean Air Act to ensure that all transportation projects conform to the approved air quality State Implementation Plans (SIP). The Clean Air Act Amendments enacted in 1990 defined conformity to a SIP as meaning “conformity to a SIP’s purpose of eliminating or reducing the severity and number of violations of the NAAQS” (Federal Register, November 30, 1993). The conformity determinations for federal actions related to transportation projects must meet the requirements of 40 CFR Part 51, subpart T. There are no non-attainment areas in Hawai‘i and resulting SIP. To determine if a project demonstrates conformity to the State Implementation and Maintenance Plans, a project must be included in a Regional Transportation Plan (RTP) and Transportation Improvement Program (TIP), and not cause or contribute any new violation of NAAQS. Conformity with the CAA takes place on two levels—first, at the regional level and second, at the project level. The proposed project must conform at both levels to be approved. U.S. EPA regulations at 40 Code of Federal Regulations (CFR) 93 govern the conformity process. Conformity requirements do not apply in classifiable/attainment areas for NAAQS and do not apply at all for state standards regardless of the status of the area. As Hawai‘i is an attainment area, these conformity requirements do not apply.

3.5.3 Mitigation Measures

Operational Mitigation

From a mesoscale viewpoint, any of the alternatives which include the project would have a net positive impact. Thus, it does not appear that mitigation for long-term impacts is warranted based on the mesoscale analysis of the project. Mitigation measures to address microscale impacts are similar to those for mesoscale impacts. An additional mitigation measure for microscale impacts might be to provide added buffer zones between walkways and roadways, although technically, the public would have to somehow be excluded from the buffer zones. The predicted worst-case concentrations discussed above are based on a separation distance of 10 feet between walkways and roadways. Doubling this distance would reduce maximum concentrations by about 10 to 15 percent. The analysis of microscale impacts indicates that any of the Build Alternatives would result in either slightly improved air quality or no change compared to the No Action Alternative, and worst-case concentrations of carbon monoxide with the project would be well within the State and national standards in the design year. Thus, mitigation of air quality impacts based on the microscale analysis does not appear to be warranted, particularly as only one of the intersections (Waikoloa Road and Paniolo Drive) contains nearby development or substantial pedestrian traffic, and traffic there would decrease with any Build Alternative. The analysis of MSAT impacts suggests that alternatives with the project could result in a small increase in MSAT emissions compared to without the project but that emissions with or without the project in the design year can be expected to be lower than present emissions. Thus, mitigation based on the MSAT impact analysis does not appear to be warranted.

Construction-Phase Mitigation

FHWA and HDOT will implement the following mitigation measures during construction:

1. Standard dust control and construction equipment emission control measures will be implemented as necessary to reduce temporary impacts to air quality during construction activities. Water or a dust palliative will be applied as necessary to minimize particulate pollution. Areas to receive such treatment will include unpaved access roads, staging sites, and construction areas where the movement and operation of construction equipment produces airborne dust. Up to 40,000 MGals of water may be used for dust control, earthwork compaction, and irrigation. This could require up to 5,000 truck trips, or 10 trucks per work day each way, depending on the hauling capacity of the equipment used. Water would be obtained from a contractor-selected source, most likely in Waimea due to its close proximity to the Project. Water will be hauled via a temporary construction access road pioneered along the new alignment and connecting to SR 190 at the Daniel K. Inouye Highway junction.
2. Construction activities will incorporate fugitive dust emission control measures in compliance with provisions of HAR Chapter 11-60.1, "Air Pollution Control," Section 11-60.1-33 on Fugitive Dust. Measures that are expected to be used to control airborne emissions include the following:
    - Use water, disturbance area limitations, and re-vegetation to minimize dust emissions.
    - Stabilize all disturbed areas with erosion control measures.
    - Cover open-bodied trucks and trailers whenever hauling material that can be blown away.
    - Revegetate disturbed area as soon as practical after construction.
    - Stabilize construction entrances to avoid offsite tracking of sediment.
    - Maintain equipment in working order.
    - Construction equipment will be required to meet all applicable emission standards.
3. Construction equipment will be required to meet all applicable emission standards. Emission impacts will be minimized by requiring the Contractor to use vehicles that are properly maintained.

3.6 NOISE

A noise analysis of the various alternatives is included as ***Appendix H*** and is summarized below. The region of influence for noise impacts includes noise-sensitive areas within a distance capable of being impacted – residences, businesses, schools, hospitals and similar developed uses, as well as portions of parks or other areas that are dedicated for activities requiring special qualities of serenity and quiet. The project corridors themselves are completely undeveloped, and the only noise-sensitive areas are present *makai* of but well set back from Queen Ka‘ahumanu Highway.

For highway transportation projects with FHWA involvement, federal regulations (23 CFR 772) govern the analysis and abatement of traffic noise impacts. The regulations require that potential noise impacts in areas of frequent human use be identified during the planning and design of a highway project. Under 23 CFR 772.7, projects are categorized as Type I, Type II, or Type III projects. FHWA defines a Type I project as a proposed federal or federal-aid highway project for the construction of a highway on a new location (such as the proposed Saddle Road Extension), or the physical alteration of an existing highway which significantly changes either the horizontal or vertical alignment, or increases the number of through-traffic lanes. A Type II project is a noise barrier retrofit project that involves no changes to highway capacity or alignment. A Type III project is a project that does not meet the classifications of a Type I or Type II project.

Background on Noise Definition and Measurement

Noise may be defined as unwanted sound. Evaluation of noise requires a consideration of loudness at various pitches. Loudness is measured in units called decibels (dB). Since the human ear does not perceive all pitches or frequencies equally, noise levels are adjusted (or weighted) to correspond to human hearing. This adjustment is known as the A-weighted scale, abbreviated dBA. The specific sound level descriptor used in this study is the hourly energy equivalent sound level – L_{eq}(h) – in decibels (dBA), which considers the combined effects of all noises near and far and includes background noise and noise fluctuation. In this document, all noise levels have been measured in terms of A-weighted decibels using the hourly energy equivalent sound level, i.e., dBA L_{eq}(h), which is abbreviated as “dBA” or “L_{eq}”.

Figure 3.6.1 relates A-weighted sound levels at various decibel levels to representative sources and typical individual or community responses. Levels over 70 dBA are considered unpleasant by most individuals; levels under 50 dBA are generally perceived as acceptably quiet.

The State and federal governments have cooperated to provide procedures for noise studies and noise abatement measures to help protect the public health and welfare. They have supplied noise abatement criteria (measured in decibels) for various categories of land use (23 CFR 772), as shown in ***Table 3.6.1*** below. These criteria help to determine whether there is a noise impact, and therefore, whether noise abatement must be considered.

Figure 3.6.1. Decibel Levels of Common Activities

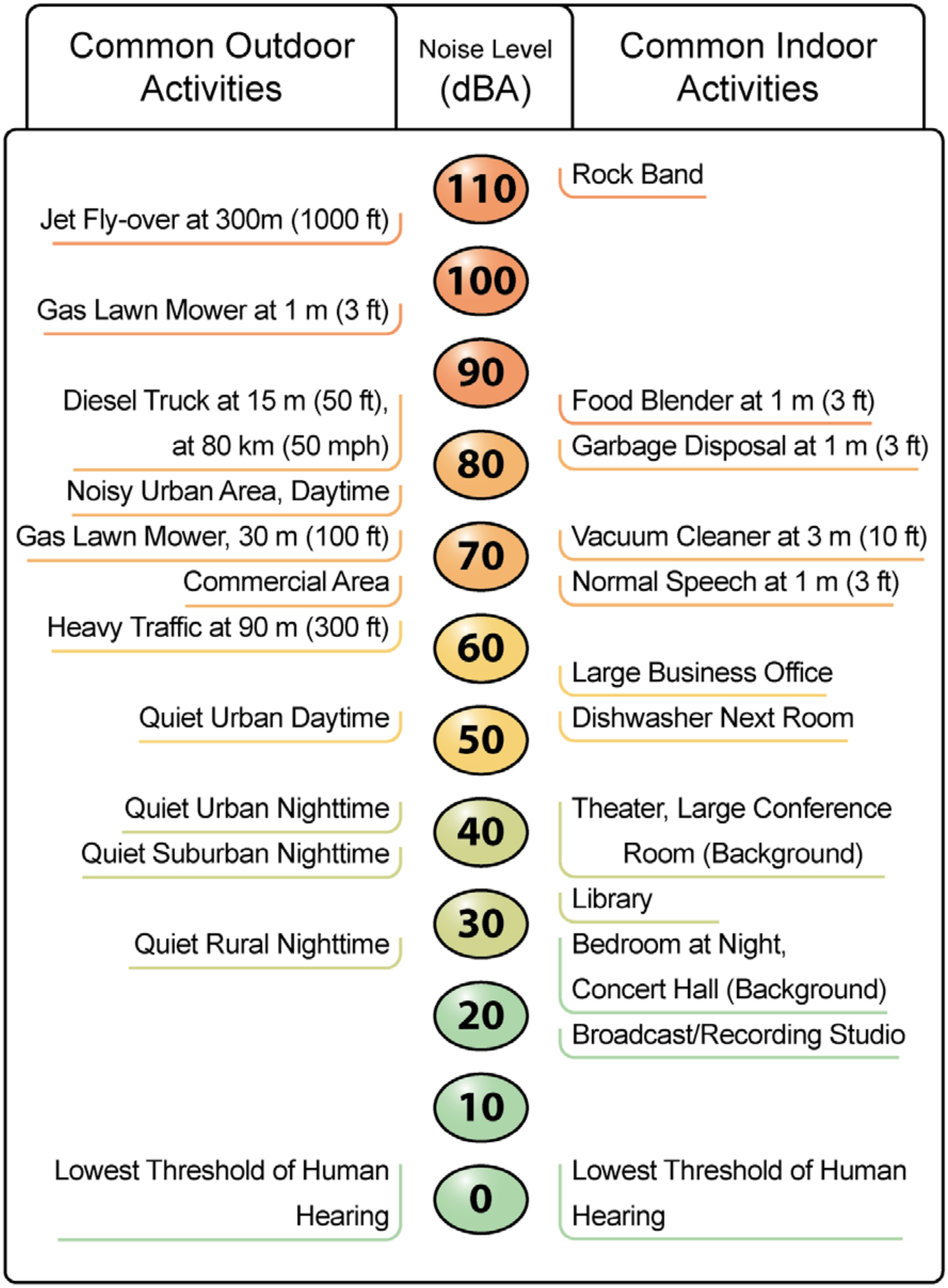


Table 3.6.1
Federal Highway Administration Noise Abatement Criteria

Activity Category	Design Noise Level L_{eq}[1]	Description of Activity Category
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important need, and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose. Such areas could include amphitheaters, particular parks or portions of parks, or open spaces which are dedicated or recognized by appropriate local officials for activities requiring special qualities of serenity and quiet.
B	67[2] (Exterior)	Residential.
C	72[2] (Exterior)	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	(52) (Interior)	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or non-profit institutional structures, radio studios, recording studios, schools, and television studios.
E	(52) (Interior)	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	___	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	___	Undeveloped lands not permitted for development

Source: U.S. Department of Transportation Policy and Procedure Memorandum 90-2, per 23 CFR 771
Notes: L_{eq} is the one-hour energy equivalent sound level measured in decibels on the A-weighted scale (see main text for definitions).
1. The Hawaii State Department of Transportation, Highways Division, utilizes Leq criteria levels which are 1 Leq unit less than the FHWA values shown, as noise impacts occur when noise “approaches or exceeds” the Noise Abatement Criteria, and HDOT defines “approach” as within 1.0 decibel of the applicable criteria.
2. Includes undeveloped lands permitted for this activity category.

3.6.1 Affected Environment

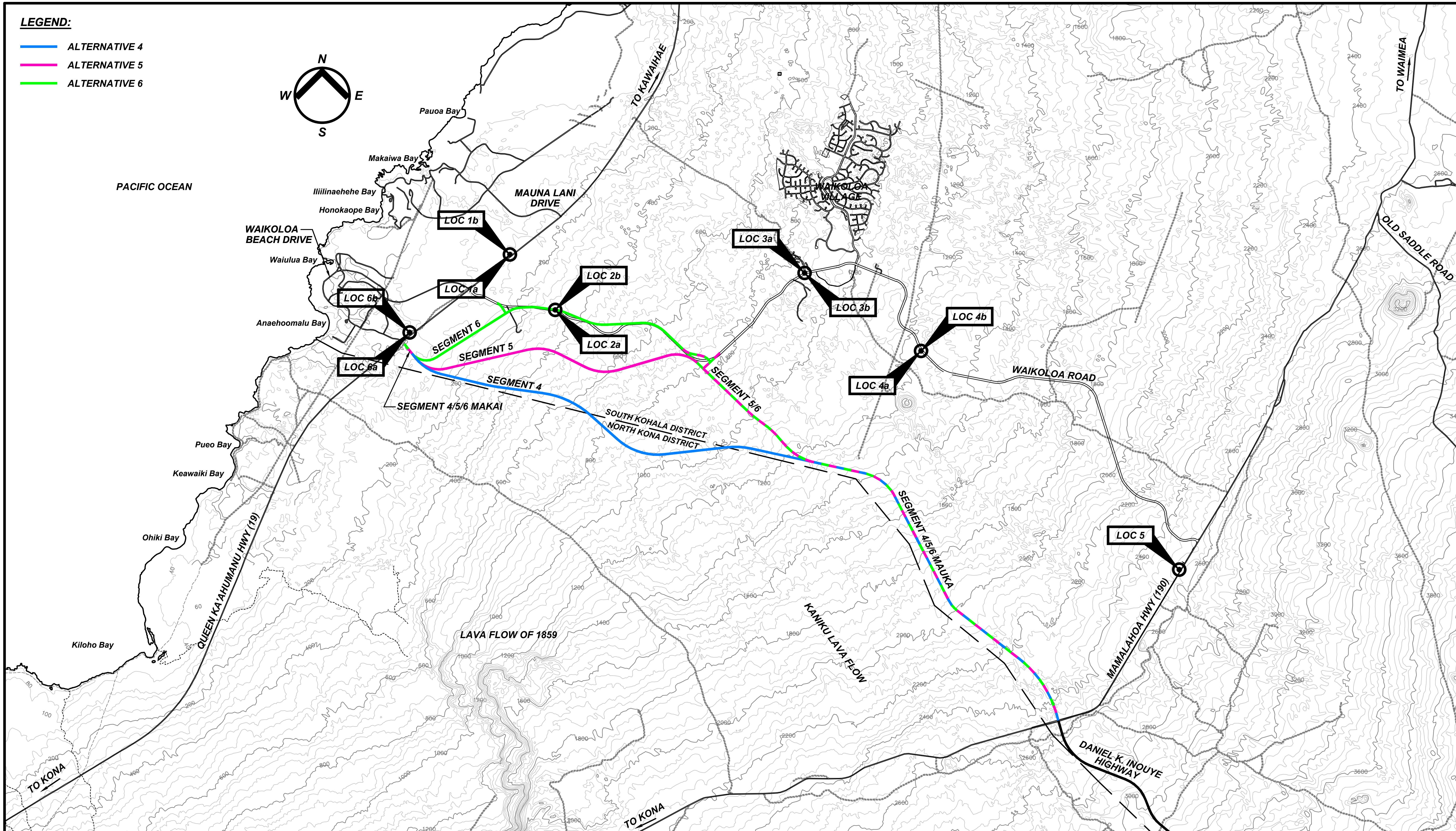
In overview, ambient noise levels along most of the length of the project corridors are very low, reflecting the undeveloped and unpopulated nature of much of the landscape. Noise levels where the project corridors intersect existing roads or highways (i.e., Queen Kaʻahumanu Highway, Waikoloa Road, and Māmalahoa Highway) vary from low to moderate due to highway traffic. Other uses in the region, including the West Hawaiʻi Sanitary Landfill, the Waikoloa Beach Resort, Waikoloa Village and the Waikoloa Quarry are all sufficiently distant to be barely audible (refer to ***Fig. 3.1.2***). No airports are located nearby; one tour heliport facility is located on Waikoloa Road, which generates tour helicopter noise that can occasionally be heard on the project corridors.

In general, no residences, hotels, hospitals, parks or other sensitive land uses are located within one mile of the any of the alternative project corridors. Only at the common western terminus of Waikoloa Beach Drive and Queen Kaʻahumanu Highway are noise-sensitive land uses present. At that location, a private outdoor arena for performances called the Queen's Garden is located approximately 1,640 feet west, and time share resort residential units are as close as 1,630 feet to the northwest.

In April 2015, traffic and background noise measurements were obtained at eleven locations in the project area (***Figure 3.6.2***). These measurements were used to define existing noise levels in the project area, and also served to validate the current FHWA Traffic Noise Model (TNM), Version 2.5, in order to ensure that noise predictions based on traffic levels would be accurate. Details of the nose measurements are contained in Table 1 of ***Appendix H***. In summary, noise at 50 feet from the centerline at peak traffic hours on various portions of Queen Kaʻahumanu Highway, Māmalahoa Highway and Waikoloa Road varied from about 58 to 73 dBA, with the highest values at Queen Kaʻahumanu Highway, with its higher traffic volumes. For areas 100 feet from the centerline, the measurements varied from 58 to 66, with similar patterns. Measured and predicted traffic noise levels at were generally in good agreement at distances ranging from 33 to 150 feet from the centerlines of the roadways. This confirmed the use of specific loss factors to be used in the TNM to account for how noise propagates and diminishes with distance from the source.

Ambient noise levels along the three alternative project corridors were then estimated using the TNM. Except for the roadway corridor sections located at or near existing roadways, the alternate roadway alignments are located in undeveloped areas where ambient noise levels are controlled by distant traffic and the natural sounds of birds and foliage movement with the wind. Existing background ambient noise levels in areas removed from Queen Kaʻahumanu Highway, Māmalahoa Highway, and Waikoloa Road can be described as being very low, which would be expected due to the undeveloped nature of those areas. Average ambient noise levels were estimated to range from 35 to 45 dBA, with instantaneous levels dropping below 20 dBA during periods of low wind with no bird sounds. For the purposes of the noise analysis, existing background noise levels in the undeveloped areas in the vicinity of the alternate roadway alignments but away from existing roadways were estimated to be 40 dBA during the AM and PM peak hours.

Along Māmalahoa Highway and Waikoloa Road, existing traffic noise levels are moderate and do not exceed the HDOT noise abatement criteria level of 66 dBA at setback distances of 56 feet from the roadway centerlines. Traffic noise levels along Queen Kaʻahumanu Highway are higher, and typically exceed the HDOT noise abatement criteria level of 66 dBA at a setback distance of 95 to 109 feet from the roadway centerline. Relatively high traffic noise levels along



FA PROJECT NO. DP-HI-0200(5)

0 3000 6000 12000

GRAPHIC SCALE IN FEET

SADDLE ROAD EXTENSION

FIGURE 3.6.2 ~ LOCATIONS OF NOISE MEASUREMENT SITES

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major highways is a typical occurrence, with traffic noise levels decreasing with increasing distances from the roadway. Existing background ambient noise levels at receptor locations alongside Queen Kaʻahumanu Highway, Māmalahoa Highway, and Waikoloa Road were assumed to be controlled by traffic along these three roadways. The FHWA traffic noise model was used to calculate Base Year traffic noise levels at receptor locations alongside these three roadways using the modeling parameters established from the traffic noise measurements. Project maps and visual survey of the developments alongside the existing roadways were used to determine terrain, ground cover, and local shielding effects and distances from building structures, which were entered into the noise prediction model. Receptor elevations were estimated using these maps as well as field observations. Traffic mix by vehicle types and average vehicle speeds for the various sections of the existing and future roadways were derived from observations during the April 2015 noise monitoring periods. Determinations of the periods of highest hourly traffic volumes and noise levels along the project corridor were made after reviewing the AM and PM peak hour traffic volumes and traffic noise level measurement results.

To summarize current conditions, Base Year traffic and background noise levels in the project area did not exceed the noise abatement criteria levels for Activity Categories B or C at any noise sensitive receptors in the project area or along the project corridors. Existing noise levels were thus considered acceptable for the purposes of this project.

3.6.2 Environmental Consequences

Short-term (Construction Phase) Impacts

Construction noise impacts are unavoidable, but would be temporary. Noise levels produced during construction would be a function of the methods employed during each stage of construction (***Table 3.6.2***). Equipment likely to be used includes, but is not limited to, drill rig, crane, excavator, backhoe, front-end loader, grader, forklift, semi-trucks, dump trucks, concrete trucks, compactors, paving equipment, and compressors. Short-term noise impacts associated with construction activities along portions of the selected Saddle Road Extension alternative are considered to be unlikely due to the large buffer distances (a minimum of 1,630 feet) between all alternatives and existing noise sensitive land uses. Construction noise may be audible as a result of the low background ambient noise levels in the project area and the relatively high noise levels of heavy construction equipment. The total duration of the construction period for the proposed project would be approximately two years, but noise exposure from construction activities at any one receptor location would not be continuous during the total construction period. Roadway Construction Noise Model User's Guide (FHWA 2006) indicates that the loudest equipment generally emits noise in the range of 80 to 90 decibels (dBA) at a distance of 50 feet, but they steadily decline with distance. Adverse impacts from construction noise will be limited to the temporary degradation of the quality of the acoustic environment at locations within audible range of the construction noise.

The State Department of Health currently regulates noise from construction activities under a permit system, per Title 11, Administrative Rules, Chapter 46, Community Noise Control. Under current permit procedures, noisy construction activities are restricted to hours between 7:00 AM and 6:00 PM, from Monday through Friday, and exclude certain holidays. Noisy construction

Table 3.6.2
Noise Attenuation (Point Source) for Standard Construction Equipment

Equipment Type	Impact Device (Y/N)	Actual Measured Average Lmax (dBA) at 50 ft	Noise Attenuation (Point Source)				
			Lmax (dBA) at 100 ft	Lmax (dBA) at 200 ft	Lmax (dBA) at 400 ft	Lmax (dBA) at 800 ft	Lmax (dBA) at 1600 ft
Backhoe	No	78	70.5	63	55.5	48	40.5
Chain Saw	No	84	76.5	69	61.5	54	46.5
Compressor (air)	No	78	70.5	63	55.5	48	40.5
Concrete Mixer Truck	No	79	71.5	64	56.5	49	41.5
Concrete Pump Truck	No	81	73.5	66	58.5	51	43.5
Concrete Saw	No	90	82.5	75	67.5	60	52.5
Crane	No	81	73.5	66	58.5	57	43.5
Drill Rig Truck	No	79	71.5	64	56.5	49	41.5
Excavator	No	81	73.5	66	58.5	51	43.5
Front End Loader	No	79	71.5	64	56.5	49	41.5
Grader	No	85	77.5	70	62.5	55	47.5
Tele Lift	No	75	67.5	60	52.5	45	37.5
Mounted Impact Hammer (hoe ram)	Yes	90	82.5	75	67.5	60	52.5
Pickup Truck	No	75	67.5	60	52.5	45	37.5
Rock Drill	No	81	73.5	66	58.5	51	43.5
Scraper	No	84	76.5	69	61.5	54	46.5

Source: FHWA's Roadway Construction Model Database (2005) and FHWA Construction Noise Handbook (2006)

activities are normally restricted to the hours of 9:00 AM to 6:00 PM on Saturdays, with construction not permitted on Sundays. These restrictions would minimize construction noise impacts on noise sensitive residences within audible range of the construction activities, and have generally been successfully applied. In this way, construction noise impacts on noise sensitive residences can be minimized. Construction activities during the evening and nighttime hours are possible but require the issuance of a noise variance by the State Department of Health.

The DOH noise permit generally does not limit the noise level generated at the construction site, but rather the times at which high-volume construction can take place. However, before issuing the permit, DOH may require noise mitigation to be incorporated into construction plans, for example, maintenance and proper muffling of construction equipment and onsite vehicles that emit gas or air. DOH may also require the contractor to conduct noise monitoring. In addition to the noise permit, a noise variance may be requested from DOH for specific occasions when work hours need to be extended into the evenings and/or on weekends to implement the overall construction schedule.

Operational Noise Impacts Background

Federal and State of Hawai‘i regulations and policies (23 CFR 772; U.S. Transportation Policy and Procedure Memorandum 90-2; HDOT's 2016 *Highway Noise Policy and Abatement Guidelines*) define a traffic noise impact as occurring when the predicted noise levels for the project year either:

- Approach or exceed FHWA's noise abatement criteria (NAC), or
- Substantially exceed the existing noise levels.

NAC for various uses are specified in 23 CFR 772 and are listed above in ***Table 3.6.1***. Approach is defined in the HDOT policy as within 1.0 dBA of the applicable NAC; i.e., 66 L_{eq} or greater for residential uses. Substantial exceedance is defined as an increase of at least 15 dBA over existing noise levels.

When noise impacts occur, reasonable and feasible mitigation measures must be considered. A noise mitigation measure is considered feasible and reasonable if it accomplishes a substantial noise reduction (at least 5 dBA) while meeting constraints of cost, safety, drainage, access, maintenance, viewplane preservation, etc. According to State policy, the price of mitigation should not exceed $60,000 per affected residence. It is FHWA policy that only existing homes or lots with a current, active building permit are factored in for calculation of both impacts and benefits. It is also important to weigh the overall magnitude of noise impacts and the contribution of other noise sources, as well as the benefit to all nearby residences (not just those defined as impacted by noise increases above criteria), when judging if a mitigation measure is "reasonable". Furthermore, State policy stresses that the opinion of impacted residents will be a major consideration in determining the reasonableness of the noise abatement measures. Finally, it is recognized that it is the policy of Hawai‘i County to discourage walls higher than six feet in order to preserve viewplanes. According to Section 25-4-43 of the Hawai‘i County Code, any proposed wall higher than six feet requires a building permit and is subject to 30-foot property-line setback requirements (which may be smaller in some zones). Exceptions to such setbacks require variance applications on a property-by-property basis.

Operational Noise Impacts of the Proposed Project

Importantly, residential or other noise sensitive structures or park lands are not located within one mile of the centerline of any of the three roadway extension alternatives, except at the Queen Kaʻahumanu Highway intersection, where sensitive uses still exceed 1,600 feet in distance. Therefore, exceedance of the HDOT 66 dBA noise abatement criteria was not expected under any of the Saddle Road Extension Build Alternatives. The need to evaluate potential exceedances of the HDOT 15 dBA-increase noise abatement criteria was examined by predicting future traffic noise levels at large distances from the project corridors, and comparing them with the estimated background ambient noise level of 40 dBA. In addition, the setback distance from the Saddle Road Extension required to ensure that noise levels would not exceed 55 dBA (and/or 15 dBA greater than then existing background noise level of 40 dB) was also calculated to assist in guiding setbacks for future development.

Predicted traffic noise levels associated with forecasted traffic on the Saddle Road Extension in 2035 are not expected to exceed 40 dBA at 2,903 feet distance from the centerlines of the proposed new roadways. At 469 feet distance from the centerline of the proposed new roadways, traffic noise levels in 2035 could exceed 55 dBA. Therefore, with current background ambient noise levels of 40 dBA or more in the undeveloped project areas, exceedance of the HDOT 15 dBA increase noise abatement criteria is not expected from traffic noise associated with any of the three Saddle Road Extension alternative project corridors, at receptor locations which are at least 470 feet from the centerlines of each alternative corridor. As noted above, the closest noise-sensitive use is over 1,600 feet away. Therefore, no noise impacts as defined by FHWA and HDOT standards would be expected to occur.

In terms of general noise increase, future traffic noise increases along Queen Kaʻahumanu Highway will be primarily due to non-project traffic that would be utilizing Queen Kaʻahumanu Highway with our without the Saddle Road Extension. Along Māmalahoa Highway and Waikoloa Road, none of the three Saddle Road Extension alternatives would be expected to add to the future traffic noise level increases resulting from non-project traffic. The Saddle Road Extension Project should actually provide beneficial impacts by reducing future traffic noise level increases at existing and future noise sensitive and commercial developments along Waikoloa Road.

Any future development involving noise sensitive uses that occurs near the Saddle Road Extension, should it be constructed, would be subject to potential noise impacts if the development did not involve sufficient setbacks. Such impacts could be mitigated through the inclusion of sound walls or other noise mitigation measures within the individual lot development plans. In addition, any future public use facilities or housing units which may be planned alongside the selected Saddle Road Extension roadway represent areas of potential adverse noise impacts if adequate noise mitigation measures are not incorporated into the planning of these future projects. It is anticipated that the Project's roadway improvements will be completed prior to any redevelopment of the presently open areas adjacent to any of the alternative corridors, and that noise abatement measures such as adequate setbacks, sound attenuating walls or berms, or closure and air conditioning will be incorporated into these new developments along the selected Saddle Road Extension, as required. In any event, federal participation in noise abatement measures will not be considered for lands that are not permitted by the date of public knowledge, which in this case would be the date of the Record of Decision (ROD), per 23 CFR part 771.

Differences in Impacts Between Alternatives 4, 5 and 6 and Intersection Design Options

There would be no operational noise impacts associated with the Project, and with mitigation as proposed above, there would be no short-term impacts. There are no differences between the alternatives or design options with respect to noise impacts.

Impacts of the No Action Alternative

There are no noise impacts associated with the Project or the No Action Alternative, and there are no differences between any project alternatives and the No Action Alternatives with respect to noise impacts.

3.6.3 Mitigation Measures

Short-term (Construction Phase) Mitigation

As discussed above, construction noise would be unavoidable but temporary, and would be largely mitigated by the simple factor of distance, as all noise-sensitive uses are a minimum of 1,630 feet from the closest point of any alternative. Per Hawai‘i Administrative Rules §11-46-3, the entire project corridor is located in Class A Zoning District (open space, conservation and residential), and Class C Zoning District (agriculture). Under the Class A Zoning District, the maximum permissible sound levels are 55 dBA during the daytime (7 am to 10 pm) and 45 dBA during the nighttime (10 pm to 7 am). Under the Class C Zoning District, the maximum permissible sound levels are 70 dBA during the daytime (7 am to 10 pm) and 70 dBA during the nighttime (10 pm to 7 am). Construction noise is expected to exceed the State’s “maximum permissible” property line noise levels, and thus the following mitigation measures will be implemented:

1. A Community Noise Permit will be obtained from DOH under HAR Chapter 11-46, Community Noise Control. For DOH to issue a noise permit, the application would describe construction activities for the Project and the specific permit restrictions required for construction projects, including the following:
   A. No permit shall allow construction activities creating excessive noise (as defined by the applicable noise district) before 7 am and after 6 pm of the same day.
   B. No permit shall allow construction activities that emit noise in excess of 95 dBA except between 9 am and 5:30 pm of the same day.
   C. No permit shall allow construction activities that exceed the allowable noise levels on Sundays and on certain holidays. Pile driving and other activities exceeding 95 dBA would be prohibited on Saturdays.
2. The DOH noise permit generally does not limit the noise level generated at the construction site, but rather the times at which high-volume construction can take place.

Before issuing the permit, DOH may require noise mitigation to be incorporated into construction plans; for example, maintenance and proper muffling of construction equipment and onsite vehicles that exhaust gas or air. DOH may also require the Contractor to conduct noise monitoring. In addition to the noise permit, a noise variance may be requested from DOH for specific occasions when work hours need to be extended into the evenings and/or on weekends to implement the overall construction schedule.

3. In addition, the following construction noise mitigation measures will be implemented:
    A. In the event that a contractor applies for and is allowed a noise variance to work during the normal curfew periods, the use of heavy excavation or rock breaking equipment will not be allowed.
    B. Heavy truck and equipment staging areas will also be located in areas that are as far from noise sensitive properties as feasible, on or as close as possible to the actual construction area.
    C. The contractor will be required to identify and select truck routes that avoid residential communities to the extent feasible.

Operational Noise Impacts Mitigation

Due to the lack of sensitive noise receptors, there are no operational noise impacts associated with the Project that would require mitigation. Future land use controls that are already part of State and County policies require adequate setbacks that should prevent noise impacts from any development that locates near the Saddle Road Extension.

3.7 GEOLOGY, GEOLOGIC HAZARDS AND SOILS

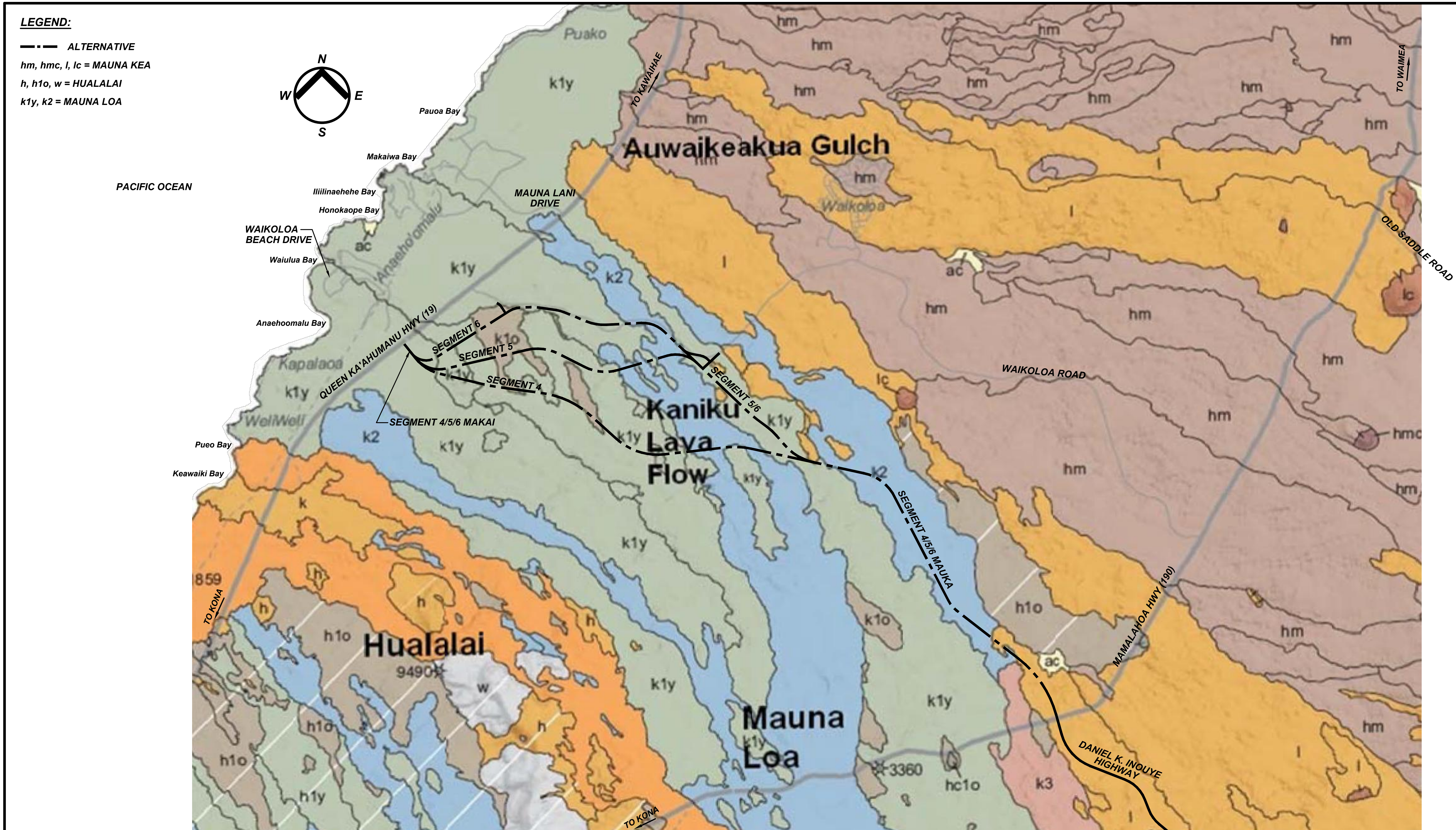
For geology and soil-related impacts, the region of influence is restricted to the project corridors themselves (refer to ***Fig. 3.1.1***), as well as the areas immediately uphill or downhill where there is potential to be affected by project activities.

3.7.1 Affected Environment

3.7.1.1 Geology, Topography and Geologic Resources

West Hawai‘i is the product of Pleistocene and Holocene lava flows and pyroclastic deposits from four volcanoes: Kohala, Mauna Kea, Mauna Loa, and Hualālai (***Figure 3.7.1***). Within the project area, the southern half consists mostly of ‘a‘a (clinkery) and pahoehoe (smooth or ropy) lava from eruptions of Mauna Loa. The northern half is mostly Mauna Kea lava flows of various ages, in places discontinuously mantled by pyroclastic, windblown or colluvial deposits. A few scoria cones from Mauna Kea are also present, as well as some Hualālai lava inclusions that were never completely covered by later, surrounding Mauna Loa flows.

As shown in the series of photographs presented in a previous chapter in ***Figure 1.2***, the topography is moderately sloped and irregularly rolling, typical of lava flows. The terrain of the project area is composed principally of the downslope segments of major basalt lava flows from Mauna Loa’s northeast rift zone. Low hills and ridges produced by ‘a‘a lava flows punctuate this surface. Slopes range from 1 to 7 degrees and are not anticipated to pose major highway



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GRAPHIC SCALE IN FEET

SADDLE ROAD EXTENSION

FIGURE 3.7.1 ~ GEOLOGY OF PROJECT AREA

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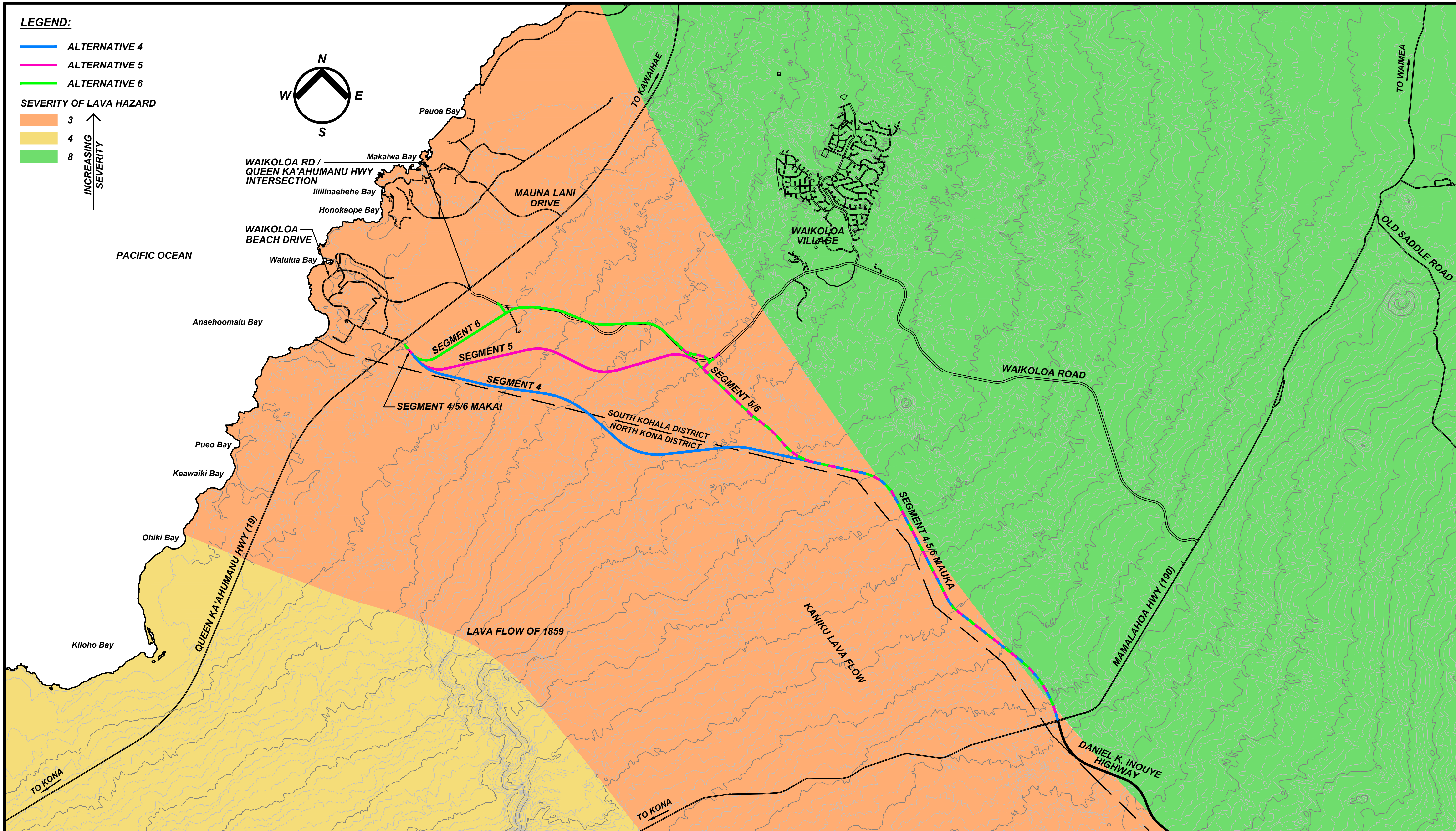

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SADDLE ROAD EXTENSION

FIGURE 3.7.2 ~ LAVA FLOW HAZARD OF PROJECT AREA

construction problems in themselves. Local relief across this generally uniform slope is minor. A few incipient drainage channels that are not well-developed enough to flow out of the project area exhibit sharp elevational changes of up to 20 feet, and thus would require limited terrain modification, such as grading, filling, and construction of culverts.

A rock quarry within the Kanikū lava flow is present near Alternative 4. A blasting safety zone around the quarry is the reason that Alternative 4 veers south into State land (refer to ***Fig. 3.1.2***). Rock quarries such as these primarily provide material for concrete and road construction.

Lava tubes, which are the long cavities left behind by underground channels of lava, are common on pahoehoe lava flows in the area. Some of the lava tubes are large enough and have openings for human entry, and may thus be classified as caves. Caves derived from various other processes may also be present on ‘a‘a and pahoehoe lava. Lava tubes and other caves in Hawai‘i often have value because they may contain native species, valuable subfossil remains, unique geological features, Hawaiian burials, and valuable and sensitive artifacts that for cultural reasons are preserved in place.

One of the objectives that guided project design was avoidance to the greatest practical extent of lava tubes. They often have complex, braided courses that stop and start, making them difficult to map. Consultation with the U.S. Geological Survey (USGS) prior to alternative alignment development identified a number of known skylights and lava tube courses. Fieldwork as well as additional consultation with the USGS, cave research organizations and landowners helped identify a number of others. Lava tubes usually trend more-or-less directly downslope. Because the regional slope was greater than seven percent – the maximum slope that project design allowed – the project corridors have slight “switchbacks”, complicating attempts to route the highway straight downslope, which is the simplest way to minimize lava tube crossing. Through an iterative process of selecting routes that were feasible considering topography, drainage and biological resources, and then conducting fieldwork to verify lava tube cave locations and values, refinements in alternative routes were developed that minimized cave crossings. In the interest of protecting these resources, cave locations were studied in detail but are not all mapped in this EIS. Agencies, organizations or individuals with legitimate need to ascertain the location of lava tube caves may do so by contacting the agency official contacts listed on the title page of this EIS.

3.7.1.2 Geologic Hazards

The USGS has classified the island into lava flow hazard Zones 1 through 9, in order of decreasing risk. The northern portion of the Waikoloa area is rated by the USGS as Lava Flow Hazard Zone 8 on a scale of ascending risk 9 to 1, and the southern portion is rated Zone 3 (refer to ***Fig. 3.7.2***). Zone 8 areas have had only a few percent of their surfaces covered by lava within the past 10,000 years. As such, there is little risk of lava inundation over relatively short time scales. Zone 3 includes areas in which lava flows have covered about 15-25 percent of the surface in the last 750 years, and risk is accordingly greater over the short-term (Heliker 1990).

Hawai‘i experiences thousands of earthquakes each year; most earthquakes are small and only detectable by instruments, though some are strong enough to be felt and a few cause minor to moderate damage. Earthquake hazards on the Island of Hawaiʻi are directly related to volcanic activity beneath the earth's surface. The largest Hawaiian earthquake in recorded history occurred in 1868, beneath the Kaʻū District on the southeastern flank of Mauna Loa. This quake it had an estimated magnitude between 7.5 and 8.1. The earthquake caused damage across the Island of Hawaiʻi and was felt as far away as the Island of Kauaʻi. According to USGS maps, the seismic hazard in the Waikoloa area of northwest Hawaiʻi can be expressed by the estimation that the earthquake peak ground acceleration (PGA) that has a 2% chance of being exceeded in 50 years has a value between 0.60-0.80% g (the acceleration of gravity, or 9.8 m/s^2) (https://earthquake.usgs.gov/earthquakes/byregion/hawaii.php; accessed March 2017). This value is less than those for the eastern and southern parts of the island of Hawaiʻi, but greater than values found in all the other Hawaiian Islands. Northwest Hawaiʻi Island experiences earthquakes that can be damaging, especially to structures that are poorly designed or built, as the 6.7-magnitude quake of October 15, 2006, demonstrated. That earthquake, centered off the coast near Kiholo Bay, along with a magnitude 6.0 aftershock, caused damage to roadway structures and particularly cut slopes. The USGS cautions that ground shaking during a strong earthquake may vary within a small area because of the nature of the underlying ground. Lava bedrock, sand and saturated soil have very different shaking characteristics. The project corridors are almost wholly situated on lava bedrock with shallow or non-existent soil.

No areas of subsidence, mass wasting or other geologic hazards are known or apparent within the project corridors, which have generally moderate slopes and stable surfaces created by lava flows.

3.7.1.3 Soils

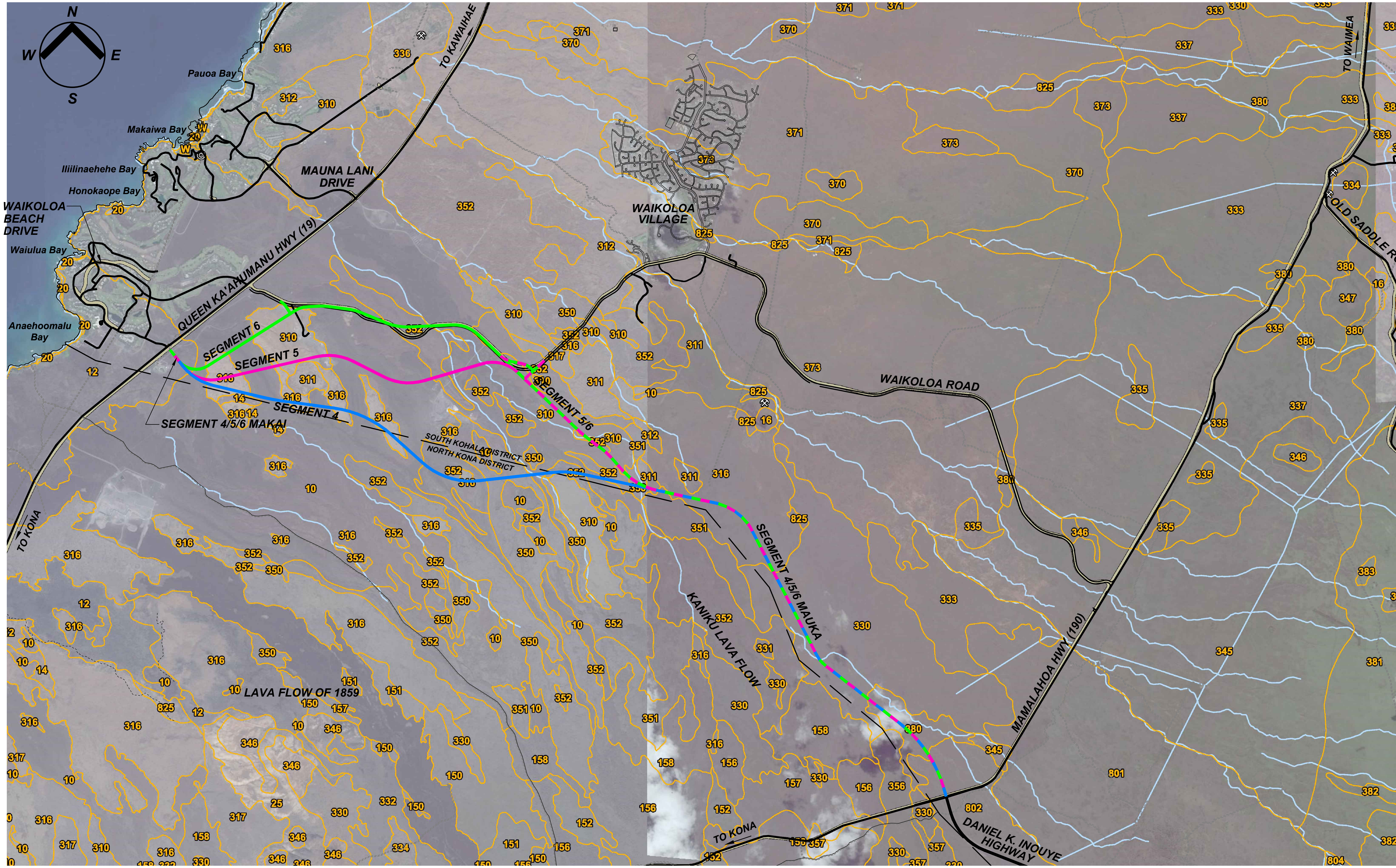
Soil is an important consideration in roadway engineering, biological resources and the agricultural value of the land. Soil types within the project area consist primarily of little-weathered pahoehoe and ʻaʻa lava flows (rLW and rLV), as well as Rock Land (rRO) and Very Stony Land (rVS) where soil pockets develop in limited locations on pahoehoe and ʻaʻa flows, respectively. At the extreme eastern end are small areas of Puʻu Pa and Punaluʻu soils (U.S. Soil Conservation Service 1973) (***Figure 3.7.3***):

- *Puʻu Pa soils* (PVD, PWD) consist of well-drained extremely stony very fine sandy loam that forms in volcanic ash. They are located on the uplands at an elevation ranging from 1,000 feet to 2,500 feet above sea level. Normal rainfall in these areas varies from 20 to 30 inches annually. This soil series is underlain by fragmental ʻaʻa lava. Permeability is moderately rapid, runoff is medium and the erosion hazard is moderate.
- *Punaluʻu soils* (rPYD) consist of well-drained, thin organic soils over pahoehoe lava bedrock. These soils are found on both gentle slopes and moderately steep areas at elevations ranging from about 1,000 to 2,000 feet in the project area, where annual rainfall is less than 30 inches. They are underlain by pahoehoe lava bedrock. The pahoehoe lava is very slowly permeable, but water moves through the cracks. Runoff is slow and the erosion hazard is slight.

LEGEND:

- ALTERNATIVE 4
- ALTERNATIVE 5
- ALTERNATIVE 6

MAP UNIT SYMBOL / NAME			
10	Lava flows, \`a\`a, 2 to 20 percent slopes	335	Waikaloa-Puu Pa complex, 10 to 20 percent slopes
12	Lava flows, pahoehoe, 2 to 20 percent slopes	336	Puako fine sandy loam, 0 to 6 percent slopes
14	Lava flows complex, 2 to 20 percent slopes	337	Waikaloa-Puu Pa complex, 2 to 10 percent slopes
16	Cinder land, 20 to 40 percent slopes	345	Waikaloa medial very fine sandy loam, 2 to 10 percent slopes
20	Beaches, 0 to 6 percent slopes	346	Waikaloa medial very fine sandy loam, 10 to 20 percent slopes
25	Badland, 10 to 50 percent slopes	347	Waikaloa medial very fine sandy loam, 20 to 50 percent slopes
150	Puuikaaka-Lava flows complex, 2 to 10 percent slopes	350	Nanuku extremely cobbly silt loam, 2 to 10 percent slopes
151	Puuikaaka-Lava flows complex, 10 to 20 percent slopes	351	Nanuku extremely cobbly silt loam, 10 to 20 percent slopes
152	Lava flows-Puuikaaka complex, 2 to 20 percent slopes	352	Lava flows-Nanuku complex, 2 to 20 percent slopes
156	Napuu extremely cobbly medial highly decomposed plant material, 2 to 10 percent slopes	356	Akahipuu very cobbly medial silt loam, 2 to 10 percent slopes
157	Napuu extremely cobbly medial highly decomposed plant material, 10 to 20 percent slopes	357	Akahipuu very cobbly medial silt loam, 10 to 20 percent slopes
158	Lava flows-Napuu complex, 2 to 20 percent slopes	370	Waikui-Hapuna complex, 2 to 10 percent slopes
310	Auwaiakeakua extremely cobbly silt loam, 2 to 10 percent slopes	371	Waikui-Hapuna complex, 10 to 20 percent slopes
311	Auwaiakeakua extremely cobbly silt loam, 10 to 20 percent slopes	373	Hapuna-Waikui-Lalamilo complex, 0 to 20 percent slopes
312	Lava flows-Auwaiakeakua complex, 2 to 20 percent slopes	380	Kamakoa very fine sandy loam, 2 to 10 percent slopes
316	Lava flows-Kiholo complex, 2 to 20 percent slopes	381	Waimea medial very fine sandy loam, 6 to 12 percent slopes
317	Kiholo-Lava flows complex, 2 to 10 percent slopes	382	Waimea medial very fine sandy loam, 12 to 20 percent slopes
330	Kahaumanu-Lava flows complex, 2 to 10 percent slopes	383	Waimea medial very fine sandy loam, 0 to 6 percent slopes
331	Kahaumanu-Lava flows complex, 10 to 20 percent slopes	801	Puu Pa-Waikaloa complex, 2 to 10 percent slopes
332	Lava flows-Kahaumanu complex, 2 to 20 percent slopes	802	Puu Pa complex, 2 to 20 percent slopes
333	Puu Pa very cobbly medial very fine sandy loam, 6 to 12 percent slopes	804	Waimea-Kemole complex, 2 to 20 percent slopes
334	Puu Pa very cobbly medial very fine sandy loam, 12 to 20 percent slopes	825	Puako, dry substratum, 3 to 6 percent slopes
		W	Water



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SADDLE ROAD EXTENSION

FIGURE 3.7.3 ~ SOILS

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The engineering properties (e.g., shrink-swell, bearing strength, and thixotropic characteristics) of all soils present are reasonably adaptable to highway construction. Where some inadequacy exists, specific solutions are most appropriately addressed in highway design and engineering work.

The soils present here do not offer any unique value for biological resources. The agricultural value of the soil is discussed above in Section 3.2.

3.7.2 Environmental Consequences

3.7.2.1 Geology, Topography and Geologic Resources

Road construction would have varying impacts on the topography and natural landforms because of excavation and fill necessary to meet design standards for grades, curves, sight distance and speeds. Substantial earthwork would be required in several locations, with fill slopes ranging from 5 to 40 feet, and cut slopes ranging from 5 to 30 feet. However, little noticeable alteration of natural landforms would occur because of the existing hummocky topography associated with lava flows.

No direct effect to the existing Waikoloa Quarry located near the 600-foot elevation would occur, although as discussed above, new access entry points might be required (CROSS REFERENCE Section 3.1.1.2). No other quarries are near the corridors and none would be affected. The potential quarry value of the lava flows that are in and near the project corridors was not assessed, as this requires detailed geologic evaluations including rock sampling. However, the existing quarry is not fully utilized, and the large areal extent of the Kanikū lava flow would seem to indicate abundant suitable rock for quarrying is present to the south of all of the proposed corridors. The construction of a highway in this area would not foreclose or significantly affect future quarrying opportunities in the area. During construction, the contractor would determine the source of rock; if appropriate and available, the conveniently located existing quarry might be a valuable asset for the Project as a source of rock for concrete and road base material.

As discussed above, lava tubes are often sensitive resources in that they may contain rare native species, important subfossil remains, recreational value, unique geological features, Hawaiian burials, and valuable and sensitive artifacts that for cultural reasons should be preserved in place. Therefore, one of the objectives that guided project design was avoidance of lava tubes to the greatest practical extent. Initial reconnaissance of the area from the air and ground identified other caves, and the alternative routes were developed with the goal of avoiding major skylights and known tube courses. Through an iterative process of selecting routes that were feasible from topographic, drainage, archaeological and biological resource consideration, and then conducting fieldwork to verify lava tube cave locations and values, alternative routes were selected that minimized cave crossings. Careful fieldwork and project design minimized cave crossing over lava tube caves. However, owing to the density and orientation of lava tube caves in the project area, no matter which Build Alternative is selected, some lava tube caves would be crossed. Because of the multiple resources afforded by such caves, they are discussed in several sections of this EIS. Section 3.10.1.3 includes discussion of lava tube cave biology, and Section 3.14 discusses impacts to historic sites or burials that may be found in caves. This section addresses the geologic aspect of caves.

Differences in Impacts Between Alternatives 4, 5 and 6 and Intersection Design Options

No difference exists with respect to topographic alteration between the alternatives, which in all cases would be minor to moderate. Design Option 2, involving a grade-separated intersection of the Saddle Road Extension with Māmalahoa Highway, would require more alteration of existing topography than Design Option 1, in which intersection would remain at-grade.

Alternative 4 traverses a slightly longer extent of the Kanikū lava flow and area that is currently and potentially used for rock quarrying, but no adverse effect on any quarry would occur under any alternative.

In terms of lava tube caves, no differences exist between the design options. Segment 4/5/6 *mauka* extends 4.9 miles between the eastern terminus of the Project and the point where Alternatives 4, 5 and 6 diverge. This segment is dominated by pahoehoe lava flows and contains the largest concentration of lava tube caves and skylights in the project area. Through the iterative process described in Section 3.8.1, above, project planners have been able to almost entirely avoid known caves and skylights in Segment 4/5/6 *mauka*. A small side-branch of one lava tube cave would potentially be overlain by the highway, depending on the finalized location of the road centerline and required cuts and fills in the shoulder, which will be determined during final design. Several other shallow blister caves would also be affected. These caves or sections of caves been determined through extensive fieldwork and consultation with the U.S. Geological Survey (USGS), the State Historic Preservation Division (SHPD) and the Hawai‘i Department of Land and Natural Resources (DLNR) to be non-significant for geological purposes, in that they are not outstanding or unique examples of lava tubes. It should be noted that lava tubes without openings (technically not called caves, because they do not afford human entry) may be discovered to be present during construction of the road. The mitigation described in Section 3,7.3, below, applies to such potential discoveries. *Makai* of the common divergence point, each alternative corridor has different lava tube cave resources.

> *Alternative 4*. From the divergence point on Segment 4/5/6 *mauka*, ‘a‘a lavas are much more common than pahoehoe, and relatively few caves are present. No significant lava tube caves are present on Alternative 4, which as only a few small blister caves that do not contain any significant resources.
>
> *Alternatives 5 and 6*. A long lava tube cave that contains artifacts and appears to have functioned as pre-Western contact refuge cave is present in the *makai* portion of the project corridors, and is crossed by both Alternatives 5 and 6, which do not intersect with the parts of the cave with cultural modifications (CROSS REFERENCE Section 3.14.1.3)

Impacts of the No Action Alternative

This alternative would avoid construction in any areas containing caves. It is likely that the widening of Waikoloa Road, which might ultimately be undertaken to increase traffic capacity if the Saddle Road Extension were not constructed, would affect caves, but to what degree cannot be ascertained without specific investigations.

3.7.2.2 Geologic Hazards

As discussed in Section 3.7.1.1, any roadway that serves the Island of Hawai‘i is subject to at least some lava flow hazard. As demonstrated by the June 27 lava flow of 2014-2015 near Pāhoa in Puna, the threat is real and ongoing but difficult to predict in terms of scope and timing. It cannot be prevented except by avoiding the area entirely, which could mean failing to serve existing areas with vital infrastructure. Similarly, a high and unavoidable seismic hazard exists for the entire Island of Hawai‘i.

Differences in Impacts Between Alternatives 4, 5 and 6 and Intersection Design Options

As mapped in ***Figure 3.7.1***, most of South Kohala, from the southern part of Waikoloa northwards, is on Mauna Kea lands, north of the edge of Mauna Loa, with a very low risk of lava inundation – Zone 8 on a scale of ascending risk 9 to 1 (Heliker 1990). The southern edge of South Kohala and the north half of North Kona are subject to flows from Mauna Loa and have a higher risk – Zone 3 on the same scale. All project corridors are within Lava Flow Hazard Zone 3, although it is reasonable to conclude that Alternative 4, which lies further south and more centrally within areas affected by Mauna Loa, is at a somewhat greater risk of lava flows. No differences with respect to geologic hazards exist between the design options

Impacts of the No Action Alternative

The No Action Alternative would not involve the risk of building infrastructure that could be subject to destruction by lava flows.

3.7.2.3 Soils

During construction activities, grubbing and earthwork would expose the soil and increase erosion potential. Soil erosion impacts would be localized and short term, related to precipitation events during the construction phase. As discussed in Section 3.7.2.2, above, only a small portion of the project corridors at the eastern end has true soil (refer to ***Fig. 3.7.2***). The remainder consists of recent lava that has not weathered sufficiently to develop soil to any substantial extent. Because of incipient soil development and the shallow depth to bedrock in project area soils, soil disturbance and stability are not substantial issues in project design. In the limited areas where soil is present, volcanic ash soils (particularly the Pu‘u Pa soils described in Section 3.7.1.3, above) are moderately susceptible to erosion in a dry state. When wetted, they have relatively low strength characteristics. If in situ moisture content is high enough, these soils become fluid and lose strength temporarily when remolded or disturbed. But even these soils have engineering properties that are reasonably adaptable to road construction, given appropriate foundational sub-bases. Where some inadequacy exists, specific solutions are most appropriately addressed in road design and engineering work.

Operationally, because of the implementation of Best Management Practices outlined in Section 3.8**,** below, no long-term increase in soil erosion is anticipated. There is negligible potential for landslides or subsidence on cut or fill sections that would disturb existing soil.

Differences in Impacts Between Alternatives 4, 5 and 6 and Intersection Design Options

Because the project corridors traverse land with highly similar soil regimes, no substantial difference between Alternatives 4, 5 and 6 or the design options exists relative to impacts on soil.

Impacts of the No Action Alternative

The No Action Alternative would avoid any temporary or permanent disturbance to soil.

3.7.3 Mitigation Measures

As discussed in previous sections, an iterative process of field investigation and road design has helped avoid any impact to lava tube caves significant for historic sites, biological, recreational or geologic resources. In areas where small, non-significant caves have been determined to be present in or near the road corridor, detailed engineering and geological investigations must be conducted to determine how to treat the caves. Engineering will locate the road centerline and adjacent cut and fill. As necessary, geological investigations will then be conducted in order to determine whether the overburden, as-is, provides a safe structure for the road, or whether structural modifications (such as collapsing and filling, structural modifications, bridging, or some combination of these methods) would be required. The following mitigation measures will be incorporated as stipulations in construction contract documents:

1. Contractors will be supplied with maps identifying general areas where lava tube caves are known to exist;
2. In case a previously undetected lava tube is breached during construction, the Hawai‘i State Department of Transportation (HDOT) will implement a contingency plan in coordination with the State Historic Preservation Division (SHPD):
   - A. If a previously undetected lava tube cave is encountered, all construction with the potential to impact the lava tube will immediately cease;
   - B. The appropriate personnel at the State Department of Transportation, Highways Division, will be contacted;
   - C. These personnel will contact SHPD, the U.S. Geological Survey and the U.S. Fish and Wildlife Service to determine whether historic sites or burials are present, and whether the lava tube cave has special geological, biological or other value that merits investigation and data collection; and
   - D. Organizations with an interest in lava tube caves will also be consulted.
3. Depending on the context and resources associated with the cave, several alternative courses of action may be pursued:

A. If burials or historic sites are present, the mitigation directed by the SHPD and Hawaiʻi Island Burial Council will be followed, in accordance with Chapter 6E, HRS, Section 106 of the National Historic Preservation Act, P.L. 101-85, and P.L. 101-601. In addition, if the historic sites are determined to be important for preservation in place, Section 4(f) will be triggered (see Chapter 7 for explanation). All work on that portion of the Project will cease while HDOT evaluates measures to avoid the significant site.

B. If no historic sites are present, the disposition of the cave will be as follows:

   I. If appropriate and feasible, the cave will be disturbed as little as possible and left as-is.

   II. If the cave poses a structural hazard to the road or related features, appropriate actions will be taken to produce a structurally sound surface for construction, such as collapse, bridging, structural modification, or some combination of these.

4. Construction specifications will be incorporated to minimize potential hazards of caves to construction workers.

Aside from avoidance of geologically hazardous areas, there is no practical mitigation for lava flow hazard. The proposed project facilitates an overall risk-spreading strategy by providing additional alternative cross-island routes around the island, in case particular routes become blocked because of lava flows.

Although there does not appear at this time to be a need for any bridges, if they are required, they will be designed in accordance with the seismic Load and Resistance Factor Design (LRFD) code for bridges published by the American Association of State Highway and Transportation Officials (AASHTO).

Mitigation measures to prevent soil erosion are discussed in Section 3.8, below, in the context of water resources.

3.8 WATER RESOURCES

Because of the importance of water resources in all aspects of the environment, the many ways that highway construction and operation can affect water resources, and the multiple laws, regulations and Executive Orders that pertain to water, the discussion of water resources in this EIS has been divided into three components.

- Section 3.8.1 discusses the general distribution of surface and subsurface water bodies, including streams, ponds, lakes, ocean waters and underground aquifers, as well as effects to water quality;
- Section 3.8.2 pertains to the special legal category of waters of the U.S., which are under the jurisdiction of the U.S. Army Corps of Engineers pursuant to Section 404 of the Clean Water Act;
- Section 3.8.3 deals with drainage and floodplains.

For all these water resources and floodplains, the region of influence is extended broadly to cover the southern portion of South Kohala and the northern portion of North Kona surrounding and downslope of the project corridors.

The following provides a guide to the major laws and regulations governing water resources that are applicable to the Project, indicating where within Section 3.8 they are discussed.

Clean Water Act. The Clean Water Act (CWA) establishes the basic structure for regulating discharges of pollutants into the waters of the U.S and regulating quality standards for surface waters. Section 402 of the CWA deals with the National Pollutant Discharge Elimination System (NPDES) permit program, which controls discharges. Point sources are discrete conveyances such as pipes or man-made ditches; industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters. The goal of the CWA is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." The following are important CWA sections:

- Sections 303 and 304 require states to issue water quality standards, criteria, and guidelines.
- Section 401 requires an applicant for a federal license or permit to conduct any activity that may result in a discharge to waters of the U.S. to obtain certification from the state that the discharge will comply with other provisions of the act. This is most frequently required in tandem with a Section 404 permit request (see below).
- Section 402 establishes the NPDES, a permitting system for the discharges (except for dredge or fill material) of any pollutant into waters of the U.S. The Department of Health, Clean Water Branch (DOH-CWB) administers this permitting program in Hawai‘i. Section 402(p) requires permits for discharges of storm water from industrial/construction and municipal separate storm sewer systems (MS4s). For construction activities that involve disturbance of more than an acre of ground surface, dewatering or certain other triggers, an NPDES permit is required. The NPDES permit process is discussed in Section 3.8.1.3.
- Section 404 establishes a regulatory program that provides that discharge of dredged or fill material cannot be permitted if a practicable alternative exists that is less damaging to the aquatic environment or if the nation's waters would be significantly degraded. The Section 404 permit program is run by the USACE, with oversight by the U.S. Environmental Protection Agency (U.S. EPA). Waters of the U.S. are discussed below in Section 3.8.2.

National Flood Insurance Program. In 1968, Congress created the National Flood Insurance Program (NFIP) to help provide a means for property owners to financially protect themselves. The NFIP offers flood insurance to homeowners, renters, and business owners if their community participates in the NFIP. Participating communities agree to adopt and enforce ordinances that meet or exceed FEMA requirements to reduce the risk of flooding. On the Island of Hawai‘i, the County Department of Public Works administers the NFIP. Most relevant to the proposed action are the requirements to have structures conform with the regulations associated with the flood zone and base flood elevation in which they are located. Several federal laws and Executive Orders that apply to federal actions, including Floodplain Management Act, 42 U.S.C., 4321, and Executive Order 11988, Floodplain Management (24 May 1977). The Floodplain Management Act deals with critical actions inside designated floodplains, and Executive Order 11988 requires federal agencies to avoid, to the extent possible, the long and short-term adverse impacts associated with the occupancy of the floodplain, and to avoid direct and indirect support of floodplain development where there is a practicable alternative. Floodplains are discussed in Section 3.8.3.

Safe Drinking Water Act. The Safe Drinking Water Act regulates the nation's drinking water supplies by establishing standards for drinking water to protect against both naturally-occurring and man-made contaminants. It also prevents contamination of drinking water resources by establishing programs such as the underground injection control (UIC) program. The Safe Drinking Water Act applies to groundwater resources in the Kona and Kohala Districts, as the aquifer beneath the proposed project area is a potential source of drinking water. Under the Safe Drinking Water Act, the U.S. EPA requires an UIC permit for the injection of subsurface fluids that might affect potential sources of drinking water. Much of the oversight of UIC activities is delegated to the states, and in Hawaiʻi, the State Department of Health administers the UIC program. The State of Hawaiʻi UIC program requirements are codified in the HAR Title 11, Chapters 23 and 23A (HAR 11-23 and 23A). UIC permits are discussed in Section 3.8.3. Currently, no drywells are planned for the highway. Final engineering will determine if there is a need for on-site runoff disposal that would require drywells.

County of Hawaiʻi Department of Public Works (DPW) Grading Permit: These are required for grading that exceeds one acre or more in extent. Measures required as conditions of County Grading Permits ensure conformance with the erosion and sedimentation requirements of Chapter 10 of the Hawaiʻi County Code. Grading permits will apply to the Project, and are discussed in Section 3.8.1.

3.8.1 Surface and Subsurface Water Bodies and Water Quality

3.8.1.1 Affected Environment

Surface Water Bodies and Water Quality

As discussed in Section 3.5, the project area is uniformly dry, with an average annual rainfall area varying from 10 to 25 inches (Giambelluca et al 2014). Infiltration of the substrate is generally high, especially in the areas of recent lava flows. The project area spans elevations between 100 feet and 2,600 feet above sea level. In general, streams develop slowly on such surfaces because of high permeability of the surface materials. No perennial or even continuous ephemeral streams are crossed by any the project corridors. Rather than drainage features, the project area's gullies are essentially the creases between lava flow hillocks that carry water short distances in very heavy rains. None of the drainages flow more than a few days a year. These short drainages have accomplished only limited downcutting, and erosional features are absent or very limited. It should be noted that USGS maps of the area at various scales depict blue-line features that on such maps generally denote streams. Nearly all of these within the project corridors are actually not hydrologic features, but rather hardened channels of lava flows from thousands of years ago that do not conduct water. In fact, as confirmed by the U.S. Army Corps of Engineers based on field examination, no streams, ponds, lakes or other surface water features are present in or near the project corridors (CROSS REFERENCE Section 3.8.2). Further north, between a mile and five miles from the project corridors, are several large ephemeral drainages including ‘Auwaiakeakua and Kamakoa Gulches, which have carved long, continuous channels that almost reach the sea (***Figure 3.8.1***). These latter drainages originate on the steep slopes of Mauna Kea and cross Māmalahoa Highway at a number of bridges, culverts, and dips in the road.

As no surface water bodies are present in or near the project corridors, there are no surface water quality data.

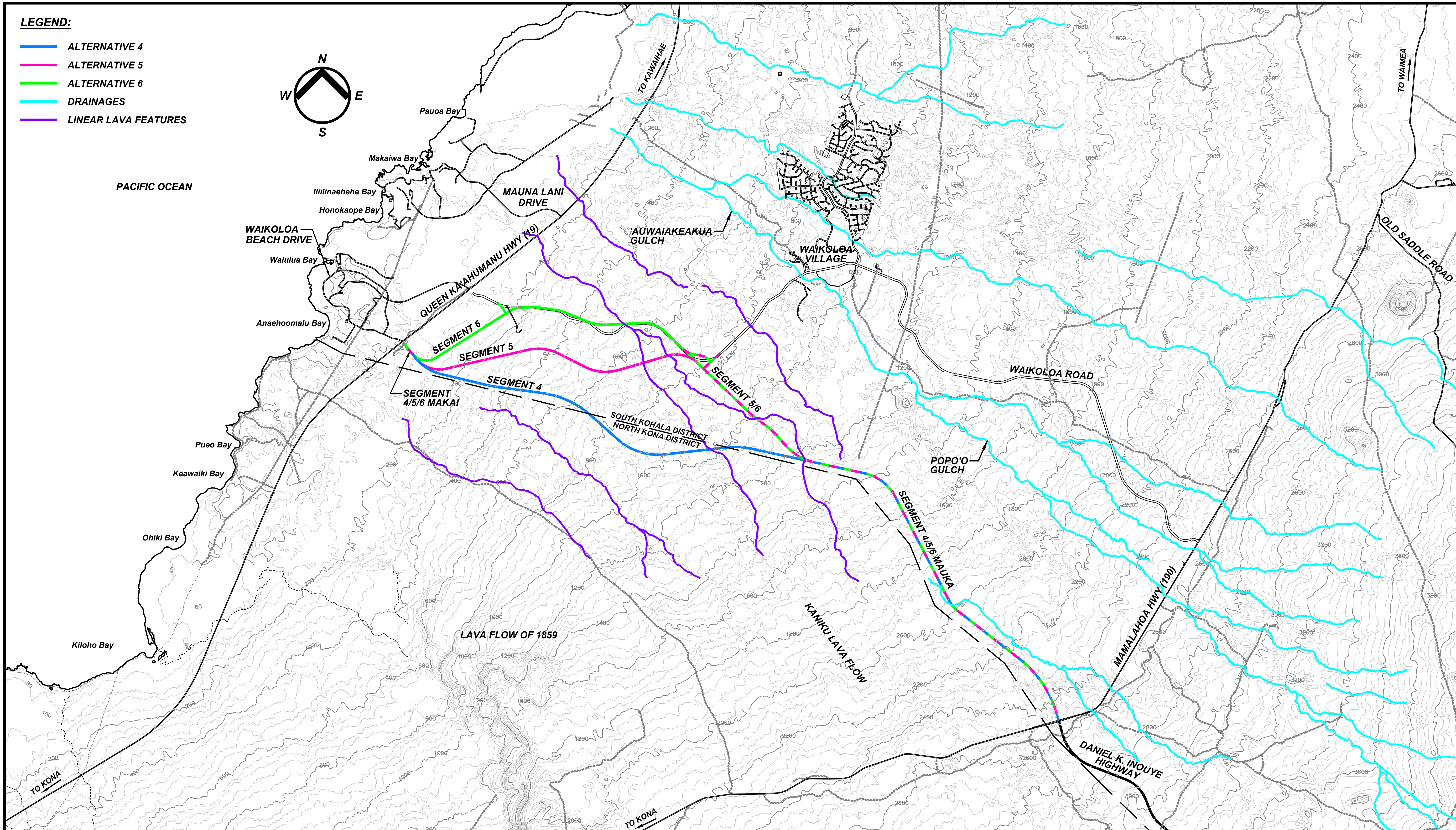
Groundwater

Owing to the lack of streams in the project area, precipitation that does not end up evapotranspiring drains rapidly into the ground. It then percolates slowly between 50 and 2,500 feet downwards to the basal aquifer perched just above sea level as a basal groundwater lens. The deep percolation of water through aerated rock achieves extensive natural filtration.

Groundwater regions in Hawai‘i are classified into a hierarchical system of aquifer units. Each island is divided into aquifer sectors based on broad hydrogeological features and geography, and each sector is sub-divided into systems based on groundwater system continuity (Mink and Lau 1990). The groundwater in the project area is classified within the Northwest Mauna Loa Sector in the Anaehoomalu System. This aquifer has a sustainable yield of 30 million gallons per day and supports a small number of wells drawing from the basal aquifer, much of it used for resort irrigation. According to the U.S. EPA, there are no Principal or Sole Source Aquifers designated under Section 1424(e) of the Safe Drinking Water Act on the island of Hawai‘i https://www3.epa.gov/region9/water/groundwater/ssa.html; accessed March 2017.

The Hawai‘i State Ground Water Protection Program has issued Groundwater Contamination Maps for the State of Hawai‘i since 1989. The maps are based on monitoring data for public drinking water wells and identify locations where groundwater contaminants have been detected and confirmed. Maps of Northwest Hawai‘i indicate no detection of groundwater contaminants (http://health.hawaii.gov/sdwb/groundwater-contamination-viewer; accessed March 2017).

The County of Hawai‘i publishes reports for all its systems, including the adjacent South Kohala and North Kona systems for the latest full year available, 2013. These water systems utilize wells from the aquifer systems listed above, which have similar geology and land use. Wells that tap both aquifers record compliance with all current State of Hawai‘i and U.S. EPA drinking water standards. Specifically, no violations were recorded for radioactive, inorganic, organic or lead and copper contaminants, with all contaminants generally far below Maximum Contaminant Levels (MCLs) (http://www.hawaiidws.org/7%20the%20water/ccrpage.htm; accessed March 2017). Water quality reports for private systems are not publicly available.



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GRAPHIC SCALE IN FEET

SADDLE ROAD EXTENSION

FIGURE 3.8.1 ~ MAPPED DRAINAGE FEATURES IN WAIKOLOA AREA

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Coastal Waters

The Pacific Ocean and its bays, inlets and ponds are located between one and 12 miles from the project corridors, with no surface waterway connection. These waters are classified as AA, with the highest level of water quality goals. These coastal waters are important for fishing, recreation, visual quality, and traditional practices. Hawai‘i Administrative Rules (HAR) 11-54-03(c)(1) states that class AA waters are:

> "…high quality waters are those in which water quality is expected to exceed that necessary to support oceanographic research, propagation of aquatic communities and wildlife, compatible recreation and aesthetic enjoyment. It is the objective of class AA waters that these waters remain in their natural pristine state as nearly as possible with an absolute minimum of pollution or alteration of water quality from any human-caused source or actions. To the extent practicable, the wilderness character of these areas shall be protected."

The coastal waters also support a number of endangered and threatened mammal and reptile species. Several of these, including the green sea turtle (*Chelonia mydas)*, the hawksbill sea turtle (*Eretmochelys imbricata)*, and the Hawaiian monk seal (*Monachus schauinslandi)*, have been recorded within West Hawai‘i nearshore waters. Anchialine pools (waters that have no surface connection to the ocean but rise and fall with the tide) are numerous near the shoreline around the resort areas of Waikoloa and Mauna Lani.

3.8.1.2 Environmental Consequences

Effects of Water Bodies

The proposed Saddle Road Extension would have no direct impacts to surface water bodies such as lakes, streams, ponds or coastal waters, as they are entirely absent from the area within and near the project corridors.

Effects to Water Quality

Construction of the highway might have limited, short-term effects on the surface water quality of runoff, particularly an increase in suspended sediments in runoff during and shortly after precipitation events during the construction phase. Construction of cuts and fills would remove vegetation, disturb soils, and change overland flow characteristics, intensifying the effects of natural erosion until soils stabilize.

Operationally, the new highway would permanently increase the extent of impermeable road surface (which is currently virtually non-existent in the area). An enlarged area of impermeable surfaces would increase surface water runoff during precipitation events. In addition, due to the geometry of roadways, a new highway would be expected to collect and concentrate stormwater runoff, potentially changing overland flow to a series of more concentrated sources.

Stormwater discharges are regulated by the EPA through the Clean Water Act (CWA) and the National Pollutant Discharge Elimination System (NPDES) program. Stormwater runoff from the highway would be tributary to minor erosional gullies and topographic swales both during construction and after construction was complete. During construction of the roadway, there is potential for degradation of stormwater quality from sediment as well as from construction materials mixing with stormwater.

Potential sources of pollution from highway operation include solids, heavy metals, and organics from fuels and motor oils. Stormwater flowing over impermeable surfaces may pick up petroleum residues, and, if not controlled, transport them off the roadway. Contaminated stormwater can degrade the quality of surface waters if any are nearby or filter through soils and degrade groundwater resources.

According to the U.S. Department of Transportation publication *Retention, Detention, and Overland Flow for Pollutant Removal from Highway Storm Water Runoff: Interim Guidelines for Management Measures,* all highway runoff contains pollutants, but pollutant loading does not always cause a problem for receiving waters. The document cites studies that monitored highway pollutant impacts to receiving waters at sites with Average Daily Traffic (ADT) volumes from 7,400 to 135,000 vehicles per day. Results showed that runoff from lower ADT, rural highways did not cause discernable toxic stress to aquatic biota. Few significant impacts were detected for roadways with less than 30,000 ADT. The ADT on the Saddle Road Extension is estimated to reach over 14,000 by the year 2035 (CROSS REFERENCE: Section 3.4.1).

There are no systematic studies on the Island of Hawai‘i concerning the effects of highways on groundwater quality. The State of Hawai‘i’s official *Draft Water Quality Plan* (Hawai‘i DOH 2014) identifies the major groundwater quality issues in Hawai‘i as legacy agricultural chemicals (many now banned), current agricultural runoff, wastewater, and urban stormwater with toxic chemicals. Although roads and highways are not specifically mentioned, oil and grease from urban environments is identified as a pollution component. As discussed above, State and County records do not indicate any water quality violations in the project area, and none island-wide that can be specifically attributed to highways.

Water Consumption

Water would also be consumed in the construction process, much of it for dust control. Based on experience in similar portions of the Saddle Road, it estimated that 30,000 to 40,000 MGals will be used over the two-year life of the Project for dust control, earthwork compaction, and irrigation, for a maximum of about 55,000 gallons per day. It is estimated that a total of 3,000 to 5,000 truck trips will be required to supply the water necessary to construct the new highway, depending on the hauling capacity of the equipment used. Assuming a 2-year construction schedule, this equates to 7 to 10 trucks per work day each way. Water would be obtained from a contractor-selected source, most likely in Waimea due to its close proximity to the Project location. The specific source of water to be used for construction would be the responsibility of the contractor, but contractors to date on the Saddle Road Improvements project have purchased and trucked water mostly from County Department of Water Supply standpipes in Kaumana, above Hilo, and on the Māmalahoa Highway, near Waimea. Accordingly, it is almost certain that the contractor would haul water from Waimea, probably via Māmalahoa Highway (SR 190).

The source of water in Waimea are wells in the West Mauna Kea Aquifer Sector. This groundwater area has a sustainable yield of 24 million gallons per day (mgd). According to the Commission on Water Resources Management database, there are 30 active production wells in the sector area, including 15 municipal, 11 irrigation, 2 industrial and 2 “other”. The total withdrawal in 2010 was less than 7 mgd (Hawai‘i County DWS 2010). The expected temporary withdrawal of a maximum of roughly 55,000 gallons per day (0.055 mgd) in the context of existing uses and sustainable yields is minor, at less than 0.8% of existing use. No stress on the aquifer system or wells would be expected from this temporary demand in water for construction.

Differences in Impacts Between Alternatives 4, 5 and 6 and Intersection Design Options

No difference exists with respect to direct effects to water bodies or water quality or quantity of water consumption during construction between the alternatives or design options.

Impacts of the No Action Alternative

The No Action Alternative would not affect water bodies or water quality in a direct or indirect way and would not involve any use of water.

3.8.1.3 Mitigation Measures

In order to comply with the Clean Water Act, measures must be provided both during and after construction to prevent pollutants, including sediment and hazardous chemicals, from degrading the quality of stormwater runoff. As required by EPA and State DOH regulations on stormwater discharges, stormwater pollution prevention measures called Best Management Practices (BMPs) would be required for the Saddle Road Extension project both during and after construction. Unlike construction activity BMPs, the stormwater permanent BMPs are designed to remain part of the Project features after the site grading operation is completed. The permanent BMPs are intended to reduce stormwater pollution typically associated with the increase in impervious surfaces (Hawai‘i State DOT 2007). The following mitigation measure will be implemented:

1. The FHWA and HDOT will require the contractor to obtain NPDES and County grading permits that will involve preparation of a Stormwater Pollution Prevention Plan (SWPPP). As the permit application and accompanying site-specific SWPPP has not yet been developed, the following is a list of potential BMPs that may be included:
   A. Practices that prevent erosion, including the stabilization of cut and fill slopes by vegetative as well as non-vegetative means.
   B. Practices that trap pollutants before they can be discharged, such as silt fences and sedimentation basins.
   C. Practices that prevent the mixing of pollutants from construction materials and stormwater, such as providing protected storage for chemicals, paints solvents, and other toxic materials.

D. During construction, erosion will be minimized by applying temporary measures that will reduce the velocity of the runoff and retain sediment on-site. Examples of these measures include but are not limited to: silt fences, check dams, mulching, culvert outlet protection, and sedimentation basins. Construction materials will be stored in a protected area with measures in place to contain and clean-up spills.

E. Permanent pollution control measures will be applied to minimize degradation of stormwater quality after construction of the road has been completed. These measures include but are not limited to the following: velocity reducers and/or settlement basins at culvert outlets; vegetating slopes; minimizing the steepness of slopes where possible; providing drainage gully bank stabilization where required; and managing the use of chemicals for roadway maintenance.

F. Cut slopes will be revegetated to reduce highway runoff pollution.

G. If a major hazardous spill occurs, cleanup efforts will be coordinated through both the County of Hawaiʻi Civil Defense Agency and the State of Hawaiʻi DOH.

3.8.2 Waters of the U.S.

3.8.2.1 Affected Environment

Waters of the United States is a regulatory term referring to surface waters that are under the jurisdiction of the U.S. Army Corps of Engineers (USACE). The USACE derives its regulatory authority over potential Waters of the U.S. from two federal laws: 1) Section 10 of the Rivers and Harbors Act of 1899 and 2) Section 404 of the Clean Water Act (CWA) of 1972. WUS are defined in 33 CFR 328 and 40 CFR 230.3.

Section 10 of the Rivers and Harbors Act of 1899 prevents unauthorized obstruction or alteration of navigable waters of the U.S. Navigable waters are defined as “subject to the ebb and flow of the tide and/or presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce” (33 CFR 322.2(a)). A Section 10 permit is required for non-fill discharging activities that would place any structure below, within, or over navigable waters of the United States, or would involve excavation/dredging or deposition of material or any obstruction or alteration in navigable waters of the U.S.

At the federal level, the CWA (33 USC 1344) is the primary law regulating wetlands and surface waters. The CWA defines waters of the U.S. subject to agency jurisdiction in 40 CFR 230.3. Under Section 404 of the CWA, dredged and fill material may not be discharged into jurisdictional waters of the United States (including wetlands) without a permit. Surface waters may include streams, streambeds, rivers, lakes, reservoirs, arroyos, washes, and other ephemeral watercourses and wetlands that have certain connections or relations to navigable waters of the U.S. Any actions that result in fill to waters of the U.S. require compliance with the CWA Section 404. Wetlands are a subset of jurisdictional waters of the United States and are jointly defined by the USACE and the U.S. Environmental Protection Agency (40 CFR 230.3) 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.” To classify wetlands for the purposes of the CWA, a three-parameter approach is used that includes the presence of hydrophytic (waterloving) vegetation, wetland hydrology, and hydric soils (soils formed during saturation/ inundation). All three parameters must be present, under normal circumstances, for an area to be designated as a jurisdictional wetland under the CWA. Wetlands are classified as "Special Aquatic Sites" and are considered waters of the U.S. under most circumstances.

As discussed in Section 3.8.1.1, although intermittent streams with well-defined channels are present several miles north of the project corridors (Popoʻo and Auwaiakeakua Streams – refer to ***Fig. 3.8.1*** for location), field inspection indicated that no water bodies such as permanent streams, lakes or wetlands were present in or near the project corridors. However, USGS topographic maps depict several stream channels, and therefore the area was intensively inspected for intermittent streams that would be considered waters of the U.S., followed by coordination and field inspection with the USACE to determine if waters of the U.S. that would be under the jurisdiction of the USACE pursuant to Section 404 of the Clean Water Act were present. The process is discussed in detail in ***Appendix B***, but the following summarizes the steps and outcome of the process.

The practical definition of waters of the U.S. by the USACE and the methods for assessing them as of 2012, the time of the assessment, were contained in the *JD Form Instructional Guidebook* and the *Approved Jurisdictional Determination Form*. In this guidance, the USACE noted that all traditional navigable waters (TNW) are jurisdictional, and that any stream that generally flows three continuous months of the year or more – called a relatively permanent water (RPW) – is also jurisdictional. It is understood that any wetlands adjacent to RPW, as well as non-RPW streams and wetlands adjacent to them, need to be evaluated to see if they have a significant nexus to a TNW. The USACE, interpreting a ruling by the U.S. Supreme Court, defines this as follows:

> "A significant nexus exists if the tributary, in combination with all of its adjacent wetlands, has more than a speculative or an insubstantial effect on the chemical, physical, and/or biological, integrity of a TNW. Principal considerations when evaluating significant nexus include the volume, duration, and frequency of the flow of water in the tributary and the proximity of the tributary to a TNW, plus the hydrologic, ecologic, and other functions performed by the tributary and all of its adjacent wetlands."

Therefore, the first task for the Saddle Road Extension waters of the U.S. analysis was to identify within the unique and common project corridors and connecting roads of Alternatives 4, 5 and 6 all TNWs, tributary RPWs, and tributary non-RPW streams, along with any wetlands or other special aquatic sites. After these were identified and mapped, certain waters would by definition be jurisdictional; for others, the issue of a significant nexus needed to be examined, and then a jurisdictional determination could be made.

As shown in ***Figure 3.7.1***, above, the project area includes some of the oldest volcanic surfaces in northwest Hawaiʻi (mid-Pleistocene; geologic units labeled *pl* and *hw* on map) to some of the youngest (1,500 to 3,000 BP; units marked *k1y* and *k2* on map). A transect from north to south at about the 500-foot elevation crosses areas where rainfall is constant and low (~10 inches/year), in which the age of the surface is highly correlated with the degree of stream dissection. The topography on this progression from older to younger surfaces indicates the influence of significant hydrological action in the older areas and its complete absence in young lava flows.

Honokoa Gulch on the Kohala Mountains near Kawaihae has developed gulches as deep as 330 feet, whereas Auwaiakeakua Gulch on older Mauna Kea Lavas (units labeled *hm* and *I* on map) has a maximum of 30 to 40 feet. On the youngest (5,000 to 10,000 BP Mauna Kea flows and similarly aged Hualālai flows (units labeled *h1o* and *h1y* on map) in the south, the channels are discontinuous and generally just a few feet deep. In the Kanikū lava flows of Mauna Loa – where much of the Saddle Road Extension project is located – no stream dissection whatsoever has occurred.

Within the project corridors there is incipient stream development on late Pleistocene (older than 10,000 BP) Mauna Kea and 5,000-10,000-year-old Hualālai flows, but none on the Mauna Loa flows, which mostly date from 1,500 to 5,000 years BP. Although the areas covered by lavas from these three volcanoes run roughly parallel to each other down the regional slopes, within the project area itself, the Mauna Kea and Hualālai surfaces are confined to the *mauka* 15 percent of the route, with almost all of the remaining *makai* 85 percent covered by Mauna Loa lavas.

On the Mauna Kea surfaces, the lava flows have a scale such that they formed natural hillocks 10 to 100 feet high spaced 100 to 500 feet apart (refer to photographs in ***Fig. 1.2***). Because the regional slope is moderately steep, these rounded hillocks are elongated downslope, with meandering lines of low elevation between them. These features form the initial topography. Through time the hillocks have been weathered, and gullies that may flow during heavy rainfall develop. Gully channels can carve up to 10 feet in some steep crevices that may lead to their being mapped as streams on USGS maps, but generally there are one to two foot banks that end in fairly flat basins with enough absorptive capacity to hold and soak in all runoff. This causes the intermittent drainages to stop advancing downslope. Moving downslope into progressively drier areas, the V-shaped channel shrinks and finally no channel at all is evident, as all runoff simply spreads and soaks into basins with no outlet channel. The water percolates through hundreds or thousands of feet of rock to high level aquifers or (more likely in this area of the island) the basal lens. These surface features are separated from TNW by many miles. These infrequently flowing hydrologic systems flow do not conduct runoff to any waters of the U.S., unlike intermittent streams found near Waimea on older Mauna Kea flows, which develop a continuous channel from the mountain to the sea.

On Mauna Loa flows, which are almost all younger than 5,000 years, there is no stream development whatsoever. The rugged, mostly ‘a‘a surface promotes rapid percolation of rainfall percolates into the ground essentially where it falls. A few small *kipuka* (isolated islands of older surfaces) of somewhat older pahoehoe Mauna Loa flows are present, but these also lack drainage channels. In some cases, photo-interpreters for USGS maps have misinterpreted lava flow channels as intermittent streams, as is evident on USGS maps of the Kanikū lava flow (refer to ***Fig. 3.1***).

The project corridors cross several features that are labeled on USGS maps as “blue-line” streams that required investigation. ***Appendix B*** contains detailed maps, photos and discussions of these crossings. ***Table 3.8.1*** summarizes the conclusions about their status.

Table 3.8.1
Corridor Crossings of USGS-Mapped Drainages

Crossing Name	Location (lat/lon)	Landform Type	Details
4/5/6 C-1	19º51’55” 155º 46’ 07”	Drainage crossing	Shallow intermittent gully
4/5/6 C-2	19º53’30” 155º 47’ 49”	Lava flow feature	Linear flow channel
5/6 C-1	19º53’55” 155º 48’ 21”	Lava flow feature	Linear flow channel/depression
4-1	19º53’35” 155º 48’ 53”	Lava flow feature	Lava flow contact zone
5-1	19º54’36” 155º 49’ 23”	Lava flow feature	Linear flow channel
5-2	19º54’31” 155º 49’ 40”	Lava flow feature	Linear flow channel
6-1	19º54’56” 155º 49’ 52”	Lava flow feature	Lava flow contact zone

None of the seven “crossings” appear to meet the definition of a Water of the U.S. Six of the seven are lava features that are completely unrelated to drainage and do not conduct water. One of the crossings involves a very ephemeral drainage with a depth of about two feet and a width of 22 feet. This channel rapidly decreases in depth and width downstream, and after 2,000 feet it has been completely absorbed in the natural settling basins and disappears. This drainage is not tributary in any way to any RPW, such as an intermittent stream, and thereby to potential TNW. This intermittent drainage provides no habitat for native reptiles or amphibians (none of which exist in Hawai‘i), and no waterbirds, fish, or aquatic invertebrates are present. Similarly, there are no wetlands or riparian plants or vegetation associated with the drainage. No other streams nor any springs, wetlands or special aquatic sites were observed in any location within the entire study area covered during these field investigations, and none are known to exist in the general area.

This finding was concurred with by the U.S. Army Corps of Engineers in a jurisdictional determination (JD) of May 22, 2012 (see ***Appendix B***). This JD is valid for five years, until May 22, 2017, after which another determination must be made based on the conditions and laws and regulations that exist at that time.

3.8.2.2 Environmental Consequences

It has been determined through coordination with the U.S. Army Corps of Engineers that no waters of the U.S. are present.

Differences in Impacts Between Alternatives 4, 5 and 6 and Intersection Design Options

There are no differences between the alternatives with respect to effects to waters of the U.S., as none or present.

Impacts of the No Action Alternative

No waters of the U.S. would be affected by the No Action Alternatives.

3.8.2.3 Mitigation Measures

No mitigation measures for effects to waters of the U.S. are necessary, as none are present and there are no effects. However, another jurisdictional determination will be required to confirm this.

3.8.3 Drainage and Floodplains

3.8.3.1 Affected Environment

As discussed in Section 2.2.2, above, concerning alternatives, avoidance of stream and flood zone crossings was a factor in alternative formulation and evaluation. In particular, Popo‘o and ‘Auwaiakeakua Streams, which have high discharge during large rainfall events and have caused flooding in Waikoloa Village, were considered. Neither stream is crossed or approached by the project corridors of Alternatives 4, 5 or 6.

All project corridors traverse an uninhabited and undeveloped area used lightly for pasture in the *mauka* half and for no active land uses in the *makai* half. Because of this, the area has not been studied for floodplain determination by the Federal Emergency Management Agency (FEMA), the County, or the State. No streams are present and the project corridors all lie entirely within Zone X, with no known areas of flood hazard. This denotes areas identified in the community flood insurance study as areas of moderate or minimal hazard from the principal source of flood in the area. However, buildings in these zones could be flooded by severe, concentrated rainfall coupled with inadequate local drainage systems. In this area, such a zone may be inundated by the 500-year flood.

3.8.3.2 Environmental Consequences

Despite the absence of flood zones, the construction and operation of any highway have the potential to disrupt drainage patterns in existing minor gullies and swales and to concentrate run-off in channels that create drainage and flood issues.

Preliminary hydrologic research of the project corridors conducted by the Project engineers reviewed and assessed aerial photographs and mapping to determine topography, flow patterns, major drainages, and potential hydraulic concerns. Several hydrologic methodologies were evaluated to determine which would be most appropriate for use on the Project, including the Federal Emergency Management Agency (FEMA) regression equations, the Soil Conservation Service (SCS) Hawaii Graphical Method, and the Technical Release 20 (TR-20) computer program. The FEMA regression equations are derived from actual rainfall and stream gauge data and were determined to be the most appropriate for the Project.

The research arrived at preliminary hydrology and hydraulics computations (50-year storm) for all drainages with watersheds larger than 25 acres. It defined storm frequency, delineated and measured major drainage areas, calculated discharges, proposed tentative structure types/sizes, and identified other notable drainage requirements. The estimated peak 50-year discharges for the ephemeral drainages along the project corridors varied from 31 to 4,628 cubic feet per second (cfs).

Drainage structures as described below in the mitigation section would be required to avoid impacts such as drainage patterns disruption, channeling of flow and subsequent flooding, or ponding of drainage on roadways. The installation of culverts would not result in the temporary or permanent loss of riparian vegetation associated with drainageways, as no such riparian vegetation exists. There are no perennial streams, and the intermittent gullies flow for only a few hours after rainfall events; therefore, aquatic wildlife is not sustained. No impacts to aquatic wildlife are anticipated.

23 CFR 650 states that is the policy of FHWA to encourage a broad and unified effort to prevent uneconomic, hazardous, and incompatible use and development of the nation's floodplains by avoiding significant encroachments on floodplains where applicable. An encroachment is any action within the limits of the base floodplain. A "significant" encroachment is defined as a highway encroachment and any direct support of likely base floodplain development that would involve construction or flood related impacts after encroachment. No designated floodplains are present, and there would no direct or indirect effect to floodplains.

Differences in Impacts Between Alternatives 4, 5 and 6 and Intersection Design Options

There are no differences between the alternatives or design options with respect to effects to floodplains or drainage impacts. No floodplain map revisions are anticipated under any Build Alternative.

Impacts of the No Action Alternative

No floodplains would be affected by the No Action Alternatives, and no drainage measures would be necessary.

3.8.3.3 Mitigation Measures

1. The 50-year design storm will serve as the basis of culvert design for the Saddle Road Extension. Based on preliminary engineering, a total of 37 drainage structures will be required. The main drainage structures that would be used to pass these flows are single or multiple circular or box culverts of reinforced concrete. Most culverts would be several feet in diameter, with an expected maximum size of 12 by 8 feet at one drainage. Although bridges are currently not anticipated to be needed, if required, the 100-year design storm would be used for bridge design, in accordance with the HDOT's Design Criteria for Highway Drainage. Drainage structures will be provided at all drainage crossings to prevent water from flowing over the roadway during major storm events. The structures will be designed to accommodate the drainage without increasing existing flood elevations or altering existing drainage patterns. The proposed design improvements will serve to better protect the road base and surface from flood drainage and associated damage, and will decrease the likelihood that flood waters will overtop and inundate the roadway in the future.

During Section 106 consultation with the Hawai'i Island Burial Council (see ***Appendix E2*** for notes of discussion), a commenter suggested that the design team investigate using the 100-year storm instead for design purposes in order to minimize damage to the landscape. The intensity of rainfall for 1 hour for a 50-year storm in this area is 2 inches, whereas with a 100-year storm, it is 2.5 inches. Each culvert would need to be upsized to accommodate the extra flow, which would particularly affect the scale of larger structures passing more than 1,000 cfs. If a culvert is too small for a certain amount of flow, water on the inlet side will back up on the roadway prism and possibly the surrounding property, but the risk for this is generally very small. There are no archaeological features or specific cultural practices that require protection near the culvert inverts (CROSS REFERENCE Section 3.14 and 3.15). In order to reduce not only costs but also to keep structures at an appropriate visual scale, the 50-year design is preferred.

3.9 BOTANICAL RESOURCES

For botanical resources, the region of influence consists primarily of the project corridors, where vegetation on the corridor for the selected Alternative would be removed for highway improvements. Intensive plant surveys were thus undertaken in a 250-foot wide swath surrounding each project corridor. Secondarily, land beyond the corridor could also be altered through invasion by non-native species or wildfire. Accordingly, the vegetation of the area within several miles of the project corridors was also considered on a broader level.

3.9.1 Affected Environment

A botanical report covering all alternatives is contained in ***Appendix C***. The purpose of this study was to describe and evaluate the vegetation of the alternatives and to identify ecologically sensitive communities or valuable plants.

Project botanists reviewed available scientific and technical botanical literature for areas in and near the project corridors. This literature review encompassed scientific journals, technical journals and reports, EAs and EISs, and other sources. Also reviewed were geospatial data, aerial photographs, and topographic maps. Project botanists walked the entire length of all project corridors, conducting a 100 percent, visual survey of a 250 foot-wide, staked corridor for each alternative. Attention was also directed outside the staked corridor to any nearby conspicuous plant or topographic feature. Vegetation descriptions were recorded in all plant communities encountered along the corridors, and all plant species found were recorded. Because the Project development history has extended over a period of 17 years, the botanical surveys and literature reviews were conducted on several different occasions, as described in ***Appendix C.***

Section 7(a)(1) of the Endangered Species Act (ESA) of 1973 (as amended) directs all federal agencies to participate in the conservation and recovery of threatened and endangered species. Section 7(a)(2) of the ESA states that each federal agency shall consult with the U.S. Fish and Wildlife Service (USFWS) to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. This project will be federally funded and FHWA is the lead agency for the Section 7 consultation. The information contained in Sections 3.9 on botanical resources and 3.10 on faunal resources relative to threatened and endangered species represents a stage in the consultation between these agencies.

Special attention was thus given to listed or proposed threatened or endangered species and critical habitat. Accordingly, the USFWS was consulted to determine whether rare, threatened or endangered animal or plant species are present within the project area, or might be affected by the development of the Project (See ***Appendix A4*** for coordination letters with USFWS). Botanists reviewed the lists of threatened and endangered plants (USFWS 2005 and 2014; and updated lists provided by the USFWS, Pacific Islands Office, Honolulu). The ranges of listed and proposed plants were determined from the *Manual of Flowering Plants of Hawai'i* (Wagner et al. 1990) and consultation with knowledgeable field scientists.

3.9.1.1 Vegetation

Mean annual rainfall along the project corridors ranges from about 10 to 25 inches, increasing from the lowest elevation at the intersection of Queen Ka'ahumanu Highway (60 feet above sea level) to the highest at Mamālahoa Highway (2,500 feet). Much of the project area consists of young lava flows with little or no soil, windy conditions and hot daytime air temperatures. These conditions combine to provide harsh growing conditions throughout the project area. It is difficult to speculate on the pre-human vegetation here, since the introduction of certain grasses, grazing animals and fire have changed the soil and microclimate of the area. Gagne and Cuddihy (1990) described the vegetation in areas with a similar geology and range of elevation as Lowland Dry Forest (in the *mauka*, eastern side), and Lowland Dry Shrubland or Lowland Dry Grasslands (in the *makai*, western side). The area may have once been dominated by *pili* grass (*Heteropogon contortus*), *kawelu* grass (*Eragrostis variabilis*) and shrubs such as *'ilima* (*Sida fallax*) and *pā'ū-o-Hi'iaka* (*Jacquemontia ovalifolia*), with a perhaps diverse but fairly sparse cover of native dry-forest trees and shrubs including *'a'ali'i* (*Dodonaea viscosa*), sandalwood or *iliahi* (*Santalum ellipticum* and *S. paniculatum*), *lama* (*Diospyros sandwicensis*), *alahe'e* (*Psydrax odoratum*), *wiliwili* (*Erythrina sandwicensis*) and *uhiuhi* (*Mezoneuron kavaiense*).

Native dry forests throughout the Hawaiian Island have been profoundly altered by wildfire, grazing by domestic cattle, feral sheep and goats, alien insect pests, and especially invasion by fountain grass (*Cenchrus setaceus*), an aggressive alien. The intense degradation of dry forest ecosystems, which have diverse flora and many endangered species, makes them one of Hawai'i's most imperiled biological resources.

For many decades domestic cattle have been pastured above the 1,400-foot elevation and feral goats have freely ranged throughout the project area. Cattle and goats eat and kill most tree seedlings and any young trees within their reach, preventing the regrowth of native trees. Fountain grass, with its ability to grow on near-barren lava, invaded the area in the early 1900s. This bunchy grass crowds out and suppresses tree seedlings, and more significantly, it promotes wildfire in a landscape that previously had little fuel for fires. Wildfire also kills young trees and sometimes older ones as well, but fountain grass quickly revives, outcompeting native trees and shrubs. It is now the dominant plant species throughout the project area. Even trees that were formerly common are not able to reproduce. Many are dying due to advancing age and they are disappearing from the landscape, just as formerly occurred with now endangered trees.

The vegetation of the specific project corridors closely matches the vegetation of the general project area, as evidenced in the photos if ***Figure 1.2***. It is dry grassland, sometimes with scattered trees. The most conspicuous biological feature is the ubiquitous presence of fountain grass. It is found at near 100-percent cover at higher elevations, and is also sparsely present on lowland lava flows, where other plants do not grow. Almost the entire ground cover of the project corridors is fountain grass, except where the surface is barren lava. A small number of native and introduced trees and shrubs co-occur with the fountain grass in various places.

The percent cover of fountain grass and the presence of various tree and shrub species provides the basis for delineation of three general vegetation zones that occur at different elevations within the project area (***Figure 3.9.1*** and ***Table 3.9.1***).

(1) *Sparse Fountain Grass with Very Scattered Kiawe* is the low-elevation vegetation zone, occurring from 50 to about 850 feet in elevation. Much of the terrain here is extremely rough ‘a‘a lava. Fountain grass cover may be less than 0.1 percent and rarely more than 5 percent*;* the rest of the surface is barren lava.

(2) *Fountain Grass with Scattered Native Trees and Kiawe* occurs between 850 and 1,400 feet in elevation. Fountain grass cover increases with elevation, generally varying from 40 to 100 percent cover; however, some areas are nearly barren, with fountain grass cover of 5 percent or less. Trees are still widely scattered, but much more frequent than at lower elevation. In addition to *kiawe* (*Prosopis pallida*), some widely scattered native trees such as *lama* can be found. A very few individuals of rare native tree species were also found in this vegetation zone, but none within the corridor, with the exception of one live *wiliwili* tree, located in Segment 5/6 (refer to ***Fig. 3.9.1***). There are a number of *wiliwili* within a few miles of the corridor, particularly on the northern side towards Waikoloa Village.

(3) *Fountain Grass Pasture* is the predominant vegetation zone above approximately 1,400 feet in elevation. Very few other plant species occur here and this land is currently used for cattle production.

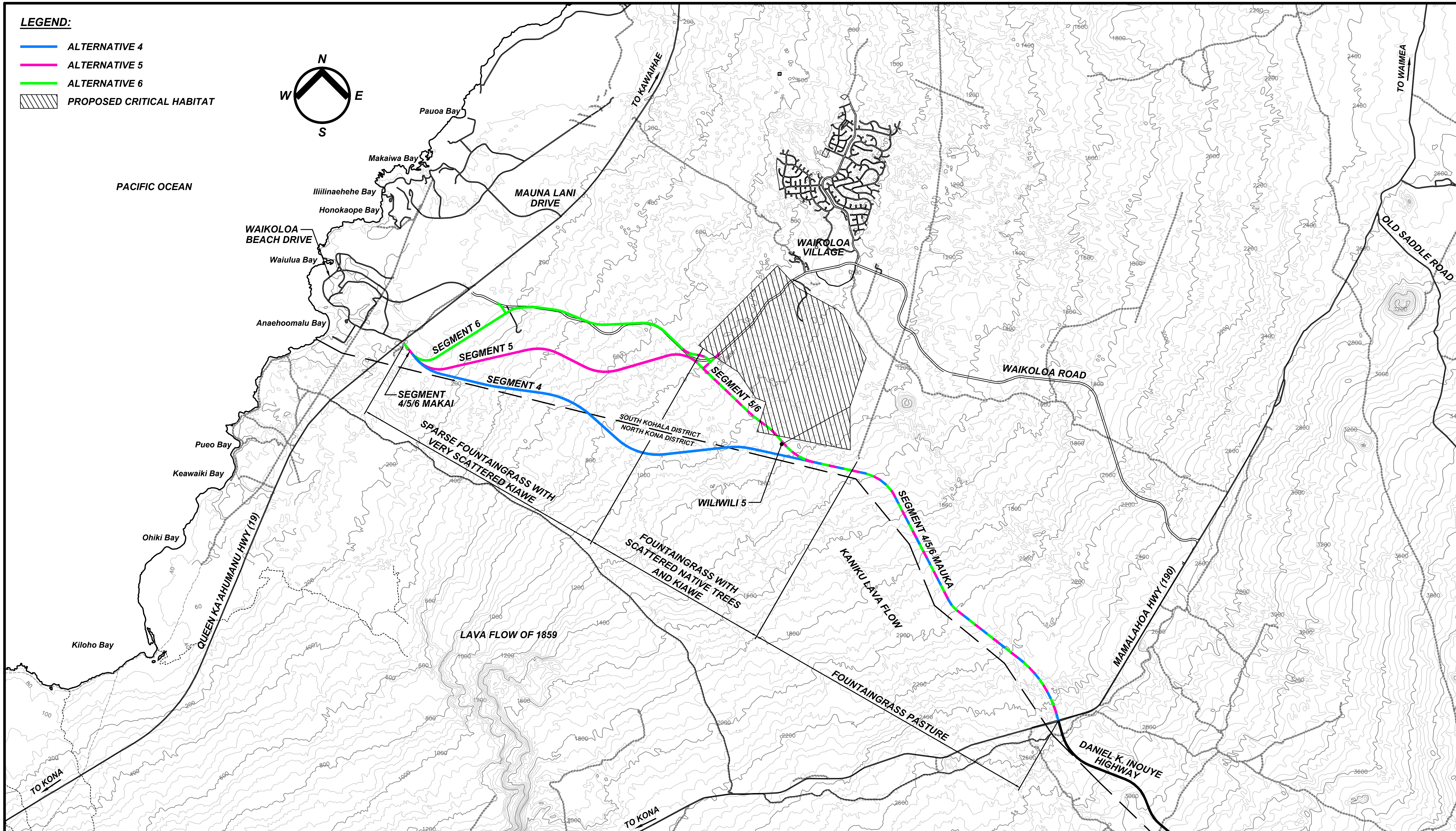
Table 3.9.1
Vegetation Types Within Alternative Project Corridors

Vegetation Type	Alternative 4	Alternative 5*	Alternative 6*
1. Sparse Fountain Grass with Very Scattered *Kiawe*	18,280	21,200	22,140
2. Fountain Grass with Scattered Native Trees and *Kiawe*	14,200	13,300	13,300
3. Fountain Grass Pasture	21,540	21,540	21,540

Notes: Units are linear feet of corridor length. *Does not include minor connecting roads, which have a vegetation of fountain grass with scattered native trees and *kiawe*.

3.9.1.2 Flora

A total of 35 different vascular plant species were seen during the most recent field surveys (***Table 3.9.2***). Of these, 3 are *endemic* (native to only Hawai‘i and found only in Hawai‘i), 4 are *indigenous* (native to Hawai‘i and other places), and 28 are *introduced* (also called *alien* or *exotic* species). It should



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GRAPHIC SCALE IN FEET

SADDLE ROAD EXTENSION

FIGURE 3.9.1 ~ VEGETATION TYPES AND PROPOSED CRITICAL HABITAT

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be noted that the flora, particularly the non-native component, varies over time. Extremely wet conditions can increase the flora to a larger number of species, and extended droughts may reduce it. The results of any particular survey provide just a snapshot of current conditions.

Table 3.9.2
Vascular Plant Species Found Within Project Corridors

Scientific name	**Origin**	**Common Name**
Calotropis gigantea (L.) W.T. Aiton	X	Crown flower
Cenchrus ciliaris L	X	Buffel grass
Cenchrus setaceus (Forsk.) Chiov.	X	Fountain grass
Chamaecrista nicitans (L.) Moench	X	Partridge pea
Chamaesyce hirta (L.) Millsp.	X	Garden spurge
Crotalaria juncea L	X	Sunn hemp
Desmodium sandwicense E. Mey	X	Spanish clover
Desmodium tortuosum (Sw.) DC	X	Florida beggarweed
Diospyros sandwicensis (A.DC) Fosb.	E	Lama
Dodonaea viscosa Jacq.	I	A‘ali‘i
Doryopteris decora Brack.	E	No common name
Erythrina sandwicensis Degener	E	Wiliwili
Galinsoga parviflora Cav.	X	No common name
Geranium pusillum N. L. Burm.	X	Small cranesbill
Indigofera suffruticosa Mill.	X	Indigo
Lepidium virginicum L.	X	Pepperwort
Leucaena leucocephala (Lam.) de Wit	X	Koa haole
Melinis repens (Willd.) Hubb.	X	Natal redtop
Mollugo cerviana (L.) Ser.	X	Threadstem carpetweed
Nicotiana glauca R. C. Graham	X	Tree tobacco
*Ophioglossum polyphyllum (*L.) C. Presl	I	Pololei
Opuntia ficus-indica (L.) Mill.	X	Panini
Oxalis corniculata L.	P	Yellow wood sorrel
Passiflora suberosa L.	X	Huehue haole
*Portulaca pilos*a L.	X	‘Akulikuli
Portulaca lutea Sol. Ex G.Forster	X	‘Akulikuli
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	X	Kiawe
Senecio madagascarensis Poir.	X	Fireweed
Sida fallax Walp.	I	‘Ilima
Solanum linnaeanum Hepper & P.Jaeger	X	Apple of Sodom
Sonchus oleraceus L.	X	Pualele
Tridax procumbens L.	X	Coat buttons
Verbesina encelioides (Cav.) Benth.&Hook	X	Crown-beard
Vulpia bromoides (L.)S.F. Gray	X	Broom fescue
Waltheria indica L.	I	‘Uhaloa

Origin: E = endemic, I = indigenous, P= Polynesian introduction, X = other alien

One introduced species that has fortuitously come to play a critical role in the survival of an endangered animal is tree tobacco, *Nicotiana glauca*. Blackburn’s sphinx moth (*Manduca blackburni*) is a large endemic moth. The caterpillar of this species feeds on the leaves of members of the nightshade family, including some introduced species such as tree tobacco. This species is widespread throughout North Kona and portions of South Kohala. ***Appendix B*** details the limited locations in which it was observed in 2012. The highly weedy species has since continued to spread in the region, but as of 2017 it has not significantly spread into the project corridors owing to the lack of geologic substrate, vegetation and disturbed ground surface that tree tobacco favors. Further discussion of the endangered Blackburn's sphinx moth is contained in Section 3.10, below, in the context of fauna.

3.9.1.3 Threatened and Endangered Plant Species

The primary federal law protecting threatened and endangered species is the Endangered Species Act (ESA): 16 USC Section 1531, et seq. (see also 50 CFR Part 402). This act and subsequent amendments provide for the conservation of endangered and threatened species and the ecosystems upon which they depend. Under Section 7 of this act, federal agencies are required to consult with USFWS and the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA NMFS) to ensure that they are not undertaking, funding, permitting or authorizing actions likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat. Critical habitat is defined as geographic locations critical to the existence of a threatened or endangered species. The outcome of consultation under Section 7 may include a Biological Opinion with an Incidental Take statement, a Letter of Concurrence and/or documentation of a no effect finding. Section 3 of the ESA defines take as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect or any attempt at such conduct."

FHWA is currently consulting with the USFWS for this project. Because of the location of the Project distant from the shoreline, the lack of surface waters or connection to the ocean or other surface waters, FHWA is not consulting with NMFS at this time. The relevant effect findings that FHWA believes may be applicable for ESA-listed species that are present in the project corridors and associated areas include the following:

- No effect: A determination of no effect means there are absolutely no effects to the species and its critical habitat, either positive or negative. It does not include small effects or effects that are unlikely to occur.
- May affect, is not likely to adversely affect: Under this effect determination, all effects to the species and its critical habitat are beneficial, insignificant, or discountable.
- May affect, is likely to adversely affect: This effect determination means that the proposed action will have an adverse effect on the species or its critical habitat. A combination of beneficial and adverse effects is still considered "likely to adversely affect," even if the net effect is neutral or positive. The effect on the species and/or critical habitat must be extremely small to qualify as a discountable effect. Likewise, an effect that can be detected in any way or that can be meaningfully articulated in a discussion of the results of the analysis is not discountable; it is an adverse effect.

In its letter of December 16, 2013, the USFWS did not list any T&E plant species but recommended that a qualified botanist conduct surveys for listed T&E plant species within the project area. As discussed above, the area has been thoroughly surveyed on multiple occasions and research was also conducted into the potential for T&E species based on studies from nearby areas. The FHWA determined through consultation of botanical experts that six plant species listed or proposed for listing as threatened or endangered by the USFWS are present in the general area of South Kohala (***Table 3.9.3***). Several of these species – *Portulaca sclerocarpa*, *Vigna o-wahuensis* and *Isodendrion hosakae* – are primarily found in cinder cone slope/summit habitats that are not present in or near the project corridors. The potential for the presence of the other three species is higher.

Table 3.9.3
Plant Species Federally Listed as Endangered or Threatened or Proposed Listed with Potential to Occur in the Project Area

Common Name (scientific name)	**Status***	**Range or Habitat Requirements and Potential for Occurrence in Project Area**
Cindercone isodendrion (*Isodendrion hosakae*)	Endangered	Variety of rocky habitats, particularly on steep, rocky portions of cinder cones. No known occurrences near project corridor.
Halapepe (*Pleomele hawaiiensis*)	Endangered	Dry areas in upper lowlands with Holocene lava substrates. One individual formerly found 300 feet north of project corridor.
O‘ahu cowpea (*Vigna o-wahuensis*)	Endangered	Variety of rocky habitats, particularly on steep, rocky portions of cinder cones. Found very sparingly in Ke‘āmuku section of PTA on lava outcrops, within 2 miles of project corridor.
Po‘e (*Portulaca sclerocarpa*)	Endangered	Variety of rocky habitats, particularly on steep, rocky portions of cinder cones. No known occurrences near project corridor.
Red ‘ilima (*Abutilon menziesii*)	Endangered	Dry lowlands with soil. A patch of red ‘ilima was formerly found 2 miles to north.
Uhiuhi (*Mezoneuron kavaiense*)	Endangered	Dry areas in upper lowlands with Holocene lava substrates. One individual formerly present near project corridor.

* Federal (USFWS) status definitions:
Endangered: Any species considered by the USFWS as being in danger of extinction throughout all or a significant portion of its range. The ESA specifically prohibits the take of a species listed as endangered. Take is defined by the ESA as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to engage in any such conduct.
Threatened: Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. The ESA specifically prohibits the take (see definition above) of a species listed as threatened.
Proposed: Any species of fish, wildlife, or plant that is proposed in the Federal Register to be listed under Section 4 of the ESA.

No threatened or endangered plant species are currently present in the project corridors or the immediate vicinity. In 2001, two individual plants of two different endangered species were found within 300 feet of Segment 4/5/6 *mauka*. These were a single living *uhiuhi* (*Mezoneuron kavaiense*) tree and a single living *halapepe* (*Pleomele hawaiiensis*) tree. By 2003, both had died, apparently due to drought. No individuals of these species are now found near any of the project corridors. The closest known endangered plant species (a cluster of protected *uhiuhi* trees) is found approximately one mile to the north of Segment 5/6 in the Waikoloa Dry Forest Preserve.

Plant Critical Habitat

Critical habitat is defined as the specific areas within the geographic area occupied by the species at the time it was listed that contain the physical or biological features that are essential to the conservation of endangered and threatened species, and which may need special management or protection. Critical habitat may also include areas that were not occupied by the species at the time of listing but are essential to its conservation. All federal agencies must insure that any action authorized, funded, or carried out by them is not likely to result in the destruction or adverse modification of the constituent elements essential to the conservation of the listed species within these defined critical habitats.

On October 17, 2012, the USFWS issued a proposed rule in the *Federal Register* entitled "Endangered and Threatened Wildlife and Plants; Listing 15 Species on Hawaii Island as Endangered and Designating Critical Habitat for 3 Species." The proposal was to (1) "designate critical habitat concurrently with listing for the plant *Bidens micrantha* ssp. *ctenophylla*, due to the imminent threat of urban development to 98 percent of the individuals known for this species and its habitat within the lowland dry ecosystem..." and ; (2) designate critical habitat for two previously listed plant species, *Isodendrion pyrifolium*, and *uhiuhi* (*Mezoneuron kavaiense*), which co-occur with *Bidens micrantha* ssp. *ctenophylla* in at least in some areas within the same lowland dry ecosystem. A total of seven units containing 18,766 acres scattered around West Hawai'i were proposed for designation.

Unit 32 is a 1,779-acre area of mostly undeveloped land located immediately south of Waikoloa Village that was proposed for designation (refer to ***Fig. 3.9.1***). Unit 32 is located in Waikoloa on the western slope of Mauna Kea between the elevations of 720 and 1,220 feet. It consists of 21 acres of State land, and 1,758 acres of land owned by the Waikoloa Village Association, for a total of 1,779 acres. This unit is not in previously designated critical habitat and comprises proposed critical habitat shown on Map 105 in this proposed rule. This unit is occupied by the plant *Mezoneuron kavaiense* and includes – at least in some spots – the mixed herbland and shrubland, the moisture regime, and canopy, subcanopy, and understory native plant species identified as physical or biological features in the lowland dry ecosystem. Although Unit 32 is not currently occupied by *Bidens micrantha* ssp. *ctenophylla* or *Isodendrion pyrifolium* (and there are no records of them ever having been present), the USFWS has determined this area to be essential for the conservation and recovery of these lowland dry species because it provides the physical or biological features necessary for the reestablishment of wild populations within the historical ranges of the species. Due to their small numbers of individuals or low population sizes, these two species require suitable habitat and space for expansion or reintroduction to achieve population levels that could approach recovery.

According to information provided by the USFWS in the *Federal Register* of May 20, 2016 (https://www.federalregister.gov/documents/2016/05/20/2016-11941/endangered-and-threatened-wildlife-and-plants-designating-critical-habitat-for-three-plant-species – accessed March 2017), the USFWS is considering excluding from critical habitat the 1,758 acres that are owned or managed by the Waikoloa Village Association. Since 2012, the landowner has voluntarily facilitated and supported the conservation of *Isodendrion pyrifolium* and *Mezoneuron kavaiense* and other federally listed species and their habitat in the lowland dry ecosystem, on their privately owned lands. In 2012, the Waikoloa Village Association Board of Directors granted permission to protect and restore 275 acres of dry forest habitat south of Waikoloa Village for a period of 75 years by way of a license agreement with the nonprofit Waikoloa Dry Forest Initiative, Inc (WDFI). The project's management program includes: (1) Construction and maintenance of a 275-acres fence to exclude ungulates; (2) removal of ungulates from the fenced exclosure; (3) control of non-native plant species to reduce competition and the threat of fire; (4) integrated pest management to reduce impacts on native plant species; (5) provision of infrastructure for propagation and maintenance of outplantings; (6) establishment of common native and endangered plant species; and (7) education and community outreach activities. Furthermore, in 2014, the Waikoloa Village Association signed an MOU with the USFWS wherein they agreed to implement important conservation actions beneficial to *Mezoneuron kavaiense*, *Isodendrion pyrifolium* and *Bidens micrantha* ssp. *ctenophylla* and the lowland dry ecosystem upon which they depend. The Waikoloa Village Association agreed not to undertake development in 60 acres adjacent to the WDFI's 275-acre exclosure and to work cooperatively with the Service or other conservation partners to conduct activities expected to benefit the listed species and their habitat. The proposed critical habitat rule has yet to be finalized.

WDFI is a nonprofit organization formed in 2011 to manage and preserve the remnant lowland *wiliwili* forest. The mission is to preserve the existing resources within the area, promote the natural regeneration of common and rare native plants, and restore the native dry forest community, as well as understanding and stewardship of the forest within the Big Island, through outreach and education. The WDFI's 275-acre preserve was developed on 10,000-50,000-year old Mauna Kea lavas. This area appears to have the critical elements that have sustained this rare forest type into the present. In its letter of December 16, 2013, the USFWS recommended that the highway alignment be planned to avoid the Waikoloa Dry Forest Preserve and the proposed lowland dry critical habitat unit in the same area.

An approximately 1,350-foot length of Segment 5/6 common section extends through the southern corner of the proposed Unit 32. Unlike the portion of Unit 32 that contains *uhiuhi* as well as *wiliwili*, the portion within the project corridor consists of 3,000-5,000-year-old Mauna Loa lava flows. The vegetation in this area is completely dominated by non-native, invasive species, and there are very few natives. The area traversed by Segment 5/6 is not within or near the Waikoloa Dry Forest Preserve.

3.9.1.4 Conservation Value

As discussed above, no threatened or endangered plants are present in or near the project corridors. Notwithstanding the intersection of a small segment of one of the project corridors with proposed critical habitat, the habitat does not appear suitable for endangered plant species at this time. Although most of the project area is currently open or vacant land, most of this region is not likely to be an important area for conservation of native plant resources, for several reasons. The area has few valuable plant resources, has severe environmental degradation, and most of the land is privately owned and is not zoned or classified for conservation. However, even alien-dominated vegetation without conservation value for native flora or fauna may have general resource value for other purposes, such as controlling erosion, aesthetics/open space, and microclimatic cooling effects. In this case, the fountain grass-dominated vegetation has at least some, modest conservation value in terms of providing, in some places, a ground cover that reduces soil erosion and subsequent water pollution. Fountain grass is also the basis for cattle ranching and goat hunting. Given the climatic setting, land use history and the dominance of fountain grass, wildfire is probably the primary ecosystem issue. Wildfire is discussed in Section 3.11.

3.9.2 Environmental Consequences

Implementation of any Build Alternative would result in removal of plants and habitat in the selected project corridor over an area of approximately 200 acres (within a right-of-way of about 334 acres), regardless of the alternative selected. Temporary BMPs would be installed as discussed below to protect nearby isolated gullies from erosion and sediment potential, and necessary BMPs would remain in place until sufficient vegetation cover has established. As none of these gullies connect to permanent waters such as streams or the sea, there would be no risk to freshwater, estuarine, and marine communities from the erosion and sediment potential that exists from vegetation removal and ground-disturbing activities when soil is exposed. The loss of vegetation would constitute a temporary habitat loss to native and introduced animals that may use the vegetation for nesting or foraging, as discussed in Section 3.10.2.

None of the land traversed by the project corridors contains primarily native vegetation or rare, threatened or endangered plant species. One portion of Segment 5/6, however, is within a proposed critical habitat unit for three endangered plants. Two of these species are not naturally present and have never been recorded from the unit, while one is present in low numbers on one lava flow habitat type about a mile distant from the nearest project corridor, adjacent to Waikoloa Road within and near the Waikoloa Dry Forest Preserve. Based on ongoing preservation efforts in the best habitat within the proposed critical habitat unit, the USFWS is considering withdrawing the area traversed by Segment 5/6 from the proposed critical habitat.

There is a potential for introduction and establishment of alien invasive plant species during construction and maintenance of the highway. Heavy construction equipment can move invasive plant seeds or vegetative material from site to site, or simply create a disturbed habitat of broken rock and soil fed by road runoff that promotes weeds. This has been the case with the Daniel K. Inouye Highway, which has been built in phases from 2003 to the present. In general, the invasive species that have spread were already widespread in the region, although not necessarily in the corridors that came to be occupied by the highway. The most prominent examples are fireweed (*Senecio madagascariensis*) and tree tobacco, although at least a dozen weed species are present.

Differences in Impacts Between Alternatives 4, 5 and 6 and Intersection Design Options

As shown in ***Table 3.9.1***, vegetation types within the project corridors are extremely similar, with only minor differences. All alternatives contain the same vegetation types in roughly the same proportions. The only notable difference is the presence of one *wiliwili* tree in the common segment of Segment 5/6 (refer to ***Fig. 3.9.1***).

Effects to Critical Habitat

Critical habitat is a tool to guide Federal agencies in fulfilling their conservation responsibilities by requiring them to consult with the Service if their actions may “destroy or adversely modify” critical habitat for listed species. A critical habitat designation helps to protect areas (occupied and unoccupied) necessary to conserve a species. In consultation with the USFWS (and NMFS, if applicable) for those species with critical habitat, federal agencies are required to ensure that their activities do not adversely modify critical habitat to the point that it will no longer aid in the species’ recovery. However, areas that are currently unoccupied by the species, but which are needed for the species’ recovery, are protected by the prohibition against adverse modification of critical habitat.

As discussed in detail above, the USFWS has proposed critical habitat for three plant species: *Bidens micrantha* ssp. *ctenophylla*, *Isodendrion pyrifolium*, and *uhiuhi* (*Mezoneuron kavaiense*) within Unit 32 of Lowland Dry habitat (USFWS, 2012, 2013b). This 1,779-acre unit is located within the general project area and one shared segment of the proposed roadway (Segment 5/6), intersects a corner of this currently proposed unit (***Figure 3.9.1***). The first two of these listed species are not found within the proposed critical habitat unit[1] (USFWS, 2012). The third, *uhiuhi,* is currently found within the proposed unit[2] but not within or close to any alignment under consideration.

The maximum area of proposed critical habitat that could be affected by the proposed project can be calculated. The approximately 1,350-foot long portion of the shared Segment 5/6 that intersects the corner of the proposed Unit will modify 7.6 acres of the proposed critical habitat, Unit 32, which is 0.43% of the area of Unit 32 as currently proposed. This area also accounts for 0.041% of the 18,365 acres of land in six units proposed in this rule for *uhiuhi*, and 0.040% of the 18,767 acres of land in seven units proposed for *Bidens micrantha* ssp. *ctenophylla* and *Isodendrion pyrifolium* (USFWS 2012 – pg. 64018).

In the USFWS proposed rule (USFWS 2012, 2013a) this agency did not differentiate between the two very distinct substrates present within Unit 32. The area within Unit 32 close to the Waikoloa Dry Forest Preserve and the extant *uhiuhi* and native *wiliwili* trees is in the area that was formed by a lava flow that erupted from Mauna Kea between 10,000 and 50,000 years ago (Wolfe and Morris 1996), and that flow is very sparsely vegetated. This substrate contrasts markedly from that on the approximately 1,350-foot long portion of Segment 5/6 that clips the Unit 32. That segment runs across a lava flow that erupted from Mauna Loa within the last 3,000 to 5,000 years (Ibid.). This area of Unit 32 is vegetated almost exclusively with a sparse covering of the alien species fountain grass and *kiawe*.

A botanical and habitat investigation of the area was conducted by biologists Ron Terry and Reginald David on July 8, 2014. It confirmed that the substrate and vegetation was markedly different on the two lava flows and that there were no *uhiuhi* or other endangered plants within

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1 Not present within the proposed Unit, thus the unit is unoccupied by these two species
2 Present within the proposed Unit, thus the unit is occupied by this species, though not in, or close to the ROW.

or close to 1,350-foot long portion of Segments 5/6 within the proposed Unit 32 boundaries, matching the findings of all previous botanical investigations.

In the proposed rule, the USFWS identified 21 native plant species as the key botanical elements supporting and defining habitat for the three listed species for which they have proposed seven Critical Habitat Units. Seven of these plants are canopy or climax tree vegetation, six are sub-canopy components and eight are understory plants (USFWS 2012: 64018). Of these 21 plant species, botanical surveys identified the presence of only three of these species – *lama*, *wiliwili* (both infrequently found) and *a'ali'i* – along the entire length of all project corridors. There is effectively no native canopy or sub-canopy and almost no native-dominated understory. Instead, the project corridors contain an almost completely degraded ecosystem unlikely to support a flourishing population of the three listed species. There is little likelihood that the area could be restored as a functioning, native species dominated habitat. The area potentially affected by highway construction is not likely to be important for conservation of native plant resources for several reasons. The area has few valuable plant resources, has severe environmental degradation, and most of the land is privately owned and is not zoned or classified for conservation.

In the event that either Alternative 5 or 6 is chosen as the Selected Alternative for the Project, construction would affect a maximum of 7.6 acres of Unit 32 of the proposed critical habitat. That area does not contain any endangered plant species. The proposed highway would provide a 40 to 52-foot wide, paved area for fire break/fuel break within the more heavily vegetated and fountain grass dominated habitat on the younger flow. This would create a partial barrier between the two habitats and would also improve response time and access for firefighters battling wildfires that threaten the Waikoloa Dry Forest Preserve area, where there are still extant uhiuhi trees. This would in turn increase the chance of survival for these listed species. As such, in the view of FHWA, the proposed project is not likely to adversely modify critical habitat.

It bears reiteration that based on ongoing preservation efforts in the best habitat within the proposed critical habitat unit, the USFWS is considering withdrawing the area traversed by Segment 5/6 from the proposed critical habitat altogether.

Impacts of the No Action Alternative

No effects to vegetation, flora or threatened or endangered species or critical habitat for them would occur with the No Action Alternative.

3.9.3 Mitigation Measures

Implementation of the proposed action would include avoidance, minimization, and/or mitigation measures to reduce or eliminate project-related impacts.

Native Plant Species

1. If Alternative 5 or 6 is selected for construction, and the one *wiliwili* tree located within Segment 5/6 is still alive prior to construction, FHWA and HDOT will work with a local conservation group to relocate the tree, if practical and reasonable.

Invasive Plant Species

Executive Order 13112 (64 Federal Register 6183), issued in 1999, requires federal agencies to implement policies to minimize the spread of invasive species. Federal agencies cannot authorize, fund, or carry out action(s) that are likely to cause or promote the introduction or spread of invasive species, unless it has been determined (1) that the benefits of the action outweigh the potential harm caused by invasive species, and (2) that all feasible and prudent measures to minimize risk of harm will be taken.

2. Temporarily disturbed areas would be revegetated as part of the Project, and the spread of noxious weeds would be managed through the implementation of BMPs as part of the project.
3. To minimize the risk of construction equipment bringing invasive weed seeds or viable vegetative matter onto the construction site the contractor shall be required to:
   A. Thoroughly wash or steam clean all construction equipment before it is brought onto the construction site. If construction equipment is moved away from the site, it shall be re-cleaned prior to being allowed back on the construction site.
   B. Restrict all construction equipment to within the clearly defined ROW, and/or within previously identified and biologically cleared equipment and materials staging areas. No equipment will be stored, parked or take short cuts through any other area within the general construction area.
   C. Certified weed free permanent and temporary erosion control measures to minimize erosion and sedimentation during and after construction according to the contract erosion control plan, contract permits, FP Section 107, FP Section 157 and SCR Section 157 will be provided.
   D. Have qualified biologists conduct quarterly surveys during the duration of the construction of the roadway of the disturbance corridor, the storage and lay down areas and any stockpiled aggregate for invasive alien weed species, any such species found shall be physically removed and/or poisoned with a suitable herbicide. Any such green waste shall be disposed of appropriately.
4. Following build-out of the highway, HDOT shall make arrangements to have qualified personnel from the Department of Land and Natural Resources or Department of Agriculture, or other qualified personnel, monitor the roadway annually. Individuals and populations of introduced plants new to the region will be eradicated, if practical. This annual survey could be done in conjunction with the periodic surveys of fuel conditions recommended for wildfire control.

Wildfire

5. Engineering design measures being incorporated into the Project's Typical Roadway Section (refer to ***Figure 2.5***) will minimize the unintended fire ignition risk posed by vehicular traffic and improve the highway's function as a firebreak and fuel break. These design elements will provide a 40 to 52-foot wide paved wildfire fuel break and firebreak. Specific design and construction features that will accomplish these goals are:
   A. Two paved 12-foot travel lanes
   B. A third paved climbing lane in the uphill direction
   C. Two paved 8-foot paved shoulders
   D. Graded clear zones of varying width outside the shoulders
   E. Installation of high fire risk signs along the highway
6. In addition, to minimize the risk of wildfire during construction, the Special Contract Requirements will include but not be limited to the following specific requirements and prohibitions:
   A. The contractor will develop a wildfire prevention and response plan that will be approved by FHWA and HDOT prior to the initiation of any construction.
   B. All construction activity shall be restricted to within the clearly delineated ROW and that entry and exit into the ROW by all construction personnel and equipment shall be at previously identified and marked non-sensitive areas. The area beyond the construction limits will not be disturbed. Trees, shrubs or vegetated areas temporarily damaged by construction operations will be re-vegetated.
   C. All construction equipment will be restricted to within the clearly defined ROW, and/or within previously identified and biologically cleared equipment and materials staging areas. Clearing and grubbing will be held to a minimum.
   D. All construction vehicles will be required to carry fire extinguishers at all times.
   E. No smoking will only be allowed by any personnel on the construction site.
   F. No cooking with open fires, barbecues, hibachis, etc., will be permitted with the construction site.
   G. During the course of construction of the road, the contractor will be required to ensure that quarterly weed surveys are conducted within all areas that have been disturbed. Weed clusters that pose a fire risk within the project limits, especially fountain and buffel grass, will be treated with herbicide and/or physically removed to reduce the risk that construction activity could ignite a wildfire.
7. Following build-out of the highway, annual field surveys will be conducted to ensure that fuel loads are not building up to a dangerous level. If fuel loads are found to be large, the potential threat will be controlled by mowing, herbicide and/or physical removal to reduce the threat of unintentional ignition of a wildfire.

Other Special Provisions to Protect Botanical Resources

8. The servicing and maintenance of heavy construction equipment will generate quantities of used oils, lubricants and hydraulic fluids. If improperly disposed of on site, these pose significant threats to the biological environment. All equipment, material and support structures shall be stored and maintained either within the clearly defined ROW, and/or within previously identified and biologically cleared equipment and materials staging

areas. No equipment will be stored, parked or take short cuts through any other area within the general construction area.

9. Emergency spills treatment, storage and disposal of all petroleum, oils and lubricants both within the construction limits and at staging areas will be handled in strict accordance with FHWA 2014 (FP-14) "Specifications for Construction of Roads and Bridges on Federal Highways Projects" as well as Federal Acquisition Regulations and the appropriate Environmental Protection Agency (EPA) regulations. FHWA will require the contractor to prepare a Spill Prevention, Control, and Countermeasure (SPCC) Plan at least 2 days before beginning work.
10. Any spill of petroleum products, hazardous materials, or other chemical or biological products released from stationary sources or construction, fleet, or other support vehicles shall be properly cleaned, mitigated, and remedied, if necessary. Any spill of petroleum products or a hazardous material shall be reported to the appropriate federal, state, and local authorities, if the spill is a reportable quantity. Response shall occur in accordance with federal, state, and local regulations.
11. In general, when gasoline, diesel fuel, antifreeze, hydraulic fluid or any other chemical contained within the vehicle is released to the pavement or the ground, proper, corrective, clean-up and safety actions specified in the SPCC and SWPPP will be immediately implemented. All vehicles with load rating of two tons or greater will carry, at minimum, enough absorbent materials to effectively immobilize the total volume of fluids contained within the vehicle.
12. Leaks will be repaired immediately on discovery. Equipment that leaks will not be used. Oil pans and absorbent material will be in place prior to beginning repair work. The contractor will be required to provide the "on-scene" capability of catching and absorbing leaks or spillage of petroleum products including antifreeze from breakdowns or repair actions with approved absorbent materials. A supply of acceptable absorbent materials at the job site in the event of spills, as defined in the SWPPP will be available. Sand and soil are not approved absorbent materials. Soils contaminated with fluids will be removed, placed in appropriate safety containers, and disposed of according to state and/or federal regulations.

3.10 FAUNA

A report describing the fauna (animals) of all alternative road segments is contained in ***Appendix D***. The purpose of this study was to describe the fauna that were observed or expected to be present and to identify ecologically sensitive habitats for native fauna. For faunal resources, the region of influence consists primarily of the project corridors and areas directly adjacent, where direct habitat disruption or noise from the highway might displace individual animals. There are no native land mammals other than bats in Hawaiʻi and no native mammalian migratory patterns that may be disrupted. Faunal surveys were thus undertaken on transects within the 250-foot wide project corridor. Attention was also directed outside the staked corridor to any visible or audible fauna. These were conducted once during the dry season and once during the wet season.

Secondarily, zoologists investigated land well beyond the corridor that could potentially experience invasion by non-native species or wildfire, altering faunal habitat. Because the Project's development history has extended over a period of 17 years, the faunal surveys were conducted on several different occasions, as described in ***Appendix D***.

Special attention was given to listed and proposed threatened or endangered species and critical habitat. Accordingly, the USFWS was consulted by letter to determine whether rare, threatened or endangered animal or plant species were present within the project area, or might be affected by the development of the Saddle Road Extension (see ***Appendix A4*** for coordination letters with USFWS). The project zoologist and FHWA officials reviewed the lists of threatened and endangered fauna (DLNR 1998; USFWS 2005a, 2005b, 2014; and updated lists provided by USFWS, Pacific Islands Office, Honolulu). The ranges of listed and proposed threatened or endangered animals were determined through consultation of published reports and consultation with knowledgeable field scientists.

The primary purpose of the field survey was to determine if there were any federally or State of Hawaiʻi listed endangered, threatened, proposed, or candidate bird or mammal species present within, or in the immediate vicinity of the project corridors. Reptiles and amphibians were not addressed, because no native species in these taxa are present in Hawaiʻi. Although no invertebrate species surveys were conducted because of the generally poor habitat for nearly all native arthropods and snails, endangered invertebrates were addressed through habitat surveys.

3.10.1 Affected Environment

The sections below discuss the major taxa of mammals, birds and invertebrates separately, noting survey methods and findings. A separate section at the end presents information on threatened and endangered species.

3.10.1.1 Mammals

Survey Methods

In an effort to detect the presence of endangered Hawaiian hoary bats or *opeʻapeʻa* (*Lasiurus cinereus semotus*), two stationary remote bat census stations were deployed on each of four nights. In addition, visual scans were made for bats during dawn and dusk on four separate evenings and four separate mornings.

All other mammalian species found on the island of Hawaiʻi are alien species and lack conservation value. Observations, therefore, were of an incidental nature, limited to visual and auditory detection, coupled with observation of scat, tracks and other animal sign. A running tally was kept of all mammal species observed and heard within the project area.

Existing Environment

The Hawaiian hoary bat is a subspecies of the continental hoary bat (*Lasiurus cinereus*) that is usually found roosting singly and widely separated from other members of the population in tall shrubs and especially trees. They are widely distributed on the Island of Hawaiʻi and are found on a seasonal basis in almost any area that still has tree cover. Hawaiian hoary bats usually have two pups.

The surveys did not detect Hawaiian hoary bats. However, the bats likely overfly the project corridors at least occasionally, as they have been seen in numerous lowland areas in South Kohala and North Kona, including areas immediately north of the project corridors (David 2014). The project corridors have little to offer a passing bat, as they lack the vegetation suitable for roosting. Given their extremely dry nature, they probably do not support significant densities of flying or drifting insects that this species preys on. The archaeological team discovered a cave located about 150 feet outside of the project corridor in which there were numerous skeletal remains of bats (Tom Wolforth, personal communication 2002), which may be a relic of former forested habitat.

Ten mammal species were detected during the course of this survey, all alien to the Hawaiian Islands (***Table 3.10.1***). Numerous European house mice (*Mus musculus domesticus*) were seen in 2013 and 2014, in response to greater than average rainfall and abundant seed resources; none were seen in 2002. The biologists encountered one domestic dog (*Canis f. familiaris*), apparently a lost pet or hunting dog; additionally, dog tracks and scat were widely distributed about the area, especially along roads. Numerous small Indian mongooses (*Herpestes a. auropunctatus*) were seen throughout the project area, as were several skeletons of this ubiquitous species. Three cats (*Felis catus*) were seen, and cat sign was also widely distributed. Although the biologists did not see horses (*Equus c. caballus*), donkeys (*Equus a. asinus*), or pigs (*Sus s. scrofa*), they did notice sign of all three species. Domestic cattle (*Bos taurus*) were encountered in the upper third of the project area, where the land is still being used for cattle pasturage. Goats *(Capra h. hircus*) were seen throughout corridors, as were numerous bedding sites, and many ungulate trails, which crisscross the entire area. Six sheep (*Ovis aries*) were seen within the Puʻuanahulu hunting area south of the project corridors; old sheep sign was also encountered within the project area. No rats were seen during the course of this survey, although skeletal remains of roof rats (*Rattus r. rattus*) were recovered from within Barn Owl (*Tyto alba*) pellets, which were found beneath several owl roost sites.

Table 3.10.1
Mammalian Species Detected Within Project Area

Common Name	**Scientific Name**
OLD WORLD RATS AND MICE -MURIDAE	
European House Mouse	*Mus musculus domesticus*
WOLVES, JACKALS & ALLIES - CANIDAE	
Domestic Dog	*Canis f. familiaris*
CIVETS & ALLIES - VIVERRIDAE	
Small Indian Mongoose	*Herpestes a. auropunctatus*
CATS - FELIDAE	
House Cat	*Felis catus*
HORSES, ASSES & ZEBRAS -EQUIDAE	
Domestic Horse	*Equus c. caballus*
Donkey	*Equus a. asinus*
OLD WORLD SWINE - SUIDAE	
Pig	*Sus s. scrofa*
HOLLOW-HORNED RUMINANTS – BOVIDAE	
Domestic Cattle	*Bos taurus*
Domestic Goat	*Capra h. hircus*
Domestic Sheep	*Ovis aries*

Notes: all detected mammals were non-native species.

All of the alien mammal species recorded during this survey are harmful to avian and floristic components of the remaining native ecosystems present on the Island of Hawaiʻi.

The findings of the mammalian survey are consistent with other surveys conducted in South Kohala and North Kona within the recent past. However, a one-time survey cannot provide a total picture of the wildlife utilizing any given area. Certain species will not be detected for one reason or another. Seasonal variations in populations coupled with seasonal usage and availability of resources will cause different usage patterns throughout a year or, in fact, over a number of years. This site, along with most of North Kona and South Kohala, had experienced severe drought conditions over the five years prior to the 2002 survey; opposite rainfall conditions occurred in 2013 and 2014.

3.10.1.2 Birds

A total of 20 bird species representing 13 separate families were recorded during transect counts (***Table 3.10.2***). Two of the 20 species detected, the *nēnē* (*Branta sandvicensis*) and the Hawaiian Stilt (*Himantopus mexicanus knudseni*), or *aʻeo*, are listed as endangered under both the federal and State of Hawaiʻi's endangered species laws (DLNR 1998, Federal Register 2002). One species, the Short-eared Owl (*Asio flammeus sandwichensis*), or *pueo*, is an endemic (i.e., native and unique to Hawaiʻi) sub-species of this near cosmopolitan species. One species, the Pacific-Golden Plover (*Pluvialis fulva*), or *kolea*, is an indigenous (i.e., native to Hawaiʻi, but also found elsewhere naturally) migratory species. The remaining species detected are alien species commonly found throughout the leeward lowland areas on the Island of Hawaiʻi. Avian diversity and densities recorded were extremely low.

The low diversity and density of bird species documented during this survey matches surveys in other fountain grass-dominated lowlands of North Kona and South Kohala, which do not provide the resources needed for the sustenance or nesting of native birds.

Biologists observed two endangered *aʻeo* flying north along the existing Queen Kaʻahumanu Highway, just north of the wastewater treatment plant located south of Waikoloa Beach Road. There are no water bodies or wetlands habitat suitable for this water-obligate species within the project corridors. Two endangered *nēnē* were observed in a pasture approximately 3,300 feet down-slope from Māmalahoa Highway. The *nēnē* were probably attracted by freshly-sprouted grass following winter rains. The largest self-sustaining flock of *nēnē* on the island of Hawaiʻi is concentrated around Puʻuanahulu and the Big Island Country Club, about five miles south of the project corridors. It is quite likely that following major rains, when abundant fresh grass shoots are available, some birds from this flock forage within the general project area.

3.10.1.3 Invertebrates

The invertebrate fauna of the project area, or for that matter of most of the island of Hawaiʻi, has not been studied scientifically or completely described. In general, native invertebrate species are associated with native vegetation. Areas dominated by non-native vegetation are less likely to harbor native invertebrates, and particularly threatened or endangered species. As the vegetation of all project corridors is heavily dominated by aliens, the potential for substantial native invertebrate populations is small, with one important exception, the Blackburn's sphinx moth. The general invertebrate fauna in this dry habitat dominated by non-native species is not likely to be highly diverse and is likely to be overwhelmingly alien. In recent invertebrate studies of similar habitats in West Hawaiʻi (Geometrician Associates 2014a and 2014b), various species of introduced ants, grasshoppers, wasps, bees, beetles, and butterflies were found to be overwhelmingly dominant, with few native species.

Invertebrate surveys conducted in 1996 for the Saddle Road Improvements EIS included investigations of habitats in Keʻāmuku (directly east of the project area) searching for land snails, slugs, insects and other arthropods (FHWA-CFLHD 1999). These habitats are similar in some ways to those found on the Saddle Road Extension, although the Saddle Road habitats are wetter and support a much higher proportion of native plant species. The surveys in Keʻāmuku found no threatened or endangered invertebrate species. Given the much more degraded habitat of the Saddle Road Extension corridors, there would be little likelihood of finding them there. Native arthropods including spiders and insects are also found in cracks, voids and caves. There are even rare and sensitive obligate cave species that are restricted to deep zone habitats – moist, still air passages beyond direct environmental effects of climatic events on the surface. In general, native cave species are associated with native vegetation, and they are far less likely and often absent in heavily degraded environments such as cattle pastures.

Table 3.10.2
Bird Species Detected Within Project Area

Common Name	Scientific Name	ST*	#*
DUCKS, GEESE AND SWANS - ANATIDAE			
Hawaiian Goose (nēnē)	*Branta sandvicensis*	EE	2
PHEASANTS & PARTRIDGES – *PHASIANIDAE*			
Black Francolin	*Francolinus francolinus*	A	7
Grey Francolin	*Francolinus pondicerianus*	A	6
Ring-necked Pheasant	*Phasianus colchicus*	A	2
TURKEYS - MELEAGRIDINAE			
Wild Turkey	*Meleagris gallopavo*	A	6
PLOVERS & LAPWINGS - CHARADRIIDAE			
Pacific Golden-Plover (kolea)	*Pluvialis fulva*	IM, MB	5
STILTS & AVOCETS - RECURVIROSTRIDAE			
Black-necked Stilt (Hawaiian) (aʻeo)	*Himantopus mexicanus knudseni*	EE	2
SANDGROUSE - PTEROCLIDAE			
Chestnut-bellied Sandgrouse	*Pterocles exustus*	A	23
PIGEONS & DOVES - COLUMBIDAE			
Rock Dove	*Columbia livia*	A	6
Zebra Dove	*Geopelia striata*	A	11
TYTONIDAE - BARN OWLS			
Barn Owl	*Tyto alba*	A, MB	1
TYPICAL OWLS - Strigidae			
Short-eared Owl (pueo)	*Asio flammeus sandwichensis*	IR, MB	4
LARKS -ALAUDIDAE			
Skylark	*Alauda arvensis*	A, MB	32
STARLINGS - STURNIDAE			
Common Myna	*Acridotheres tristis*	A	13
EMBERIZIDS - EMBERIZIDAE			
Yellow-billed Cardinal	*Paroaria capitata*	A	5
CARDULINE FINCHES & ALLIES - FRINGILLIDAE			
House Finch	*Haemorhous mexicanus*	A	11
OLD WORLD SPARROWS - PASSERIDAE			
House Sparrow	*Passer d. domesticus*	A	2
WAXBILLS & ALLIES - ESTRILDIDAE			
African Silverbill	*Lonchura cantans*	A	52
Scaly-breasted Munia	*Lonchura orizyvora*	A	13
Java Sparrow	*Padda oryzivora*	A	9

*Notes: ST Status
A Alien Species (introduced to Hawaiʻi by humans)
IM Indigenous (native to Hawaiʻi, but also found elsewhere naturally) Migratory Species
EE Endangered Endemic Species (native, and unique to Hawaiʻi)
IR Indigenous Resident Breeding Species
MB Protected under Migratory Bird Treaty Act
Highest number of individuals recorded between the two surveys

Only one invertebrate species listed or proposed as threatened or endangered is known to occur in the project area, and that is an outcome of its fortuitous adaptation to a highly invasive plant species. Blackburn's sphinx moth (*Manduca blackburnii*) may be present as eggs, pupae or larvae on annual or semi-perennial plants at some sites. This close relative of the tomato hornworm of North America was formerly common on all Hawaiian Islands. Its populations were drastically reduced because of the decline of its principal natural host plant, the native tree *'aiea* (*Nothocestrum* spp.), which is not found in the project area. Blackburn's sphinx moth has since been found to occasionally utilize non-native host plants, particularly *Nicotiana glauca* (tree tobacco). As discussed above in Section 3.9, this plant is presently found in low numbers mainly in the uppermost elevations of the Segment 4/5/6 *mauka*, but it is known to spread wherever there is ground disturbance, as evident after construction of the western portion of the Daniel K. Inouye Highway. Other potential hosts are various other weedy members of the Solanaceae family, including *Nicotiana tabacum* (commercial tobacco), *Solanum melongena* (eggplant), *Lycopersicon esculentum* (tomato), and possibly *Datura stramonium* (Jimson weed), the last two of which are sometimes found wild in the region. According to the USFWS, the full range of the taxa that Blackburn's sphinx moth larvae may feed on is not known.

Critical habitat for the Blackburn's sphinx moth has been designated by the USFWS in several locations in North Kona. None is within or directly adjacent to the project corridors, but one unit is as close as 4.5 miles to the south (refer to ***Fig. 2.3***). The primary constituent elements required by the Blackburn's sphinx moth larvae for foraging, sheltering, maturation, and dispersal are the *Nothocestrum* spp. plants, and the dry and mesic habitats between the elevations of sea level and 5,000 feet, where rainfall is between 10 and 100 inches. The primary constituent elements required by Blackburn's sphinx moth adults for foraging, sheltering, dispersal, breeding, and egg production are native, nectar-supplying plants including, but not limited to, *Ipomoea indica* and other species within the genus *Ipomoea*, *Capparis sandwichiana*, and *Plumbago zeylanica*. None of these plants considered primary constituent elements are present in the project corridors, and therefore no land within the project corridors was included in critical habitat.

3.10.1.4 Threatened and Endangered Species

Background concerning the Endangered Species Act and the relationship between the USFWS and FHWA is contained in Section 3.9.1.3, above, and will not be repeated here.

In its letter of December 16, 2013, the USFWS stated that its databases, including data compiled by the Hawaii Biodiversity and Mapping Program, indicated that the following four listed animal threatened or endangered species have been observed in the vicinity of the proposed project:

1. Endangered Hawaiian goose *(Branta sandvicensis; nēnē)*
2. Endangered Blackburn's sphinx moth *(Manduca blackburni;* BSM*)*
3. Endangered Hawaiian hoary bat *(Lasiurus cinereus semotus)*
4. Endangered Hawaiian hawk *(Buteo solitarius)*

As discussed above, the potential presence of several of these animals was systematically evaluated. In summary, although few *nēnē* were directly observed, it is quite likely that birds from flocks that utilize nearby golf courses forage within the general project area after rains, when tender grass shoots are available. Blackburn's sphinx moth is likely to be sparingly present, particularly on the eastern terminus of the project corridors, based on the abundance of tree tobacco at the intersection of the Daniel K. Inouye Highway and Mamālahoa Highway. Hawaiian hoary bats were not detected during the survey, and the area lacks good foraging or roosting habitat, but they are likely to overfly the project site at least occasionally, as they have been seen in nearby areas. The Hawaiian Hawk is unlikely to be present because of the lack of forest cover in or near the project corridors. No Hawaiian Hawks were observed in any of the surveys conducted or consulted for this EIS.

In addition to the species mentioned in the USFWS letter, surveys noted the nearby presence of endangered Hawaiian Stilts (*Himantopus mexicanus knudseni*) flying outside the corridor along Queen Kaʻahumanu Highway near the wastewater treatment plant. As there are no water bodies or wetlands habitat suitable for this water-obligate species within the project corridors, this waterbird would be unlikely to use habitat in the project corridors.

Although undetected during this survey, some endangered Hawaiian Petrels (*Pterodroma sandwichensis* or ʻ*ua*ʻ*u*) and Band-rumped Storm-Petrels (*Oceanodroma castro*), as well as threatened Newell's Shearwaters (*Puffinus auricularis newelli*), may overfly area between the months of June and October. All three of these pelagic seabird species nest high in the mountains in burrows. There is no suitable nesting habitat for any of these seabird species within or near any of the project corridors.

No animal critical habitat is located within or near any of the project corridors.

3.10.1.5 Migratory Bird Treaty Act and Fish and Wildlife Coordination Act

In addition to the Endangered Species Act, the Migratory Bird Treaty Act (MBTA) and Migratory Bird Conservation Act (16 USC 701-715), and the Fish and Wildlife Coordination Act (FWCA), as amended (16 USC 661 et seq.) provide protection for certain classes of organisms. The FHWA is in active consultation with the U.S. Fish and Wildlife Service related to these laws.

The MBTA provides federal protection to all migratory birds, as well as their nests and eggs. Two native bird species (Pacific Golden-Plover or *Pluvialis fulva* and Short-eared Owl or *Asio flammeus sandwichensis*) and two non-native species (Barn Owl or *Tyto alba* and Eurasian Skylark or *Alauda arvensis*) protected under the MBTA were observed during the field surveys. The human noise and activity that would result from construction may temporarily displace some of these birds, but long-term impacts are not expected. These migratory birds are expected to find abundant foraging habitat in nearby areas. The temporary displacement of these individuals at the site is not expected to affect an individual's survival or overall species' abundance. Impacts would be temporary and minor; therefore, the proposed project would not adversely affect birds protected under the MBTA.

The FWCA requires consultation with the U.S. Fish and Wildlife Service (USFWS) and fish and wildlife agencies of the States when the “waters of any stream or other body of water are proposed or authorized, permitted or licensed to be impounded, diverted . . . or otherwise controlled or modified” by any agency under a federal permit or license. Consultation is to be undertaken for the purpose of “preventing loss of and damage to wildlife resources.” No streams or other waters would be impounded or diverted and there would be no effect upon aquatic organisms or habitat.

3.10.2 Environmental Consequences

Non-Threatened and Endangered Animal Species and Habitat

Animal habitat would be affected in both permanent and temporary ways by the Project. These effects are generally not highly adverse because the habitat consists primarily on non-native vegetation that supports mostly common, widespread and non-native animals.

During construction, habitat adjacent to the construction corridor would be affected by noise and emissions from construction equipment, which would drive away mammals, birds and some invertebrates. As there is abundant nearby identical habitat, effects to the health or behavior of these animals would be negligible.

Permanent impacts would occur because of the permanent habitat loss associated with the replacement of vegetation with the highway and associated infrastructure, as well as ongoing noise. In general, this would affect primarily non-native species with little conservation value.

Impacts and mitigation measures related to habitat change derived from alien species invasion and wildfire are considered in the context of vegetation and plant habitat in Section 3.9.3 above.

Native birds that are known to utilize this habitat include the *pueo*, *nēnē* and *kolea*. As shown in ***Table 3.10.1***, above, the survey of the project corridors detected relatively low densities of these birds, which is typical of this habitat. Only the *pueo* utilizes the alien, rocky grassland vegetation here as part of its primary habitat, while *kolea* is most prevalent near the coast and *nēnē* are just occasional visitors. The loss of several hundred acres to highway uses in the context of over 50,000 acres of similar habitat in West Hawai‘i would be a negligible concern. Collisions with vehicles on highways can lead to bird deaths, and observations by the field biologists indicate that non-native birds as well as the native *pueo* and *kolea* are occasionally struck on the area’s highways. On rare occasions, *nēnē* are also killed or injured. Because they are an endangered species, this impact is discussed below.

Aside from the Hawaiian hoary bat, discussed below, all mammals in the area are non-native. No important habitat disruption would occur, but the placement of a highway in an area that was previously rocky grassland poses increased risks of vehicular collisions with goats and pigs. This is primarily a safety rather than a conservation issue.

There would be little loss of invertebrate individuals and habitat since the Project would occur within and remove almost exclusively alien vegetation, where native invertebrates are generally scarce, and if present, usually belong to very common native species. It is considered highly unlikely that the Project would seriously threaten the existence of a single species or an entire population because this action, by itself, would not eliminate or even substantially reduce the extent of any native plant community type.

Threatened and Endangered Animal Species

FHWA is currently consulting with the USFWS for this project. The relevant effect findings that FHWA believes may be applicable for ESA-listed species that are present in the project corridors and associated areas include the following:

- No effect: A determination of no effect means there are absolutely no effects to the species and its critical habitat, either positive or negative. It does not include small effects or effects that are unlikely to occur.
- May affect, is not likely to adversely affect: Under this effect determination, all effects to the species and its critical habitat are beneficial, insignificant, or discountable.
- May affect, is likely to adversely affect: This effect determination means that the proposed action will have an adverse effect on the species or its critical habitat. A combination of beneficial and adverse effects is still considered "likely to adversely affect," even if the net effect is neutral or positive. The effect on the species and/or critical habitat must be extremely small to qualify as a discountable effect. Likewise, an effect that can be detected in any way or that can be meaningfully articulated in a discussion of the results of the analysis is not discountable; it is an adverse effect.

The main impact that construction and operation of a highway poses to Hawaiian hoary bats is during the clearing and grubbing stages of construction. During the pupping season, females carrying their pups may be less able to rapidly vacate a roost site as a tree is being felled. Additionally, adult female bats sometimes leave their pups in the roost tree when they forage, and very small pups may be unable to flee a tree that is being felled. Adverse impacts from such disturbance can be avoided or minimized by refraining from clearing woody vegetation taller than 15 feet high between June 1 and September 15 (the bat pupping season). As there are almost no suitable roosting trees within the project area, the construction of the highway is unlikely to result in harmful impacts to Hawaiian hoary bats and is therefore insignificant and discountable. Nevertheless, the measures discussed in Section 3.10.3 are necessary to avoid or minimize impacts.

Although not detected during the bird surveys and lacking nearby habitat, the threatened or endangered seabirds Hawaiian Petrel, Newell's Shearwater, and Band-rumped Storm-Petrel may seasonally overfly the area on their way between higher elevation areas and the sea. The principal impacts that construction and operation of any highway pose to these seabirds are related to lighting. Exterior lighting during the seabird fledgling season (which typically runs from the beginning of September through the middle of December) can disorient the birds and cause them to collide into structures and become downed, injuring or killing them. These impacts could occur both during construction, if there are nighttime construction activities, and following build-out, as a result of the operation of streetlights or other outdoor lighting during the seabird fledging season. No nighttime construction is currently proposed during the construction phase of the Project. Therefore, there will likely be no construction related light issues for to fledging seabirds. Project plans call for installing streetlights at all major intersections along the project corridor, i.e., at Queen Kaʻahumanu Highway, Māmalahoa Highway, and potentially Waikoloa Road, depending on the alternative selected. The measures discussed in Section 3.10.3 are necessary to avoid or minimize impacts.

The principal potential impacts of the highway to *nēnē* are associated first with the clearing, grubbing and construction phases of the Project, as vegetation that may contain nests is removed. Construction activity has the potential to directly harm *nēnē* or disturb them such that they abandon their nests, eggs or chicks. Later, during highway operation, *nēnē* may be attracted to the shoulders of the new highway and be hit by vehicles, as has occurred on several highways in the Hawaiian Islands (David 2014). *Nēnē,* like other gallinaceous birds, are attracted to grit and small rocks and seeds that may accumulate on roadway shoulders, putting them at risk of being struck by vehicular traffic. The measures discussed in Section 3.10.3 are necessary to avoid or minimize impacts.

The endangered Blackburn's sphinx moth could be harmed by construction and maintenance of a highway if the host plants used in its larval and pupae stages, or the ground immediately surrounding them, are disturbed. In the context of the Project alternatives, the only host plant is likely to be tree tobacco, which is currently present in only very limited locations. However, after construction this invasive weed has the potential to become ubiquitous on the highway margins, as it has on the Daniel K. Inouye Highway. This has posed a maintenance dilemma for highway agencies charged with the joint mandate of ensuring safety and protecting endangered species. For most of its larval stage, which is a large caterpillar similar in appearance to its close relative the tomato hornworm, it is highly visible feeding on plants and identifiable by personnel with training. At the end of this stage, however, the larvae descend from their host plants and search for suitable soil before pupating underground. They are most likely to pupate within 10 meters of the larval host plant, although they may transit farther over paved and hardened surfaces to find a suitable site to enter the ground. They may therefore be difficult or impossible to detect during much of the time they are near a host plant. The measures discussed in Section 3.10.3 are necessary to avoid or minimize impacts.

Differences in Impacts Between Alternatives 4, 5 and 6 and Intersection Design Options

Very few differences exist between the alternatives with respect to impacts to animals, animal habitat, or threatened or endangered animals. A minor difference exists related to the number of intersections with streetlights, which constitute a very minor potential threat to passing endangered seabirds through risk of attraction and collision. Alternative 4 would have only two such intersections, while Alternatives 5 and 6 would have three.

Impacts of the No Action Alternative

The No Action Alternative would not affect animals, animal habitat, or threatened or endangered animals.

3.10.3 Mitigation Measures

Implementation of the proposed action would include a variety of avoidance, minimization, and/or mitigation measures to reduce or eliminate Project-related impacts. These measures have been developed in consideration of the December 16, 2013 letter from the USFWS and additional meetings between FHWA and USFWS on the subject since that time.

General

1. Construction will be preceded by implementation of an Endangered Species Awareness Training program. This training will be given to all construction workers and managers working on highway construction. In the training module, construction crews will become familiar with the appearance, general habits and behavior of the listed species they may encounter. Training will also cover specific restrictions that workers must follow when encountering any of these species to ensure that their activities do not result in harmful impacts to the listed species. It will detail emergency response protocols and reporting procedures that will be followed in the event of an injury or death of a listed species.

Hawaiian Hoary Bat

2. Any fences that may be erected or replaced as part of the Project will have barbless wire to prevent entanglements of Hawaiian hoary bats on barbed wire.
3. Very few tall trees or shrubs are present in the project corridors. However, no trees or shrubs taller than 15 feet will be trimmed or removed as a part of the Project between June 1 and September 15, when juvenile bats that are not yet capable of flying may be roosting in the trees.

Nēnē

4. The listed species that construction workers are most likely to encounter during highway construction is the Hawaiian Goose or *nēnē*, which may be drawn to the activity, water, and possibly human food and garbage. The Endangered Species Awareness training module will focus especially on this species. Specific restrictions that will be followed during the construction phase of the Project include:
   A. No pets on the construction site;
   B. Police all human food scraps, soda cans and any other food stuffs into covered garbage containers to reduce predators being attracted to the area and *nēnē* eating human food;
   C. Do not feed or pet *nēnē* or any other wild animals; and
   D. Report all *nēnē* seen immediately to a supervisor.
5. If a nesting pair of *nēnē* are encountered, work shall stop within 100 feet of the birds or nest and will not resume until consultation with the USFWS and/or DOFAW has been concluded and all conditions imposed by the regulatory agencies have been fulfilled.
6. If temporary irrigation is utilized, irrigation must be removed 90 days prior to the opening of the highway to deter foraging in revegetated areas.

7. After the highway is in operation, HDOT personnel will monitor the route. It is conceivable that *nēnē* may be attracted to the roadside somewhere along the route. *Nēnē* may be seen browsing, or crossing the road in a specific area repeatedly. If this activity persists, additional roadside fencing will be erected to discourage birds from occupying the highway margins and being at risk from vehicles.

Threatened and Endangered Seabirds

8. Construction activity will be restricted to daylight hours during the peak fallout period for Hawaiian Petrels, Newell's Shearwaters and Band-rumped Storm-Petrels (September 15–December 15) to avoid the use of nighttime lighting that could attract seabirds. Dark sky procedures will be used outside the peak fallout period in the unlikely event that night work is required.
9. All streetlights installed as part of this project will be full cut-off, down-pointed fixtures adhering to the "Dark Skies Initiative". This minimization measure is credited with reducing the potential for collisions of nocturnally flying Hawaiian Petrels and Newell's Shearwaters with external lights and man-made structures (Telfer et al. 1987). This minimization measure would minimize the threat of disorientation and downing of seabirds and also fully comply with the Hawai'i County Code § 14-50 et seq., which requires the shielding of exterior lights in order to lower the ambient glare for the astronomical observatories located on Mauna Kea.

Blackburn's Sphinx Moth (BSM)

10. The FHWA shall minimize the potential for harassment, harm, or mortality of BSM within the action area. This minimization will be achieved by taking all reasonable measures to constrain disturbance of BSM to the minimum needed to accomplish the proposed action.
11. To ensure that clearing and grubbing activities do not result in harm to Blackburn's sphinx moth, the project corridor for the Selected Alternative will be inspected for tree tobacco by a qualified biologist prior to the onset of construction, at a time approved by the USFWS. The current general guidelines are that searches should be conducted between 30 and 45 days after the start of heavy spring rains. Any tree tobacco plants found will be searched for eggs, larvae and adult moths. If found, trees will be flagged and a 33-foot radius buffer will be established around the tree.
12. Mitigation will follow the USFWS-approved protocols that are in place at that time. Currently, these protocols call for larvae and eggs to be translocated to an area designated by the USFWS and DOFAW. After the moth is translocated, the plant is cut to a few inches above ground and herbicide is applied to the stump, in order to ensure that it will not be utilized again prior to highway construction (a very large number of alternate tree tobacco host plants are present in surrounding areas). Areas cleared of BSM eggs and larvae will be managed by cutting and/or herbicide treatments to ensure that no tree tobacco plants taller than three feet are on the site for the duration of construction activities.
13. Disturbed areas will be revegetated as soon as possible to avoid re-infestation of tree tobacco to ensure adverse effects to BSM eggs and larvae are avoided.

14. After construction, the right-of-way will be regularly inspected and infestations of weeds removed through mechanical or suitable herbicide methods. Tree tobacco will be removed before it reaches three feet in height to avoid use by the BSM.

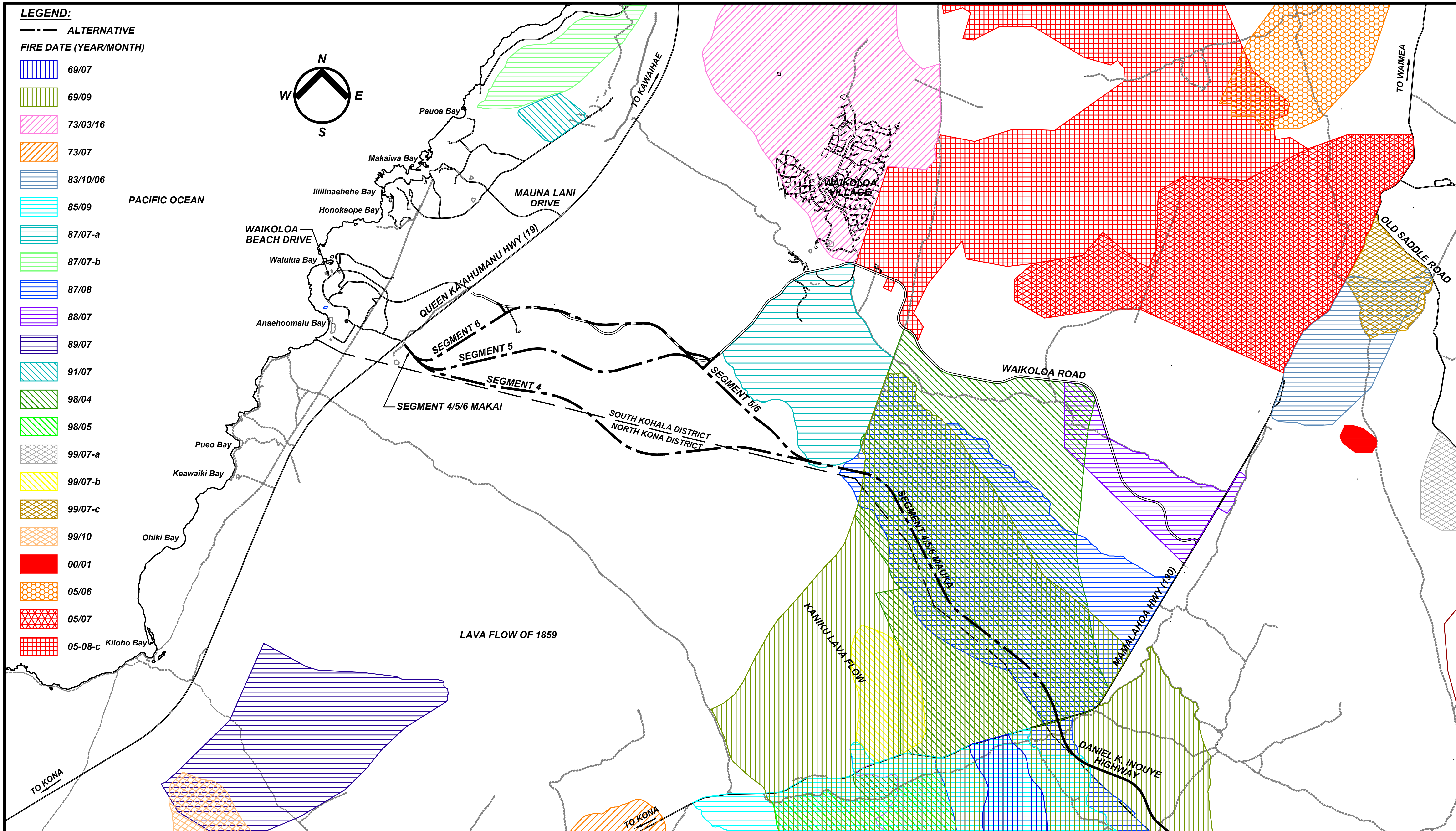
Per request of the USFWS, Section 7 consultation will conclude once the alternative has been selected. Given these avoidance and minimization measures, FHWA-CFLD expects that the results of consultation with the USFWS will determine that, regardless of the alternative selected, the Project may affect, is not likely to adversely affect, listed faunal species.

3.11 WILDFIRE HAZARD

3.11.1 Affected Environment

Wildfire can be a severe threat to communities on the urban-wildland interface. They can injure or kill people and wildlife, damage property, erode soil, degrade water and air quality, and mar the scenic resources that sustain tourism. Perhaps most important for Hawaiʻi is the grave threat wildfire imposes on native ecosystems. Wildfire tends to convert native habitats into grasslands or shrublands dominated by non-native species (Cuddihy and Stone 1990). Fires in Hawaiʻi are usually caused by human activity. Unlike many other areas in the world, the majority of dryland native Hawaiian plants are not adapted to wildfires, and they generally perish when exposed to fire. Native shrubs and trees may recover from fire to some degree, but native plant communities are often overwhelmed by more aggressive alien species after fires. Conversely, many non-native species are pyrophytic (adapted to fire) and thrive in the aftermath of wildfires. Unlike native shrubs and trees, many alien grasses recover quickly, increasing in ground cover and biomass after a fire. Fires encourage non-native grass by stimulating growth from the base of clumps and encouraging seed production. The establishment of pyrophytic grasses increases the threat of additional fires. The cycle of fire and invasive species proliferation has been the primary cause for the degradation and even disappearance of two-thirds of the dry forests of the Big Island (HWMO 2007).

All dry parts of northwest Hawaiʻi, from Hawi in the north to Kealakehe in the south, and extending into the uplands at least to the tree line, are subject to periodic, extensive wildfires. Therefore, the region of influence for wildfire is centered around the project corridors but extends into all of this fire-prone region. Fires here have been ignited by construction activities, cigarettes thrown from car windows, hot catalytic converters of vehicles pulling off of the pavement, and arsonists. Maps of wildfires from 1954-2005 compiled by the Hawaiʻi Wildfire Management Organization (HWMO) (***Figure 3.11.1***.) show that most of the non-bare lava surface between Waimea and Puʻuwaʻawaʻa has burned, much of it multiple times (HWMO 2007). Puʻuanahulu was "ground zero" for many of the fires, which also affected the southern portion of Waikoloa, the project area for the proposed Saddle Road Extension. Since 2002, several other fires have burned parts of Puʻuanahulu, Waikoloa and Puakō. In August 2005, one of the largest fires ever recorded on the Island of Hawaiʻi burned 25,000 acres of grassland around Waikoloa Village (Federal Emergency Management Agency: https://www.fema.gov/media-library-data/1407256815321-eeff22bf021813225aecacb864a3b13d/HMGP_12-J-005_EnvironmentalAssessment_FINAL_07%2024%202014.pdf Accessed January 2017).



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SADDLE ROAD EXTENSION

FIGURE 3.11.1 ~ FIRE HISTORY MAP AND FIRE INCIDENTS MAP

Source: WEST HAWAII WILDFIRE MANAGEMENT ORGANIZATION

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Within the area traversed by the project corridors, there have been fires at nearly all combinations of elevations and lava flows. In general, however, fires are infrequent at elevations below 1,200 feet and on lava flows younger than 3,000 years. On lands above this elevation with older lava substrates, wildfires may repeat at intervals of ten years or less. According to the fire history map, few fires have been recorded in the pastures north of Waikoloa Road and *mauka* of Māmalahoa Highway, between 2,500 and 3,500 feet in elevation. Intensive cattle grazing here by Parker Ranch may have reduced the fuel load and susceptibility to wildfire. Four large, overlapping wildfires are recorded within the project area from Māmalahoa Highway down to the elevation of Pu‘u Hinai (about 1,200 feet) in 1969, 1987 and 1998 and 2007.

The greatest direct concern for these fires is effects on lives and property within towns and villages, but wildfires may also devastate native habitat. Although much of the project area consists of pastures with low native species habitat value, wildfires here may spread onto the southwest slope of Mauna Kea. The intact *māmane/naio* forest on the southwest slopes of Mauna Kea is the last refuge of the critically endangered *Palila* (*Loxoides bailleui*), the lone surviving finch-billed honeycreeper found in the main Hawaiian Islands. These birds are currently restricted to the upper elevation slopes of Mauna Kea above 6,000 feet, with over 95 percent of the population restricted to the southwest slope. *Palila* have evolved an extremely specialized diet dependent on *māmane* trees and associated invertebrates for its survival. Dangerous wildfires have affected the southern part of Mauna Kea as recently as 2003, when a large fire burned in the Ka‘ohe Game Management Area, and October 2011, when 1,200 acres burned east of Mauna Kea State Park and Saddle Road had to be closed. Fires from lower elevations may also spread into the saddle between Mauna Kea and Mauna Loa, including the area above Pu‘uanahulu in Pōhakuloa Training Area, where there is one of the Big Island’s greatest concentration of endangered plants.

Responsibility for fighting wildfires rests with the Hawai‘i DLNR and the Hawai‘i Fire Department (HFD). The HFD has stations near the project area in Waimea, Waikoloa and on Queen Ka‘ahumanu Highway south of Mauna Lani Drive. DLNR has offices in Hilo and Waimea. A firefighting unit from the U.S. Army’s Pōhakuloa Training Area is responsible within the military base but also assists on fires that affect adjacent State and private lands.

In addition to fighting wildfires after they ignite, County, State and federal agencies have worked with non-profits such as the Hawai‘i Wildfire Management Organization and local communities to prevent or manage wildfire. Significant wildfire mitigation has been undertaken by the Hawai‘i DLNR at Pu‘uwa‘awa‘a and Pu‘uanahulu. Strategies include substitution of fire-resistant for fire prone vegetation around homes, fuel breaks and firebreaks, alternate emergency road egresses, and new sources of firefighting including fire dip tanks for helicopters. One of the goals of the Hawai‘i County Multi-Hazard Mitigation Plan was establishing Firewise Community Development Workshops for Firewise Communities. The Waikoloa Firewise Committee began developing a wildfire risk reduction plan in 2003 focused on protecting Waikoloa Village. The firebreak built by this group in July 2005 as a volunteer effort was instrumental in saving the community during the August 2005 wildfire.

The Hawai‘i Wildfire Management Organization is working with the Federal Emergency Management Agency (FEMA) to acquire funds to construct a series of 6,700-gallon fire dip tanks for several locations around West Hawai‘i, including the project area. Strategically located dip tanks allow firefighting helicopters the ability to fight fires in inaccessible locations on a short turnaround.

Finally, the U.S. Army has developed and progressed on implementation of various actions called for in the *Integrated Wildland Fire Management Plan*, *Oahu and Pōhakuloa Training Areas* (IWFMP) (U.S. Army 2003). The Army recognizes that wildfire poses a significant threat to the sensitive ecosystems, cultural sites, and training lands of the U.S. Army, Hawai‘i, and that the munitions and weapons systems that are necessary for effective training often increase the chance of wildfire ignition. The actions outlined in the IWFMP are intended to minimize the occurrence and size of training-related fires within PTA, including the Ke‘āmuku Maneuver Area, which is directly east of the Saddle Road Extension project area. They are also intended to prevent such fires from escaping beyond the PTA boundary, and to ensure that fires do not move onto the installation from outside and threaten operations and resources at PTA. These measures include fire suppression, resource staffing procedures, training restrictions based on calculated fire danger rating, installation and maintenance of dip sites, fuel modifications, and weather stations.

3.11.2 Environmental Consequences

Any new highway between Māmalahoa Highway and Queen Ka‘ahumanu Highway near the southern border of South Kohala will extend through fire prone areas in the grasslands found on the *mauka* third to half of such a route (refer to ***Fig. 3.11.1***). Both the Hawai‘i Wildfire Management Organization fire history map and the activity during the August 2005 Waikoloa wildfire show that in this area, highways sometimes act as barriers to fire movement, while at other times fires cross highways. The wildfire starting point map indicates a strong correlation with roads, which would be expected in area such as Hawai‘i with limited sources of natural ignition (http://hawaiiwildfire.org/hwmo-products.html; accessed March 2017).

The Saddle Road Extension would have the adverse effect of being a new source of ignition for regional wildfires, as occurred on the realigned Saddle Road in the arsonist-lit wildfires on Saddle Road in 2011 and the Daniel K. Inouye Highway in 2015. However, the proposed new highway’s wide cross section would also serve as a critical firebreak between the private, grazed lands of Waikoloa and the State lands of Pu‘uanahulu to the south. Furthermore, it would provide a new route for emergency evacuation, allow faster times for emergency fire response within and through the region, and offer a staging area for fire operations. The Daniel K. Inouye Highway has served this invaluable purpose several times since its opening in September 2013. DLNR was able to combat wildfire from an operations site on the highway, but traffic could still cross the island using the Old Saddle Road. A similar relationship would occur with the Saddle Road Extension and Waikoloa Road.

In addition to operational issues, construction equipment used during grading and paving as well as careless construction workers can cause fires. Construction fires can largely be controlled by proper management.

Differences in Impacts Between Alternatives 4, 5 and 6 and Intersection Design Options

There is only a slight difference in impacts between the alternatives. The most wildfire-prone section of all project corridors is the *mauka* third, where they all share a common alignment. At the point where the alignments diverge, they are within lightly vegetated or bare lava with little to no wildfire potential. Alternatives 5 and 6 head north into more vegetated and fire-prone territory, but also offer a more direct connection to Waikoloa Village and its fire station, which is located three miles *mauka* of the connection point between Waikoloa Road and the Saddle Road Extension. No differences with respect to wildfire exist between the design options.

Impacts of the No Action Alternative

Under the No Action Alternative, there would be no additional highway source of ignition in the upper area of Waikoloa Road *makai* of Māmalahoa Highway. Conversely, there would be no firebreak between Waikoloa and Puʻuanahulu, and no redundant route to provide emergency evacuation, emergency responder access, and firefighting staging.

3.11.3 Mitigation Measures

1. Engineering design measures being incorporated into the Project's Typical Roadway Section (see ***Figure 2.5***) will minimize the unintended fire ignition risk posed by vehicular traffic and improve the highway's function as a firebreak and fuel break. These design elements will provide between a 40 and 52-foot wide paved wildfire fuel break and firebreak. Specific design and construction features that will accomplish these goals are:
   A. Two paved 12-foot travel lanes
   B. A third paved climbing lane in the uphill direction
   C. Two paved 8-foot paved shoulders
   D. Graded clear zones of varying width outside the shoulders
   E. Installation of high fire risk signs along the highway
2. Where existing fenced cattle pastures are present, the Project will include constructing fences along the right-of-way of the highway for access control and cattle control, with HDOT being responsible to maintain the fence. This will also prevent vehicles from accessing grassy or brushy areas and causing fires.
3. In addition, to minimize the risk of wildfire during construction, the Special Contract Requirements will include but not be limited to the following specific requirements and prohibitions:
   A. The contractor will develop a wildfire prevention and response plan that will be approved by FHWA and HDOT prior to the initiation of any construction.
   B. All construction activity shall be restricted to within the clearly delineated ROW and that entry and exit into the ROW by all construction personnel and equipment shall be at previously identified and marked non-sensitive areas. The area beyond the construction limits will not be disturbed. Trees, shrubs or vegetated areas temporarily damaged by construction operations will be re-vegetated.

C. All construction equipment will be restricted to within the clearly defined ROW, and/or within previously identified and biologically cleared equipment and materials staging areas. Clearing and grubbing will be held to a minimum.
D. All construction vehicles will be required to carry fire extinguishers at all times.
E. No smoking will only be allowed by any personnel on the construction site.
F. No cooking with open fires, barbecues, hibachis, etc., will be permitted with the construction site.
G. During the course of construction of the road, the contractor will be required to ensure that quarterly weed surveys are conducted within all areas that have been disturbed. Weed clusters that pose a fire risk within the project limits, especially fountain and buffel grass, will be treated with herbicide and/or physically removed to reduce the risk that construction activity could ignite a wildfire.

4. Following build-out of the highway, annual field surveys will be conducted to ensure that fuel loads are not building up to a dangerous level. If fuel loads are found to be large, the potential threat will be controlled by mowing, herbicide and/or physical removal to reduce the threat of unintentional ignition of a wildfire.

These wildfire mitigation measures are also listed above in the context of botanical resources (CROSS REFERENCE Section 3.9.3).

3.12 WILD AND SCENIC RIVERS

The Wild and Scenic Rivers Act, 15 U.S.C. 1271-1287, makes it the national policy that certain rivers of the U.S which, along with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in free-flowing condition. There are no designated Wild and Scenic Rivers in the State of Hawaiʻi at this time. Consequently, construction and operation of any Build Alternative of the Saddle Road Extension would not lead to any impacts to Wild and Scenic Rivers.

3.13 COASTAL BARRIERS RESOURCE ACT AND COASTAL ZONE MANAGEMENT ACT

The Coastal Barrier Resources Act, 16 U.S.C. 3501, designated various undeveloped coastal barrier islands, depicted by specific maps, for inclusion in the Coastal Barrier Resources System. No coastal barriers are present in the State of Hawaiʻi, and construction and operation of any Build Alternative of the Saddle Road Extension would not affect any resources protected by the Coastal Barriers Resource Act.

3.13.1 Affected Environment

The Coastal Zone Management Act (CZMA) (U.S.C. Sections 3501 et seq., as amended in 1990 under the Coastal Zone Act Reauthorization Amendments), administered by the National Oceanic and Atmospheric Administration's Office of Ocean and Coastal Resource Management, provides for management of the nation's coastal resources and balances economic development with environmental conservation. The purpose of the Coastal Zone Act Reauthorization Amendments (CZARA) of 1990 is to improve the management of the coastal zone and enhance environmental protection of coastal zone resources. The overall program objectives of CZMA remain balanced to "preserve, protect, develop, and where possible, to restore or enhance the resources of the nation's coastal zone."

Section 307 of the CZMA requires federal agency activities and development projects affecting any coastal use or resource to be undertaken in a manner consistent to the maximum extent practicable with the state's Coastal Zone Management (CZM) program. Also, activities requiring a federal permit or license, and activities conducted with federal financial assistance, that affect coastal uses and resources must be conducted in a manner consistent with the state's CZM program. The CZMA federal consistency provision ensures that federal agencies cannot act without regard for, or in conflict with, state policies that have been officially incorporated into a state's CZM program. Federal actions affecting any coastal use or resource must be reviewed by the state CZM program to ensure that proposed activities are consistent with state enforceable policies.

Section 6217 of CZARA seeks to address non-point source pollution (NPS) problems in coastal waters by implementing the Coastal Nonpoint Pollution Control Program (CNPCP). The CNPCP is a statewide coastal zone program that establishes and oversees a set of management measures to prevent and reduce NPS pollution from six sources: forestry, agriculture, urban areas, marinas, hydromodifications, and wetlands and riparian areas. The CNPCP also includes a monitoring and tracking condition to ensure that the management measures are being implemented. This program is administered jointly by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) (Hawaiʻi State DOH-CWB 2014).

The Hawai'i Coastal Zone Management (CZM) Program was established in 1977 through the adoption of the Coastal Zone Management Act, incorporated in Chapter 205A HRS. The CZM area encompasses the entire state of Hawaiʻi, including all marine waters seaward, to the extent of the State's police power and management authority, including the 12-mile U.S. territorial sea and all archipelagic waters. As a result, the Project is within the CZM area and is subject to consistency with the objectives and policies of the Hawaiʻi CZM Program. The CZM Federal Consistency Certification is reviewed by the State Office of Planning. Under the CZM program, federal projects must conform with objectives and policies related to ten areas: recreation resources, historic resources, scenic and open space resources, coastal ecosystems, economic uses, coastal hazards, managing development, public participation, beach protection and marine resources. The CZM objectives are outlined as follows.

- <u>Recreational Resources</u>. Provide coastal recreational opportunities accessible to the public.

- Historic Resources. Protect, preserve, and, where desirable, restore those natural, man-made historic, and pre-historic resources in the CZM area that are significant in Hawaiian and American history and culture.
- Scenic and Open Space Resources. Protect, preserve, and, where desirable, restore or improve the quality of coastal scenic and open space resources.
- Coastal Ecosystems. Protect valuable coastal ecosystems from disruption and minimize adverse impacts on all coastal ecosystems.
- Economic Use. Provide public or private facilities and improvements important to the State's economy in suitable locations.
- Coastal Hazards. Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, and subsidence.
- Managing Development. Improve the development review process, communication, and public participation in the management of coastal resources and hazards.
- Public Participation. Stimulate public awareness, education, and participation in coastal management, and maintain a public advisory body to identify coastal management problems and provide policy advice and assistance to the CZM program.
- Beach Protection. Protect beaches for public use and recreation; locate new structures inland from the shoreline setback to conserve open space and minimize loss of improvements due to erosion.
- Marine Resources: Implement the state's ocean resources management plan.

Chapter 205A also established the *Special Management Area* (SMA), which is a zone of particular concern that requires a higher level of management to ensure the coastal resources are appropriately protected and managed. Accordingly, any development proposed within the SMA requires the approval of a minor or major use permit, dependent on the cost and impact of the proposed activity. No portion of the project corridors is within the SMA, which does not include any areas of the island of Hawai‘i farther than one mile from the coast.

3.13.2 Environmental Consequences

All federal projects require a determination to ensure that the proposed project is consistent with the objectives and policies of the CZM Program. As part of the review of the Draft EIS, the FHWA has submitted a CZM assessment form to the Hawai‘i CZM Program. After review of the CZM assessment form and the Draft EIS, the agency will make a determination of consistency of the proposed project with the objectives and policies of the CZM Program. Because the entire project area is outside of the established SMA, no review under the SMA Use Permit provisions is required for the Project. The FHWA believes that the Project is consistent with the CZM objectives and policies, based on the following relationships to the individual criteria:

- Recreational Resources. The proposed Saddle Road Extension would not directly impact existing or potential future coastal recreational opportunities accessible to the public, but would indirectly improve accessibility of these opportunities through a safer and more efficient cross-island route.
- Historic Resources. Depending on the alterative selected, up to 20 archaeological sites from the pre-Western Contact and Historic eras would be present in the area of highway

construction. An adverse effect would result, but the effect can be mitigated through data recovery (CROSS REFERENCE Section 3.14).

- Scenic and Open Space Resources. The proposed highway would affect the visual character and visual quality of the landscape, but this would occur almost exclusively in fenced-off pastures and areas where there are currently no viewers. With the Project, drivers would enjoy new vistas of scenic pastures, lava flows, mountains and coastal areas that are currently not possible to view.
- Coastal Ecosystems. No direct or indirect impacts to coastal ecosystems would be anticipated with the proposed project.
- Economic Use. The proposed Saddle Road Extension would result in a notable, positive economic benefit to the island in employment and income, tourism, time-savings for cross-island travel, and safety (CROSS REFERENCE Section 3.3).
- Coastal Hazards. During natural disasters (tsunami, storm waves, stream flooding, lava flows, erosion, and subsidence), key coastal roads on the island may be heavily traveled. The addition of the Saddle Road Extension to the highway network would provide a safe and efficient alternative route or connection that could assist in evacuation efforts.
- Public Participation. The proposed highway is not inconsistent with the objective of stimulating public awareness, education, and participation in coastal management.
- Beach Protection. No beaches are present or would be affected by the proposed project.
- Marine Resources. The improved highway would not affect marine resources in any adverse way, would not adversely affect implementation of the State's ocean resources management plan, and is not inconsistent with this objective.

Differences in Impacts Between Alternatives 4, 5 and 6 and Intersection Design Options

There are no differences between the alternatives with respect to effects to coastal zone resources.

Impacts of the No Action Alternative

No coastal zone resources would be affected by the No Action Alternatives.

3.13.3 Mitigation Measures

The key mitigation measures related to the objectives and policies of the CZM program are listed in several sections of this SEIS: Section 3.8 relating to water quality and floodplains, Sections 3.9 and 3.10 relating to biological resources and threatened and endangered species; Sections 3.14 and 3.15 relating to archaeological, historic, and traditional cultural properties; and Section 3.17 relating to visual resources.

3.14 ARCHAEOLOGICAL AND HISTORIC RESOURCES

An archaeological inventory survey (AIS) of the project area was conducted that involved documentary research, field studies and consultation with Native Hawaiian Organizations (NHOs) as well as native Hawaiian individuals and others highly familiar with the history of the area. The AIS report is found in full in ***Appendix E1*** and is summarized below. The report included substantial cultural and historic information that along with consultation provides the basis for a cultural impact assessment contained in Section 3.15. In the interest of readability, most references have been removed – readers may find the fully referenced discussion in ***Appendix E1***. ***Appendix E2*** contains correspondence as well as meeting agendas and notes related to consultation under Section 106 of the National Historic Preservation Act (NHPA).

3.14.1 Affected Environment for Archaeological and Historic Resources

3.14.1.1 Pre-Western Contact Background

Physical Environment and Early Settlement

The Saddle Road Extension project area lies primarily within Waikoloa Ahupuaʻa, South Kohala District, with a small segment of the project area in Puʻuanahulu Ahupuaʻa, North Kona District (refer to ***Fig. 1.1*** and ***Fig. 3.1.1***). This situates the project area in the lower and upper *pili* zones, well southwest and east of the major areas of agricultural production and habitation during the pre-Western Contact era. The *pili* zone is named for the *pili* grass (*Heteropogon contortus*) that once grew abundantly in the region and was used for traditional thatching. The lower *pili* region is arid, with bare lava and scattered low grasses and herbs. In modern times, the vegetation has converted to almost entirely non-native species, especially fountain grass (CROSS REFERENCE Section 3.9).

The earliest documented settlements nearest the project area lands were established along the coast of South Kohala at Kalāhuipuaʻa and ʻAnaehoʻomalu, *makai* of the project area, and at inland sites in the near present day Waimea, about 15 miles to the north. Archaeological evidence suggests that settlement was underway between A.D. 900 and 1100. The early coastal settlements were located on the dry, rocky shoreline and were likely temporary habitations used when fishing. Later permanent habitations developed into small villages associated with fishpond production. Temporary fishing shelters were likely constructed by people who farmed in the uplands at Waimea where rainfall was more abundant. People living permanently along the dry shoreline likely shared extended family relations with people inland, allowing for an exchange system that distributed marine resources to inland agriculturalists and brought inland agricultural products to people at the coastal settlements.

The fertile plain of Waimea, which receives 40 to 80 inches of rainfall annually and is watered by streams from the Kohala Mountains, was planted in taro (*Colocasia esculenta*) and sweet potato (*Ipomoea batatas*). Sweet potato was the dominant crop at mid-elevations that received from 30 to 60 inches. At lower elevations in Waikoloa, especially along the coast, rainfall is less than 30 inches and soils are shallow or nonexistent.

In Waimea and Kohala, new settlements and agricultural field systems continued to spread and intensify between A.D. 1200 and 1500. Permanent communities were developing at Lapakahi and along the coastal region from ʻUpolu Point to Kawaihae. Temporary residences and an agricultural field system were also established in the upland or *kula* region of the wider Waimea area. As communities grew and agriculture intensified during this period, polities began to form, along with competition between polities. Two major settlement and political zones appear to have developed prior to the A.D. 1200 and to have lasted until late in prehistory – one focused on Waimea and Kawaihae in the south, and the other in north Kohala up to ʻUpolu Point.

By the late A.D. 1700s extensive permanent field systems were well established in North Kohala, Waimea, and the eastern portions of Lālāmilo and ʻŌuli Ahupuaʻa, which lie just south of the current Kawaihae Road in South Kohala. The Lālāmilo fields, part of the Waimea Field System, were the nearest agricultural field system to the current project area (the field system is roughly seven miles to the north). Banana (*Musa spp.*), sweet potato, sugar cane (*Saccharum officianarum*), and dryland taro were cultivated in the fields by farmers who built C-shaped and L-shaped enclosures for temporary use and lived some distance away from the fields.

Kawaihae was a center of political power. ʻAnaehoʻomalu and Kalāhuipuaʻa were likely *ʻili kūpono*, from around A.D. 1100 onward. An *ʻili kūpono* was a land division within an *ahupuaʻa* whose inhabitants who gave tribute directly to the king, rather than to the *konohiki*, as in the case of those living in an *ʻili ʻāina* division of an *ahupuaʻa*. These areas has extensive and productive fishponds.

Historical Narratives, the Aliʻi, and Warfare in the Region

Historical narratives set near the project area describe battles between warring *aliʻi*, lands traversed by warriors, and places where battles were fought. There are three accounts of historical events that took place near the project area between A.D. 1300 and 1600.

The first event is the 14th century battle between Kamiole, a Kaʻū chief and Kalapana, the son of Kanipahu, the sixth *mōʻī* (king or highest chief) of the Pili line. Kamiole and his warriors and others from Kona, Hilo, and Puna, had previously defeated Kanipahu at Kohala. Kalapana, with the aid of chiefs from Kohala and Hāmākua met Kamiole at ʻAnaehoʻomalu and defeated him.

The second event that took place near the project area is the battle between Lonoikamakahiki (ruler, A.D. 1640-1660) and rebel chiefs (most notably his elder brother Kanaloa-kuaʻana) encamped along the shore at ʻAnaehoʻomalu. Lonoikamakahiki and his Kona warriors were joined by forces from Kaʻū at the border of Kohala and Kona, on inland ʻAnaehoʻomalu.

A third battle was fought north of project area during the reign of Lonoikamakahiki. Kamalālāwalu and his forces captured Puakō, and misled by two old men of Kawaihae, marched through the dry grassy plains of Waikoloa to Waimea, and the hills of Hōkūʻula and Puʻu ʻOaʻoaka, to await the warriors of Hawaiʻi. Almost all of the chiefs and warriors of Maui were slain either on the field of battle or at the Kawaihae shoreline.

Historical narratives of the Waikoloa area underline its location as a nexus of travel between often contending political centers. Trails were the sidewalks, lanes, roads and highways of their time, and were numerous and diverse. Trails stretched from the coast to Waimea, and from Kona to Kohala, crossing the lava flats inland of ʻAnaehoʻomalu and Puakō. Other trails ran from Kona, south and then east of Hualālai, and down to Waimea or the coast. Trails from Hilo crossed the saddle between Mauna Kea and Mauna Loa, and then led downhill to Lālāmilo, where travelers could take trails either east or west. Trails also linked the Waipiʻo-Hāmākua region and Waimea. The system connected Kawaihae, Waimea, and leeward Kohala to other centers of royal power and figured prominently in interregional conflict.

3.14.1.2 Post-Western Contact Background

Initial Contact with the Western World

By the late 1700s the Waimea area supported an estimated population of approximately 10,000, while North and South Kohala likely had a population of roughly 23,000. Captain Cook's journals from his arrival in 1779 describe the area along the coast of Kohala as unpopulated, with very few houses or agricultural fields. Fishing, aquaculture, salt production, and abrader production were carried out along the coast from Kawaihae to ʻAnaehoʻomalu.

The majority of agricultural production occurred in the foothills of the Kohala Mountains and from Lālāmilo to the Waipiʻo Valley, especially along Waikoloa, Waiʻaka, and Keanuʻiʻomanō Streams. Large areas of the foothills of southern Waikoloa were covered in *pili* grass traditionally used for thatching. *Māmane* (*Sophora chrysophylla*), *naio* (*Myoporum sandwicense*), *wauke* or paper mulberry (*Broussonetia papyrifera*), *ʻiliahi* or sandalwood (*Santalum paniculatum*), and *ʻōhiʻa* (*Metrosideros polymorpha*) grew on the plains of Waimea and at upper elevations in the foothills of Mauna Kea and Mauna Loa. Traditional resource extraction from the area included *kapa* cloth made from *wauke*, *māmane* limbs cut for adze handles, and birds trapped for their meat and feathers.

The arrival of Europeans and the Hawaiian people's introduction to world markets drastically altered population centers, agriculture, and cultural practices in Hawaiʻi. In the Waimea-Waikoloa region, maritime trade and ranching slowly replaced traditional fishing, fish pond aquiculture and farming practices as chief economic activities.

Sandalwood harvesting for China's markets commenced in 1808 and reached a peak in the 1820s. Kamehameha held a monopoly on the collection and sale of sandalwood to foreign trading vessels. Sandalwood trees were rapidly harvested from the Waimea-Waikoloa area and an island-wide *kapu* was placed on the cutting of sandalwood in 1830. The royal government next looked to ranching as a steady source of income. Sheep and cattle ranching provided wool, fresh meat, salted beef, tallow, and hides for local markets on Hawaiʻi and Oʻahu, and also for provisioning merchant and whaling vessels until as late as 1860.

Ranching has its roots in the first cattle and sheep brought to the island in 1793 by Vancouver. Five cows, one bull, two ewes, and a ram were released to prosper in the region of Waimea, Mauna Kea, Mauna Loa, and Hualālai. Kamehameha placed a ten-year *kapu* on the killing of cattle so that they would have time to multiply. Vancouver returned in 1794 with more cattle, sheep, goats, geese, and various plants and seeds. Two American captains, William Shaler and Richard Cleveland, presented two horses to John Young in 1803. Cleveland later returned with more than 200 horses brought from California. Donkeys, mules and oxen were also imported for transportation and hauling.

By 1813 to 1815 cows began overrunning agricultural fields, destroying crops and posing a danger to travelers and residents alike. A wall called *Kauliokamoa* after the King’s *konohiki* was constructed between 1813 and 1819 to keep cattle in Waikoloa off of agricultural land to the east (Lālāmilo and Waimea). The wall extended from roughly the northern border of Waikoloa to near Puʻu Huluhulu, separating the less fertile annual grasslands from the perennial grasslands.

John Parker was granted permission to hunt wild bullock for the crown in 1822. Wild cattle were captured in bullock pits seven to eight feet long by four feet wide covered with branches and a thin layer of dirt. Cattle were also hunted with guns, and in after the arrival of *vaqueros* from Latin America they were lassoed.

Organized sheep ranching in the Waimea region is credited to William French, who arrived in Hawaiʻi in 1819 as a representative of an American shipping venture involved in the sandalwood trade. In 1826 he began grazing sheep and cattle between Waimea and Kawaihae and by 1844 was exporting wool. French owned the Līhuʻe Livestock Farm and a home in Waimea, now the historic Spencer House. French’s ranching operation was taken over by Francis Spencer and his partners after French’s death in the mid-1850s.

In 1830 Governor Kuakini moved to Waimea to oversee and improve government cattle operations. He ordered the construction of corrals and the widening and improvement of twelve miles of the trail from Waimea to Kawaihae. Liholiho visited Waimea the same year in order to see firsthand the strides made in the nascent cattle ranching industry. He hoped that the export of tallow, hides, and salted beef would supplant the defunct sandalwood trade as a major source of income. By 1835, William French had opened a store in Waimea and begun several ventures related to ranching, including tallow making, tanning, and saddle making. Cowhide was tanned using the astringent bark of local trees. Other craftsmen included carpenters and a blacksmith.

By 1840 bullock hunting had drastically reduced the numbers of wild cattle, driving them to higher and higher elevations of Mauna Loa and Mauna Kea. A five-year *kapu* was placed on cattle hunting, incentivizing efforts to tame, brand, and fence in herds on privately owned land. The decline of whaling and the *kapu* placed on killing cattle created economic hardship and population decline in the Waimea area.

Grazing, the opening of new pastureland, and fires were denuding the forested plains of Waimea and pushing the tree line to higher and higher elevations. Over time, cattle operations shifted from hunting wild herds to privately owned, fenced-pasture ranches, with consolidated land ownership and improved breeding stock. This trend reduced the rampant degradation of the lands of Waimea and Waikoloa.

The Māhele and the Expansion of Ranching in West Hawaiʻi

The Legislature of the Hawaiian Kingdom passed Article IV of the Board of Commissioners to Quiet Land Titles in December 1845, initiating the legal process of establishing private land ownership in Hawaiʻi. Through the Māhele of 1847-48 and the Kuleana Act of 1850, land was made available for private ownership. The Māhele established a board of five commissioners to oversee land claims and to issue patents and leases for valid claims.

The lands of the kingdom of Hawai‘i were divided among the king (crown lands), the *ali‘i* and *konohiki*, and the government. Once lands were thus divided and private ownership was instituted, those *maka‘āinana* (commoners) who had been made aware of the procedures were able to claim the plots of land, called *kuleana*, on which they had been cultivating and living as stipulated in the Kuleana Act (1850). These claims could not include any previously cultivated but presently fallow land, forest clearings, stream fisheries, or many other resources traditionally necessary for survival. The right of claimants to land was based on the written testimony of at least two witnesses who could corroborate the claimant's long-standing occupation and use of the land in question. If successful, the claimants were awarded a patent for the property, subsequently called Land Commission Awards (LCAs) (Chinen 1961:16).

At least 26 claims were made for *kuleana* plots in Waikoloa (see Table 1 of ***Appendix E1*** for details). The project area is located within the boundaries of LCA 8521-B, which was awarded to George Davis Hu‘eu. G.D. Hu‘eu had inherited and owned a large portion of the good grazing lands of Waikoloa. Kamehameha I had given the land to G.D. Hu‘eu's father, Isaac Davis, as an *‘ili kūpono* for services rendered during the conquest of the Hawaiian Islands. Local chiefs claimed some portions of his land when Isaac Davis died intestate in 1810. It became necessary for his friend John Young to ask the crown for stewardship of the property for Davis' children's sake. Isaac Davis' land (Royal Patent Grant 5671) was granted to G.D. Hu‘eu as an unsurveyed LCA (8521B) in 1865. G.D. Hu‘eu's property contained a house lot, various livestock facilities, and huge tracts of *pili* land in the *kula* (uplands).

On July 2, 1868, G.D. Hu‘eu leased his land in Waikoloa to William L. Green on behalf of the Waimea Grazing and Agricultural Company (WGAC) for $600 per year. The 20-year lease included all of the land awarded to G.D. Hu‘eu under LCA Number 8521 B Parcel 1, except properties previously sold to William C. Jones in October 1866. The lease allowed the Hu‘eu family to continue grazing approximately 1,000 cattle, 100 horses, and 1,000 sheep.

In a complex arrangement, the WGAC, in turn, leased the land to Francis Spencer, who leased the grazing rights back to the WGAC. The lease, combined with previously owned/leased land (seven properties altogether) gave Francis Spencer and the WGAC the right to hunt wild (unbranded) cattle and sheep, and to graze their cattle, sheep, horses, and mules over a vast area of land from Hilo to Hāmākua, to South Kohala, and to Kona.

A.W. Carter purchased the former Hu‘eu property in 1904 on behalf of Parker Ranch. During the 20th century, Parker Ranch became the largest sheep and cattle ranch on the Island of Hawai‘i and one of the largest in the U.S. Parker Ranch offices were centered in Waimea with ranch stations in the surrounding areas of Waikoloa, Hāmākua, Humu‘ula, and elsewhere. Much of the inland portion of the project area was used by Parker Ranch for cattle ranching, grazing or crossing over while driving cattle down to the coast for transport to O‘ahu and other ports.

Military Training

As discussed in Section 3.16.2, approximately 123,000 acres in the Waimea-Waikoloa area of Hawai‘i were leased in December of 1943 by the U.S. War Department for use as a troop training area. The military utilized portions of this property for troop maneuvers and weapons practice as well as artillery, aerial bombing and naval gun fire ranges. Troop exercises were conducted using .30 caliber rifles, .50 caliber machine guns, hand grenades, bazookas, flame throwers, and mortars. From 1943 through 1945 nearly the entire Waikoloa Maneuver Area was in constant use, as the Marine infantry reviewed every phase of training from individual fighting to combat team exercises. Intensive live-fire training was conducted in grassy areas, cane fields, and around the cinder hills of Puʻu Pā and Puʻu Holoholokū.

A military cantonment was also established just outside Waimea town. Initially called Camp Waimea, it was later rechristened Camp Tarawa in honor of the first successful amphibious land invasion of the Pacific War. Camp Tarawa was the largest Marine training facility in the Pacific, covering an area of approximately 467 acres. It consisted of a small city of canvas tents, Quonset huts and wood framed structures all connected by a network of dirt and cinder roads. Between 1943 and 1945 as many as 50,000 men passed through Camp Tarawa on their way to the Pacific Theater. Between 1946 and 1959, the property comprising the former Waikoloa Maneuver Area was gradually returned to Parker Ranch and the State of Hawaiʻi, and the area was once again used for cattle grazing. Many temporary structures built by the military remained on the land.

3.14.1.3 Archaeological Sites and Historic Properties

The National Historic Preservation Act of 1966 (NHPA) recognizes the nation's historic heritage and establishes a national policy for the preservation of historic properties. Section 106 of the NHPA requires that federal agencies consider the effects of their projects on historic properties. The purpose of the Section 106 consultation process is to evaluate the potential for effects on existing historic sites, if any, resulting from the Project. This law designates the State Historic Preservation Officer (SHPO) in each state as the entity responsible for coordination and consultation on historic sites. Similarly, Chapter 6E of HRS provides for a similar process in its intent of conserving and developing the historic and cultural property within the State for the public good. Both processes include efforts to identify historic properties, evaluate effects of agency actions on identified properties, and consult those findings with the SHPO and other identified consulting parties.

Under contract to HDOT, Scientific Consultants Inc. prepared an Archaeological Inventory Survey for the project. This report is summarized below and is included in full in ***Appendix E1*** of this EIS. Survey efforts included database searches and fieldwork including 100% pedestrian survey and subsurface testing, Consultation in the form of mailings, meetings, and interviews were also conducted to seek to identify historic properties and potential effects.

Archaeological Background

Prior to historic site investigations for this Project, no sites were listed on the State or National Registers of Historic Places in or near the project area. Roughly 50 archaeological studies have been conducted in a wide zone surrounding the project area. Previous investigations were sited in three regions: the coast, the mid-elevation lava fields, and the eastern, upland *pili* lands. The majority of studies were mainly concentrated in the coastal and near-coastal region. The mid-elevation lava field studies were mostly associated with urban development in and around Waikoloa Village. Upland archaeological studies were focused on the former Parker Ranch Keʻāmuku Station property. The following discussion of previous archaeological studies and the distribution of archaeological site types considers all three regions.

Archaeological remains within coastal caves suggest that the initial occupation of the Waikoloa area may have occurred as early as A.D. 900-1100. The presence of small modified lava blisters near the coast with tools and food debris indicates that by A.D. 900 people were coming to the area to extract marine resources. More permanent and continuous use of the coast is reflected in the construction of fish ponds and larger habitation structures by A.D. 1200. Natural lava tubes near the coast were modified to afford refuge during times of warfare, and for places to work and inter the dead.

A number of small caves were used intermittently as temporary habitations while bird hunting, quarrying and passing through the barren lava of Waikoloa on the way to other locations. Small caves in this region often have few if any archaeological remains. Somewhat larger caves appear to have been occupied early during prehistory, and intermittently for many centuries thereafter.

A series of paved platforms situated about three miles inland from ʻAnaehoʻomalu has been interpreted as burial features. Although an absence of archaeological excavations in those features leaves that proposition untested, the size, shape and especially the fine paving and construction of the architecture makes that a likely proposition. An isolated blister burial was recorded in the barren lava fields northwest of the paved platforms mentioned above.

Many of the archaeological investigations in the barren lava of inland Waikoloa have recorded quarry and manufacture areas for abraders. These are evident as small pits in the lava, often with pieces of bedrock moved from the inside to the rim of the pit. There are also grooves and shallow lines in the bedrock that appear to have been created by rubbing pieces of rock against the bedrock, most likely to shape the quarried rock. Some of the outcrops contain a rough, scoriaceous lava that is particularly well-suited as raw material for abrading tools. It could be said that virtually the entire lava landscape functioned as a "toolbox" for the cutting, scraping and abrading tasks of everyday life.

The most common archaeological features recorded in the central, barren lava regions of Waikoloa are military training positions, hunting blinds, rock mounds interpreted as survey markers and boundary markers from various eras, intermittently used temporary habitation rock shelters, and trails. Site density in this region is very low.

The greatest concentration of pre-Western contact population settlement near Waikoloa was at Waimea, about ten miles from the project corridors. The fertile Mauna Kea soils were enhanced for cultivation with water from the Kohala Mountains via a network of channels referred to as the Lālāmilo Field System. Based on several sources of data, it appears that the field system was created during the late 12th century.

There is evidence that a type of floodwater farming occurred within the barren zone that was dependent on intermittent seasonal flows of surface water. Several small agricultural features were identified within the narrow Kamakoa Gulch, about five miles north of the project corridors, and similar features were also found near the base of Pu‘u Hinai, about two miles north.

Based on the size and configuration of the *ahupua‘a* of Waikoloa, it is assumed that people within Waikoloa had direct access to the cultivated fields of Waimea and the marine, grass, and scoriaceous lava resources at lower elevations and along the coast. At the least, it is expected that these resources were exchanged between the coast and population concentration at Waimea. The exchange may have involved travel through the project area lands.

Upland archaeological sites are primarily associated with Historic-era ranching and military training. Archaeological studies were conducted at the U.S. Army’s Pōhakuloa Training Area, across the Māmalahoa Highway from the project area, at the former Ke‘āmuku Cattle Station. A number of separate investigations have documented 68 sites, 52 of them associated with post-Contact ranching, habitation, and boundary markers.

Archaeological Fieldwork in Project Corridors

A consulting firm specializing in archaeology conducted an archaeological inventory survey of the project corridors (AIS) under the guidance of FHWA and HDOT (refer to ***Appendix E1*** for full survey). The survey conformed with State of Hawai‘i rules at Hawai‘i Administrative Rules 13§13-284 and 275, as well as the Rules Governing Minimal Standards for Archaeological Inventory Surveys and Reports contained in Hawai‘i Administrative Rules 13§13-276, the National Historic Preservation Act (NHPA) of 1966, as amended, and as defined in 36 Code of Federal Regulations (CFR) 800. Under Section 106 in Hawai‘i, the federal agency must consult with the State Historic Preservation Officer (SHPO) and Native Hawaiian Organizations (NHOs) regarding the potential of effect to historic properties identified in the project area. The AIS is a supporting document in the consultation process.

Prior to the commencement of field work, the archaeologist conducted historical and archaeological archival research including a search of historic maps, aerial photos, written records, Land Commission Award documents, and State and County planning documents and tax records. A number of knowledgeable area residents were also interviewed. The interviews produced information on ranch activity, some historical use of the project area and surrounding region, and perceptions of legends and traditional history.

A critical element of the archaeology survey process is the establishment of a project Area of Potential Effect (APE). The total length of the combined project alignments, connector roads, and road widening areas is 25.3 miles. The width of the construction corridor, which will be determined along the entire length of the selected alternative during final design, is expected to vary from 120 to 240 feet, with the majority of the construction corridor less than 150 feet wide. To ensure that all potentially impacted cultural resources are identified, it is prudent to study a wider area than the construction corridor. The FHWA determined that the APE for study of the proposed highway would be a 250-foot wide corridor around Alternative 4, 5 and 6, as well as areas for intersection improvements at Waikoloa Road, Queen Kaʻahumanu Highway, and Māmalahoa Highway. At the latter intersection, an area sufficiently large to accommodate a potential grade-separate intersection was studied. Although the AIS study includes all of the alternative road corridors and covers approximately 784 acres, it bears emphasis that only one corridor will be selected for construction, with an estimated disturbance area of approximately 200 acres (within a right-of-way of about 334 acres), and that no effects to archaeological sites would occur on the non-selected corridors as a result of the proposed project.

As part of ongoing Section 106 Consultation, a public notice were published in the *West Hawaiʻi Today* and *Hawaiʻi Tribune-Herald* newspapers on August 17, 20, and 21, 2014. The public notice was also published in the *Honolulu Star-Advertiser* on September 3, 2014 and in the September 2014 issue of the Office of Hawaiian Affairs (OHA) *Ka Wai Ola* newspaper. Section 106 Consultation letters were mailed to Native Hawaiian Organizations (NHO), cultural practitioners, and individuals who had knowledge of the project area lands, who were in turn asked to share the information with others who might be interested. A summary of this consultation, as well as the ethnographic and historical consultation that was conducted during the original research for the Project, is presented in ***Table 3.14.1***. Information obtained from these agencies was critical not only for assessing archaeological sites but also for understanding the cultural sites and former and ongoing traditional cultural practices in the region and potentially within the project corridors. Such sites and practices are discussed in Section 3.15, below.

The main archaeological fieldwork was conducted in October and November, 2001, November 2003, and March 2012, with several brief field visits afterward. During the pedestrian survey, the archaeologists were spaced at intervals, allowing for thorough inspection of the project corridors and the surrounding environs. Sites and features identified in the field were plotted by means of Global Positioning System (GPS) units and then mapped, described, measured, drawn, and photographed. Trails and other linear features were mapped to their termini, often well beyond the boundaries of the project area.

Archaeologists attempted to locate all lava tube caves that are present below or in close proximity to the APE. It was recognized that by limiting the surface survey to the project corridors, lava tube caves that passed below the APE might be missed. Openings to such lava tubes could be well beyond the APE and out of visual range of the surveying team. Aerial photographs and helicopter surveys were used to locate lava tube openings outside the project APE. After this, surface survey was conducted beyond the APE in all places identified as having a potential for having cave openings. Several cave openings beyond the APE were located, and their lava tubes were surveyed and documented during the archaeological study.

Table 3.14.1
Section 106 Consultation and Related Consultation

Name	Title, Organization	Phone call	Email	Letter	Interview
Section 106 Consultation, 2014					
Akau, Julia	Puʻuanahulu Ohana	-	-	9/10/14	-
Bergin, Billy	Kamuela Ohana	-	7/21/14 & 8/28/14	9/2/14	-
De Silva. Donnie	Parker Ranch Cowboy	9/30/14		-	-
Harp, Isaac Paka	Kona Ohana		8/29/14	-	-
Hind III, Robbie	Puʻuanahulu/Kona Ohana	7/7/14	7/7/14	-	-
Humble, Marnie		-	-	9/10/14	-
Keakealani, Kuʻulei	Puʻuanahulu Ohana	8/1/14	7/21/14 & 8/1/14	-	-
Keakealani, Sonny	Puʻuanahulu Ohana	-	-		-
Kilte, Merline	Puʻuanahulu Ohana	-	-	9/10/14	-
Lui, Nicole	Kohala/Kona Ohana	-	8/28/14	8/23/14	-
Mitchell, Robert L.	Puʻuanahulu Ohana	-	-	9/10/14	-
Vredenburg, Keawe	Kamuela Ohana	7/7/14	-		-
Wilcox, Clarese	Puʻuanahulu Ohana	-	-	9/10/14	-
Previous Ethnographic/Historical Consultation					
Andrade, Punahele	Cultural Specialist, Outrigger Hotel	6/25/01	-	6/25/01	11/29/01
Bergin, Billy		-	7/7/14	-	-
Hind, Robbie, III	Kamuela ʻOhana	7/7/01	7/7/14	-	-
Irons, Darby	Resident, Parker Ranch	6/28/01	-	6/28/01	-
McCarthy Keakealani, Kuʻulei	Puʻu Anahulu ʻOhana	6/25/01	7/7/14	6/25/01	11/28/01
Vredenburg, Keawe	Waimea ʻOhana	7/7/14	-		-
Yamaguchi, Jiro (dec'd)	Paniolo, Parker Ranch	-	-	-	4/15/02
Yamaguchi, Mark	Paniolo, Parker Ranch	-	-	-	4/15/02
Andrade, Punahele	Cultural Specialist, Outrigger Hotel	6/25/01	-	6/25/01	11/29/01
Soon, Ray	Department of Hawaiian Home Lands	-	-	6/25/01	-
Aloot, Sebastian	OHA*	6/26/01	-		-
Sherlock, Ululani	OHA, Hilo Cultural Resource Coordinator	-	-	7/18/01	-
Flores, E. Kalani	OHA, Historic Preservation Council	-	-	6/26/01	-
Springer, Hannah Kihalani	OHA, Historic Preservation Council	-	-	6/29/01	-
McDonald, Ruby (dec'd)	OHA, Kona Cultural Resource Coordinator	-	-	7/18/01	-
Giffin, Jon	DLNR, Division of Forestry and Wildlife	6/25/01	-	-	-
Oshiro, Rod	DLNR, Division of Forestry, Na Ala Hele	-	-	6/25/01	-
Maly, Kepā	Kumu Pono Associates	7/3/01	-		-
Cole, Heather	Nature Conservancy	6/29/01	-		-
Saldua, Ben	Puʻukoholā National Historic Park	-	-	6/26/01	-
Tolentino, Mabel	Waimea Hawaiian Civic Club	6/25/01*	-	6/25/01	
Cook, Patti	Waimea Community Association	-	-	-	6/28/01

* Spoke with relative.

Historic Properties Present

Fifty (50) archaeological sites were recorded during the inventory survey process (***Table 3.14.2***, ***Figure 3.14.1***). Twenty-eight of the sites recorded are within or partially within the project APE. The remaining 22 sites are located outside the APE and will not be impacted by construction activities. ***Appendix E1*** contains detailed maps, sketches, photographs and descriptions of each site and many individual features of many of the sites, for the reader interested in site details.

In terms of location, most sites recorded are in the western, *makai* portion of the project area. These lower elevation sites were likely visited more often because they were closer to habitation areas clustered along the coast. The central and upland sites are generally smaller and less complex and used for shorter durations.

Forty of the 50 sites recorded during the inventory survey were located in the western, lower elevations within two miles of the coast, near Queen Ka‘ahumanu Highway. The sites are clustered around an area of level pāhoehoe containing both lava tubes and friable surface lava used to make abraders. Several small caves and a refuge cave were documented in the coastal area. Numerous pāhoehoe excavations and a trail network were also documented. The high site density is related to the coastal habitation areas at ‘Anaeho‘omalu Bay, about a mile away.

Only five sites were found within the central portion of the project area along the Kona-Kohala boundary. Four of these sites contained rock mounds constructed to mark the boundary between South Kohala and North Kona districts. The fifth site was a ridge quarry. The low density of sites in the central portion of the project area is consistent with archival documentation describing it as an arid, uninhabited area prior to its use for cattle ranching.

Another concentration of five sites was identified in the uplands in the eastern end of the project area. Three were located in lava tubes, none of which was actually within the APE. One lava tube site contained cultural material, one contained a quarry feature, and one was marked by rock mounds. As these sites are outside the APE, none would be impacted by the proposed road construction. The remaining two sites were pre-Western Contact rock mound markers (*ahu*), both within the APE. As with the mid-elevations, the low density of sites the upper areas matches archival documentation describing it as basically uninhabited prior to cattle ranching.

Readers interested in detailed descriptions of each archaeological site are referred to ***Appendix E1***. The following discussion highlights some of the functional categories of sites (see ***Table 3.14.2*** for characteristics and ***Figure 3.14.1*** for locations).

> *Refuge Cave*: Natural lava tubes were sometimes modified to afford refuge during times of warfare, and one such refuge cave with two archaeological sites is present in the low elevation portion of the project area. Approximately 3,500 feet long, the cave intersects the project corridors of both Alternative 5 and Alternative 6. There are two openings to the surface, one on the east and one on the west. Cultural modification of the cave is concentrated in a 1,200-foot long section of cave that roughly corresponds to the cave area between the two openings. The eastern, *mauka* skylight opening is the main opening to the cave. There are several modifications here, including a large wall of rock that fills

Table 3.14.2. Archaeological Sites

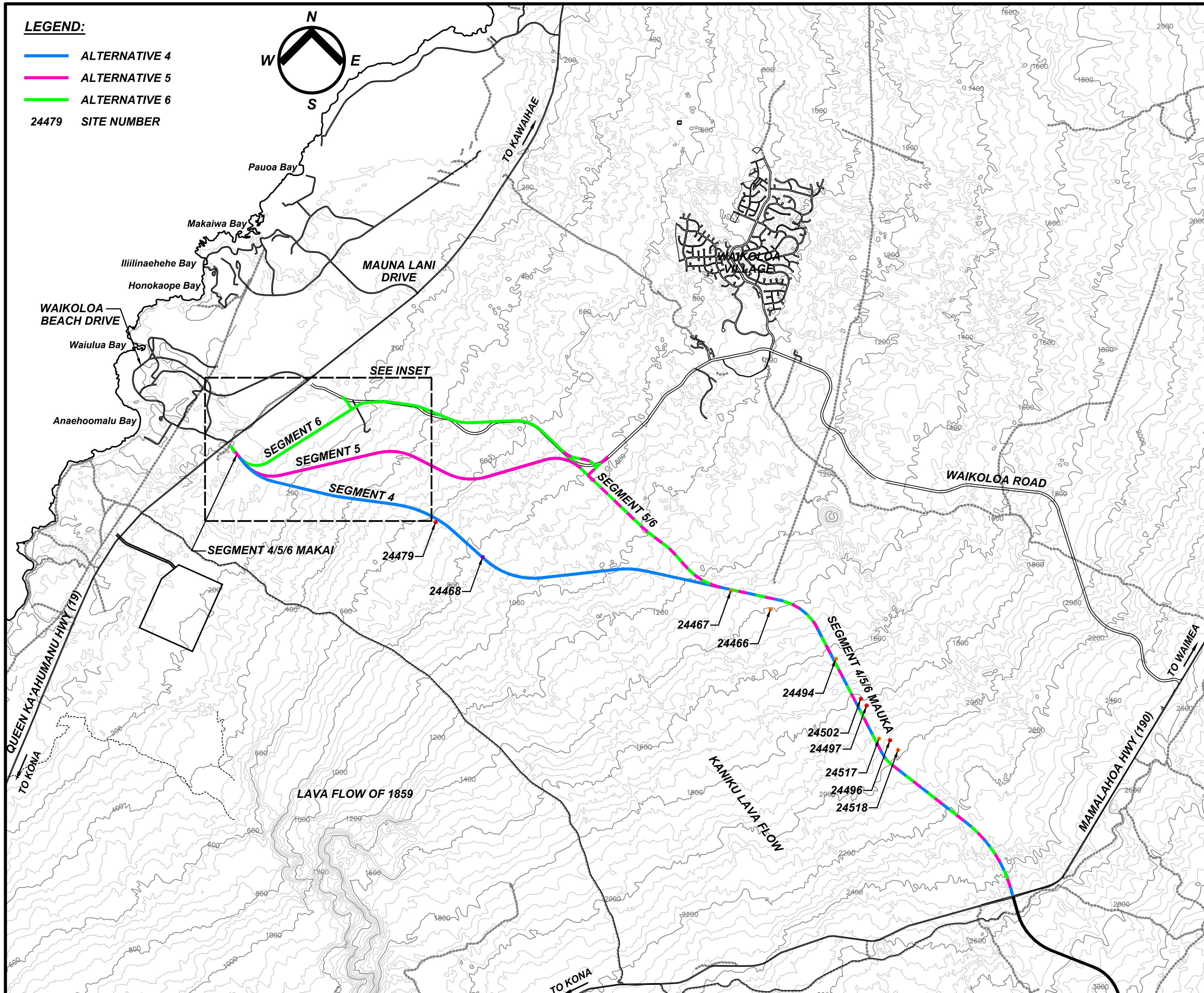
SIHP	Alternative	Relation to APE	Site Type	Chronology and Function	Criteria for Significance and Recommended Mitigation
24466	4-5-6	Out	*Ahu* with post	Historical survey marker	D None
24467	4-5-6	In	Group of *ahu*	Prehistoric trail markers	D None
24468	4	Partially in	Ridge quarry and 3 *ahu*	Prehistoric resource extraction, trail markers	D Data Recovery
24469	6	Out	*Ahu* and graffiti	Possibly Prehistoric and historic markers	D None
24470	5	Partially in	Modified cave	Prehistoric refuge cave	D Data Recovery
24471	4	In	*Pāhoehoe* excavation	Prehistoric resource extraction	D Data Recovery
24472	4	In	*Pāhoehoe* excavation	Prehistoric resource extraction	D Data Recovery
24473	4	In	*Pāhoehoe* excavation	Prehistoric resource extraction	D Data Recovery
24474	4	In	Ridge quarry	Prehistoric resource extraction	D Data Recovery
24475	4	In	*Pāhoehoe* excavation	Prehistoric resource extraction	D Data Recovery
24476	5	In	*Pāhoehoe* excavation	Prehistoric resource extraction	D Data Recovery
24477	5	In	*Pāhoehoe* excavations	Prehistoric resource extraction	D Data Recovery
24478	5	Partially in	*Ahu* in cave	Prehistoric marker	D None
24479	4	Partially in	Ridge quarry	Prehistoric resource extraction	D Data Recovery
24482	6	Out	*Pāhoehoe* excavation, alignments	Prehistoric resource extraction and shelter	D None
24483	6	In	*Pāhoehoe* excavation	Prehistoric resource extraction	D Data Recovery
24484	6	Out	*Pāhoehoe* excavation	Prehistoric resource extraction	D None
24485	4	Out	*Pāhoehoe* excavation	Prehistoric resource extraction	D None
24486	4	Out	Materials stored in cave	Prehistoric tool manufacture cache	D None
24487	4	In	*Pāhoehoe* excavation	Prehistoric resource extraction	D Data Recovery
24488	6	Out	Petroglyph	Prehistoric image	D None
24489	4	In	*Pāhoehoe* excavation	Prehistoric resource extraction	D Data Recovery
24490	5	Out	*Ahu* at skylight at refuge cave	Prehistoric marker	D None
24491	4	Out	*Pāhoehoe* excavation	Prehistoric resource extraction	D None
24492	4	In	*Pāhoehoe* excavation	Prehistoric resource extraction	D Data Recovery
24494	4-5-6	In	*Ahu*	Prehistoric marker	D None
24495	5	In	Ridge quarry	Prehistoric resource extraction	D Data Recovery
24496	4-5-6	Out	Fire and material collection	Prehistoric shelter	D None
24497	4-5-6	Out	2 *ahu* in Beta 3 opening	Prehistoric shelter	D None
24498	6	Out	3 *ahu* with trail Site 24499	Prehistoric markers	D None
24499	6	Out	Trail	Prehistoric transportation	D None
24502	4-5-6	Out	Quarry in cave	Prehistoric quarry	D None
24503	6	Partially in	Trail	Prehistoric transportation	D Data Recovery
24504	4	Out	3 *ahu* in a line	Prehistoric transportation	D None
24505	4	Partially in	Trail	Prehistoric transportation	D Data Recovery
24506	4	Partially in	Trail	Prehistoric transportation	D Data Recovery

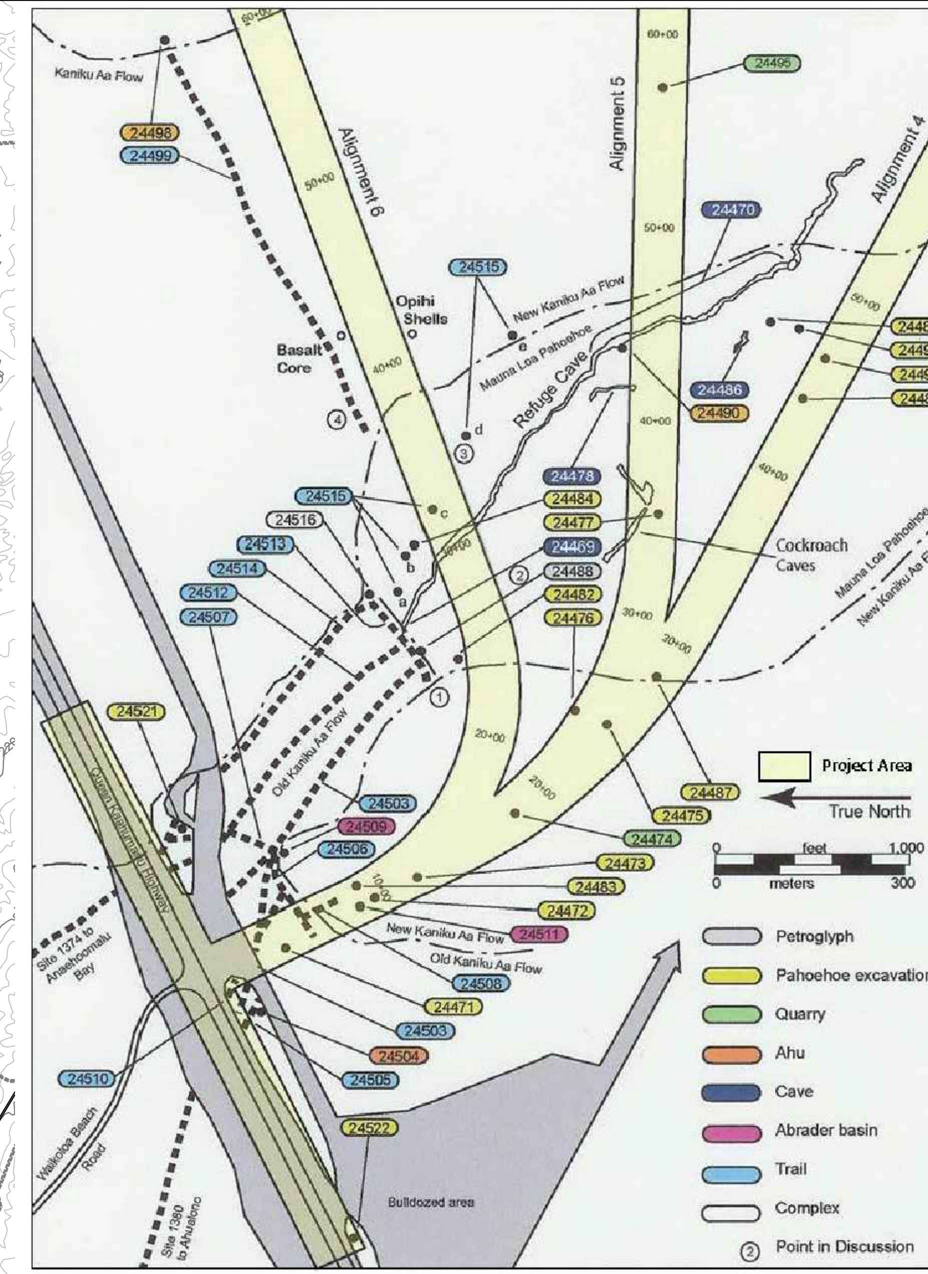
SIHP	Alternative	Relation to APE	Site Type	Chronology and Function	Criteria for Significance and Recommended Mitigation
24507	4	Out	Trail	Prehistoric transportation	D Data Recovery
24508	4	In	Trail	Prehistoric transportation	D Data Recovery
24509	4	Out	Abrader basin, pāhoehoe excavation	Prehistoric tool manufacture	D None
24510	4	In	Trail	Prehistoric transportation	D Data Recovery
24511	4	In	Abrader basins	Prehistoric tool manufacture	D Data Recovery
24512	6	Out	Trail	Prehistoric transportation	D None
24513	6	Out	Trail	Prehistoric transportation	D None
24514	6	Out	Trail	Prehistoric transportation	D None
24515	6	Partially in	5 *ahu* in a line	Prehistoric transportation	D Data Recovery
24516	6	Out	*Ahu* and alignment	Prehistoric marker	D None
24517	4-5-6	In	*Ahu*	Prehistoric marker	D None
24518	4-5-6	In	*Ahu*	Prehistoric marker	D None
24521	QK[1]	Out	Pāhoehoe excavation	Prehistoric resource extraction	D None
24522	QK[1]	In	Pāhoehoe excavation	Prehistoric resource extraction	D Data Recovery

[1] In right-of-way of Queen Ka‘ahumanu Highway

most of the entrance. The piled rock wall constricts the opening to the size of a human being, making it a defendable refuge. The two portions of the cave with concentrations of cultural features are deemed two distinct archaeological sites (Site 24469 and 24470). Most of the features of these sites are outside the project corridors of both Alternative 5 and Alternative 6, and these areas would not be affected by the project and could remain in their current condition.

Trails. Trails are present on the landscape in several contexts: 1) *mauka-makai*, 2) parallel to the ocean, and 3) in a mesh-like network. There are also two places where several trails converge. One is situated at the edge of the mesh-like network of trails and is notable for the presence of scraped areas on the smooth pahoehoe, as well as a single petroglyph. Another is situated at the boundary of the Kanikū lava flow and the older flow, also marked by a petroglyph. Two distinct and formerly well-used *mauka-makai* trails (Site 24503 and 24514) connect shoreline areas, which area outside the APE at Ahuolono Heiau and Anaeho‘omalu Bay, to the western end of the project corridors. These two trails enter into a mesh-like network of trails in the area where there are many abrader basins, pahoehoe excavations, and ridge quarries. Clearly these trails provided access to stone that was used to manufacture tools that were important in daily living for cutting, grinding and scraping. Another trail in the western portion of the project area is oriented parallel to the ocean on the Kanikū lava flow (Site 24499). The trail is relatively straight, with mild meanders around difficult terrain and spots where rocks have been placed in crevices for the pathway. The trail is not evident in the smooth older flow or the Kanikū flow further to the north, where it may have been destroyed by modern quarrying activity. Several *ahu* distributed in the higher elevations of the project area (Sites 24493, 24494, 24517, 24518, and at Site 24465) may represent markers for area trails. Trails in the uplands were probably designed to facilitate movement from the ocean to the upland resources such as forests and even to the mountains.





INSET MAP OF ARCHAEOLOGICAL SITES LOCATED ON THE WEST END OF PROJECT AREA

FA PROJECT NO. DP-HI-0200(5)

0 3000 6000 12000

GRAPHIC SCALE IN FEET

SADDLE ROAD EXTENSION

FIGURE 3.14.1 ~ ARCHAEOLOGICAL SITES

FILE: 99011-190 QUEEN K\Figures\FIG-3.14.1.DWG

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Significance Assessments

Sites identified during this project were assessed for their eligibility for listing on the National Register of Historic Places (NRHP) Criteria for Evaluation, as outlined in 36 CFR 60, as well as under the State of Hawai‘i significance criteria, which are contained in Hawai‘i Administrative Rules 13§13-275-6 (see ***Table 3.14.2***). To be assessed as significant NHRP criteria a site must possess integrity of location, design, setting, materials, workmanship, feeling, and association and must be characterized by one or more of the following four criteria:

A. It must be associated with events that have made a significant contribution to the broad patterns of our history;
B. It must be associated with the lives of persons significant in our past;
C. It must embody distinctive characteristics of a type, period, or method of construction; or represent the work of a master; or possess high artistic value or represent a significant and distinguishable entity whose components may lack individual distinction; or
D. It must have yielded, or may be likely to yield, information important in prehistory or history.

With respect to the State of Hawai‘i process, a substantially similar set of criteria exist, with one additional one. The State criteria are denoted by lower case rather than upper case letters. To be significant, a site must:

a. Be associated with events that have made an important contribution to the broad patterns of our history;
b. Be associated with the lives of persons important in our past;
c. Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;
d. Have yielded, or is likely to yield, information important for research on prehistory or history;
e. Have an important value to the native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts – these associations being important to the group’s history and cultural identity.

All of the archaeological sites were assessed as significant under criterion D for the information they contain. Aside from archaeological sites, other types of historic properties that may potentially be present on any landscape area include architectural properties and Traditional Cultural Properties (TCPs). No architectural structures including bridges or buildings are present in the APE. A TCP can be defined under the National Historic Preservation Act generally as a historic property that is eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community’s history, and (b) are important in maintaining the continuing cultural identity of the community. Typical examples of TCPs include mountain tops associated with deities, groves of sacred trees specifically associated with a significant cultural practice, beliefs about the sacredness of certain areas, and important historic or legendary sites such as battlefields, and other locations with these kinds of associations. TCPs are defined by place, with definite boundaries.

Although TCPs of the Island of Hawaiʻi and the North Kona-South Kohala area are not fully inventoried, certain hills (e.g., Puʻu Waʻawaʻa and Puʻuanahulu, about five miles south of the project area) are known to have rich cultural associations that would likely qualify them as TCPs if federal undertakings potentially affected them and an analysis was conducted. During the Saddle Road Improvements Project EIS (FHWA-CFLHD 1999), the summit of Mauna Kea was identified as a TCP. Based on interviews with informants and consultation of oral history, written accounts of legend and history, the Māhele records and maps, none of the landscape features present in or near the Saddle Road Extension project corridors would appear to have the level of significance in association and use that would merit being considered a Traditional Cultural Property. Nevertheless, as described in Section 3.15, below, some members of the community do ascribe some cultural value to various features of the landscape, which deserves consideration in the context of cultural impacts. None of the cultural resources beyond the APE would be affected by this undertaking.

3.14.2 Environmental Consequences

As shown in ***Table 3.14.2***, of the total of 50 sites identified, 22 are outside the APE and will not be impacted by the Project. All sites are on private property and many sites will be separated from the highway by cattle fencing and will not be accessible from the highway except to the private property owners that currently already have access to them. In many cases, these sites will be a hundred feet or more beyond the highway, as only a portion of the archaeological study area width will be contained within the eventual right-of-way area.

The remaining sites within the project corridor for the alternative that is eventually selected (or within the footprint of associated side roads and intersection improvements) have the potential to be impacted because they may lie in the path of the roadway, the shoulders, adjacent clear zones, or land that is cut or filled for the highway roadbed. Altogether, the width of the disturbed corridor will generally vary between about 80 and 150 feet, however, and therefore sites recorded within the 250-foot wide project corridor that constitutes the APE may not actually be affected.

Differences in Impacts Between Alternatives 4, 5 and 6 and Intersection Design Options

A total of 20 historic sites are present within the APE of the project corridor for Alternative 4, 16 sites are present for Alternative 5, and 12 sites are present for Alternative 6. Many of these sites are shared by two or three of the Alternatives. The number of sites is not necessarily an indicator of the general presence or value of historic resources, as sites may have few or many features, may extend over small or large areas, and may have high or low information value. No differences with respect to historic properties exist between the design options. FHWA anticipates that project implementation under alternatives 4, 5 or 6 would result in an “adverse effect” on a NRHP eligible archaeological site(s) in accordance with federal regulations (35 CFR 800.5) and “effect, with proposed mitigation commitments” in accordance with HAR §13-13-275-7. The agreed upon mitigation would include avoidance and minimization of archaeological impacts, archaeological data recovery, and archaeological monitoring during construction. If cultural resources or human remains are inadvertently discovered during construction, the contractor would comply with State law and administrative rules for handling them. Consultation with the SHPO for the above effects is ongoing and will be completed prior to project advancement.

Impacts of the No Action Alternative

The No Action Alternative would avoid any disturbance of archaeological sites. Without the data recovery associated with Project construction, valuable historic information about the historic sites would not be collected, but the sites would remain in or close to their present condition for the foreseeable future and separate future efforts might be able to document them.

3.14.3 Mitigation Measures

In addition to determining the significance of each site, FHWA evaluated the archaeologist's findings and recommendations and determined the appropriate treatment for each of the sites to mitigate for any adverse effects. The following mitigation measures will be undertaken:

1. Of the 28 total sites within the APE, no further work is recommended for four (identified as "none" in ***Table 3.14.2*** for Mitigation Treatment), because the significant data contained within these sites has been collected in the form of measurements, photographs, descriptions, figures, documentary research, oral interview, and historical research. The appropriate research has been conducted for these sites, and further study would not contribute any new information. Avoidance measures have and will continue to be incorporated into the design of the Project. Consultation with the Hawaiʻi SHPO will continue and any adverse effects to archaeological resources will be mitigated in accordance with an approved data recovery treatment plan and Memorandum of Agreement (MOA) if warranted. FHWA will implement the measures as outlined in a final signed MOA for the Project.
2. In addition, the FHWA will provide a full-time archaeological monitor during clearing, grubbing, and excavation operations on the proposed project.

Treatments for 24 sites that are recommended for data recovery work are outlined in ***Appendix E1***. A detailed data recovery plan will be completed and approved by the SHPD prior to the start of data recovery fieldwork. The principal proposed data recovery investigations center on the following research questions:

- **Origins of refuge cave (Site 24470).** Based on the limited investigations conducted in this inventory survey, it appears that the cave may have been used during different times for different purposes. The early date of AD 1400 may be associated with intermittent use of the cave during fishing forays to this part of the island. Refuge activity may have been concentrated elsewhere in the cave and been conducted at various times. Data recovery excavations should be designed to investigate several different parts of the cave to examine potential multiple functions and chronology of the archaeology in the cave. Recommendation for additional excavations reiterates a previous recommendation to do so (Bevacqua 1972:14).

- **Trail sites (Various Site Nos.).** As part of the survey, trails were mapped relative to the station markers for the alternative project corridors. This provided relatively accurate locations sufficient for determining the extent of potential impact that the proposed highway might have on these resources. Data recovery should be conducted for all trails that will be impacted by road construction in the selected alternative. Two kinds of data should be recovered: precise locations and morphology. Precise locations can be generated by walking all trails with GPS equipment. Recorded locational data should include changes in lava flows and elevation. Data on the morphology should be collected to examine intensity of use. For instance, it was evident in the inventory survey that some trails were "well-worn" while others were ephemeral and difficult to observe. Detailed observations of this kind of data may provide insights into how the area was used. Why is there an apparently heavily-used trail that runs parallel to the ocean yet is so far from the ocean? Did one or more trail link the shoreline habitation to the refuge cave, and if so, what does that say about the relationship of the refuge area to the settlement(s)?
- **Quarry sites (Various Site Nos.)**. There are two kinds of quarry sites: pāhoehoe excavations and ridge quarries. It can be expected that materials from these quarries were used locally in settlements at the nearby shoreline. They may also have been moved, traded, or given to people to use in places further afield in the *ahupuaʻa* (at Waimea for instance), with neighboring *ahupuaʻa*, across the island, or with other islands. Research into the use and distribution of raw materials can be enhanced with mineralogical studies of raw material composition. Currently all of the rough ʻaʻa is identified as the Kanikū flow. However, by walking the flow it is clear that there are several different flow events that are lumped into this label. Different flows will have different mineralogical signatures. Materials for quarry sites from different parts of the Kanikū flow should be collected and examined for distinguishing mineralogical markers. These can be compared with materials collected and identified from other archaeological sites in Hawaiʻi.

3.15 CULTURAL RESOURCES AND PRACTICES

For cultural resources and practices, the region of influence consists primarily of the alternative project corridors, but at a broader level the entire landscape at the northern edge of the Kona *moku* and southern edge of the Kohala *moku*. Cultural resources and practices need to be treated in this larger context, in consideration of the land use practices and care embodied in the *ahupuaʻa* land use system, which stresses the *mauka-makai* connection on both a physical and a spiritual level.

Consistent with the requirements of HRS Chapter 343, the cultural impact assessment (CIA) presented in this EIS is based on several sources. Information on cultural history reflects research by cultural and archaeological specialists that is presented in full in ***Appendix E1***. A summary of some of this material is presented in Section 3.14.1.1, above, which provides the basis for expectations for the investigation of historic sites, particularly archaeological sites. This information was obtained from a number of published sources as well as interviews with local residents and cultural experts conducted in various phases of the Project from 2000 to 2014. In early phases, formal interviews were conducted with four individuals, and several others were interviewed less formally. Audiotapes of the formal interviews are on file at SCS, Inc., the consultant for the Project. The interviews produced information on ranch activity, historical use of the project area and surrounding region, and perceptions of legends and traditional history. The following individuals were interviewed:

- Kuʻulei Keakealani McCarthy has lived in the Puʻuanahulu area most of her life, and was interviewed in November 2001 (and met with later during Section 106 consultation, as discussed below). Her father, Sonny Keakealani, Jr., was raised in Puʻuanahulu and was a *paniolo* at Puʻuwaʻawaʻa Ranch and Parker Ranch. She learned about the history of this area from her father and uncle Howard Alapaʻi.
- Paul Andrade, cultural specialist Director for the Outrigger Resort at Mauna Lani, was interviewed in November 2001. Mr. Andrade was born in Honokaʻa in 1962, and the elders in his family worked at Parker Ranch.
- Jiro Yamaguchi was 77 years old at the time of his interview in April 15, 2002. He was born in Waimea, and started working at Parker Ranch when he was 13 years old. Before World War II, Mr. Yamaguchi worked at the dairy, mended ranch fences, and worked with mules. Afterwards, he became a full-time cowboy. He learned to speak Hawaiian to work with the other Hawaiians on the ranch and to communicate about the place names on the ranch. Four generations of his family have worked at Parker Ranch. Mr. Yamaguchi passed away prior to the submittal of this report.
- Mark Yamaguchi, Jiro's son, was 43 years old at the time of his interview in April 2002. He was born in Honokaʻa and worked at Parker Ranch for most of his adult life.
- P. F. Kwiatkowski provided valuable insights into activities conducted in the grasslands of Kohala in conversations during 2003.

As discussed in detail in Section 3.14.1, above, as part of Section 106 Consultation, public notices were published in the *West Hawaiʻi Today, Hawaiʻi Tribune-Herald, Honolulu Star-Advertiser* and the Office of Hawaiian Affairs (OHA) *Ka Wai Ola* newspapers in August and September of 2014. Section 106 Consultation letters were mailed to Native Hawaiian Organizations (NHO), cultural practitioners, and individuals who have knowledge of the project area lands (see ***Table 3.14.1***).

A detailed discussion of the process and chronology of Section 106 consultation is contained in ***Appendix E1***, and ***Appendix E2*** contains letters, newspaper ads, and other material related to the consultation. In summary, thirteen individuals and members of eleven organizations were contacted to ask if they knew of, or knew of anyone who has information concerning, historic properties, archaeological sites, or cultural practices associated with the project area lands. Individuals contacted included long-standing members of the Puʻu Anahulu, Kohala, and Waimea communities, and former Parker Ranch employees who are familiar with the project area lands. Organizations invited to consult included the Office of Hawaiian Affairs (OHA), the Hawaiʻi Island Burial Council (HIBC), the Department of Hawaiian Home Lands (DHHL), the Hawaiʻi State Historic Preservation Division (SHPD) Burial Sites Specialist, Hui Mālama I Na Kūpuna ʻO Hawaiʻi Nei, the Ala Kahakai National Historic Trail-National Park Service, the Hawaiʻi County Planning Department Cultural Resources Commission, the Waimea Community association, the Waikoloa Community Association, the Paniolo Preservation Society, the Waimea Hawaiian Civic Club, and the Kona Hawaiian Civic Club. Maps of the Project's Area of Potential Effect were provided to those contacted to provide information and context. Meetings, interviews, and telephone interviews were conducted with nine individuals as well as with members of OHA, DHHL, and the HIBC.

All individuals contacted were interested in consulting, as were several organizations. The individuals and organizations that responded asked to review the draft AIS report. The draft AIS report was provided to these individuals and organizations. Additional consultation comments generated through the review of the draft AIS, or received through additional interviews and meetings, will be included in the final draft of the AIS report and in the Final EIS.

Information obtained from these respondents and interviewees was critical not only for assessing archaeological sites and formal Traditional Cultural Properties (TCPs), as discussed above in Section 3.14.1, but also for understanding broader patterns of cultural use and ongoing traditional cultural practices within the project corridors or landscapes with similar natural resources. The category of TCPs is restricted to resources that are an identifiable place on a landscape that is not intangible, i.e., it must have some kind of boundary. Although not restricted to one particular place, the practice of gathering diverse types of resources is a cultural practice that transcends the place-based restrictions of TCPs. Furthermore, some types of landscapes are also valued beyond the association with any one particular place. Lava flows, forests and topographic ridges often are seen as valuable cultural landscapes wherever they are found in the Hawaiian Islands. This type of analysis was outlined in the1997 *Guidelines for Assessing Cultural Impacts* from the Hawai‘i State Office of Environmental Quality Control (OEQC), and later adopted as a requirement for a Chapter 343, EIS, in Act 50, enacted by the Legislature of the State of Hawai‘i in 2000. Cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-related, recreational, and religions and spiritual customs. The analysis in this section attempts to identify and assess impacts to these types of practices and resources.

3.15.1 Existing Environment

Environmental Setting

Before discussing the cultural practices and resources, it is important to review the basic physical environment, as traditional Hawaiian culture is closely linked to its environment. The ancient Hawaiians saw (as do many Hawaiians today) all things within their environment as being interrelated. That which was in the uplands shared a relationship with that which was in the lowlands, coastal region and even the sea. This relationship and identity with place worked in reverse as well. The *ahupua‘a* as a land unit was the thread that bound all things together in Hawaiian life (Handy and Handy 1991; Handy and Pukui 1972; Maly 2000).

Entire *ahupua‘a*, or portions of the land were generally under the jurisdiction of appointed *konohiki* or lesser chief-landlords, who answered to an *ali‘i-‘ai-ahupua‘a* (chief who controlled the *ahupua‘a* resources). The *ali‘i-‘ai-ahupua‘a* in turn answered to an *ali‘i ‘ai moku* (chief who claimed the abundance of the entire district). Thus, *ahupua‘a* resources supported not only the *maka‘āinana* who lived on the land, but also contributed to the support of the *ali‘i* of regional and/or island kingdoms. As long as sufficient tribute was offered and *kapu* (restrictions) were observed, the *maka‘āinana* who lived in a given *ahupua‘a* had access to most of the resources from mountain slopes to the ocean. This right to gather resources was generally tied to residency within an *ahupua'a*, and also was tied to the obligation to pay tribute to the *ali'i* (Malo 1951:63-67; Kamakau 1961:372-377; and Boundary Commission testimonies cited in Maly 2000).

Detailed descriptions of environmental characteristics are contained in various sections in other locations of this chapter dealing with geology (Section 3.7), water (Section 3.8) and biology (Sections 3.9 and 3.10). It bears reiteration that lava flows associated with Mauna Kea, Mauna Loa, and Hualālai volcanoes cover the project area (Wolfe and Morris 1996). The various compositions and ages of the flows create several distinctly different terrains and substrates, ranging from cinder cones, to hummocky, nearly bare 'a'a flows, to sandy loam colluvium on certain flats. Because of aridity, no permanent streams are found within or immediately adjacent to the project area. Pockets of *pili* grasslands, useful for thatching, were directly associated with the *kipuka* of older and weathered lava flows. Just upslope of Pu'u Hinai the soils were sufficient to sustain scattered *'aina mahi* or farmlands, associated with level deep soil created from accumulation of colluvial deposits. Another notable aspect of the regional physical setting is the occasionally strong winds, which were traditionally called *mumuku*.

The absence of water in most of the project area severely restricted agriculture, although many resources were widely gathered. To Western eyes, such a landscape might appear bereft of utility, much less beauty, but traditional Hawaiian culture regarded it as abundant with resources such as rock, grass and bird eggs. Areas such as southern Kohala and Kekaha, the arid northern portion of Kona, were affectionately regarded by their residents, who developed an ingenious and sustainable set of fishing, dryland farming, and pond aquaculture technologies adapted to the difficult setting.

Traditional Accounts of Early Waikoloa and Surrounding Lands

Hawaiian legends provide insights into the social structure, daily lives, relationship between the realms of people and nature, and remarkable events of the past (Beckwith 1970). In the project area, the importance of the shoreline, with its life-giving waters and many resources, is evident. Traditional accounts (*mo'olelo 'āina*) of legendary places (*wahi pana*) in Waikoloa and Waimea include legends and historical narratives documented in historic times by native Hawaiians and 19th century authors. The accounts refer to events that took place from the 13th century to the arrival of European explorers. None of the accounts specifically mention lands within the project corridors, but they do refer more broadly to lands of Waikoloa, Waimea, Lālāmilo, and the coastal region from 'Anaeho'omalu to Puakō. Accounts include legends of supernatural entities, descriptions of places they traveled to in this region, and also legends that tell the stories of deities and persons whose actions and namesakes are the origins of prominent natural features and places on the landscape. There are also historical narratives that describe battles between warring *ali'i* and describe and name lands traversed by warriors and places battles were fought.

The Heart Stirring Legend of Ka-Miki relates the origins of several place names in the area of South Kohala.

> "The region of Lālāmilo was named for the young chief Lālāmilo, grandson of Kanakanaka, an expert lawai'a hī-'ahi (deep sea tuna lure fisherman) and Pilia-

mo‘o, a powerful priestess and ‘ōlohe. Kanakanaka and Pilia-mo‘o were the parents of Nē'ula (a fishing goddess), and she married Pu‘u-hīna‘i a chief of the inlands, and they in turn were the parents of Lālāmilo. Kanakanaka's sister was the wind goddess, Waikoloa, for whom the lands are now named.

Lālāmilo gained fame as an expert ‘ōlohe and fisherman. And through his wife Puakō, he came to possess the supernatural leho (cowry octopus lure) which had been an ‘ōnohi (cherished) possession of Ha‘aluea, a goddess with an octopus form... How this octopus lure came to rest on the reefs fronting this land remains a mystery. . .

Puakō was the daughter of Wa‘awa‘a (kāne) and Anahulu (wahine), and the sister of: ‘Anaeho‘omalu (wahine); Pū‘āla‘a (kāne); and Maui-loa (kāne). Puakō's great desire was to eat he‘e (octopus), and Pū‘āla‘a was kept continually busy acquiring he‘e for Puakō, and getting pa‘ou‘ou fish for ‘Anaeho‘omalu. When he could no longer provide sufficient numbers of fish for his sisters they left Puna and set out in search of suitable husbands who could provide for their needs.

Because of their great love for ‘Anaeho‘omalu and Puakō, Anahulu, Wa‘awa‘a, their relatives and attendants also moved to the Kona - Kohala region and dwelt at sites which now bear their names; only Pū‘āla‘a remained in Puna. This is how Pu‘u-Huluhulu, Pu‘u-Iki, and Mauiloa came to be named; and Pu‘u Anahulu (Ten day hill [ceremonial period]) was named for Anahulu, the chiefess wife of Wa‘awa‘a (Pu‘u Wa‘awa‘a).

Arriving at Kapalaoa in the Kekaha lands of Kona, ‘Anaeho‘omalu married Nāipuakalaulani, son of the chiefess Kuaīwa of Kapalaoa. Puakō went on to Waimea where she met with natives of that area, and was introduced to the chiefess Nē‘ula, mother of Lālāmilo. When Nē‘ula learned that Puakō greatly coveted he‘e, she told Puakō that her son was the foremost lawai‘a ‘ōkilo he‘e (octopus fisherman) of the region. And because Puakō was so beautiful, Nē‘ula introduced her to Lālāmilo. Lālāmilo saw Puakō, and compared her to the foremost “he‘e” which he could catch (*Ka Hoku o Hawaii*, July 5 and 19, 1917, translated in Maly and Maly 2002: 22-23).”

The origin of the large ‘Auwaiakeakua gulch that runs from near Ke‘āmuku to Waikoloa Village was told to Maly by former residents of Waiki‘i. ‘Auwaiakeakua (Water channel of the gods) was built by *menehune* who abandoned the construction in fear of the coming dawn.

The legend of Kanikū and Kanimoe, two *mo‘o* (water-spirits with lizard bodies) relates to the conspicuous lava flow that dominates the landscape of the lower project area. These two *mo‘o* would take the form of beautiful women, and live in the large coastal fishpond of Wainānāli‘i in Pu‘uanahulu, which was said to have been one and a half miles wide and over two miles long. A lava flow covered the pond and Kanikū and Kanimoe were turned into stone. Their bodies remain in the middle of the ʻaʻa, lying side by side in the lava flow now known as the Kanikū Flow (Keakealani Interview). Kanimoe means "prostrate sound", and Kanikū means "upright sound" (Pukui *et al.* 1974:85).

The story of the origin of the settlements in the region provide insights into island-wide movements and local interactions. They also illuminate valued cultural places and landscapes that continue to have meaning.

Cultural Continuity and Change in the 19th and 20th Centuries

There are many events and places on the island of Hawaiʻi that are associated with the rise to dominance over the island chain by Kamehameha in the late 1700s and early 1800s. One of the critical events in consolidating his power over the island took place at the *heiau* at Puʻukoholā in Kawaihae. The *heiau* was built by Kamehameha to demonstrate his allegiance to and respect for the war god Kukailimoku (Kamakau 1961:154; Cordy 2000; 334; Desha 2000:267, 268). He chose the location at Kawaihae where Lonoikamakahiki had constructed a *heiau* during his reign (Fornander 1917:324; Kinney 1913:43). Puʻukoholā Heiau was probably completed by the summer of 1791 (Cordy 200:338). With the assistance of his advisors, Kamehameha convinced his rival Keoua Kauahuʻula to come to Kawaihae. When Keoua arrived he was overpowered and killed, and his body was used to consecrate the new *heiau*.

Kamehameha also employed foreign methods and materials. Through an unusual set of circumstances, two Englishmen, John Young and Isaac Davis, became trusted advisors and friends of Kamehameha, assisting him in many of his battles on the sea and land. Both married Hawaiian women, had families, and spent the rest of their lives in Hawaiʻi. John Young and Isaac Davis were rewarded with various lands on Oʻahu and Hawaiʻi. Isaac Davis received a large, relatively unproductive portion of Waikoloa referred to as the "*pili*" lands. Waikoloa had previously been under the control of the Waimea chiefs, a descendant of whom (Kahaʻanapilo) had married George Hu'eu, a son of Isaac Davis (Barrère 1983:28).

Kawaihae was a small but significant village with a calm harbor at the crossroads between North and South Kohala. It was a royal center for the powerful in the early 1800s, as well as for centuries before that (Barrère 1983; Cordy 2000). When in residence, Kamehameha stayed at Pelekane on the beach below Puʻukoholā Heiau where a few brackish water springs and Makeahua Gulch supplied an intermittent source of fresh water (Apple 1978:34). Shallow salt ponds were located nearby and salt was manufactured both here and at Puakō (Menzies 1920:355, Ellis 1969:397-398). Trails connected Kawaihae to the upland settlements and their agricultural fields (Barrère 1983:30).

By 1823, Puakō was a "considerable village" that specialized in salt production and marine resources and had a small fishpond supporting mullet and (Ellis 1969:399-400). Fresh water from shoreline springs formed brackish ponds. Behind the beach surrounding ʻAnaehoʻomalu Bay are two fishponds, Kuʻualiʻi and Kahapapa, which contain several species of shrimp and fish. Other settlements were dispersed along the coast, with nodes of habitation at Kalāhuipuaʻa and Kapalaoa (Ellis 1969).

Hawai‘i changed rapidly and dramatically after the death of Kamehameha I in 1819. Population moved from traditional homelands and decreased due to the introduction of alien diseases, and new concepts of economy and ownership (Cordy 2000; Daws 1968; Doyle 1953; Ellis 1963; Kuykendall 1938; Kame‘eleihiwa 1992; Kelly 1983). Events of this kind that directly affected the people of the project area include the introduction of cattle and sheep by Vancouver in 1974. The cattle had multiplied fruitfully by 1820 due to a *kapu* on killing cattle and the hospitable habitat of the regional uplands. Immense herds of wild cattle and horses roamed Waimea and Mauna Kea by the 1820s.

Wild cattle were considered property of the government until the Māhele. John Parker was granted permission by Kamehameha I to hunt the king’s cattle, helping to supply hides for both local and foreign consumption (Brennan 1974:37-40). Parker married Chiefess Keliikipikaneo-kaolohaka, a granddaughter of Kamehameha, thereby gaining control and access to royal lands. He had established a tame herd of cattle in the Waiki‘i area and in 1835 moved his family to Mānā at Waimea, where he began improving his cattle herds with imported stock. The cattle were driven downslope to Kawaihae and Puakō to be shipped to market. By 1846 there were approximately 25,000 wild and 10,000 tame cattle on the island.

Traditional agricultural practices conducted in the fertile irrigated fields of Waimea and surrounding areas were diminished and transformed in the early 1800s (Ellis 1969; McEldowney 1983; Menzies 1920). In addition to the network of irrigated fields, smaller and isolated areas in the slopes of Waikoloa and along the coast were also cultivated. (Boundary Commission Vol. B:64 and 74).

On the rising ground above the seacoast settlements, several main trails led past occasionally cultivated ground to the uplands of Waimea, where, in the early 1820s were three major settlements, about two miles apart. One was Ke‘eali‘i, one at Waikoloa, and one at Pu‘ukapu. All three were concentrated where a major stream emptied itself upon the plateau (Barrere 1983:30).

During the early and mid-1800s, old trails were being altered to accommodate newer forms of transportation (Apple 1965). The road between Waimea and Kawaihae and further south was an old road that was modified to be broader and straighter.

Details of the Māhele that divided land among the king, the chiefs, and the government are discussed above in Section 3.14 and will not be repeated, but several aspects of the process relate to ongoing cultural practices. Once lands were made available and private ownership was instituted, the *maka‘āinana* (commoners), if they were fully aware of the procedures and comfortable with asserting claims, were able to claim the plots on which they had been cultivating and living. These claims, however, could not include any previously cultivated or presently fallow land, *okipu‘u* (forest clearings), stream fisheries, *pili* lands, and many other resources traditionally necessary for survival (Kelly 1983, Kame‘eleihiwa 1992:295, Kirch and Sahlins 1992). This limitation often left them without a firm basis for gathering many of the resources that were vital for traditional subsistence and cultural practice.

Royal Patent Grant (5671) was issued to Isaac Davis. This large parcel of land did not include any access to the ocean. In addition, the fertile and productive Waikoloa uplands of Pu‘ukapu, Pukalani, Noho‘aina, Kuku‘i‘ula, and Paulama had been withheld from the award to Davis. Consequently, Davis received only the *pili* lands, the dry, grassy slopes of the region which constitutes the project area for the proposed Saddle Road Extension (Barrère 1983).

The exact type of land unit for Waikoloa during the institution of the Māhele and related procedures was not clearly defined, and was under dispute. Waikoloa was referred to as an *‘ili* of Waimea Ahupua‘a in testimony during the 1840s and on early survey maps (Boundary Commission Book No. 1 pp.6-12). George Hu‘eu, son of Isaac Davis, referred to the family’s land of Waikoloa as an *‘ili* (*‘ili kūpono*) within the *kalana* of Waimea. In addition, both Crown lands and Davis’ land were identified as Waikoloa during the Māhele. Eventually the Crown lands were renamed Lālāmilo (Barrère 1983). Ultimately that portion of Waikoloa owned by the Davis family was upslope from the shoreline, and below the fertile lands of Lālāmilo.

Kamehameha I had passed the most favored lands in this area, the shoreline at ‘Anaeho‘omalu (which came with fishing rights), to Kamehameha II and then to Kamehameha III. He kept it as crown land but eventually passed it on to his wife, Queen Kalama Kapakuhaili Hakaleleponi (LCA 4452). Both the *‘ili* of ‘Anaeho‘omalu and Kalāhuipua‘a were considered *‘ili kūpono* and as such were not included in Hu‘eu‘s Royal Patent. They were both given to Queen Kalama (Boundary Commission Book 1:8; Cordy 1987). There were no LCA claims made for *kuleana* in ‘Anaeho‘omalu, Kalāhuipua‘a, Lālāmilo (Waikoloa Iki), or Waikoloa. Had there been claimants, they undoubtedly would have utilized the upland areas for *pili* grass and rock resources, bird eggs, medicinal plants, and other such resources.

Ongoing Cultural Practices in Project Area

Examples of Hawaiian cultural practices include: gathering of subsistence items; commercial activities; loci of recreation, habitation, and agriculture; use of pathways to resources; and places where religions and spiritual customs are conducted.

The sources consulted during the research conducted for this investigation indicated that the types of resource gathering that may have once existed in the past have not been conducted in the project area for generations. This is partly due to the fact that traditional villages along the coast, which relied on the use of upland resources, are no longer present. Consequently, there are no gatherers of birds and bird feathers, nor of *pili* grass, a resource now barely present in the project area. Other natural resources that the archaeological data indicate were taken from the project area in ancient times, such as scoriaceous stone to produce abrading tools, have not been collected for such purposes within the project area for many generations. The *mauka* third of the project area is within fenced cattle pastures that are not open to the general public, although they could be accessed by cultural practitioners. Because of the lack of most types of valuable resources in this area, and the presence of public lands of equal or superior resource value nearby (e.g., shorelines and the State lands of Pu‘uanahulu), there appears to be little or no gathering occurring in this area.

Aside from gathering sites, archaeological sites can also be culturally significant in Hawai‘i. In addition to providing information and interpretation on the past, archaeological sites may offer a dynamic link between the vital culture of the present and events of the past. Certain archaeological sites such as ceremonial places and burial locations warrant special consideration and protection, or provide information on and cultural practices and beliefs. Places in South Kohala that are revered for their historical associations and past events, such as *heiau* where religious and spiritual customs continue to be conducted, are situated well beyond the project area. As discussed above in Section 3.14, all of the archaeological sites within the project area have been evaluated as significant for the information that they contain that contributes to the understanding of the past (Criterion D). That information can be retrieved through data recovery procedures. For many of the sites, sufficient data was collected during the inventory survey stages of the Project, and no further work will be required. For other sites, data recovery will need to be conducted prior to commencement of construction. None of the sites within the project area are recommended for preservation. There do not appear to be any sites that have special cultural significance.

It is important to note that archaeological survey did not locate any *iwi kupuna* (Hawaiian burials) within the area that would be affected directly or indirectly by construction of any alternative of the Project.

Based on interviews with informants and consultation of oral history, written accounts of legend and history, the Māhele records and maps, although resource gathering was universally practiced here and elsewhere in Hawai‘i, there are no unique, identified places for cultural practices in the area. Although the area, like all land in Hawai‘i, is implicitly imbued with cultural importance, and the entire landscape of the island, including its lava flows, hills, bays and forests, are storied, no specific sites of cultural significance with the potential to be impacted by the proposed project appear to be present.

3.15.2 Environmental Consequences

Although no cultural resources or practices specific to the land have been identified, there are more general cultural concerns about the use of any natural Hawaiian landscape, including this one. These concerns were expressed in interviews conducted with the residents of Pu‘uanahulu (about five miles to the south, but within the same *ahupua‘a* as a two-mile segment of Alternative 4), and at a meeting of the Hawai‘i Island Burial Council. As discussed in detail on Pages 8-13 in Appendix E1, interest centered on the following:

> ***Iwi Kupuna* (Hawaiian Burials) and Archaeological Sites**. Although no burials are present in any of the project corridors, there is concern about the potential for a highway to increase access to burials in the wider area. Burials are known to be present in the lands of Waikoloa and Pu‘uanahulu. A number of other archaeological sites associated with ancient and post-Western contact are also present. These lands can be accessed by the Māmalahoa Highway, Waikoloa Road, and Queen Ka‘ahumanu Highway. Although the Saddle Road Extension would provide a fourth access corridor in this region, there would generally be cattle fences near the edges of the right-of-way to prevent easy access. While fences cannot prevent unauthorized access, it appears to have been generally successful in limiting unauthorized visitation of the area and there are no known issues of desecration or damage to burials or archaeological sites on these lands.

Storied Landscapes. Residents of Puʻuanahulu expressed concern about the crossing of the Kanikū lava flow, a storied landscape, as evidenced in the actions of the legendary figures Kanikū and Kanimoe discussed above. Most of the actions associated with these figures are represented as outside of the project corridors. However, the proposed highway could not avoid crossing the Kanikū lava flow, as do the Māmalahoa Highway, Waikoloa Road, and Queen Kaʻahumanu Highway. The Waikoloa Beach and Mauna Lani resorts, a portion of the West Hawaiʻi Sanitary Landfill and much of the area identified in the County General Plan for future development *makai* of Waikoloa Village also are built on this lava flow. The Kanikū lava flow is such a large feature – about 30 miles long and 3 miles wide, occupying a large area of North Kona and South Kohala – that it has been unavoidable for any highways that connect West Hawaiʻi communities.

Protection for Rare Native Plants. Some interviewees expressed concern that highway construction could harm native plants, which have not only biological but cultural value that could be lost if habitat for these species continues to degrade. The primary concern was that every effort should be made to avoid the rare endemic and indigenous plants that are part of the cultural heritage of the Hawaiian people. As discussed in Section 3.9, no threatened or endangered plants would be affected, However, one *wiliwili* tree, a increasingly uncommon species that had many ethnobotanical uses and whose striking appearance symbolizes the dry forest, was present in Segment 5/6. Alternatives 4, 5 and 6 were specifically selected over other routes in the Alternatives Study (CROSS-REFERENCE: Chapter 2) to minimize impacts to rare species.

Use of Undeveloped Land. In discussions with the Puʻuanahulu community as well as the Hawaiʻi Island Burial Council, the question was asked if the need for a new road, rather than improving existing roads, justifies impacting undeveloped land and impacting its plants (through removal of native plants and spread of invasive plants), animals (including impacts to goats that are hit by vehicles), landforms, soil, drainage, archaeology, development potential and scenic value, all of which have cultural implications.

Cultural Boundary Markers. Members of the Hawaiʻi Island Burial Council expressed concern that the highway would cross the North Kona-South Kohala *moku* (district) boundary in two places. They expressed that these are traditional boundaries may be invisible or difficult to discern but they are culturally and historically important to Hawaiians. In addition, there was likely pre-contact era activity along the boundary, including the construction of rock mounds to mark the boundary. There might also be other archaeological features, such as trails and burials, along the *moku* boundary.

Differences in Impacts Between Alternatives 4, 5 and 6 and Intersection Design Options

The only substantial differences related to the concerns expressed above are as follows:

- Alternative 4 involves more use of the Kanikū Lava Flow (refer to ***Fig. 3.1.1*****).** *Makai* of the eastern segment common to all three alternatives, Segment 4/5/6 *mauka*, Alternatives

5 and 6 stay to the north out of the flow while Alternative 4 soon enters this flow. The lower third of all alternatives is within the flow, however.

- Alternative 4 crosses the North Kona/South Kohala *moku* boundary twice, while Alternatives 5 and 6 remain outside the North Kona District.
- Use of either Alternative 5 or 6 would involve the loss of one *wiliwili* tree, while none are present in Alternative 4.

No differences with respect to cultural practices exist between the design options.

Impacts of the No Action Alternative

The No Action Alternative would avoid any impacts to undeveloped lands and all cultural values or resources associated with them.

3.15.3 Mitigation Measures

The mitigation measures here are derived primarily from the suggestions of those consulted during interviews and meetings. Some mitigation measures were developed for physical and historic resources discussed above, as cross-referenced. As the Draft EIS will undergo review by the consulted parties as well as others who may not have been reached during the first phases of Section 106 consultation, refined and/or additional mitigation may be suggested that may then be adopted in the Final EIS and Record of Decision.

1. As has occurred previously as part of newly-constructed segments of the Daniel K. Inouye Highway are opened for public use, proper cultural protocol will be completed by a native Hawaiian who follows the ways of the old culture to release and sanctify or bless the construction project.
2. Cultural monitors will be employed during ground disturbing activities as part of construction of the highway. These monitors will complement the efforts of archaeological monitors in assuring that significant cultural resources that may have not been documented during the EIS are recognized and dealt with appropriately. Native Hawaiian Organizations (NHOs) and others in the Hawaiian community will be consulted in the selection and hiring of cultural monitors.
3. As the *moku* boundary is culturally important, it will be marked with signage for entering and exiting travelers. In addition, some of the trails will be marked where the proposed highway crosses them. During final design, FHWA will consider utilizing a distinct road surface color that will show the pathway. These measures will honor these cultural divisions of space and will educate the public.
4. Despite such mitigation, the disturbance of the cultural landscape is seen by many as almost unmitigable. As suggested by the Hawaiʻi Island Burial Council, FHWA will work with the University of Hawaiʻi at Hilo to provide funding for students to assist in an effort to collect information from the archaeological sites and the cultural landscape prior to construction.

3.16 HAZARDOUS MATERIALS AND TOXIC SUBSTANCES AND ORDNANCE AND EXPLOSIVES

For hazardous materials and toxic substances and ordnance and explosives, the region of influence consists of the project site corridors, where construction has the potential to uncover or disturb these materials of concern. This section identifies locations of known regulated materials so they can be avoided or their impacts minimized. Regulated materials are substances or materials, including hazardous substances and materials that have been determined by the Environmental Protection Agency (EPA) to be capable of posing an unreasonable risk to health, safety, and property. Examples of regulated materials include asbestos, lead-based paint, heavy metals, and petroleum hydrocarbons (e.g., gasoline and diesel fuels), which could be harmful to human health and the environment.

3.16.1 Hazardous Materials and Toxic Substances

Hazardous materials, including hazardous substances and wastes, are regulated by many state and federal laws. Statutes govern the generation, treatment, storage and disposal of hazardous materials, substances, and waste, and also the investigation and mitigation of waste releases, air and water quality, human health and land use.

The primary federal laws regulating hazardous wastes/materials are the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) and the Resource Conservation and Recovery Act of 1976 (RCRA). The purpose of CERCLA, often referred to as "Superfund," is to identify and clean up abandoned contaminated sites so that public health and welfare are not compromised. The Resource Conservation and Recovery Act provides for "cradle to grave" regulation of hazardous waste generated by operating entities. Other federal laws include:

a. Community Environmental Response Facilitation Act (CERFA) of 1992
b. Clean Water Act
c. Clean Air Act
d. Safe Drinking Water Act
e. Occupational Safety and Health Act (OSHA)
f. Atomic Energy Act
g. Toxic Substances Control Act (TSCA)
h. Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

In addition to the acts listed above, Executive Order (EO) 12088, Federal Compliance with Pollution Control Standards, mandates that necessary actions be taken to prevent and control environmental pollution when federal activities or federal facilities are involved.

The Hawaiʻi Department of Health (DOH) received delegation of its hazardous waste program in 1999, and is regulated under the DOH Title 11, Chapter 260 (Hazardous Waste Management, General Provisions) of the Hawaiʻi Administrative Rules. This provision defines hazardous waste and addresses specific handling, storage, transportation, disposal, treatment, reduction, cleanup and emergency planning of hazardous waste.

Worker and public health and safety are key issues when addressing hazardous materials that may affect human health and the environment. Proper management and disposal of hazardous material is vital if it is found, disturbed, or generated during project construction.

3.16.1.1 Existing Environment

The project corridors traverse areas that have undergone no modern land use except for very scattered grazing and two utility lines. No roads or buildings are present, and no extractive activities such as mining or logging have occurred in or immediately adjacent to the corridors. Therefore, no Phase I Site Assessment was conducted to systematically investigate potential hazards such as hazardous material sites, petroleum hydrocarbon sites, or above ground or underground storage tank (AST or UST) locations. Discussions with County Fire, Police and Civil Defense conducted as part of EIS early consultation did not indicate any issues in the area, and visual reconnaissance of the survey corridor at various dates between 2000 and 2015 have revealed no evidence of hazardous materials, toxic substances or other conditions that would be of concern, with the exception of scrap and other inert material related to ordnance and explosives, as discussed below in Section 3.16.2. State DOH hazardous material databases indicate no active or former Underground Storage Tanks, Leaking Underground Storage Tanks, or generators of hazardous materials along the project corridors (http://eha-web.doh.hawaii.gov/ehw/ accessed March 2017).

3.16.1.2 Environmental Consequences

Based on the apparent lack of hazardous materials or toxic substances, it appears unlikely that any adverse impacts from construction or use of the Saddle Road Extension related to existing hazardous materials or toxic substances within any of the alternative project corridors.

Differences in Impacts Between Alternatives 4, 5 and 6 and Intersection Design Options

At this time, it does not appear that there are any substantial differences between the alternatives with respect to the potential to the potential for hazardous materials or toxic substances.

Impacts of the No Action Alternative

The No Action Alternative would avoid any potential for encountering hazardous materials or toxic substances.

3.16.1.3 Mitigation Measures

1. If previously unidentified hazardous substances or toxic materials are found during or before Project construction that indicate an existing release, a past release, or a material threat of a release of any hazardous substance or petroleum products into the project corridor of the selected alternative, work will cease at that location and appropriate regulatory or resource personnel will be contacted.

2. In areas where right-of-way is needed outside of that already surveyed, the project area will be further investigated prior to land acquisition and construction to confirm the absence of hazardous substances or toxic materials, if appropriate.

3.16.2 Ordnance and Explosives (OE)

3.16.2.1 Affected Environment

Background

The entire area traversed by all project corridors is part of the former Waikoloa Maneuver Area (WMA) (***Figure 3.16.1***). Through a licensing agreement with Richard Smart, then-owner of Parker Ranch, the U. S. Navy acquired 91,000 acres in Waikoloa in December of 1943. The area was bordered by Pōhakuloa Training Area, the sea, Kawaihae Road and the North Kona-South Kohala border. It was used as an artillery firing range on which live ammunition and other explosives were employed, with the remaining acreage utilized for troop maneuvers. Larger ordnance and explosives (OE) or unexploded ordnance (UXO) items used included 37 millimeter (mm), 75 mm, 105 mm, and 155 mm high explosive (HE) shells, 4.2-inch mortar rounds, and barrage rockets. From 1943 through 1945 nearly the entire WMA was in constant use, as the Marine infantry reviewed every phase of training from individual fighting to combat team exercises. Intensive live-fire training was conducted in grassy areas, fields, and around the cinder hills of Puʻu Pā and Puʻu Holoholokū.

A military cantonment was also established just outside Waimea town. Initially called Camp Waimea, it was later rechristened Camp Tarawa in honor of the first successful amphibious land invasion of the Pacific War. Camp Tarawa was the largest Marine training facility in the Pacific, covering an area of approximately 467 acres. It consisted of a small city of canvas tents, Quonset huts and wood framed structures all connected by a network of dirt and cinder roads. Between 1943 and 1945 as many as 50,000 men passed through Camp Tarawa on their way to the Pacific Theater. These included members of the 2nd and 5th Marine Divisions, the 31st Naval Construction Battalion, the 471st Army Amphibian Truck Company, the 726th Signal Aircraft Warning Company, the 11th Amphibian Tractor Battalion, the 5th Joint Assault Signal Company, and the 6th Marine War Dog Platoon. The 2nd Marine Division was assigned to Waikoloa in December 1943 for five months of training, in preparation for the Saipan-Tinian campaign. The 5th Marine Division began arriving in August 1944 at the camp vacated by the 2nd Marine Division.

In September of 1946, the property comprising the former WMA, with the exception of the 9,141-acre Lālāmilo Firing Range, was returned to its original land owners. The Lālāmilo Firing Range was retained as a camp site and training area by the U.S. Marines until 1953, through a permit granted by the Territory of Hawaiʻi. The permit was cancelled in December 1953, and the Territory of Hawaiʻi began using the land for cattle grazing. The State of Hawaiʻi has had ownership of the 9,141-acre Lālāmilo property since 1959.

At least two ordnance clearance efforts were conducted, one in 1946 just prior to the departure of the 5th Marine Division, and the other in 1954 following accidental detonation of a dud fuse or shell that killed two civilians and seriously injured three others. The 1954 effort detected as many as 400 dud items including hand grenades, 60 and 81 mm mortars, 75 mm shells, and 105 and 155 mm shell fuses, 31 mm anti-tank cannon shells, and 4.2 inch mortars. Live ordnance, ranging from grenades and bazooka rounds to hedgehog missiles, continues to be found in the former WMA as land development progresses. Unexploded ordnance has even been found near Waimea Middle School. Artillery rounds have caused at least nine accidental deaths since the end of World War II. Given the presence of 20,000 persons who live, work, or go to school within the boundaries of the former WMA, as well as numerous visitors, the former WMA has been ranked high in national risk assessments.

In order to address this problem, the U.S. Army Engineering and Support Center, Huntsville (CEHNC), and the U.S. Army Corps of Engineers (USACE), Honolulu District (CEPOH), teamed to produce a *Phase II Engineering Evaluation/Cost Analysis (EE/CA) for the Former Waikoloa Maneuver Area and Nansay Sites, Island of Hawai'i, Hawai'i* (U.S. Army Corps of Engineers 2002). The report documented the decision process to determine the most appropriate ordnance and explosives (OE) response actions for the Former Waikoloa Maneuver Area and Nansay Sites.

The project site was divided into sectors based on past military usage, current and future land uses and other factors. Visual reconnaissance surveys, surface clearance, geophysical mapping, visual surface searches, anomaly investigation, and intrusive OE sampling were all conducted in order to characterize the areas. A portion of the area (which now comprises over 100,000 acres), was investigated during the Phase II EE/CA field investigation. This effort detected thousands of individual items and many types of unexploded ordnance (hazardous) and scrap (inert and nonhazardous).

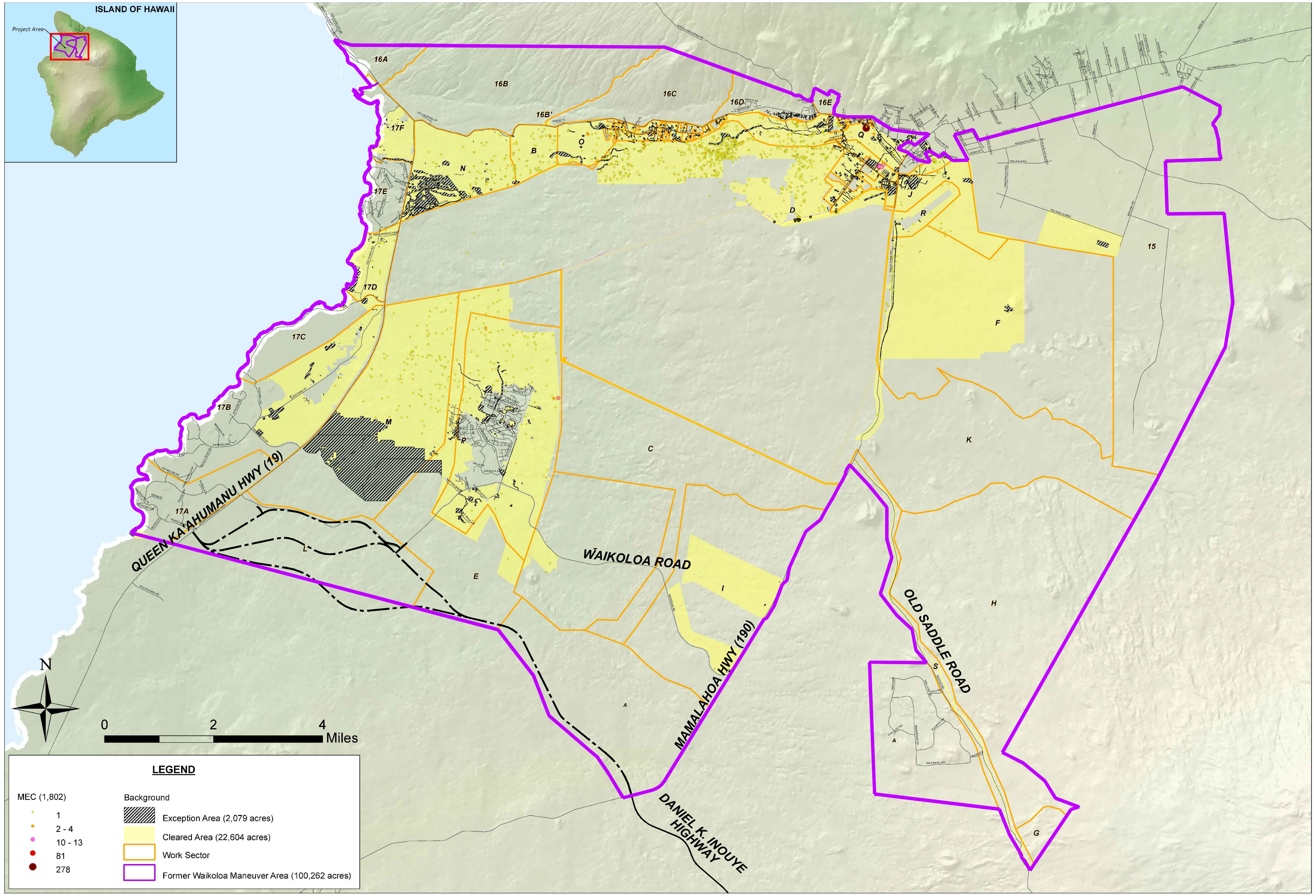
Since that time, OE removal has been ongoing. As of 2014, more than 100 different types of munitions had been found at the former WMA, including mortars, projectiles, hand grenades, rockets, land mines and Japanese ordnances. Over 1,800 munitions and explosives of concern, over 117,000 pounds of military debris, and over 149,000 pounds of munitions debris have been removed from more than 25,000 acres. The current estimated cost is $800 million to complete investigation, clean-up and long term monitoring, which are being carried out through ongoing contracts involving hundreds of workers.

OE in Project Corridors

As shown in ***Figure 3.16.1***, the project corridors are on the extreme south of the former WMA and pass through three sub-units into which the area is divided, Areas E, L and A. A portion of Area E further north has been subject to a new hazard evaluation (USACE Honolulu District 2014). Based on this, the preferred removal alternative presented in the Addendum to the Phase II EE/CA is subsurface clearance of military munitions to depth of soil or soil/basalt interface on 532 acres of Area E near Waikoloa Village.

LEGEND:

ALTERNATIVE



FA PROJECT NO. DP-HI-0200(5)

SADDLE ROAD EXTENSION

FIGURE 3.16.1 ~ FORMER WAIKOLOA MANEUVER AREA MAP

Source: U.S. ARMY CORPS OF ENGINEERS, Honolulu District

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Although the entire former WMA has been investigated at some level, and there have limited OE finds in the far south, no part of the project corridors has yet been systematically swept and cleared of OE. FHWA and HDOT are unaware of any discoveries of hazardous unexploded ordnance in or near the corridors, although material that is presumed to be scrap (inert and nonhazardous) was observed during field surveys.

3.16.2.2 Environmental Consequences

There are currently no indications that construction in any portions of the project corridors would encounter substantial quantities of OE that would prevent use of the area for a highway or involve extraordinary efforts and expense to remediate. As with most major construction with the former WMA, coordination with the USACE will be necessary to determine the level of surveys and clearance required.

Differences in Impacts Between Alternatives 4, 5 and 6 and Intersection Design Options

At this time, it does not appear that there are any substantial differences between the alternatives or design options with respect to the potential to encounter ordnance and explosives.

Impacts of the No Action Alternative

The No Action Alternative would avoid any potential for encountering ordnance and explosives.

3.16.2.3 Mitigation Measures

1. The FHWA and HDOT will consult with the USACE Honolulu District to determine the appropriate actions to reduce potential for the hazard from OE during and after construction of the selected highway route. Ordnance survey and disposal will precede construction activities in areas to be determined as part of the consultation.

3.17 SCENIC CHARACTER

3.17.1 Affected Environment

3.17.1.1 Existing Scenic Character

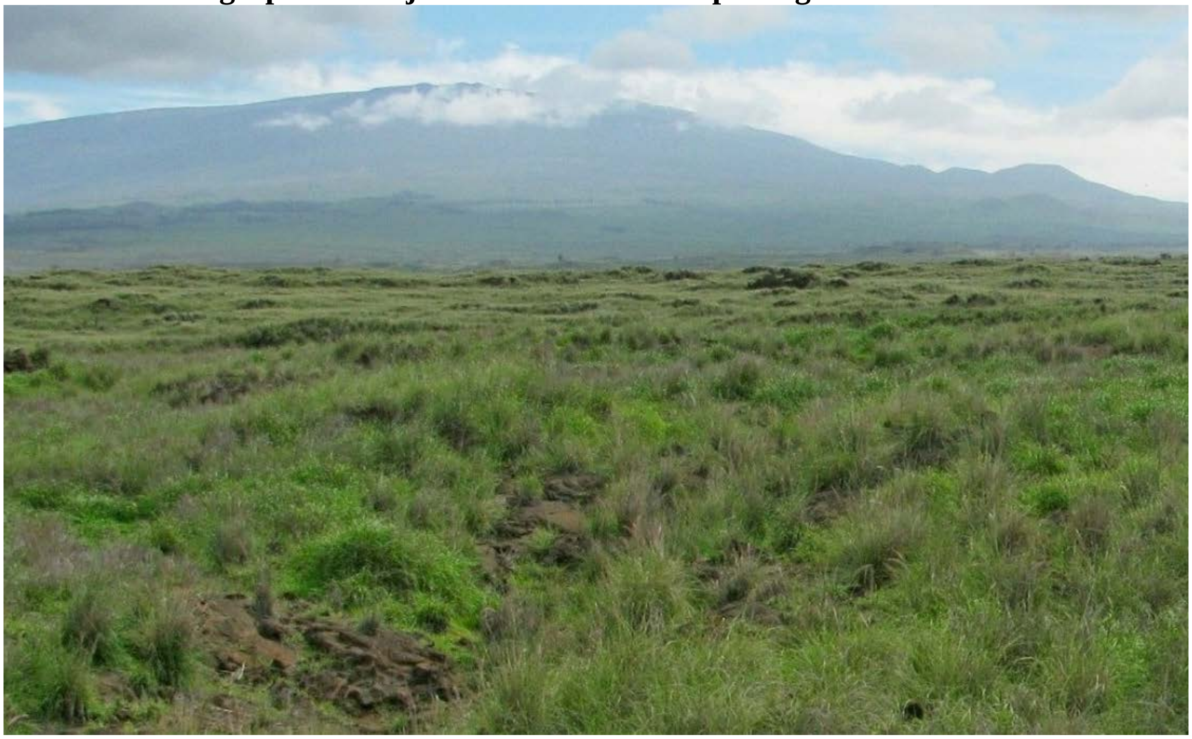
Dramatic terrain over an elevational range of between 60 and 2,500 feet above sea level coupled with open vegetation provides panoramic vistas with interesting landscape features. A foreground of rolling ridges and broad valleys, along with more distant vistas of cone-shaped *pu‘u* (hills), towering shield volcanoes and the Pacific Ocean provide scenic interest, as shown in the photographs in (***Figure 3.17.1***).

Natural features such as rock outcrops of basaltic lava, native shrublands, and grasslands that change hue from brown to green in times of rain are visible along all project corridors. There are only subtle cultural modifications of the natural landscapes, such as a few rough unpaved roads, powerlines, fence lines, and water tanks and troughs.

Figure 3.17.1a
Photographs of Project Corridor Landscape: Project Termini

Eastern terminus, at DKI Highway ▲ ▼ Western terminus, at Waikoloa Beach Drive

Figure 3.17.1b
Photographs of Project Corridor Landscape: Segment 4/5/6 *mauka*



View to Mauna Kea from upper area ▲ ▼ View to north from lower area

Figure 3.17.1c
Photographs of Project Corridor Landscape: Alternative 4

Lava landscape of upper area ▲ ▼ South of power line corridor

Figure 3.17.1d
Photographs of Project Corridor Landscape: Alternatives 5 and 6

Landscape in Segment 5/6 ▲ ▼ Alternative 5 in center of Kanikū lava flow

Visual resources may be defined in terms of two primary elements, visual character and quality. The landscape components of landforms, water features, vegetation types, and cultural modifications, as well as the patterns they create, provide the basis for defining the project area's visual character. The quality of the visual resources in the project area varies because of changes in the landscape components and their patterns. The visual quality of an area is rated by criteria such as the landscape's distinctiveness, its visual integrity, and the compatibility of its components. Visual quality is expressed as *very high*, *high*, *moderately high*, *moderate*, *moderately low*, *low*, and *very low*. It should be noted that different observers may value the same landscape quite differently, depending on visual habituation or novelty, aesthetics and cultural values. This analysis attempts to acknowledge the variety in assessment of visual quality.

The western, low-elevation (50 to 800 feet above sea level) portion of all project corridors is characterized by rough, jumbled flows of black ʻaʻa lava with little apparent weathering and only a few scattered shrubs and trees. Small, grassy *kipuka* (inclusions of older geologic surfaces) are present in some areas offering contrasting textures and colors that may change seasonally from green to brown. This area offers the closest vistas of the sea, but because of the low elevation the width from shoreline to the horizon is narrow. The rugged, primal nature of the lava flows and their interesting topography offer high visual quality to many observers, although some find the landscape too stark and monotonous, even forbidding. The visual quality could be rated moderately high to very high in this area.

From about 800 feet to 2,000 feet in elevation, the slight increase in rainfall and decrease in average annual temperature has allowed more vegetation growth on the lava flows. Although still somewhat sparse in terms of overall biomass, fountain grass and scattered *kiawe* alter the starkness of the landscape, which resembles a rugged, sloping savanna. In the distance are interesting panoramas of four mountains (including Haleakalā, on Maui), the sea, and Waikoloa Village. Alternatives 5 and 6 also have mid-distance views to the north of a *wiliwili* forest at about 1,000 feet in elevation. Visual quality is high to moderately high.

The upper elevations have a surface where lava is visible only on outcrops. Shallow soils supporting a dense vegetation of grass and shrubs soften the landscape, which has tones of yellow, brown, tan and black, and after periods of heavy rainfall, areas of green. The views of mountains are closer, while the sea is farther. Cinder cones from Mauna Kea and Hualālai are still distant but more prominent from this vantage. Visual quality is high to moderately high.

The visual quality changes rapidly near the Māmalahoa Highway and Queen Kaʻahumanu Highway, owing to not only traffic but also the intrusion of overhead transmission and distribution lines, which break up the landscape and introduce an industrial appearance.

3.17.1.2 Characteristics of the Viewer

Visual assessment also considers the level of sensitivity or attitude that the viewer would have in response to the change in appearance of the existing landscape. Identification of viewer groups, duration of viewer exposure, and type of viewer activity provide an indication of the level of viewer response. The great majority of the viewers now and in the future would travel the highway by vehicle, viewing the landscape at speeds of about 50-60 MPH. Other viewers might be stationary or near-stationary, such as those engaged in military training on Pōhakuloa Training Area to the east across Māmalahoa Highway, and motorists on Waikoloa Beach Drive approaching the Queen Ka‘ahumanu Highway intersection. There would also be the occasional bicyclist, and, rarely, goat hunters on the barren ‘a‘a land to the south. In the future, there may be viewers living in large-lot agricultural subdivisions in the upper elevation (if these areas are ever subdivided).

3.17.2 Environmental Consequences

Construction (Temporary) Impacts

The project could result in temporary visual impacts during the construction period as a result of dust, vegetation removal, the presence of heavy equipment, the presence of additional vehicles traveling throughout construction areas, detour roads and traffic control facilities, and lighting associated with night-time construction activities (although currently these are not anticipated). These impacts would be minimal and temporary.

Operational (Long-term) Impacts

Construction of the proposed Saddle Road Extension would result in a substantial permanent change in visual character due to the introduction of a paved highway to the existing pastoral or lava wilderness setting. The highway would to some degree lower the existing visual quality of the foreground area, based not only on the appearance of the paved surface, but also on cut and fill slopes. Over its length, fill slopes would range from 5 to 40 feet, and cut slopes would range from 5 to 30 feet, although eventual vegetation of these slope faces would minimize the change in visual quality and character.

This change in visual character related to a new highway is unavoidable. However, one of the most frequent comments heard from drivers on the improved Daniel K. Inouye Highway, which in its western end completely relocated the highway to a new route within pastures and lava flows, was the beauty of the scenery revealed by the new highway. The scale and appearance of that highway in general matches its surroundings. As with the Daniel K. Inouye Highway, the Saddle Road Extension would traverse areas of which there are currently very few views, except for a short distance from drivers on Māmalahoa Highway. The most important visual effect of the proposed highway would be the substantial number of new scenic vistas that would be available to motorists who have never seen them before. The Project would not interfere with existing vistas of the Pacific Ocean, Mauna Kea, Mauna Loa, Hualālai, or the Kohala Mountains, the major scenic resources in the area, regardless of viewer location.

Differences in Impacts Between Alternatives 4, 5 and 6 and Intersection Design Options

While there are no substantial differences between the scenic resources or impacts of the three alternatives, Alternative 4 is more distant from existing highways and urban development than Alternatives 5 and 6. This marginally increases the wilderness character of this corridor.

However, it closely follows an existing 138-kv electrical transmission line/access road, which actually lessens the route's existing visual quality.

Impacts of the No Action Alternative

The No Action Alternative would neither impose and scenic impacts or open up new scenic vistas.

3.17.3 Mitigation Measures

The severity of adverse visual impact is generally lessened by minimization of the amount of cut and fill slopes, revegetation of disturbed areas, and by blending any proposed improvements into the surrounding landscape. The intent of visual impact mitigation measures is to reduce the contrast between the proposed improvements and the existing landscape. The following mitigation measures will be employed:

1. Final cut and fill slope faces will be made to blend with the surrounding landscape. The natural appearance of the slopes will be improved by rounding the toe and top of slopes, warping, blending the ends of slopes, varying the slope ratios, utilizing staggered ledges, and roughening the face of cut slopes, either by ripping or blasting, where appropriate. (Warping results in a slope face that is not parallel to the roadway. Slope rounding refers to blending the slope into the natural terrain by excavating additional area at the top of the cut slope. Laying back the ends of slopes or blending provides a smooth transition to adjacent cut, fill, or drainage area by flattening the slope ratio at the ends of slopes. Varying slope ratios leaves an irregular, undulating or roughened appearance with staggered ledges rather than a uniform grade. Staggered ledges are benches with varying dimensions and heights on the cut face which do not cross the entire face.) The slope ratios will vary from the top to the bottom of the slope face as well as horizontally along the face, if practicable and feasible.
2. Rock slope surface treatment will be applied to cut slopes in competent rock areas as identified in the geotechnical testing results. These treatments include roughening of the cut face to incorporate short, staggered ledges, minor warping, and other irregularities in the rock that take on a natural appearance.
3. In areas not recommended for revegetation, the top three feet of lava material in disturbed areas will be stockpiled prior to construction. After construction, the stockpiled material will be used as plating material. The plating material will be placed over slope faces to resemble the adjacent, undisturbed ground surface conditions or used as rip rap material along ledges and outside of ditch backslopes.
4. Intercepted drainages on cut slopes will be cut at the angle to existing joints, planes or rock features, and drainage patterns. These features will be incorporated into the NPDES SWPPP.
5. Where guardrails are needed, natural-appearing guardrail material, such as naturally weathered steel or a material approved by HDOT, will be used to blend more effectively with the surrounding landscape.

6. To reduce contrast and blend more effectively with the surrounding landscape, aesthetic fencing materials will be used, such as naturally weathered metal or steel, or painted or wooded posts, as approved by HDOT.
7. Clearing of trees and large shrubs along an irregular edge adjacent to the recovery zone will be done to create a gradual transition or feathered edge.
8. As determined appropriate during final design, the Project may include informal scenic pullouts, which may include interpretive signage. This will be determined during final design.

3.18 ENERGY AND CLIMATE CHANGE

3.18.1 Affected Environment

There is a scientific consensus that the earth is warming due to manmade increases in greenhouse gases (GHG) in the atmosphere, according to the United Nations’ Intergovernmental Panel on Climate Change (UH Manoa Sea Grant 2014). Human activity is changing the earth’s climate by causing the buildup of heat-trapping GHG emissions through the burning of fossil fuels and other human influences. Carbon dioxide (CO_2) is the largest component of human produced emissions; other prominent emissions include methane (CH_4), nitrous oxide (N_2O) and hydrofluorocarbons (HFCs). These emissions are different from criteria air pollutants evaluated in federal environmental reviews because their impacts are not localized or regional due to their rapid dispersion into the global atmosphere, and also since they remain in the atmosphere for decades to centuries, depending on the molecules. Greenhouse gas emissions are often reported together as CO_2 equivalent (CO_2e) emissions, weighting the global warming potential of the gases in terms of CO_2.

GHG emissions have accumulated rapidly as the world has industrialized, with concentration of atmospheric CO_2 increasing from roughly 300 parts per million in 1900 to over 400 parts per million today. Over this timeframe, global average temperatures have increased by roughly 1.8 degrees Fahrenheit (1 degree Celsius), and the most rapid increases have occurred over the past 50 years. Scientists have warned that significant and potentially dangerous shifts in climate and weather are possible without substantial reductions in GHG emissions. They commonly have cited 2 degrees Celsius (1 degree Celsius beyond warming that has already occurred) as the total amount of warming the earth can tolerate without serious and potentially irreversible climate effects. For warming to be limited to this level, atmospheric concentrations of CO_2 would need to stabilize at a maximum of 450 part per million (ppm), requiring annual global emissions to be reduced 40-70% below 2010 levels by 2050 (IPCC 2014). State and national governments in many developed countries have set GHG emissions reduction targets of 80 percent below current levels by 2050, recognizing that post-industrial economies are primarily responsible for GHGs already in the atmosphere. As part of a 2014 bilateral agreement with China, the U.S. pledged to reduce GHG emissions 26-28 percent below 2005 levels by 2025; this emissions reduction pathway is intended to support economy-wide reductions of 80 percent or more by 2050 (“U.S.-China Joint Announcement on Climate Change,” White House, Office of the Press Secretary, November 11, 2014, on the White House website, https://www.whitehouse.gov/the-press-office/2014/11/11/us-china-joint-announcement-climate-change, accessed June 5, 2015.).

Greenhouse gases trap heat and make the planet warmer. The primary sources of greenhouse gas emissions in the United States are from electricity production, transportation, industry, commercial and residential activities, and agriculture (***Figure 3.18.1***). Most of the emissions are due to burning fossil fuels, such as petroleum, coal, and natural gas. Others are due to the handling and waste management of certain chemicals. Recent concerns with climate change (global warming) have prompted directives to reduce GHG, of which carbon dioxide is the primary component.

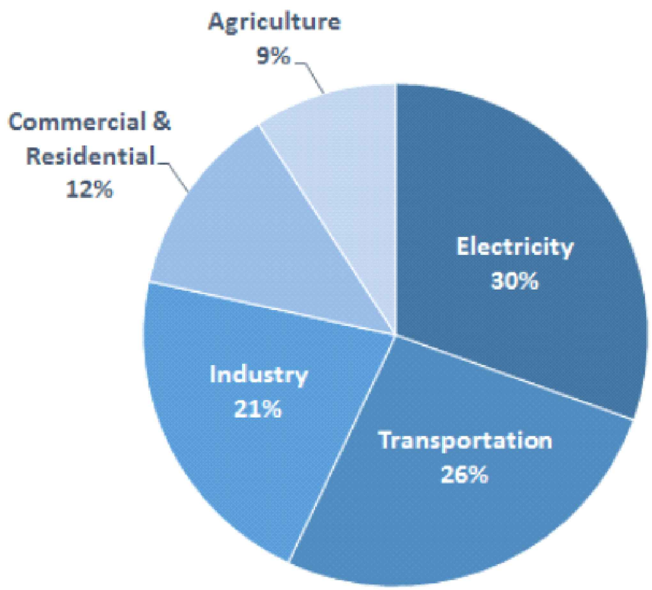
Global mean air temperatures are projected to increase by at least 2.7°F by the end of the century. The full effects of global warming caused by GHG are largely unknown but potentially very serious, including changes in precipitation causing flooding and drought; heat waves; warming of the oceans with the associated melting of the ice caps and rising sea levels; and higher acidity in the oceans. Warming of ocean waters, expected to be highest in tropical and subtropical seas of the Northern Hemisphere. Wet and dry season contrasts will increase, and wet tropical areas in particular are likely to experience more frequent and extreme precipitation. For Hawaiʻi, where warming air temperatures are already quite apparent, not only is the equable climate at risk but also agriculture, ecosystems, the visitor industry and public health. Sea level rise will flood coasts, degrade coastal ecosystems, erode beaches, and ruin existing infrastructure and development in low-lying areas.

Guidance to federal agencies for addressing climate change issues in environmental reviews was released in August 2016 by the Council on Environmental Quality (US CEQ 2016). The guidance urged that when addressing climate change, agencies should consider: 1) the potential effects of a proposed action on climate change as indicated by assessing greenhouse gas emissions in a qualitative, or if reasonable, quantitative way; and, 2) the effects of climate change on a proposed action and its environmental impacts. It recommends that agencies consider the short- and long-term effects and benefits in the alternatives and mitigation analysis in terms of climate change effects and resiliency to the effects of a changing climate. The State of Hawaiʻi encourages a similar analysis, as reflected in Hawaiʻi Revised Statutes §226-109.

3.18.2 Environmental Consequences

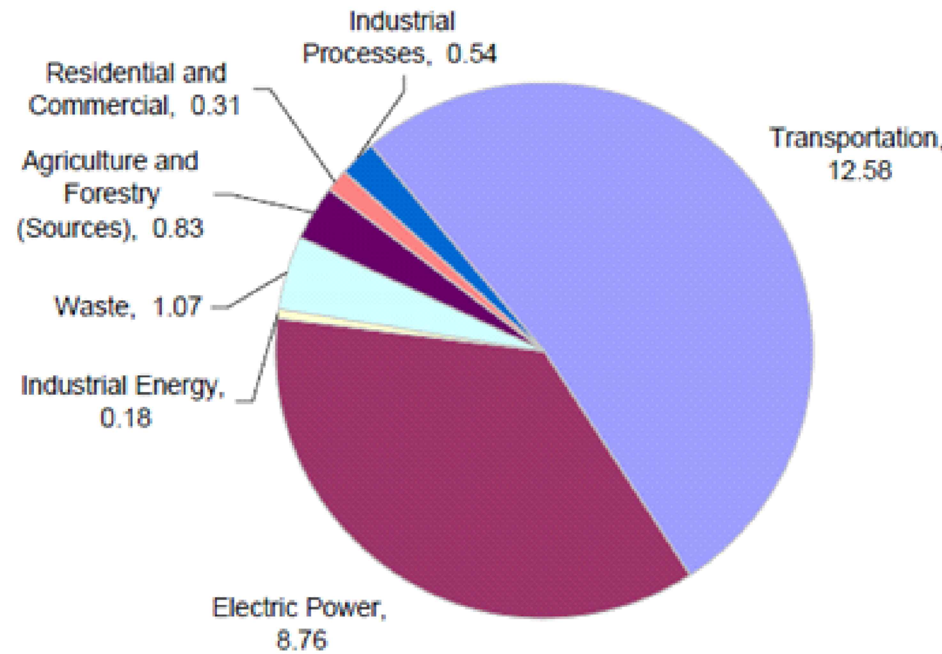
There are three primary energy demands associated with the proposed Saddle Road Extension project. Energy would be consumed for construction, operation of vehicles once the highway opens, and maintenance.

- Construction – GHG emissions primarily come from fuel burned in the equipment used to build a project, such as bulldozers, pavers, and rollers. Construction emissions also come from increased traffic congestion caused by construction activities and materials used.



Total Emissions in 2014 = 6,870 Million Metric Tons of CO_2 equivalent

TOTAL U.S. GREENHOUSE GAS EMISSIONS
BY ECONOMIC SECTOR IN 2014



COMPOSITION OF HAWAII GHG EMISSIONS
(EXCLUDING SINKS, INCLUDING AVIATION), 2007
(MILLIONS OF METRIC TONS CO_2Eq

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SADDLE ROAD EXTENSION

FIGURE 3.18.1 ~ GREENHOUSE GAS EMISSIONS BY SECTIONS, U.S. AND HAWAII

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- Operational – The three largest sources of highway-related energy consumption and GHG emissions are tailpipe emissions, upstream fuel cycle emissions (the emissions associated with producing and transporting the fuel used by highway vehicles), and roadway construction emissions. The combined sum of tailpipe and upstream fuel cycle emissions is known as "well to wheel" emissions. GHG emissions come from vehicles ("tailpipe emissions") using project roadways and upstream from the "fuel cycle". Approximately 72% of transportation emissions are from on-road transport, including both passenger and freight travel (AASHTO, Primer on Transportation and Climate Change, 2008 http://downloads.transportation.org/ClimateChange.pdf accessed January 2017). Vehicle emissions depend on assumptions about fuels, fuel efficiency, speeds, distances, and volumes. "Fuel cycle" emissions account for the emissions released during fuel extraction, refining, and transport.
- Maintenance – GHG emissions from fuel combusted in maintenance equipment.

Vehicles emit a variety of gases during their operation; some of these are GHGs. The GHGs associated with transportation are carbon dioxide (CO_2), methane, and nitrous oxide. Any process that burns fossil fuel releases CO_2 into the air. Carbon dioxide makes up the bulk of the emissions from transportation.

Vehicles are a significant source of GHG emissions and contribute to global warming primarily through the burning of petroleum fuels. Over 90 percent of the fuel used for transportation is petroleum based, which includes gasoline and diesel fuels. National estimates in 2014 show that the transportation sector (including on-road vehicles, construction activities, airplanes, and boats) accounts for about 26 percent of total domestic CO_2 emissions. However, in Hawaiʻi, transportation accounts for over half of GHG emissions because the State relies heavily on tourism which requires a large aviation and transportation sector. The next largest contributors to total GHG emissions in Hawaii are fossil fuel combustion in the energy sector. ***Figure 3.18.1*** shows the gross GHG emissions by sector, for the State of Hawaiʻi and nationally.

GHG emissions from motorists utilizing a single new highway in Hawaiʻi may be small – and even less than without the project. However, overall, users of the transportation system contribute close to half of the State's GHG emissions (see ***Figure 3.18.1***). Transportation GHG emissions are better addressed at the region, state, and transportation systems level where multiple projects can be analyzed in aggregate. It is recognized that most current plans at these broader levels do not yet provide the emissions analysis that would put the Saddle Road Extension in a larger context, as well as the public's interest in these issues and the need to disclose GHG emissions at the project level for major public projects.

The State and federal investments in transportation projects are made to improve current conditions of the multi-modal transportation network, including system efficiency that can lead to lower emissions. The proposed Saddle Road Extension would conform with this purpose. In overview, it provides the appropriate regional connection between the current terminus of the Daniel K. Inouye Highway at Māmalahoa Highway and Queen Kaʻahumanu Highway. This connection would create a faster and more direct route which would benefit the roadway network in reducing projected future traffic congestion at key intersections within the study area and reducing the need for roadway improvements on Māmalahoa Highway. Improvements would be needed on Queen Kaʻahumanu Highway where all SRX alternatives are proposed to intersect it. The improvements proposed on the project would minimize stop and go conditions thereby conserving fuel. It would also promote more efficient energy consumption by moderating speeds. Following construction, the proposed project would enable better movement of vehicles for project area intersections and on the mainline, thereby reducing traffic congestion and collisions. Decreased vehicle delay at off and on ramps further reduces collisions and promotes more efficient driving. An added benefit of the proposed SRX is the forecasted reduction in through-traffic volume using Waikoloa Road, thereby improving traffic operations at the Waikoloa Village access.

Construction-phase Impacts

During construction, GHG emissions would be released. Construction emissions would be generated from the fuel used on-site to power construction equipment as well as the emissions released in the manufacture and production of construction materials. Traffic delays occurring due to construction are another source of construction emissions. The 1999 Final EIS for the Saddle Road Improvements project (FHWA-CFLHD 1999) calculated energy expenditures for that entire 47-mile long new highway project based on existing technologies. Energy use per section was not calculated. Based on the generalized working efficiency of various pieces of construction equipment (e.g., grader, roller, D9 bulldozer, scraper), the estimated fuel consumption for construction of the entire proposed Saddle Road was calculated at approximately 0.6 to 0.7 million gallons.

A similar rate of energy use would be expected for construction of the Saddle Road Extension. As this project is less than 11 miles long, energy construction would be roughly one quarter of the Saddle Road figure, or 0.15 million gallons. Construction of the project is currently planned to last from 2018 to 2020. The project traffic plan would include detours and strategic construction timing (including weekend work) during construction phases to allow the continued movement of traffic through the area and reduce backups to the traveling public to the greatest extent possible. FHWA will ensure that the active construction areas, staging areas, and material transfer sites are established in a way that reduces standing wait times for construction equipment.

Operational Impacts

Operational GHG emissions from highway projects depend on several factors, but primarily vehicle miles traveled (VMT) and fuel economy. Total VMT in a project area is determined by both the project and the project's relationship to the surrounding transportation network. Fuel economy varies with speed and vehicle type. The Transportation Impact Assessment Report identifies the periods of peak traffic volumes and models the anticipated periods when traffic congestion would be worst and when fuel-efficiency would be lowest (i.e., "worst-case" scenario).

A major factor in mitigating the CO_2e associated with VMT is EPA's GHG emissions standards, implemented in concert with national fuel economy standards. In December 2012, the U.S. Energy Information Administration (EIA) of the Department of Energy released its 2013 Annual

Energy Outlook, providing projections for the energy markets through 2040. The EIA projects that vehicle energy efficiency (and thus, GHG emissions) on a per-mile basis will improve by 28% between 2012 and 2040 (Accessed March 2017: http://www.nacsonline.com/magazine/pastissues/2013/march2013/pages/cover_story.aspx).

In terms of operational energy use, and thus greenhouse gas emissions associated with a new highway here, the Project is not expected to increase total VMT travelled on the Island of Hawaiʻi. Instead, it will offer a new and more efficient route between the termini at Māmalahoa Highway and Queen Kaʻahumanu Highway. Savings of up to 6.6 minutes per one-way trip will occur, depending on trip origin and destination, as discussed in Section 3.3.6. In addition to the savings that occur because of reducing the trip length, there are other energy saving benefits for vehicles on more efficient highways. They foster fuel conservation by lowering congestion, reducing curves and grades, providing safe opportunities for passing, and allowing more steady highway speeds. Automobiles are up to 15 percent more fuel efficient, and produce 15 percent less CO_2, when traveling at 55 MPH rather than 35 MPH. Trucks experience even greater efficiency. Any alternative of the Project would substantially allow efficient speeds and eliminate start-and-stop driving on Māmalahoa Highway and Queen Kaʻahumanu Highway.

GHG emissions rates decrease with reductions in VMT and efficient vehicular speed over the range of average speeds encountered in this corridor. The project Build Alternatives will improve vehicle speeds by providing additional lane-mile capacity, reducing the number of curves, and increasing the typical curve radius and design speed for vehicles traveling along the SRX. The average travel speed across the entire study area would increase from 45 miles per hour under the No Action alternative to 55 miles per hour under the Build Alternatives. Every trip that is shorter and more efficient would save a varying amount of fuel but may average a quarter gallon, which would reduce CO_2 emissions by 5 pounds. One gallon of gasoline, which weighs about 6.3 pounds, can produce 20 pounds of carbon dioxide (CO2) when burned. However, most of the weight of the CO2 doesn't come from the gasoline itself, but the oxygen in the air. Although it is not feasible to calculate projected energy savings because of a lack of data on the precise trip origin and distribution on the proposed Saddle Road Extension, as well as uncertainty about levels of fuel consumption in passenger vehicles or trucks that might utilize the Saddle Road Extension, savings will likely be substantial, given the expected average daily traffic of 14,300 to 16,800 in the year 2035.

In summary, the proposed Saddle Road Extension project contains several features that will improve overall GHG emissions on an operational basis. In general, project-level actions that can help reduce greenhouse gas emissions include:

- Reducing stop and go conditions
- Improving roadway speeds to a moderate level
- Improving intersection traffic flow to reduce idling
- Creating more safe and efficient freight movement

Maintenance Impacts

The addition of new roadway miles to the study area roadway network will also increase the energy and GHG emissions associated with maintaining those new roadway miles in the future. To the extent that the project diverts traffic from existing roadways, the increase in maintenance needs due to the addition of new roadway infrastructure will be partially offset by the reduced need for maintenance on existing routes (because of lower total traffic and truck volumes on those routes) and the reductions in VMT on the regional transportation system.

Adaptation to Climate Change Impacts

In terms of adaptation to climate change, the project corridors are located from 130 to 2,500 feet above sea level, and are not vulnerable to sea level rise during the next century. The minor drainages crossed by the project could theoretically experience increases in the volume of water they carry during 50-year rainfall events. Precipitation scenarios for leeward parts of the Hawaiian Islands under various climate models are quite variable, with some predicting wetter conditions and others drier. However, under any scenario, extreme events such as tropical storms and droughts may become more frequent. The project would include drainage structures designed based on models of the 50-year storm, which improves on alternative local roads. The uncertain nature of the risk of substantially greater future rainfall and the long time scenario indicates that it is prudent to construct the Project as planned and realize its benefits for a period of up to many decades rather than fail to implement it or design for currently unknowable, extreme contingencies.

*Energy Supply Impact*s

The cumulative use of energy for construction of the Daniel K. Inouye Highway east of the project area, combined with other users on the island during the 2003 to 2016 period of intermittent construction, has not exceeded the capacity of fuel or electricity supplies in the area, which periodically support multiple large construction projects. Therefore, construction of the Saddle Road Extension should not represent a problem in the future.

Differences in Impacts Between Alternatives 4, 5 and 6 and Intersection Design Options

The energy use for construction of Alternative Alignment 4 would be proportionally less, because at 10.18 miles this route is approximately 3 percent shorter. Because there would be fewer intersections and no associated side-roads with Alternative 4, the actual reduction could be closer to 10 percent less. Alternative 6, at 10.71 miles, would have side roads and intersections similar to those of Alternative 5, would consume approximately 2 percent more energy to construct. However, Alternatives 5 and 6 would allow more motorists to achieve time savings and potentially reduce VMT based on end destination. Design Option 2, involving a grade-separated intersection of the Saddle Road Extension with Māmalahoa Highway, would involve mores construction cost, and thus energy use and greenhouse gas emissions during construction; operationally, however, it would be more efficient and require less use of fuel because of reduced braking and acceleration at this intersection.

Impacts of the No Action Alternative

If the project is not completed, the net energy savings and greenhouse gas emission reductions due to shorter travel times, reduced congestion and idling as well as more efficient engine performance will not be achieved. However, the energy that would need to be consumed in construction would not be expended, with a concomitant reduction in GHS emissions.

3.18.3 Mitigation Measures

Uncertainty exists for long term GHG production as fuel consumption rates and types continue to evolve. Increases in vehicle efficiency resulting from the Corporate Average Fuel Economy Program (CAFE) are expected to continue throughout the life of the project. First enacted by Congress in 1975, the purpose of CAFE is to reduce energy consumption by increasing the fuel economy of cars and light trucks. The CAFE standards are fleet-wide averages that must be achieved by each automaker for its car and truck fleet, each year, since 1978. When these standards are raised, automakers respond by creating a more fuel-efficient fleet, which improves our nation's energy security and saves consumers money at the pump, while also reducing greenhouse gas (GHG) emissions.

CAFE standards are regulated by DOT's National Highway Traffic and Safety Administration (NHTSA). NHTSA sets and enforces the CAFE standards, while the Environmental Protection Agency (EPA) calculates average fuel economy levels for manufacturers, and also sets related GHG standards. NHTSA establishes CAFE standards under the Energy Policy and Conservation Act (EPCA) of 1975, as amended by the Energy Independence and Security Act (EISA) of 2007, while EPA establishes GHG emissions standards under the Clean Air Act. Following the direction set by President Obama on May 21, 2010, NHTSA and EPA have issued joint Final Rules for the CAFE and GHG emissions regulations for passenger cars and light trucks built in model years 2017 and beyond, and have also developed fuel efficiency and GHG emissions regulations for medium- and heavy-duty vehicles built in model years 2014 through 2018.

In 2012, NHTSA established final passenger car and light truck CAFE standards for model years 2017-2021, which the agency projects will require in model year 2021, on average, a combined fleet-wide fuel economy of 40.3-41.0 mpg. NHTSA's standards since 1978 have saved (and will continue to save) many billions of gallons of fuel for American drivers. As part of the same rulemaking action, EPA issued GHG standards, which are harmonized with NHTSA's fuel economy standards that are projected to require 163 grams/mile of carbon dioxide (CO_2) in model year 2025. EPA will reexamine the GHG standards for model years 2022-2025 and NHTSA will set new CAFE standards for those model years in the next couple of years, based on the best available information at that time. As such, continued improvements in vehicular efficiency will continue to reduce GHG emissions nationally.

For project specific mitigation measures, FHWA will implement the following:

1. Construction contractors will be required to limit idling of diesel on-road vehicles and non-road equipment during construction to no more than five minutes when not in use.
2. Contract specifications will require use of use recycled and/or locally available

construction materials to the extent feasible.

3. The project traffic plan would include detours and strategic construction timing (including weekend work) during construction phases to allow the continued movement of traffic through the area and reduce backups to the traveling public to the greatest extent possible.
4. FHWA will ensure that the active construction areas, staging areas, and material transfer sites are established in a way that reduces standing wait times for construction equipment.

3.19 LIST OF REQUIRED PERMITS AND APPROVALS

The following required permits and approvals must be met to implement the proposed project:

Federal

- Section 106 Consultation (National Historic Preservation Act [NHPA]), Hawai‘i Department of Land and Natural Resources (DLNR) State Historic Preservation Officer (SHPO)
- Section 7 Consultation (Endangered Species Act [ESA]), U.S. Fish and Wildlife Service (USFWS)
- Department of the Army Approved Jurisdictional Determination Update (Section 404 of the Clean Water Act [CWA]), U.S. Army Corps of Engineers (USACE)
- Section 4(f) (U.S. DOT Act), Federal Highway Administration (FHWA)

State

- National Pollutant Discharge Elimination System (NPDES) Permit, DOH
- Coastal Zone Management Act (CZMA) Federal Consistency Review, Hawai‘i Department of Business, Economic Development, and Tourism Office of Planning
- Historic Preservation Review (HRS Chapter 6E), DLNR State Historic Preservation Division (SHPD)
- Americans with Disabilities Act Review (HRS §103-50), DOH Disability and Communication Access Board
- Occupancy and Use of State Highway Right-of-Way Permit, HDOT
- Community Noise Permit/Variance, DOH

County

- Grading, Grubbing and Stockpiling Permits; Permit for Work in County Right-of-way, Hawai‘i County Department of Public Works

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4 CUMULATIVE IMPACTS

Introduction

The National Environmental Policy Act (NEPA) and the Hawai‘i Environmental Policy Act (Chapter 343, HRS) require that the direct, indirect, and cumulative impacts of proposed actions be assessed and disclosed. The NEPA definition of a cumulative impact, which is also used in Hawai‘i, comes from the Council on Environmental Quality (CEQ), which defines a cumulative impact as:

> …the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR §1508.7).

Cumulative impacts encompass the total effect on a natural resource, ecosystem, or human community due to past, present, and future activities or actions of federal, non-federal, public, and private entities. Cumulative impacts may also include the effects of natural processes and events. Accordingly, there may be different cumulative impacts on different environmental resources. A cumulative impact is defined in terms both spatial (geographic) and temporal (timeframes in which to identify past, present, and reasonably foreseeable actions). One analytic measure of cumulative impact is the health or status of an individual resource, which can help determine if it is in a sustainable state considering past, present, and reasonably foreseeable actions. According to the U.S. EPA, an ecologically sustainable system will support biological processes; maintain its level of productivity; function with minimal external management; and repair itself when stressed (U.S. EPA 1999). For human resources such as archaeological sites, sustainability is more a matter of identification and care for resources. In any case, conservation actions or recovery plans identified by agencies or communities that are reversing a declining trend for the resource and helping make it sustainable must also be taken into consideration.

The cumulative impact analysis approach undertaken in this EIS is derived from several sources (Caltrans 2009; USEPA 1999; and CEQ 1997). It has been developed interactively during initial and subsequent NEPA and Chapter 343 scoping as well as the NEPA coordination plan process. The early focus on cumulative impacts helped in conceptualizing three Build Alternatives that would avoid or minimize impacts. The analysis for identifying and assessing cumulative impacts followed here consists of seven steps:

1. Identification of resources in consultation with agencies, groups, individuals and reliable information sources.
2. Identification of the direct and indirect impacts of the proposed project that might contribute to a cumulative impact on the identified resources.
3. For all resources that have a potential to be impacted by the Project, definition of a geographic boundary or Resource Study Area (RSA) for each resource to be addressed.
4. Description of the current health and the historical context of each resource.
5. Identification of other current and reasonably foreseeable future actions or projects and their associated environmental impacts to include in the cumulative impact analysis.
6. Assessment of the potential cumulative impacts.

7. Assessment of the need for mitigation and the potential to avoid, minimize, rectify or compensate for impacts.

The sections in this chapter correspond to these steps. Rather than providing an exhaustive list of issues that may have little relevance to the effect of the proposed action or the eventual decisions, this cumulative impacts analysis “counts what counts,” in accordance with federal guidance (CEQ 1997).

4.1 Identification of Resources

The initial identification of resources in an EIS looks broadly at the universe of natural and cultural resources that may be present in the broader project area, generally during early coordination or scoping. These resources are intensively studied during EIS development, often through on-ground field studies that tend to concentrate on direct and secondary impacts. ***Table 4.1.1*** (Resources for Initial Cumulative Impacts Consideration in Project Area) provides an overview of resources in the general project area that includes West Hawaiʻi north of urban Kona to the Waikoloa area, extending from Queen Kaʻahumanu Highway to about 2,500 feet in elevation. Because of their importance, all these resources have been studied for the project corridor, as described in detail in Chapter 3.

4.2 Identification of Direct and Indirect Project Impacts

Using the foundation of resources of concern established in the previous section, the cumulative impact analysis focused on identifying resources impacted by the Project in a more than insubstantial way. For those resources for which the Project will not cause direct or indirect impacts, the Project will not contribute to a cumulative impact on that resource, and the resource does not require further discussion in the context of cumulative impacts. ***Table 4.2.1*** (Project’s Direct and Indirect Impacts on Resources of Special Cumulative Impact Concern) summarizes direct and indirect impacts as described in Chapter 4. Those resources denoted with italics in the “Resource” column of ***Table 4.2.1*** were found to be impacted by the Project in a more than insubstantial way and were carried forward for further cumulative impact analysis. These resources include Floodplains and Drainage Features, Threatened and Endangered Species, Wildfire, Recreational Areas, Historic Properties, Areas for Practice of Traditional Culture and Visual Quality.

Table 4.1.1
Resources for Initial Cumulative Impacts Consideration in Project Area

Resource	**Distribution**	**Critical Issues of Concern**
Surface Waterbodies/ Floodplains/Drainage	Because of recent lava geology, all significant features and flooding found outside/north of project area.	Water quality, including sedimentation, nutrients, microbial pollution. Avoiding floodplain effects.
Groundwater	Primarily basal aquifers with relatively small sustainable yields.	Protecting sustainable yield and water quality.
Native Ecosystems	Concentrated at shoreline fringe in certain areas and elevations higher than 2-4,000 feet.	Protecting the integrity of the ecosystems from fragmentation, loss of rare species, invasive species invasions, and overall habitat diversity and value.
Threatened and Endangered Species	Hawaiian hoary bat, seabirds, Nēnē, Blackburn's sphinx moth. With few exceptions, dryland forest plants are locally rare to absent at these lower elevations.	Protection of existing populations from a variety of threats including predation, competition with introduced species, and habitat alteration/destruction.
Important Farmland	Primarily on lower northern and western slopes of Mauna Kea and southeastern slope of Kohala Mts. outside project area.	Protection from development, particularly near urban areas. Farming and grazing land near towns have been converted to urban uses in last two decades.
Community Character, Socioeconomic Health, Economy	Existing community of Waikoloa and areas beyond that are indirectly accessed by highway network.	Maintaining character of community, including avoiding growth induction from highway projects. Maintaining healthy economy by allowing trade, tourism and employment.
Recreational Areas	Most recreation occurs outside project area on coast; limited urban parks; hunting and recreational areas only at Puʻuanahulu.	Loss of hunting land for conservation uses; loss of park land or access.
Historic Properties	Pre-contact temporary use sites; Post-contact ranching and military sites.	Loss of some of the tens of thousands of uninventoried archaeological sites from historic and pre-Western contact era prior to modern laws due to development, natural decay.
Areas for Practice of Traditional Culture	Most occurs outside project area on coast, but some gathering, also associations with geological features.	Loss of gathering and other cultural areas due to development, particularly on coast, outside project area.
Scenic Character	Developed areas with coastal or mountain views; highway and road corridors and places visible from them.	Degradation of scenic resources due to development.
Resources not of Special Concern for Cumulative Impacts in Project Area		
Air Quality	West Hawaiʻi.	Air quality meets all standards by large margin for motor vehicle pollutants. [REF: 3.5.1.]
Noise	Proposed Saddle Road Extension and adjacent areas.	Area not affected by high noise levels. [REF: 3.6.1]
Wild and Scenic Rivers	All parts of island.	None present in State of Hawaiʻi. [REF: 3.12]
Coastal Barriers/Coastal Environments	Coastlines of island.	Project is located over nine miles from coast with no surface water connection. No coastal barriers present in State of Hawaiʻi. [REF: 3.13.1]

Notes: REF = EIS Section reference.

Table 4.2.1
Project's Direct and Indirect Impacts on Resources of Special Cumulative Impact Concern

Resource	**General Nature of Impact to Resources from Highways**	**Impacted Resources in Project Area**	**Impacts of Saddle Road Extension Alternatives**
Surface Waterbodies/ Floodplains	Highway runoff to receiving waters such as streams, ponds, wetlands, and coastal waters.	No waters of U.S. or floodplains. [REF: 3.8.]	Insubstantial, as no project runoff can reach any sensitive resource. [REF: 3.8.]
Drainage Features	Alteration of existing drainage patterns and quantities.	Swales that convey drainage exist. [REF: 3.8.]	Adding runoff to drainage areas, increasing drainage quantities in swales. [REF: 3.8.]
Groundwater	Migration of pollutants from roadway runoff through ground into aquifer.	Basal aquifers, 50 to 2,500 feet below land surface. [REF: 3.8.1.1]	Insubstantial, as runoff is filtered through soil and thick column of aerated rock. [REF: 3.8.1.2]
Native Ecosystems	Direct loss of rare species, community fragmentation, loss of habitat value, invasive species.	No native ecosystems in project area. [REF: 3.9.1]	Insubstantial, as no native ecosystems present. [REF: 3.9.1]
Threatened & Endangered Species	Loss of existing pops. from habitat take and indirect threats: invasive species and increased wildfire propensity.	No T&E plants in or near corridors, but critical habitat present for 2. [REF: 3.9.1] Endangered Blackburn's sphinx moth and Nēnē. [REF: 3.10.1]	Plant critical habitat and T&E animals in or near corridors. Potential for impact due to highway construction and operation. [REF: 3.9.2; 3.10.2]
Wildfire	Threat of ignition from vehicles, accidents, arson.	Fire-prone vegetation in all project corridors. [REF: 3.11.1]	Potential for impact due to highway construction and operation. [REF: 3.11.2]
Important Farmland	Direct take of farmland and indirect effects to ability to use farmland.	No Important Farmland present. [REF: 3.2.1]	Insubstantial, as there is no Important Farmland present. [REF: 3.2.2]
Community Character, Socioeconomic Health, Economy	Dividing communities; presenting barriers to travel, walking, or biking; inducing inappropriate growth; bypassing communities.	No communities adjacent to any project corridor; Waikoloa within 3 miles. [REF: 3.3.1.1]	Insubstantial, with benefits to Waikoloa from traffic reduction; minimal growth induction because of land use regulations and lack of infrastructure in areas newly accessed. Drive-by business in existing commercial areas slightly reduced. [REF: 3.3.1.2]
Recreational Areas	Direct take of recreational areas or indirect impacts on quality of recreational areas.	Some hunting area; no other recreational land. [REF: 3.1.1.1]	Project would involve loss of 0.5 sq. mi. of marginal hunting land in 65 sq. mi. unit but may assist in better access to hunting land. [REF: 3.1.1.2]
Historic Properties	Direct destruction of historic properties and indirect effects on qualities that give historic property its significance.	28 archaeological sites from pre-Western and historic era in all project corridors. [REF: 3.14.1]	Destruction of all or portions of 8-20 sites significant primarily for information content. [REF: 3.14.2]
Areas for Practice of Traditional Culture	Direct loss of gathering and other cultural areas, and indirect impacts from noise, increased access, etc.	No gathering or other cultural areas identified in area on or near any project corridors. [REF: 3.15.1]	No impacts to specific resources, but general degradation of natural-cultural landscape. [REF: 3.15.2]
Scenic Character	Loss or degradation of quality of scenic landmarks, viewpoints, vistas, and general landscape.	Project would insert built landscape in area currently without structures. [REF: 3.17.1]	Potential for degradation of scenic resources. [REF: 3.17.2]

Notes: REF = EIS Section reference. Resources in italics in Column 1 carried forward for further analysis.

4.3 Delineation of Resource Study Areas for Impacted Resources

Cumulative impacts need to be considered within spatial (geographic) and temporal boundaries. It is usually necessary to define a unique study area for each resource rather than a single, consolidated study area. To clearly understand the health of a resource, the resource must be viewed in its appropriate geographical context. A Resource Study Area (RSA) was defined for each resource for which the Project had an adverse impact that might accumulate with impacts from other projects. The RSA are essentially appropriate sub-areas of the broader project area within which resources were considered in Table 4.1.1, above. The RSAs provided a logical unit for analysis of the existing state of each resource type and potential effects to it. These RSAs were determined in consideration of scoping comments, subsequent agency communications, and the specialist resource studies contained in the appendices to this EIS. ***Table 4.3.1*** lists RSA by resource, and ***Figures 4.3.1*** and ***4.3.2*** provide maps that illustrate each RSA.

Table 4.3.1
Resource Study Areas (RSAs) for Resources Under Study for Cumulative Impacts

Resource	**Description of Study Area**
Drainage Features	Intermittent drainages crossed by Segment 4/5/6 *mauka* (common to all 3 Alternatives), the only existing drainages present.
Threatened and Endangered Species	Portion of Northwest Hawaiʻi containing endangered *Mezoneuron*, *Bidens*, and *Isodendrion* plants; *Nicotiana glauca*, host to endangered *Manduca* moth; and endangered *Branta* (Nēnē).
Wildfire	Arid portions of Northwest Hawaiʻi.
Recreational Areas	Puʻuanahulu Game Management Area (hunting) and Waikoloa Village (urban parks).
Historic Properties	Former *pili* lands, lava flows and ranching areas of Northwest Hawaiʻi from Puʻuanahulu to Puʻu Nohonaohae (Old Saddle Road junction).
Areas for Practice of Traditional Culture	Former *pili* lands, lava flows and ranching areas of Northwest Hawaiʻi from Puʻuanahulu to Puʻu Nohonaohae.
Scenic Character	Views from Waikoloa Village, the Waikoloa Resort Area, and viewshed for drivers and others on Māmalahoa Highway, Queen Kaʻahumanu Highway and existing Saddle Road towards the coast and the mountains Mauna Loa, Mauna Kea, and Hualālai.

The rationale for each RSA is discussed below:

Drainage Features RSA. Because of the geologically recent lava substrate, which readily soaks up rainwater, the only areas potentially affected by additional runoff quantities that would be generated by the proposed highway are several ephemeral drainages into which a portion of the runoff will be directed. These ephemeral drainages are short, ending in natural settling basins between lava flow hillocks. As discussed above, there are no permanent streams or continuous gulches nor any FEMA-designated and mapped floodplains in the RSA.

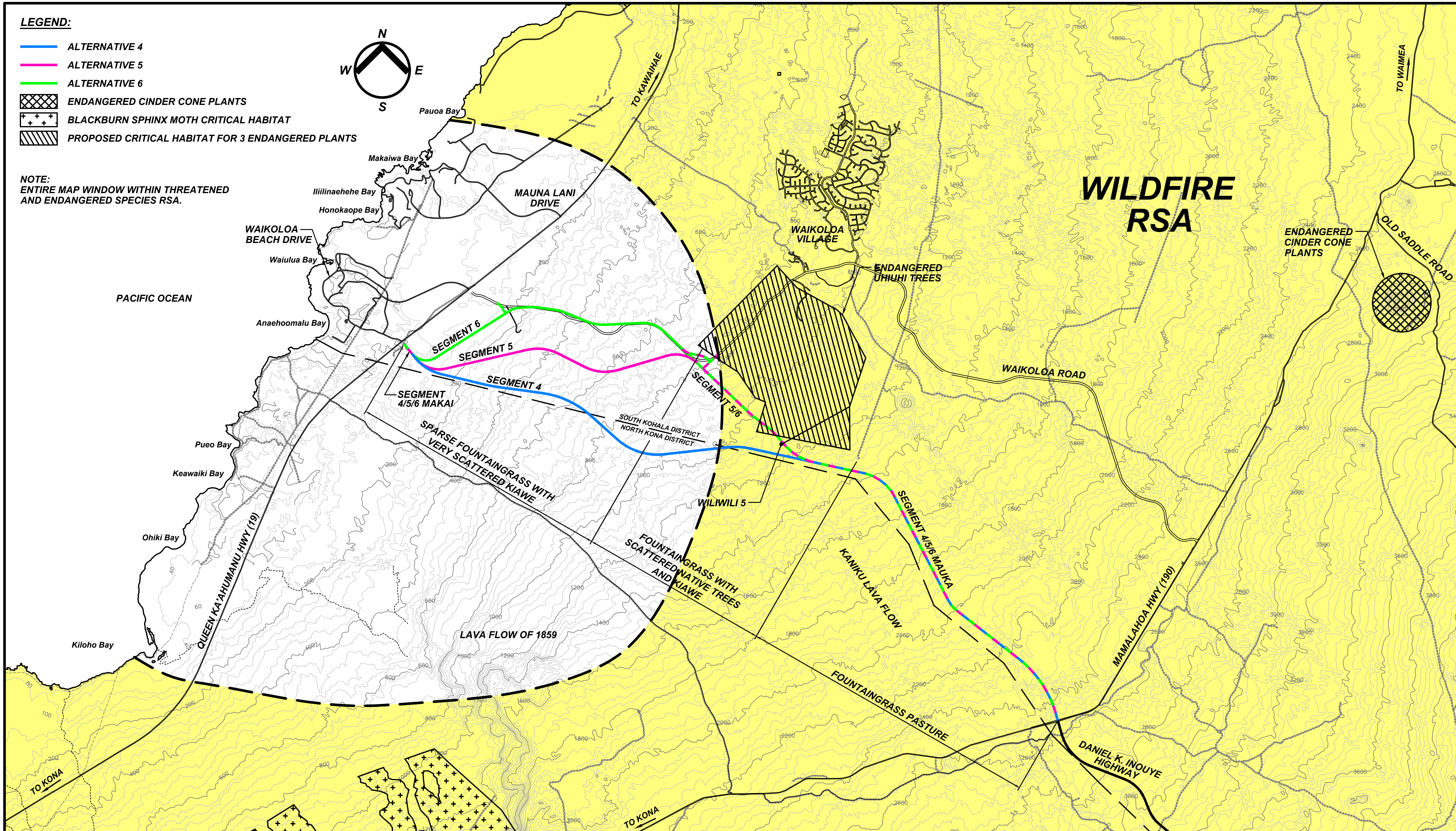
Threatened and Endangered Species RSA. Critical habitat for three endangered plants have been proposed in Waikoloa area. Endangered Blackburn's sphinx moth and Nēnē are known from entire region.

Wildfire RSA: As discussed in Section 3.11, northwest Hawaiʻi is arid, and aside from bare lava flows and the centers of urban areas protected by extensive pavement or lush vegetation, nearly all of it is highly fire prone grassland or shrubland. Maps compiled by the Hawaiʻi Wildfire Management Organization (2007) from 55 years of fire data indicate that fires that begin in any given location in Northwest Hawaiʻi have been known to grow as large as 25,000 acres and travel as far as ten miles from the point of ignition. While areas contiguous to the highway that could burn from ignition events on the highway – or benefit from the firebreak role of highway – constitute the areas of direct and indirect effects, the entire arid portion of Northwest Hawaiʻi that could experience wildlife – virtually all areas not covered by mostly barren lava – is an appropriate RSA. Each such area could have a wildfire at the same time as a wildfire caused by (or blocked from spreading by) the Saddle Road Extension. Firefighters based in Waikoloa, Puakō, Waimea and PTA might be required to respond to simultaneous fires throughout this area, and the immediate effects from one fire, such as smoke and closed highways, as well as long-term effects, such as dust, erosion and loss of vegetation, could accumulate with effects from other fires in the region.

Recreational Areas RSA. Effects from loss of hunting area associated with the road are restricted to an area of marginal hunting value in the Puʻuanahulu Game Management Area. However, this loss could accumulate with other potential reductions in area in this large unit, including losses from the proposed Hawaiʻi Island Shooting Range, future expansion of the West Hawaiʻi Sanitary Landfill (not currently planned), or hunting restrictions that could arise from efforts to protect threatened and endangered species or native ecosystems. Therefore, the entire unit is considered. In addition, urban parks within Waikoloa, the only other recreational uses in the project area, are considered.

Historic Properties and Areas for Practice of Traditional Culture RSA. These related resources share a common RSA within the former *pili* lands, lava flows and ranching areas of Northwest Hawaiʻi from Puʻuanahulu to the terminus of the dry side of Waimea, near Puʻu Nohonaohae at the Old Saddle Road junction. There are scattered archaeological sites that reflect pre-Western contact resource extraction and temporary habitation, as well as early historic ranching and boundary survey markers. The area encompassing Keāmuku and Puʻu Waʻawaʻa was united by sheep and cattle ranching, overlapping ranch ownership, trade, transportation, and social relationships during the 19th and first half of the 20th centuries, and similar historic properties and values are present. Although similar in many aspects to ranching areas in Waimea, Kona, and Humuʻula, the land within the RSA is distinct in terms of environment, resource type and current land use. There are also a number of coastal archaeological and architectural sites on the State (and in some cases National) Register that are separated from the RSA by Queen Kaʻahumanu Highway. They are distinctly different from the areas affected by the proposed highway, as they are associated with coastal uses and are surrounded by modern development, These include the Ala Loa Foot Trail, the Puakō Petroglyph Archaeological District, Hoku Loa Church, the Kiholo-Puako Trail and the Francis Iʻi Brown Beach Residence. None of the alternatives for the Saddle Road Extension would impact these directly or indirectly, and they are thus not considered as part of the RSA.

Scenic Character RSA. The near and medium range viewsheds for Waikoloa residents, Waikoloa Resort area residents and visitors, and the drivers and others on Queen Kaʻahumanu Highway, Māmalahoa Highway and existing Saddle Road towards the coast and the mountains Mauna Loa, Mauna Kea, and Hualālai were selected as the RSA because these are the viewpoints from which the landscape alterations produced by the Saddle Road Extension



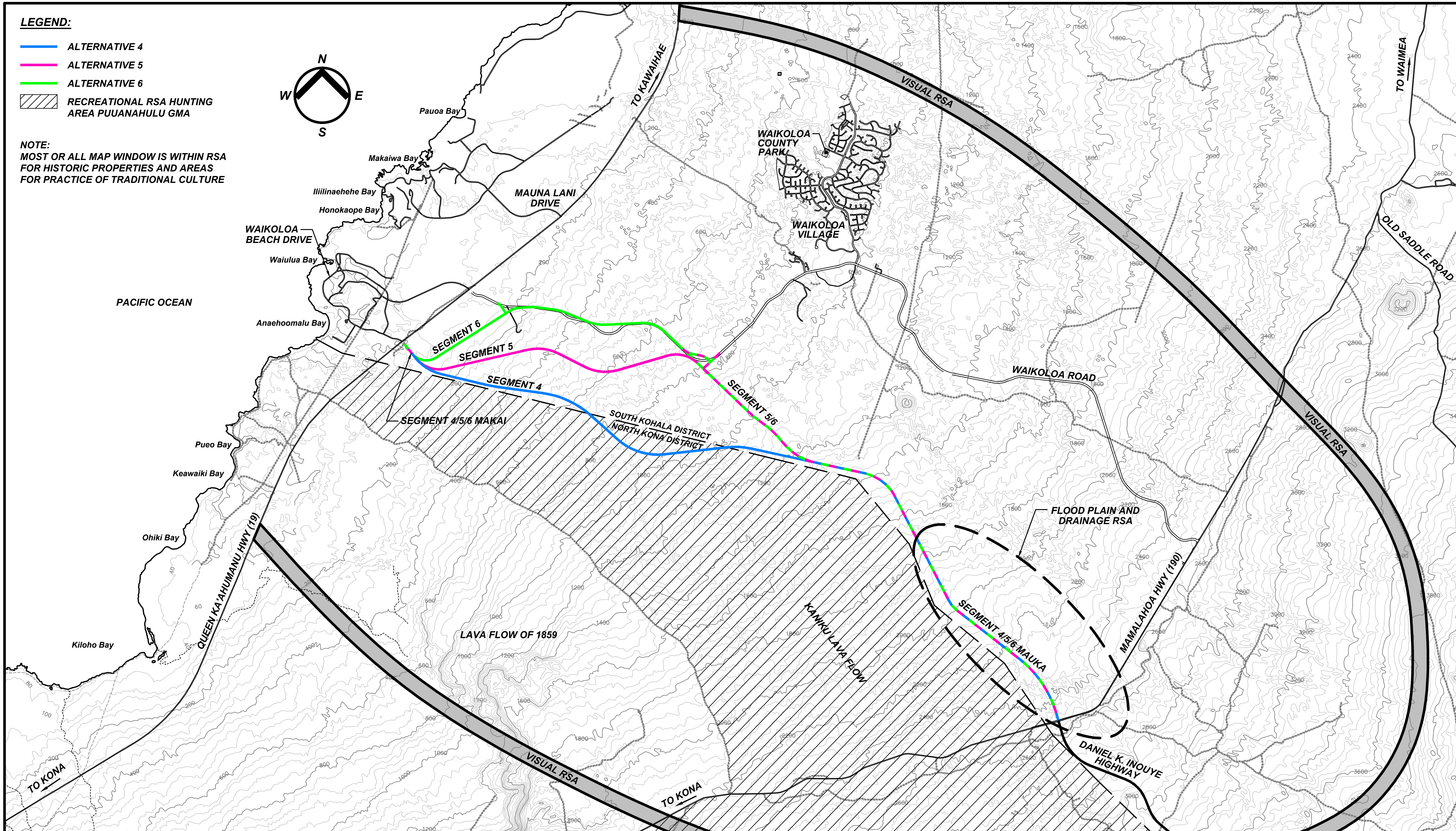
FA PROJECT NO. DP-HI-0200(5)

0 3000 6000 12000
GRAPHIC SCALE IN FEET

SADDLE ROAD EXTENSION

FIGURE 4.3.1 ~ CUMULATIVE IMPACT RESOURCE STUDY AREAS (RSA) FOR THREATENED AND ENDANGERED SPECIES AND WILDFIRE

FILE: 99011-190 QUEEN K\Figures\FIG-4.3.1.DWG



SADDLE ROAD EXTENSION

FA PROJECT NO. DP-HI-0200(5)

0 3000 6000 12000

GRAPHIC SCALE IN FEET

FIGURE 4.3.2 ~ CUMULATIVE IMPACT RESOURCE STUDY AREAS (RSA) FOR FLOOD PLAINS AND DRAINAGE AREAS, RECREATIONAL AREAS, HISTORIC PROPERTIES, AREAS FOR PRACTICE OF TRADITIONAL CULTURE AND VISUAL QUALITY

FILE: 99011-190 QUEEN K\Figures\FIG-4.3.2.DWG

alignment will occur. This broad area offers unique, far-ranging scenic vistas with brown and black lava flows, straw-colored grasslands, rounded cinder cones, snow-capped mountains, and distant glimpses of turquoise coastal waters and the expanse of the open ocean.

4.4 Description of Current Health and Historical Context of Each Resource

The next step in the cumulative impact analysis consisted of describing the current health, condition, or status of each affected resource within its respective RSA, including the recent trends. “Health,” as it is used here, refers very broadly to the overall condition, stability, or vitality of a resource, regardless of whether it is natural, cultural or social. To provide a deeper context, the analysis looks at historical trends to evaluate how each resource got to its current state. The health of each resource within its RSA is discussed below.

Health of Drainage Feature Conditions in the RSA. As discussed above, the recent Mauna Loa lava substrate readily soaks up rainwater, and there are no areas of widespread flooding or ponding. Ephemeral gulches run for a few hours or at most a day during extremely heavy rains, but since they are geologically young, they have not carved continuous courses to the sea, and after short distances they outlet into natural settling basins between lava flow hillocks lightly coated with soil. None of the drainages that would outlet from any of the project corridors affects any area outside the lightly grazed pastures south of Waikoloa. Despite the light grazing that has probably led to some soil loss, the health of the natural drainage in the area can be assessed as good.

Health of Threatened and Endangered Species in the RSA. The habitat for endangered species in the RSA varies from poor to moderate. Low elevation areas are generally dominated by fountain grass (*Cenchrus setaceus*), which promotes fire and destroys habitat for native species. An exception is found where goats cannot access the plants, such as near a few cave openings and in parts of Puʻuanahulu, where the lava flows are so barren that native vegetation and even endangered plant species may be present. At elevations over 2,500 feet above sea level, *mauka* of Māmalahoa Highway, domestic cattle and feral goats, pigs and sheep heavily graze natives, nearly or completely extirpating many sensitive species already threatened by other factors and radically changing species composition, promoting introduced species or hardy natives such as *Dodonaea viscosa*. This is one reason that the shrubland dominated by this plant is so pervasive in the area and can be said to be in a sustainable, if not entirely natural, state. Prominent cinder cones where rough substrates and steep topography reduce grazing pressure may contain isolated populations of endangered herbs, shrubs and vines, which can persist if protected. At still higher elevations – well outside the RSA – plant communities such as *Chenopodium* shrubland and *Eragrostis* grassland promote an environment that fosters endangered plants, especially in rugged terrain above 6,000 feet in elevation.

Five endangered plants are found in the RSA. At low elevations are two endangered trees, both extremely uncommon: *uhiuhi* (*Mezoneuron kavaiense*) and *halapepe* (*Pleomele hawaiiensis*). One individual of each of these species was found as recently as 2003 in the general vicinity of Saddle Road Extension Segment 4/5/6 *mauka*, but they have since died. The Waikoloa Dry Forest Preserve, which protects the remaining individuals of *uhiuhi* near Waikoloa Village on land set aside by the Waikoloa Village Association, has leveraged government grants and public support and been highly successful in its conservation efforts.

A small patch of the subshrub *Abutilon menziesii* was formerly present *mauka* of Queen Ka‘ahumanu Highway and north of Waikoloa Road, but it appears to have been extinguished around 1991. At higher elevations across Māmalahoa Highway, several cinder cones support *ihi* (*Portulaca sclerocarpa*), *nehe* (*Melanthera venosa*), *Vigna o-wahuensis* and *Isodendrion hosakae*. Conservation efforts by the U.S. Army at Ke‘āmuku are protecting these plants on land within Pōhakuloa Training Area. Significant endangered species mitigation is being undertaken by the Hawai‘i DLNR just to the south at Pu‘uwa‘awa‘a and Pu‘uanahulu. Although few active conservation efforts are occurring, Parker Ranch ensures that populations of these plants are not affected by quarrying or other intensive activities. The health of the threatened and endangered plant populations that remain within the RSA is relatively good, although this must be interpreted within a context of two centuries of shrinking and degraded habitat that has rendered these plants very restricted in range and endangered.

A number of listed threatened or endangered bird species (and one bat species) overfly or forage in portions of the RSA, but because of the lack of suitable habitat in the project area, there is only a minor potential for direct or cumulative impacts. The most important consideration is the Nēnē or Hawaiian Goose (*Branta sandvicensis*), which is a listed endangered species. Golf courses have become significant attractants for Nēnē. They are often observed near the Big Island Country Club in Pu‘uanahulu and also within the Waikoloa Village Golf Course. The status of this bird is reasonably healthy in the RSA, although there are many complexities related to human interaction.

The only designated critical habitat for animals in the RSA is for Blackburn’s sphinx moth (*Manduca blackburnii*), which is present at the extreme south of the RSA at elevations of about 1,000 feet in Pu‘uwa‘awa‘a. However, wherever the extremely common non-native tree tobacco (*Nicotiana glauca*) if found, it may serve as host plants for this endangered moth. This weedy shrub is locally abundant throughout the RSA, especially on disturbed surfaces such as recently graded lava and highway shoulders.

Health of Wildfire Prevention and Suppression Efforts in the RSA. As discussed above in Section 3.11, the Hawai‘i Fire Department (HFD) and the Hawai‘i DLNR’s Division of Forestry and Wildlife have the responsibility for fighting wildfires in Hawai‘i County. With stations in the RSA in Waimea, Waikoloa and on Queen Ka‘ahumanu Highway between Mauna Lani Drive and Puakō, HFD is well positioned to respond. DLNR has offices in Hilo and Waimea. A firefighting unit from the U.S. Army’s Pōhakuloa Training Area is responsible within the military base but also assists on fires that affect adjacent State and private lands. County, State and federal agencies have worked with non-profits such as the Hawai‘i Wildfire Management Organization (HWMO) and local communities to prevent wildfire. Strategies include substitution of fire-resistant for fire prone vegetation around homes, fuel breaks and firebreaks, alternate emergency road egresses, and new sources of firefighting including fire dip tanks for helicopters. One of the goals of the Hawai‘i County Multi-Hazard Mitigation Plan was establishing Firewise Community Development Workshops for Firewise Communities. The Waikoloa Firewise Committee began developing a wildfire risk reduction plan in 2003 focused on protecting Waikoloa Village. The firebreak built by this group in July 2005 as a volunteer effort was instrumental in saving the community during the August 2005 wildfire. The Hawai‘i Wildfire Management Organization is working with the Federal Emergency Management Agency (FEMA) funds to construct a series of 6,700-gallon fire dip tanks for several locations around West Hawai‘i, including within the RSA. Strategically located dip tanks allow firefighting helicopters the ability to fight fires in inaccessible locations on a short turnaround. The combination of efforts by County, State, federal and private organizations has assisted in protecting the RSA from wildfire to a great degree, although additional funding and projects are continually needed.

Health of Recreational Areas in the RSA. More than 3,000 residents hunt for meat and recreation on the island of Hawaiʻi. Pigs, sheep, goats and a variety of gamebirds are hunted by rifle or archery in some three dozen units largely concentrated in the central portion of the island. Public hunting occurs on the State land south of the North Kona/South Kohala district boundary, within the Puʻuanahulu Game Management Area (GMA). This is part of State Hunting Unit E, where hunting of pigs, goats, sheep and birds is permitted by archery or firearms. Although the rocky and barren area traversed by two miles of Alternative 4 is generally marginal hunting habitat, with very few plants or goats, the Puʻuanahulu GMA as a whole offers good hunting. Pōhakuloa Training Area also offers periodic hunting directly across Māmalahoa Highway within Keʻāmuku. Impacts to hunting from individual projects must be carefully analyzed in the context of the cumulative loss of thousands of acres of public hunting area over the last few decades, most of it because of fencing and mammal removal to protect endangered plants and ecosystems. This has occurred in several locations in the higher elevation areas of Pōhakuloa Training Area. The Hawaiʻi Island Shooting Range is being planned by DLNR and the non-profit On Target Inc. in an area within the Puʻuanahulu GMA between the West Hawaiʻi Sanitary Landfill and the South Kohala/North Kona district boundary. The status of that project is currently uncertain, but if constructed, it would reduce the useable area in GMA by at least 1 square mile, but enhance hunting through areas for shooting practice. In the RSA as a whole, however, hunting area has actually recently expanded because of the Army's purchase of the 28,000-acre Keʻāmuku property from Parker Ranch and the subsequent establishment of public hunting of a large portion of this property.

Health of Historic Properties in the RSA. No full database of archaeological sites in this broad area exists, but archaeological reports resulting from surveys done over the last 40 years for proposals for land development, public infrastructure, military activities, and other projects indicate that thousands of sites exist. These included temporary habitations and shelters, resource extraction features, burials and trail networks from pre-Western contact time, and fences, trail markers, temporary camps, corrals, work areas, and other sites from ranching and military use. Many archaeological sites and other historic properties from the ranching era have been preserved as part of community planning and private efforts for the major historical ranches that anchored the economy and social life of the area from 1830 until a few decades ago. Most of this is outside the RSA, in Waimea and Humuʻula, but there has also been preservation in Keʻāmuku, Waikiʻi and Puʻu Waʻawaʻa. ***Appendix E1*** provides details on the results of other studies in the area. ***Table 4.3.2*** provides a high-level summary of selected historic properties or concentrations of inventoried sites in the RSA. The State of Hawaiʻi has historic preservation statutes in Chapter 6E, Hawaiʻi Revised Statutes, that require archaeological surveys and assessment of significance for all major actions and most other actions that require a permit, such as grading. Chapter 6E also requires concurrence from the State Historic Preservation Division on treatment for significant historic properties, including data recovery, preservation, and burial treatment. Based on these protections, and the extensive preservation of major representative elements of the pre-Contact as well as ranching era historic properties with substantial information content or interpretive value, the historic properties resource in the RSA can be described as in good health.

Table 4.3.2
Partial List of Historic Properties in Resource Study Area

Property(ies) Description and Importance	Location	State Historic Site No. (prefix 50-10)	Inventory and Preservation Status
Parker Ranch. Parker Ranch, almost two centuries old, has long been one of the largest ranches in the U.S. John Parker came to Hawai‘i in 1809 and worked for King Kamehameha. Rewarded with right to hunt wild bullock, builds salt beef and hide industry. Began ranching in Waimea in 1816. Alfred Carter led ranch through growth of late 19th century, when it acquired much adjacent land, from Humu‘ula to Waikoloa. Most inventoried historic properties within Parker Ranch are in the central, wetter portions of Waimea and **outside the current RSA**. No Parker Ranch properties on the Historic Register are within the RSA.			
	Waikoloa *mauka*, through which all alternatives pass	None on Register in RSA.	Many archaeological sites not yet inventoried.
Waiki‘i Ranch. Originated as sheep station in 1882, acquired later by Parker Ranch. Village in Waiki‘i began in 1904 with water pipeline from Kohala. Between 1900 and 1957, a number of families, Hawaiians as well as immigrants from China, Germany, Japan, Portugal, and Russia, were brought in. Ranch had rich fattening paddocks, fruit orchards, fowl-raising, and at one time over 2,000 acres of corn. Also served as base for sheep operations in Ke‘āmuku and Humu‘ula. Changing transportation, markets, and weather led to closure in 1957, with most houses moved to “Little Waiki‘i” in Waimea. Once had more than 20 structures, including a schoolhouse, but only a fraction remains. Still extant are parts of the Russian camp, corn crib, stable facilities, manager’s house.			
	Waiki‘i, *mauka* of areas through which alternatives pass	None on Register	Private. Preservation status uncertain.
Ke‘āmuku Village. Entire Ke‘āmuku area has about 100 sites, most related to ranching. In Ke‘āmuku Sheep and Cattle Station, 5 sites w/ ca. 100 features: remnants of Ke‘āmuku House, w/ furo, catchment; Lower Shear Barn, and Figure 8 corral. Ke‘āmuku continued as a ranch section and in 1962 general repairs were made. Abandoned by 1965, the shear barn and larger (more recent) residence were dismantled in 1972. The house (bachelors’ quarters) at the Ke‘āmuku Section was moved to the grounds of the Japanese Church (Hongwanji) in Waimea, the shear barn was demolished, and the area around it bulldozed.			
	Mauka of areas through which alternatives pass	21-23499; 23515-517; 23539	Remnants of area all preserved by military.
Pu‘u Wa‘awa‘a Ranch. Sheep raising began in 1987. Eben Low and Robert Hind Leased 84,000 acres in 1897 for ranching. Homesteading lots for workers later set foundation for today’s traditional Hawaiian community in Pu‘uanahulu. Dillingham owned from 1956-1972, with three owners since. Much of historic core of Pu‘u Wa‘awa‘a Ranch remains. Ranch HQ (1900s), Pihakalani (main ranch house) (1905-1910) and worker housing, corral with old cattle chute, and Hale Piula water catchment area (1930s) on State Register.			
	South of areas through which alternatives pass	20-26170 20-26171	All private. Main house restored in last decade; all planned for preservation/ adaptive reuse.
Waikoloa Quarry Archaeological Preserve. Various features interpreted as burials but not tested were recorded.			
	Between Alternatives 5/6 and 4	None on Register	Preserve boundary exists
Miscellaneous. At least 12 archaeological surveys have been conducted in the RSA, with findings of hundreds of historic and prehistoric sites (see Section 3.14 and ***Appendix E1***)			
	Waikoloa south, through which all alternatives pass.	None on Register	Sites generally assessed as data recovery; some preserved.

Sources: ***Appendix E1***; IARII 2001; South Kohala Community Development Plan (County of Hawai‘i 2008); Escott 2006; Hawai‘i State DHHL 2009; Pers. comm. P. Ponthieux (Pu‘u Wa‘awa‘a architect) to R. Terry; Maly and Maly 2002: 209-210; Maly Associates 1999; Ketner et al 2008; Hawai‘i State Register of Historic Places.

Health of Areas for Practice of Traditional Culture in the RSA. Land in the RSA is private (and aside from Waikoloa Village, mostly undeveloped) north of the North Kona/South Kohala District boundary. To the south, it is public and mostly undeveloped. It is dry and rocky, with sparse vegetation. Prior to Western Contact, as discussed in Section 3.15, the area would have been utilized by coastal inhabitants to gather *pili* grass for thatching, various lava types for tools, bird eggs, medicinal plants, and similar resources. Today, with no traditionally-living inhabitants on the coast who might need to walk inland for everyday needs, no such resource gathering occurs. Some medicinal or ceremonial plants such as ʻ*uhaloa* (*Waltheria indica*) or *ʻilima* (*Sida fallax*) are still gathered around the Hawaiian archipelago. The project area lands are not highly utilized because there are more convenient sources nearer the homes of those who may wish to gather these ubiquitous plants. The *mauka* third of the project area is within fenced cattle pastures that are not open to the general public, although they could be accessed by cultural practitioners. Several *wahi pana* or places that are traditionally celebrated are present in this area, including the hills of Puʻuanahulu and the massive Kanikū lava flow, which covers about 100 square miles. Although the general degradation of the Hawaiian ecosystem that resulted from Western contact and development has greatly reduced the diversity and ranges of biological resources, the health of these traditional resources is generally stable in the RSA at this point. There are no commonly gathered resources that are in danger of disappearing. Access to such resources assured by either land ownership (e.g., Puʻuanahulu Game Management Area) or the recognition by the courts of the right for Native Hawaiians to gather traditional resources on tracts of undeveloped private land.

Health of Scenic Character in the RSA. Only one settlement is contained within the RSA, Waikoloa Village. This planned, modern, compact settlement of just under 7,000 inhabitants looks over dry, rocky grasslands to distant views of the coast and the mountains of Mauna Loa, Mauna Kea, and Hualālai. The views for drivers and others on the highways that traverse the RSA – the Māmalahoa Highway, Queen Kaʻahumanu Highway, Waikoloa Road, and the new section of the Daniel K. Inouye Highway – are similar. As these highways have sequentially developed, they have opened up new vistas that before had been visible only to the occasional cowboys, now enjoyed by all. Urban development has been compact, centered around Waikoloa Village, and little sprawl exists in this area. Although a few other scattered land uses are present, a quarry being the only extensive one, they do not intrude into the viewscape. This resource can be considered to be in good health.

4.5 Identification of Other Reasonably Foreseeable Projects

This step of the cumulative impact analysis identified current and reasonably foreseeable transportation and non-transportation projects within the RSA for each resource. Reasonably foreseeable actions are those that are likely or probable, rather than merely possible. ***Table 4.5.1*** includes a discussion of reasonably foreseeable projects within the RSA for all resources for which the Saddle Road Extension project has a potentially adverse effect. These are mapped on ***Figure 4.5.1***. Data concerning these projects is from the Hawaiʻi State OEQC *Environmental Notice*, newspaper articles, various websites, and interviews. In addition, the analysis includes ongoing projects in the area, particularly the slow but steady infill of Waikoloa and Mauna Lani resort housing.

Table 4.5.1
Description of Reasonably Foreseeable Projects in Resource Study Areas

SR 19 (Queen Ka‘ahumanu Highway) Widening; Keahole Airport to Waikoloa Road [1]	
Summary of Project and Impacts	Summary of Mitigation
Project: Would widen highway from two to four lanes with separate turning lanes at major intersections for a length of 17 miles; Visual Impacts: Create more urban appearance for drivers on and viewers of highway. Timing: uncertain, 2020-2030?	None yet proposed.
SR 19 (Queen Ka‘ahumanu Highway) Widening; Waikoloa Road to Kawaihae [2]	
Summary of Project and Impacts	Summary of Mitigation
Project: Would widen highway from two to four lanes for a length of 7 miles with separate turning lanes at major intersections. Visual Impacts: Create more urban appearance for drivers on and viewers of highway. Timing: uncertain, 2020-2030?	None yet proposed.
Paniolo Avenue Project [4]	
Summary of Project and Impacts	Summary of Mitigation
Project: $55.4 M extension of Paniolo Avenue in Waikoloa from recently extended section at Kamakoa Nui north as a 4-lane arterial to connect to Kawaihae Road. Historic Sites Impacts: Not yet studied. Visual Impacts: Insert urban feature in landscape that currently has limited development; corridor would not likely be visible from any alternative of Saddle Road Extension, Māmalahoa Highway, or Waikoloa Road (outside urban Waikoloa Village). Timing and status: uncertain.	None proposed yet.
Wehilani at Waikoloa [5]	
Summary of Project and Impacts	Summary of Mitigation
Project: Total of about 700 units on 256 acres adjacent to Golf Course, partially built out, in phases. Started in 2005, not complete. No budget available. Traffic Impacts: Adds traffic to Waikoloa Road. Visual Impact: Adds substantially to existing urban area at Waikoloa. May be partially visible from the Saddle Road Extension. Timing and status: uncertain.	Visual Impacts: mitigated by open space, landscaping, and covenants.
‘Aina Le‘a [6]	
Summary of Project and Impacts	Summary of Mitigation
Project: 3,000 acres at Puako Mauka. Up to 1,924 homes and several golf courses are permitted. 384 affordable units, 25-acre commercial. Traffic Impacts: Adds traffic to Queen Ka‘ahumanu Highway. Visual Impacts: Adds substantially to existing urban area below Waikoloa Village and east of coastal resorts. Will be partially visible from any alternative of Saddle Road Extension. Timing and status: uncertain.	Visual Impacts: mitigated by open space, landscaping, and covenants.
Waikoloa Heights, Waikoloa Ma Lai LLC [7]	
Summary of Project and Impacts	Summary of Mitigation
Project: A 570-640-unit development is planned beginning soon on 800 acres, 1st phase about 2750 units. The Paniolo Road Extension is required as part of the Project. Traffic Impacts: Adds traffic to Waikoloa Road. Visual Impacts: Adds substantially to existing urban area at Waikoloa. May be partially visible from new Saddle Road Extension. Timing and status: uncertain.	Visual Impacts: mitigated by open space, landscaping, and covenants.

Hawaii Island Shooting Range[8]	
Summary of Project and Impacts	Summary of Mitigation
Project: Planned by DLNR and the non-profit On Target Inc. for an approximately one square mile area between the West Hawaiʻi Sanitary Landfill and the South Kohala/North Kona district boundary: Impacts: Use of Kanikū lava flow, regarded by some as cultural resource. Will be partially visible from Saddle Road Extension. Noise Impacts to immediate area. Timing: 2017-2018 construction; permanent use after. Status uncertain.	Restrictions on noise producing activities.
Kamakoa Nui Hawaiʻi County/ Workforce Housing Project[9]	
Summary of Project and Impacts	Summary of Mitigation
Project: 1,000-1,200 units including small family homes and condos on 260 acres. Some units now available. Traffic Impacts: Adds traffic to Waikoloa Road. Visual Impacts: Adds substantially to existing urban area at Waikoloa. Distantly visible Saddle Road Extension. Timing and status: uncertain.	Visual Impacts: mitigated by open space, landscaping, and covenants.
BioEnergy Hawai`i, LLC Hawaiʻi Integrated Resource Recovery Facility[10]	
Summary of Project and Impacts	Summary of Mitigation
Project: BioEnergy Hawaiʻi, LLC would use land within West Hawaii Concrete Quarry to construct/operate a facility to divert municipal solid waste from the County's landfills. Recyclable materials will be recovered and collected for offsite sales. Organic materials will be separated for use and in an anaerobic digester and use for thermal conversion using a gasifier or pyrolysis unit. Waste digested in the anaerobic digestion system will produce renewable natural gas. Waste disposed in the thermal conversion unit will be used to produce electricity. The natural gas will be used to power the waste collection fleet and also sold to offsite consumers to displace fossil fuels. The facility will provide a substantial reduction in greenhouse gas emission over the existing solid waste disposal system. Location: adjacent to alternatives. Impacts: uncertain. Timing: 2017 construction.	Erosion, sedimentation, and emissions controls.
BIVWR Investment LLC Subdivision[11]	
Summary of Project and Impacts	Summary of Mitigation
Project: Consolidation of two lots (TMKs 6-9-002: 012 & 013 (1,878 acres) and subdivide it into approximately 20 80-acre lots. Impacts: access, erosion and sedimentation. Directly adjacent to all alternatives. Timing: 2017-2020.	None proposed yet.

Only impacts and mitigation that correspond to appropriate Resource Study Areas are included. Superscript numbers also correspond to Key Number on ***Figure 4.5.***1. Sources and notes:

[1] Hawaiʻi Department of Transportation (HDOT), Hawaiʻi Long Range Land Transportation Plan (HLRLTP); Federal-Aid Highways 2035 Transportation Plan for the District of Hawaii (FHTPDH).

[2] HDOT; HLRTP; FHTPDH. [3] Hawaii Tribute Herald (HTH) 8/13/13 "Waimea connector road considered"

[4] http://bigislandnow.com/2014/04/29/paniolo-avenue-extension-completed-in-waikoloa-village/ (accessed March 2017)

[5] Castle and Cooke, Waikoloa Village Association; South Kohala Community Development Plan (SKCDP).

[6] http://luc.hawaii.gov/ & SKCDP; FEIS in OEQC Environmental Notice 11-8-2010. (accessed March 2017)

[7] Source: Lynch Investments, Waikoloa Village Association, Honolulu Star Bulletin, KCDP.

[8] The Score, Newsletter of On-Target Inc., var. issues [9] Waikoloa Village Association; SKCDP.

[10] http://oeqc.doh.hawaii.gov/Shared%20Documents/Environmental_Notice/Archives/2010s/2016-08-23.pdf (accessed March 2017)

[11] Pers. comm. Roger Harris to HDOT/FHWA,

Table 4.6.1
Cumulative Impact Assessment Summary

DRAINAGE FEATURES		
Historic Character	**Current Character**	**Effect of Proposed Action**
In an area with no streams or mapped flood hazard, minor gullies with ephemeral flow provide drainage. No development, little alteration; some grazing has altered runoff and erosion.	Continuation of low intensity grazing, no other influences.	Adds generally minor amount of 50-year storm runoff from impermeable road surface to local drainages that currently have flows between 31 and 4,628 cfs. No effects to any receiving waters.

Effects from Future Actions	**Overall Cumulative Effect from Past, Present and Reasonably Foreseeable Future Projects**
Potential for additional runoff from infrastructure and lots associated with future large-lot BIVWR ag. subdivision in *mauka* part of Segment 4/5/6. No other current plans in drainage sensitive areas of RSA.	Additional runoff, but within capacity of existing drainages given adherence to County drainage ordinances; no resources at risk, as drainages do not reach other waters and no drainage sensitive uses are/will be present in affected area.

THREATENED AND ENDANGERED SPECIES		
Historic Character	**Current Character**	**Effect of Proposed Action**
Plant T&E species almost extirpated from area; habitat for animal T&E species degraded and populations shifted elsewhere.	Remaining T&E plants within Waikoloa Dry Forest Preserve and on cinder cones in Army-controlled preserves on PTA. Island wide-ranging invertebrates present in sparse numbers. Blackburn’s sphinx moth resurgent due to adaption to invasive plant host.	Takes places outside areas with known T&Es and avoids indirect effects. Surveys for Blackburn’s sphinx moth necessary in order to avoid impact. Indirect wildfire impact, although mitigated by project design. May impinge on unoccupied critical habitat.

Effects from Future Actions	**Overall Cumulative Effect from Past, Present and Reasonably Foreseeable Future Projects**
No known actions nearby that would contribute to further harm to T&E species. Establishment of Unit 32 of Critical Habitat and/or continued maintenance of Waikoloa Dry Forest Preserve and Army preserves will improve quality and resiliency of resource. Major indirect risk is wildfire.	Mitigation efforts of proposed project coupled with ongoing management by DLRN at Pu‘uwa‘awa‘a and by the Waikoloa Dry Forest Preserve will result in overall neutral to beneficial impacts to listed species. No cumulative adverse effect to listed species expected.

WILDFIRE		
Historic Character	**Current Character**	**Effect of Proposed Action**
Maps from 1954-2005 show most vegetated surface in region has burned at least once. In August 2005, one of largest fires recorded on island burned 25,000 acres of grassland around Waikoloa Village just north of project corridors.	Area remains vegetated with pyrophytic grasses and is susceptible to fire after wet winters and dry summers. Community efforts such as Firewise are mitigating and adding resiliency.	The Project represents an additional ignition source, but also a fuel break and staging area for firefighting.

Effects from Future Actions	Overall Cumulative Effect from Past, Present and Reasonably Foreseeable Future Projects
Additional development will place more properties at risk and provide additional ignition sources but also provide fuel and fire breaks. The significant wildfire mitigation that the Hawai‘i DLNR has undertaken and continues at Pu‘uwa‘awa‘a and Pu‘uanahulu will reduce risk.	Mixed adverse and beneficial impacts will continue to occur with each new instance of developed infrastructure. Community efforts are critical for mitigation.

RECREATIONAL AREAS

Historic Character	Current Character	Effect of Proposed Action
Formerly all grazing land. Establishment of hunting areas in public lands at Pu‘uanahulu, opening of Ke‘āmuku to weekend hunting with Army management. Public parks in Waikoloa.	Sufficient hunting areas in exist, but access and management remain issues. Demand for public parks exceeds current inventory.	Alternative 4 traverses the multi-use 65-square mile Pu‘uanahulu GMA, which supports mammal hunting. Permanent loss of 0.5 square miles of hunting area (direct highway use /50-yard standoff areas). Would also improve access for hunters to remaining 99% of the unit.

Effects from Future Actions	Overall Cumulative Effect from Past, Present and Reasonably Foreseeable Future Projects
Hawai‘i Island Shooting Range may take land but will improve hunting-related recreation. No known hunting impacts from other sources. Fair-share contributions will provide more park space/facilities as urban development projects are built.	Impacts to hunting conditions will be neutral to slightly beneficial; other recreational facilities will expand with population, outstripping additional growth in demand due to County policies imposing improvements upon developers.

HISTORIC PROPERTIES

Historic Character	Current Character	Effect of Proposed Action
Large variety of sites scattered on landscape. Historic preservation laws since 1960 have prompted inventories, data and preservation, but with loss of “non-significant” sites in many cases.	Tens of thousands of inventoried features. Many high quality sites preserved in public or private hands. Some degradation of both inventoried and non-inventoried sites	Destruction of some fraction of 28 sites inventoried, with prior data recovery for all impacted sites designated for data recovery.

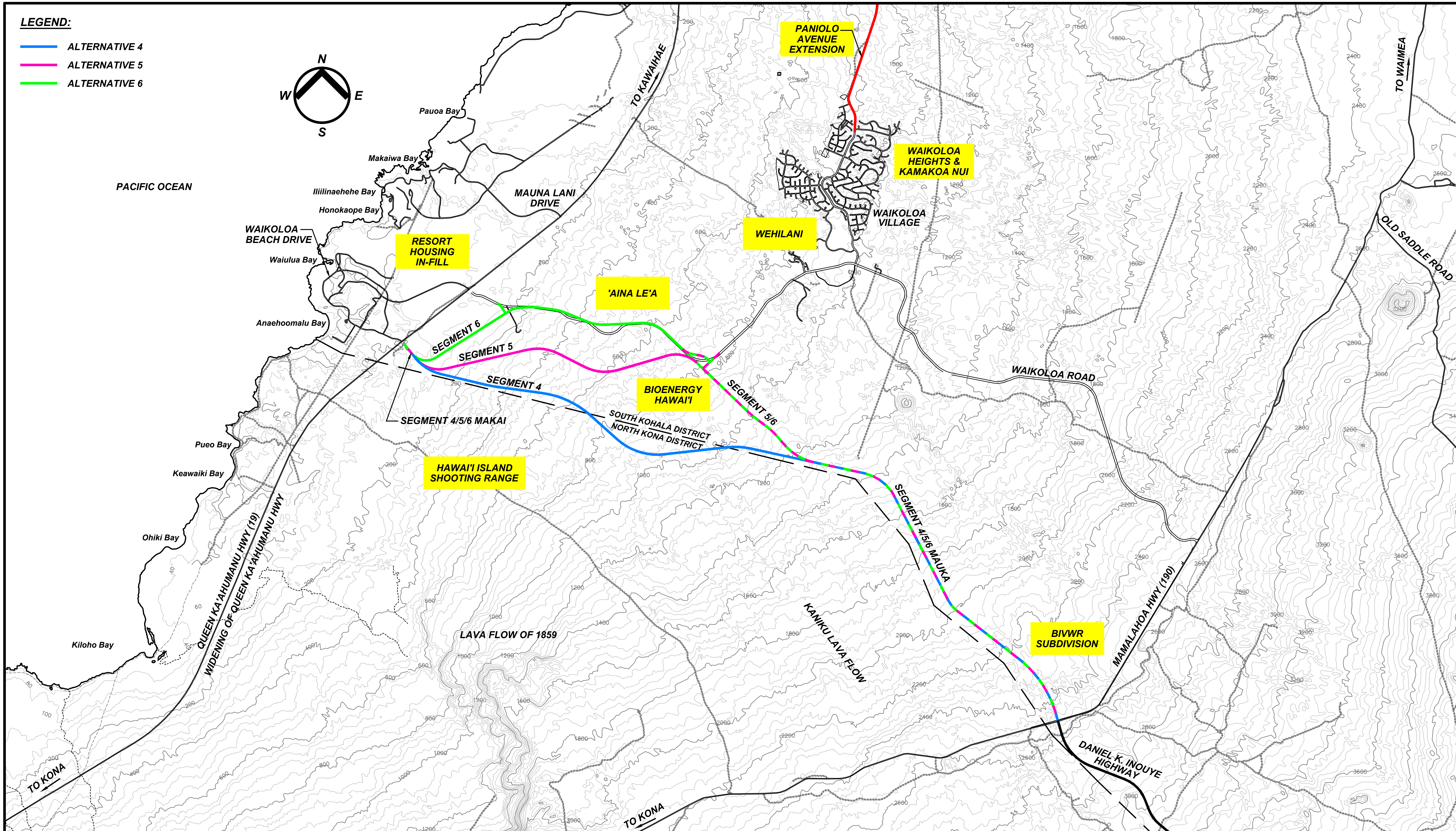
Effects from Future Actions	Overall Cumulative Effect from Past, Present and Reasonably Foreseeable Future Projects
Land development will first inventory and then destroy some non-preservation quality sites and preserve many additional higher quality sites.	The best representatives of the pre-Contact and ranching history will remain preserved. Historic preservation laws enforced prior to development will limit the potential for future actions to damage significant sites. Additional data and preservation sites will result through future actions. No substantial adverse impact.

AREAS FOR PRACTICE OF TRADITIONAL CULTURE		
Historic Character	**Current Character**	**Effect of Proposed Action**
Gathering of various biological and geological resources, ceremonial use, and associations with places and resources strengthen the cultural fabric. Over time, there has been alienation from land and resources through land and social change.	Little current use of these lands for gathering or other purpose; loss of names for many features, but renewed interest in recovery and preservation of landscape and traditional relationship to it.	Inserts another built element into a landscape that has been radically transformed but retains undeveloped character. No loss of gathering resource; but another intrusion into the massive Kanikū lava flow, which has traditional associations.

Effects from Future Actions	**Overall Cumulative Effect from Past, Present and Reasonably Foreseeable Future Projects**
Future actions will continue to alter the character of the land and change the context for cultural relationships.	Although no gathering resources or ceremonial sites will be jeopardized, the SRX project will combine with other projects in the region and the State to reduce the undeveloped character of the landscape.

SCENIC CHARACTER		
Historic Character	**Current Character**	**Effect of Proposed Action**
Viewshed has not been highly subject to major landscape alterations, but subtle effects from plant community change and fire are present.	Viewshed offers unique, far-ranging scenic vistas that are relatively pristine.	Will insert a built element into the environment, changing the vistas. A new set of unique and highly scenic views for the driving public will be provided, similar to those associated with the Daniel K. Inouye Highway.

Effects from Future Actions	**Overall Cumulative Effect from Past, Present and Reasonably Foreseeable Future Projects**
Large-lot development will insert scattered structures, and urban development will transform at least some vistas from rural or wilderness to urban.	The scenic vistas that are currently enjoyed from Waikoloa Village and existing viewpoints will not change. Views from most of the existing highways will not be altered significantly. Views for drivers in a limited area near the junctions with Māmalahoa Highway will be altered to include elements of a more urban character because of the SRX. New vistas will continue to develop.



FA PROJECT NO. DP-HI-0200(5)

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GRAPHIC SCALE IN FEET

SADDLE ROAD EXTENSION

FIGURE 4.5.1 ~ LOCATIONS OF REASONABLY FORESEEABLE PROJECTS

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4.6 Assessment of Potential Cumulative Impacts

Table 4.6.1 summarizes the manner in which impacts from the proposed project will combine and interact with those of other projects. The next section summarizes these impacts and proposes mitigation that can be effective in avoiding or reducing cumulative impacts.

4.7 Cumulative Impact Summary and Need for and Potential Efficacy of Mitigation

Although some adverse cumulative impacts are identifiable within the RSAs for the seven categories of resources that have a potential to be impacted, they are for the most part negligible, as they are controlled by planning, mitigation and monitoring. In addition, a number of positive trends are contributing to the maintenance or recovery of these resources.

FHWA’s regulations implementing NEPA call for the consideration of mitigation for all adverse impacts. With cumulative impacts, determining feasible mitigation measures is often difficult. In many cases, a cumulative impact results from the combined actions of numerous agencies and private entities. The requirement to implement a potential mitigation measure to address a cumulative impact is often beyond the jurisdiction of highway or cooperating agencies. Therefore, development of mitigation for cumulative impacts is not based on or limited to specific mitigation measures that can be implemented by the lead agency. However, a project may provide opportunities for the project proponent to propose innovative cumulative impacts solutions. If it is not possible to identify a mitigation measure, the discussion may consist of listing the agencies that have regulatory authority over the resource and recommending actions those agencies could take to influence the sustainability of the resource. By doing so, the needed mitigation would be disclosed to the public and reviewing agencies even though it could not be implemented by the lead agencies. Once disclosed, the information could be used to influence future decisions or to help identify opportunities for avoidance and minimization when other projects are proposed.

The following provides a discussion of the level of overall cumulative impact, the need for mitigation, if any; the proposed mitigation, if necessary, and a consideration of jurisdiction and practicality.

> For the resources of *drainage features*, there are no adverse cumulative impacts that require mitigation. Most of the area is rapidly draining recent lava, with no drainages that reach waters and no drainage sensitive uses are or will be present in affected area. The current system is stable, with limited erosion and sedimentation occurring, and none that affects receiving waters. With foreseeable development, there will be increases in runoff, but they will be within capacity of existing drainages, given adherence to County drainage ordinances. In the particular setting of the project corridors, local grading ordinances and permit processes under the Clean Water Act very effectively limit erosion and sedimentation that could result from past, present and future actions, and no additional mitigation is required.

All *threatened and endangered species* that are present in the RSA are either: (1) protected in preserves; (2) very rare in the RSA but reasonably abundant elsewhere, with robust populations that activities in the RSA do not threaten; or (3) being recovered through federal and State programs. The cumulative effect of highway and development projects, ongoing/future agriculture and hunting will not directly affect any individuals or populations of these species, or adversely modify critical habitat. However, there is the related issue of wildfire, which can have a damaging and even devastating impact on preserved or recovering populations and habitat. The increased propensity for wildfire that is in some way attributable to the new highway (whether related to construction, arson, accidents or improper cigarette disposal) could combine with increased fire risk from other projects (e.g., a housing development), to result in a higher overall risk. In addition to risks to life and property and stresses on firefighting personnel and infrastructure, threatened and endangered species could be at greater risk. Mitigation for direct effects has been designed into the proposed highway's typical section, which maximizes both fire prevention and firefighting benefits. The reduction of cumulative risk for wildfire relies on continuation of ongoing government and private actions, the most noteworthy being the Waikoloa Firewise Program, the gradual implementation of the Pōhakuloa Training Area's *Integrated Wildland Fire Management Plan* (U.S. Army Garrison, Hawaii, HQ 2003), and the island-wide efforts of the Hawaiʻi Wildfire Management Organization. These efforts are being coordinated in a self-sustaining, integrated, collaborative manner that recognizes the cumulative effects of projects and activities in West Hawaiʻi and seeks to build community resilience to the total wildfire hazard. Because of the attention that each new project receives and the attendant mitigation efforts, the net cumulative effect should actually end up being beneficial.

Urban *recreational facilities* are required to be built as part of new projects by County and State zoning conditions. These facilities will expand as development does, likely outstripping additional growth in demand due to County policies, ensuring that cumulative needs will be accounted for. The status of hunting land and game in the RSA is stable, with very little potential for future cumulative impact because of the relatively protected status of hunting units in this area. Aside from the proposed coordination with game agencies to cooperate concerning improving access for hunters, no mitigation for cumulative impacts should be required.

State and federal laws and regulations have succeeded in ensuring that *historic properties* are properly inventoried, studied and protected where appropriate. The nature and scale of planned development over the foreseeable future in the RSA would indicate that this level of oversight will continue, resulting in additional knowledge, preservation and interpretation for those sites that are not yet inventoried. No additional mitigation for cumulative impacts should be required.

The *scenic values* in the landscape of the RSA are associated with wide vistas of open grasslands and lava flows, as well as distant views of the sea and prominent hills and mountains. The design for Saddle Road Extension includes minimization of the amount of cut and fill slopes, revegetation of disturbed areas, and blending any proposed improvements into the surrounding landscape, as outlined in Section 3.17.3. Preservation of these views associated with cumulative development can be maintained through design controls available to local governments, which have planning mechanisms to prescribe protection in regulations associated with change of zone and other permits.

The resource for which the degree of cumulative impacts and appropriate mitigation may be harder to define is the category of *traditional cultural uses*. There is a diversity of opinion on whether land development per se is a severe and even unmitigable impact. Although there are no known cumulative threats in the RSA to most manifestations of the practice of traditional culture (e.g., there is no imminent cumulative threat to particular gathering resources, *wahi pana* or ceremonial sites), a subtler effect has been cited by several cultural practitioners during consultation. Each development project reduces the undeveloped character of the landscape. This changes the context in which other traditional activities that might not in themselves be threatened occur. Development changes landscapes and views and introduces new people who may not understand or appreciate the Hawaiian worldview, in which the connections among the natural and spiritual world, the present and the past, are seamless. There may be no complete mitigation for this effect, other than ceasing development altogether, which some have advocated as an extreme but necessary preventative measure. The tradition of the Saddle Road project, which was guided by the long-serving citizens of the Saddle Road Task Force and is being continued in the Saddle Road Extension project, has been to sincerely and humbly request the blessings of a traditional practitioner upon the Project. This has been done with the knowledge that project represents development that has both positive and negative aspects for traditional culture. Familiar landscapes are altered, but landscapes lost for centuries are newly rediscovered around each curve of the highway. New and sometimes disharmonious development may ensue, but so does a deepening of ties among families scattered around the island, who now may travel easily and safely.

Although beyond the power of FHWA and HDOT to implement, mitigation measures proposed for the Saddle Road Extension may also be adopted by other development and County road projects that cumulatively alter the natural landscape and can create a feeling of alienation among those with deep cultural roots. These include conducting proper cultural protocol to release and sanctify or bless the construction project; utilizing cultural monitors during ground disturbing activities to ensure that significant cultural resources that may have not been documented during the EIS are recognized and dealt with appropriately; and marking for entering and exiting travelers the *moku* boundaries, which are highly significant. These measures, as modified and enhanced by public input during the EIS process, can serve as models and lessons for future projects that entail the scale of landscape transformation that is inherent in highway construction.

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5 EIS FINDINGS

This chapter has been prepared to satisfy EIS content requirements of NEPA and Chapter 343, HRS. Section 5.1 summarizes probably unavoidable adverse environmental effects. Section 5.2 discusses the relationship between local short-term uses of man’s environment and maintenance and enhancement of long-term productivity. Section 5.3 examines the irreversible and irretrievable commitment of resources for the Project. Finally, Section 5.4 addresses the topic of unresolved issues.

5.1 Probable Unavoidable Adverse Environmental Effects

Chapter 343 of the Hawaiʻi Revised Statutes (HRS) is the basis for the environmental impact process in the State of Hawaiʻi. The implementing regulations for this law, Title 11, Chapter 200 of the Hawaiʻi Administrative Rules (HAR), contains the following requirements:

> §11-200-17(j): The draft EIS shall include in a separate and distinct section a description of the relationship between local short-term uses of humanity's environment and the maintenance and enhancement of long-term productivity.
>
> §11-200-17(k): The draft EIS shall include in a separate and distinct section a description of all irreversible and irretrievable commitments of resources....
>
> §11-200-17(n): The draft EIS shall include a separate and distinct section that summarizes unresolved issues....

This chapter addresses these requirements of the State of Hawaiʻi EIS law.

If a Build Alternative is selected, the Project would create limited adverse environmental impacts that cannot be fully mitigated by the measures planned to be implemented at the site. The following two lists include those short-term and long-term impacts that are expected to be unavoidable. Refer to Chapter 3 for full explanation of impacts, mitigation measures and comparison among alternatives.

5.1.1 Unavoidable Adverse Short-Term Impacts

1. Negligible temporary increases in soil erosion would result from construction operations, and a negligible amount of soil would be carried off-site in surface runoff water.
2. Operation of construction equipment, trucks, and worker vehicles may temporarily impede traffic in a limited area during a small portion of the construction period.
3. Negligible release of air contaminants would occur from construction equipment. Small amounts of dust may be generated during dry periods as a result of construction operation despite mitigation.
4. The visual character of the area would be affected by construction activities and by the presence of construction equipment.

5. Noise levels would increase during construction activities.

5.1.2 Unavoidable Adverse Long-Term Impacts

1. Soils would be disturbed by grading, excavation, and mounding activities at the site during construction. Since soil cover on the site is very sparse, soil would be imported to cover cleared and graded land for planting landscaping materials, except for areas left in natural vegetation.
2. Modifications to the current topography and views would be made at the site to accommodate development of the highway.
3. Vegetation, some of which is partly native, would be removed.
4. Depending on final action by the USFWS, two of the three build alternatives may cut through a corner of a critical habitat unit for three endangered plants, although the area is unoccupied by the plants.
5. Archaeological sites associated significant for information content, for which data recovery will have occurred prior to construction, will be destroyed. No sites significant for preservation would be destroyed.
6. Approximately 200 acres of very sparsely grazed pasture would be converted to highway uses, and pastures would be divided, affecting ranching infrastructure and grazing patterns.

5.2 Relationship Between Short-Term Use of Man’s Environment and the Maintenance and Enhancement of Long-Term Productivity

The construction and operation of the Saddle Road Extension would involve trade-offs between short-term environmental losses and economic costs, and long-term transportation and economic and environmental benefits. There is little difference among Build Alternatives in the type or magnitude of such trade-offs. No short-term exploitation of resources that would entail negative long-term consequences has been identified for any Build Alternative. All substantial adverse impacts resulting from the Project are capable of mitigation to minor levels using reasonable measures. The principal long-term benefits are providing an improved arterial connection to Queen Kaʻahumanu Highway from Daniel K. Inouye Highway, saving time, fuel and money; completing the last link in an alternate State Highway route between East Hawaiʻi and West Hawaiʻi, providing efficiency and redundancy; and providing an appropriate route for existing military and commercial truck traffic, allowing this to be removed from a 14-mile section of local roads or inadequate State highway. Air quality would also improve relative to the No-Build Alternative. Considering the long-term transportation and economic utility and the minimal adverse environmental effects, the Project appears beneficial to the community and to ongoing and future land uses in the area.

A comparison of short-term use versus long-term productivity considers the commitments of resources that would directly or indirectly result from the Project. For example, typical mining operations might significantly contribute to local short-term productivity of a land resource, but generally do not contribute to the maintenance and enhancement of its long-term productivity. For the purpose of this discussion, short-term refers to the construction phase and the first 5 to 10 years of the Project. Long-term refers to the estimated life cycle of the Project, or 20 to 50 years.

The Project would require the direct taking or conversion of existing land uses into a transportation corridor use and the commitment of resources for road construction and regular maintenance. It would be expected to very slightly increase the number of cross-island vehicle trips, resulting in some changes in roadway use and traffic levels. It would strengthen economic conditions and increase access to public lands within the area. The Saddle Road Extension is not expected to foster substantial new development, because the lack of a State highway in this location is not an important factor in influencing the development of permitted or potentially allowable uses in the area under State and County zoning.

Over the life of the Project, the construction phase of approximately two years would likely represent the period of most concentrated impact to the natural, biological, and social environment. Construction-related impacts, such as soil erosion and sedimentation, the generation of air pollutants and dust, traffic congestion due to detours and delays, and noise from construction equipment would be temporary and would not be expected to affect the area’s long-term productivity.

The conversion of existing sparse grazing land uses, the direct loss or displacement of at least some common native plants that are mixed in the primarily non-native vegetation, the destruction of some archaeological sites, and the modification of the visual environment would not be retrievable for the long-term productivity of the area.

Economic benefits associated with the construction efforts would occur immediately upon initiation of the Project. Those economic benefits associated with increased cross-island connectivity and time-savings would begin following the construction period and would be expected to increase over time, contributing to the long-term productivity of the area.

Mitigation measures committed for the Project would be initiated and maintained over time as appropriate, including permanent erosion and sedimentation BMPs and fire protection. These would contribute to the maintenance and enhancement of the region’s long-term productivity. No plant or wildlife species is expected to become extinct as a direct result of project activities.

Proposed improvements would enhance safety and reduce travel time for many cross-island commuters. While the Project is a new highway facility, it preserves the efficient function of other existing road and highway facilities. The short-term use of Project resources represents an efficient means to achieve a primary transportation goal.

5.3 Irreversible and Irretrievable Commitments of Resources

The construction and operation of the proposed roadway system would involve the irretrievable commitment of certain natural, social and fiscal resources. Major resource commitments include land, money, construction materials, labor and energy. In addition, approximately 200 acres of sparsely grazed rangeland would be converted to urban uses. The impact of using these resources should, however, be weighed against the economic benefits to the residents of the County and State and the consequences resulting from taking no action.

The commitment of resources required to accomplish the Project includes labor and materials that are primarily nonrenewable and irretrievable. The operation of the Project would also include the consumption of petroleum-derived fuels, which also represents an irretrievable commitment of resources.

Resources committed to the Project would be material and nonmaterial, including financial. An irreversible commitment of resources refers to resources, which once committed to the proposed project, cannot be restored to their pre-project condition. An irretrievable commitment of resources refers to resources used, consumed, destroyed, or degraded by implementation of the proposed project such that the resource cannot be retrieved or replaced in any form. As an example, while the crushing of stone to create an aggregate base is irreversible, the commitment of the resource is only irretrievable for the life of the Project. Although the crushed stone cannot be un-crushed, it could be put to another use after the life of the Project.

The proposed construction of the Saddle Road Extension is planned for completion in roughly two years. The life cycle of a completed roadway segment spans a period of 20 years. Irreversible and irretrievable commitments of resources for the proposed project are summarized in ***Table 5.1***.

5.4 Unresolved Issues

One unresolved issue exists. This concerns whether the highway will intrude into critical habitat after the current proposed critical habitat for *Isodendrion pyrifolium*, and *uhiuhi* (*Mezoneuron kavaiense*), *Bidens micrantha* ssp. *ctenophylla* is finally designated. Discussed in detail above in Section 3.9.1.3, on October 17, 2012, the USFWS issued a proposed rule in the *Federal Register* entitled "Endangered and Threatened Wildlife and Plants; Listing 15 Species on Hawaii Island as Endangered and Designating Critical Habitat for 3 Species." One of the seven units containing 18,766 acres scattered around West Hawai‘i was Unit 32, a 1,779-acre area of mostly undeveloped land located immediately south of Waikoloa Village, into which Segment 5/6 intrudes. As published by the USFWS in the *Federal Register* of May 20, 2016 (https://www.federalregister.gov/documents/2016/05/20/2016-11941/endangered-and-threatened-wildlife-and-plants-designating-critical-habitat-for-three-plant-species accessed March 2017), the USFWS is considering excluding from critical habitat the 1,758 acres that are owned or managed by the Waikoloa Village Association, including the land that would be utilized by Segment 5/6. Since 2012, the landowner has voluntarily facilitated and supported the conservation of *Isodendrion pyrifolium* and *Mezoneuron kavaiense* and other federally listed

Table 5.1
Irreversible and Irretrievable Commitment of Resources

Resource	Type of Commitment	Irreversible	Irretrievable
Land Use	Reduction in Grazing Area	Yes	Project Life Only
Important Farmland	No Loss of Use (No Use At Present or in Foreseeable Future)	N/A	N/A
ROW/Relocation	Property Acquisition Only	Yes	Project Life Only
Air Quality	Degradation of Air Quality	Construction Phase Only	Construction Phase Only
Noise	Noise Level Exceeding Ambient (But No Sensitive Uses)	Yes	Project Life Only
Fire Hazard	Change, Both Beneficial and Adverse, During Life of Project	Yes	Project Life Only
Water Resources	Sedimentation	Yes	Construction Phase Only
Wetlands, Waters of U.S. and Floodplain	No Loss	N/A	N/A
Geology and Soils	Loss From Construction	Yes	Yes
Biological Resources	Modification of Habitat, Loss of Flora and Fauna	Yes	Yes
Cultural Resources	Disturbance or Modification of Sites	Yes	Yes
Native Hawaiian Resources	No Modification or Loss	N/A	N/A
Visual	Degradation of Natural Scenic Quality, with New Views	Project Life Only	Project Life Only
Construction Materials, Fuels and Energy	Use of: Aggregate Water Steel Concrete Wood Fossil Fuels	Yes Yes Yes Yes Yes Yes	No Yes No No No Yes

species and their habitat in the lowland dry ecosystem, on their privately owned lands. If removed from proposed critical habitat, there would be no use of any type of critical habitat by any Build Alternative of the Project. The proposed critical habitat rule has yet to be finalized. It is expected that this issue will become resolved in 2017. Irrespective of its resolution, the Project would not substantially affect the ability to recover these species within Unit 32. There is no rationale for delaying a decision concerning the Project pending resolution of this issue.

6 CONSULTATION, COORDINATION AND DOCUMENT DISTRIBUTION

This chapter documents the chronology of the consultation and coordination events that were conducted as part of the preparation of this EIS, the list of parties to whom the Draft EIS was sent, and the planned post-Draft EIS coordination process.

6.1 Consultation and Coordination to Date

6.1.1 Pre-2012 EIS Public and Agency Involvement

The Project scooping process began on April 1999, as key State and County agencies were invited to two project initiation meetings in Honolulu, on May 18, 1999, and Hilo, on May 20, 1999. The purpose was to introduce project and purpose and need, explain location, request cooperating agency status, and gather input on site conditions and issues

Project representatives met with the U.S. Army Corps of Engineers on June 16, 1999, to discuss issues and concerns related to Waters of the U.S. In July of 1999, the project team introduced the Project to Waikoloa Development Company, one of the major landowner in area, to determine issues and concerns associated with Project and project area. On July 27, 1999, the project team presented the project overview to the board of the Waikoloa Community Association, the other major landowner, in its meeting room in Waikoloa Village. Attendees expressed overall support for the Project because of its ability to remove a portion of cross-island traffic, especially truck and military traffic, from Waikoloa Road. They also provided input as to alternatives that might be considered.

The FHWA prepared a federal Notice of Intent to prepare an EIS (NOI) that was published in the *Federal Register* on July 13, 1999. Shortly thereafter, a State of Hawaiʻi Environmental Impact Statement Preparation Notice (EISPN) was published by the State of Hawaiʻi Office of Environmental Quality Control (OEQC) in the August 8, 1999, issue of *OEQC Environmental Notice*. These documents provided notice to agencies and the public that FHWA, in cooperation with HDOT, intended to prepare a joint State-federal EIS concerning the Saddle Road Extension, and allowed an opportunity to provide comments. Because the Project and its context have changed markedly in the intervening years, and because a revised NOI and EISPN were issued after the Project restarted, the written comments resulting from this era of consultation are not reproduced in this EIS.

Additional public and small-group meetings ensued. A public scoping meeting was held on the Project at Waikoloa Middle School on September 23, 1999, during the comment period for the EISPN. From 1999 to 2003, numerous one-on-one meetings were held upon request with interested individuals, agency representatives, and public and private organizations to provide project briefings and/or receive input on project issues and concerns. These included groups such as community councils, community associations, chambers of commerce, and clubs.

As discussed in detail in Section 1.1, the Saddle Road Extension project was on hold from 2003 to 2010. In November 2003, the U.S. Army began an EIS for expansion of its training activities. This had a substantial bearing on the need for and location of the proposed Saddle Road Extension. Until the EIS and decision making were complete, the Saddle Road Extension could not reasonably proceed. The EIS process for the military training concluded in April 2008, and shortly thereafter, the U.S. Army determined that it would acquire the Keʻāmuku Parcel on Parker Ranch (see ***Figure 1-1***), and that the proposed western terminus of the Saddle Road would have to move as far south as possible in order to reasonably accommodate training activities in the newly acquired Keʻāmuku Parcel. With the information that the western terminus of the Saddle Road might be shifted south, HDOT and FHWA continued to keep the Saddle Road Extension project on hold to focus on an analysis of a revised Saddle Road realignment alternative that could be constructed within the southern fringe of the Keʻāmuku Parcel. A Supplemental EIS for the Saddle Road Improvements was prepared, and a Record of Decision was completed in 2010. The portion of the Saddle Road highway utilizing the revised alignment alternative has since been built, after which the entire Saddle Road was renamed the Daniel K. Inouye Highway.

6.1.2 EIS Public and Agency Involvement Since 2012

Following completion of environmental and engineering analyses for the realignment of the Daniel K. Inouye Highway, HDOT and FHWA resumed efforts on preliminary design and environmental studies for the Saddle Road Extension project. The EIS process for the Saddle Road Extension was formally resumed in late 2011. A revised State of Hawaiʻi EISPN was issued in May 2012, and a NEPA Revised Notice of Intent was issued on March 11, 2014. Coordination and consultation activities occurred as part of compliance with various environmental laws, regulations and policies. At times these activities were combined, but at other times they were separate and independent.

Chapter 343, HRS, EISPN

Pursuant to State law, an Environmental Assessment and Notice of Preparation of an EIS (EA-EISPN) was submitted to the State of Hawaiʻi Office of Environmental Quality Control. This notice was published in May 2012 in the *OEQC Environmental Notice*, an environmental bulletin which is monitored regularly by interested agencies, organizations, and the public. ***Appendix A1*** contains a copy of the Environmental Notice. A public meeting was held at Waikoloa Elementary and Middle School on June 14, 2012 at which the Project's purpose and need, preliminary alternatives and plan of analysis were presented (see ***Appendix A5*** for meeting materials and notes).

National Environmental Policy Act NOI

A NEPA Revised Notice of Intent was issued on March 11, 2014 to provide official federal notice to agencies and the public that FHWA, in cooperation with HDOT, intended to prepare an EIS concerning the Saddle Road Extension. ***Appendix A1*** contains a copy of the NOI.

Comments to EISPN and NOI

Comments to the EISPN and NOI and responses to those comments are contained in ***Appendix A2***. No comments were received from federal agencies, four comments from State agencies, three comments from County agencies, and nineteen from businesses, organizations and individuals. The following is a list of agencies, organizations and individuals who provided written comments.

Federal:

- None

State of Hawai‘i:

- Department of Accounting and General Services
- Department of Health (DOH), Environmental Planning Office
- DOH, Office of Environmental Quality Control
- Department of Land and Natural Resources

County of Hawai‘i:

- Fire Department
- Department of Environmental Management
- Police Department

Businesses, Organizations and Individuals:

- BIVWR Investment LLC
- Cory Harden
- Merna Izawa
- Takeo Izawa
- Janie Rees Packet
- People’s Advocacy for Trails Hawai‘i
- John Simmermann
- Bob Smith
- Mary Ellen Smith
- Ruth Smith
- Aaron Stene
- Kelvin Sumic
- Michael Traub
- South Kohala Traffic Safety Committee
- Waiki‘i Ranch Homeowners’ Association
- Waikoloa Dry Forest Initiative
- Robert Ward
- Michael Wolf

Several agencies responded concerning service issues and/or land use designations for project area lands. A number of individuals and organizations urged the highway agencies to include safe avenues for bicycle and pedestrian traffic along this new addition to highway system. Some also suggested a separated, multi-use paved path with a switchbacking course having grades appropriate for leisurely bicycle travel. Other suggestions included close coordination with landowners, large buffers from *uhiuhi* trees and relocation of *wiliwili* trees, scenic pullouts, park and ride and transit station areas, consideration of grade-separated interchanges and four-lane divided highways, and a number of other design and route suggestions. Each comment and suggestion has been considered in the design of the highway alternatives and the environmental analysis.

FHWA Coordination Plan

As discussed in detail in Section 1.2, above, FHWA environmental requirements under the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) and Moving Ahead for Progress in the 21st Century Act (MAP-21), include provisions intended to streamline the planning and environmental review of highway projects. Among the new procedures is the development early in the planning process of a Coordination Plan (CP) addressing how coordination and communication with agencies and the public will occur throughout the NEPA process.

The CP process includes inviting agencies to assist in the EIS process by serving as cooperating or participating agencies. A cooperating agency is any federal agency (or in special cases a State or local agency), other than a lead agency, that has jurisdiction or special expertise with respect to any environmental impact involved in the proposed project. Participating agencies include those “federal, State, tribal, regional, and local government agencies that have an interest in the Project and that have agreed to participate in the NEPA and scoping processes.” Cooperating and participating agencies are expected to play a critical role in defining the project, the project’s purposes and needs, the alternatives to be addressed, and methodologies to be employed. The agencies’ participation in the planning process is intended to improve the quality of roadway planning while fulfilling the mission of the agency.

The initial version of the CP was developed in May 2014. Thirty-seven federal, State and County agencies were invited to be involved in the Project as cooperating or participating agencies. The U.S. Army Corps of Engineers, Honolulu District (USACE) accepted cooperating agency status, and a number of agencies accepted as participating agencies. A CP meeting was held at State DOT offices in Hilo and Honolulu, Hawai‘i on June 26, 2014. Seven agencies attended and provided input into the project purpose and need, alternatives and potential project elements (see ***Appendix A3*** for meeting materials).

The CP will be updated at various parts of the EIS process to plan and document the consultation and/or meetings with participating and cooperating agencies.

Other Public Input and Agency Coordination

The Saddle Road Task Force is a diverse group of citizens originally appointed by former Senator Daniel K. Inouye to provide his office with input from the public and to advocate for the Saddle Road project. As that project wound down its activity, the Task Force also took on responsibility for the Saddle Road Extension. This group has met several times a year for the lifetime of both projects to get updated on the status of the projects and to improve two-way communication with government and the public.

As part of consultation undertaken pursuant to Section 106 of the National Historic Preservation Act, FHWA and HDOT and its consultants have communicated with Native Hawaiian organizations (NHOs) formally through letters and informally through meetings and telephone calls and emails. This process is described in detail above in Section 3.14.1.3.

6.2 List of Parties Receiving Copies/Notice of the EIS

The following agencies, organizations, and individuals have been provided with a copy of the Draft EIS and/or provided via mail, delivery service or email with the website address where the document is available for review. Required recipients under Chapter 343, HRS, are in blue italic font.

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6.3 Planned Post-Draft EIS Release Consultation and Coordination

The availability of the Draft EIS has been announced in the *Federal Register* and in *Environmental Notice*. This initiated a 45-day comment period in which agencies and the public are invited to provide written comments. A public hearing is being held during the comment period at a time and place to be announced in local media. The Final EIS will have an appendix containing comments to the Draft EIS along with detailed response letters to each individual comment. This appendix will also contain a transcript of the public hearing. This chapter will be augmented in the Final EIS to include a section providing a detailed summary of issues raised in comments and at the public hearing.

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7 SECTION 4(F)

Section 4(f) refers to the original section within the U.S. Department of Transportation Act of 1966 which established the requirement for consideration of park and recreational lands, wildlife and waterfowl refuges, and historic sites in transportation project development. The law, now codified in 49 U.S.C. §303 and 23 U.S.C. §138, is implemented by FHWA through the regulation 23 CFR 774. Section 4(f) requires consideration of:

- Parks and recreational areas of national, state, or local significance that are both publicly owned and open to the public.
- Publicly owned wildlife and waterfowl refuges of national, state, or local significance that are open to the public to the extent that public access does not interfere with the primary purpose of the refuge.
- Historic sites of national, state, or local significance in public or private ownership regardless of whether they are open to the public (See 23 U.S.C. § 138(a) and 49 U.S.C. § 303(a)).
- Section 4(f) applies to archeological sites that are on or eligible for the National Register and that warrant preservation in place. Section 4(f) does not apply to archaeological sites if FHWA determines, after consultation with the SHPO/THPO, Native Hawaiian Organizations (as appropriate), and the ACHP (if participating) that the archeological resource is important chiefly because of what can be learned by data recovery (even if it is agreed not to recover the resource) and has minimal value for preservation in place, and the SHPO/THPO and ACHP (if participating) does not object to this determination (See 23 CFR 774.13(b)).

Use of a Section 4(f) property occurs when: (1) land is permanently incorporated into a transportation facility; or (2) there is a temporary occupancy of land that is adverse in terms of the statute's preservation purpose; or (3) there is a constructive use (a project's proximity impacts are so severe that the protected activities, features, or attributes of a property are substantially impaired). The regulation lists various exceptions and limitations applicable to this general definition. Before approving a project that uses Section 4(f) property, FHWA must determine that there is no feasible and prudent alternative that avoids the Section 4(f) properties and that the project includes all possible planning to minimize harm to the Section 4(f) properties; or, FHWA makes a finding that the project has a de minimis impact on the Section 4(f) property.
In accordance with 23 CFR 774.17 a feasible and prudent avoidance alternative avoids using Section 4(f) property and does not cause other severe problems of a magnitude that substantially outweighs the importance of protecting the Section 4(f) property. In assessing the importance of protecting the Section 4(f) property, it is appropriate to consider the relative value of the resource to the preservation purpose of the statute. An alternative is not feasible if it cannot be built as a matter of sound engineering judgment. An alternative is not prudent if:

i. It compromises the project to a degree that it is unreasonable to proceed with the project in light of its stated purpose and need;
ii. It results in unacceptable safety or operational problems;
iii. After reasonable mitigation, it still causes:

   a. Severe social, economic, or environmental impacts;
   b. Severe disruption to established communities;
   c. Severe disproportionate impacts to minority or low income populations; or
   d. Severe impacts to environmental resources protected under other Federal statutes;

iv. It results in additional construction, maintenance, or operational costs of an extraordinary magnitude;

v. It causes other unique problems or unusual factors; or

vi. It involves multiple factors in paragraphs 23 CFR 774.17(3)(i) through 23 CFR 774.17(3)(v) of this definition, that while individually minor, cumulatively cause unique problems or impacts of extraordinary magnitude.

In the case of the Saddle Road Extension project, 28 NRHP eligible archaeological sites are present, with a maximum of 20 sites affected, depending upon the selected alternative; none of sites warrant preservation in place. There are no public parks or recreational lands or wildlife or waterfowl refuges as defined by the statute. The FHWA has consulted with the appropriate jurisdictional entities in determining whether and how these properties will be affected. The FHWA has concluded that no use of 4(f) properties will occur as a result of the Project. The analysis supporting this conclusion is contained below.

7.1 Archaeological Sites

7.1.1 Sites and Significance

None of the 28 archaeological sites within or partially within the Area of Potential Effect are 4(f) properties. Based on consultation to date with the Hawai‘i SHPO, those portions of the archaeological sites that are within the APE are primarily eligible for the NRHP under Criterion D only, and none of the sites require preservation in place. It is expected that data recovery is the appropriate and sufficient mitigation for all of the maximum of 20 archaeological sites within the APE where avoidance is not possible. In several instances, interpretive signage and periodic monitoring will be conducted as part of the mitigation process. These procedures are outlined below in detail. With the completion of the data recovery activity, there will be no adverse effect to any of the archaeological sites within the project area. Documentation on the characteristics and planned mitigation for each of the eight sites that require further mitigation is provided below. The consultation history is the same for all of the sites and provided in detail in ***Table 3.14.1***.

7.1.2 Section 106 Coordination Summary

Original significance assessments and recommendations for mitigation were presented in the archaeological inventory survey report (AIS) (***Appendix E1***). The Hawai‘i SHPO is currently reviewing the AIS. The Final EIS will report on the status of this review.

7.2 Public Parks and Recreation Areas

Publicly owned land is considered to be a park or recreation area when the land has been officially designated as such by a federal, State or local agency, and the officials with jurisdiction over the land determine that its primary purpose is as a park or recreation area. No public parks or recreation areas are located in or near any of the project corridors. The nearest public parks are located approximately one to two miles away at the shoreline in Waikoloa and in Waikoloa Village. The Puʻuanahulu Game Management area is an extensive tract used primarily for hunting. Section 4(f) does not apply to such multiple-use public properties that function primarily for any purpose other than significant park, recreation or refuge purposes. Based on this information, no use of a public park as defined in Section 4(f), either through a direct take or constructive use, will occur.

7.3 Waterfowl or Wildlife Refuges

Consultation of maps and databases as well as discussions with agency personnel determined that no public wildlife or waterfowl refuges are located in or near any of the project corridors. The nearest State or local wildlife or waterfowl refuge is located at the Hawaiʻi Forest Bird Sanctuary at Puʻuwaʻawaʻa, approximately 5 miles to the south. The nearest federal refuge is at the Hakalau Forest National Wildlife Refuge, approximately 25 miles to the east. Based on this information, no direct or constructive use of a wildlife or waterfowl refuge as defined in Section 4(f) will occur.

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