

4.6 Natural and Manmade Hazards

Earthquakes:

On the Island of Hawai'i the majority earthquakes are linked to volcanic activity and the movement of magma within the Kīlauea Volcano or Mauna Loa Volcano. Based on the 2006 United States Geological Survey (USGS) International Building Code (IBC) Seismic Design Map, the County of Hawai'i could experience severe seismic activity with ground motion anywhere from 0.30 up to 1.23 of the earth's ground motion accelerations (g-force). The seismic hazard is highest along the southeast coast of the Island of Hawai'i, followed by the Kona coast. The most recent large earthquake on Hawai'i Island occurred on May 4, 2018, on the south flank of Kīlauea, with a magnitude 6.9. Seismic tremors on the Island of Hawai'i have caused ground cracks, landslides, ground settlement, damaging tsunami, and mudflows. Existing buildings and infrastructure have been destroyed or damaged, and new construction could be impacted by seismic activity resulting in destruction and possible injury or loss of life (Fletcher III, Grossman, Richmond & Gibbs, 2002). The UNK Update must comply with IBC and County design standards.

Lava Hazards:

Hazard zones from lava flows are based mainly on the location and frequency of both historic and prehistoric eruptions. Volcanic hazard zone maps developed for the Island of Hawai'i were revised by the U.S. Geological Survey in 1987. The Island of Hawai'i is divided into nine (9) hazard zones according to the level and degree of potential hazards related to lava flows. An area designated as Zone 1 is considered to be an area of greatest potential hazard. The Petition Area is within lava hazard Zone 4, indicating a moderate hazard. Zone 4 includes all of Kailua-Kona and the entire Hualālai Volcano. The rating of 4 is for areas having a greater distance from active vents and topography making it less likely that flows will cover that area. The Petition Area is situated on the west-facing flank of the Hualālai Volcano. Hualālai Volcano is considered dormant, having last erupted in 1801. The percentage of Mount Hualālai that has been subject to damage from lava in the last 750 years is less than 15 percent. The Hualālai Volcano is considered by geologists to represent a post-shield stage of Hawaiian volcanism, characterized by a marked decrease in the eruption rate as the volcano drifts off the Hawaiian hotspot. Property loss and economic devastation are the most frequent consequences of lava flow. Based on the probability of lava flows in Zone 4, there is a low concern for developing structures in the Petition Area (*Figure 4-3*).

Hurricanes and Tropical Storms:

Hurricanes and tropical storms are both categorized as tropical cyclones, which are warm-core storms that originate over tropical waters with well-defined centers of closed surface wind circulation. A hurricane is a tropical cyclone that sustains surface winds of 64 knots (74 mph) or more. Tropical storms are categorized as an organized system of strong thunderstorms with defined circulation and maximum sustained winds of 39-73 mph (NOAA, 2015).

Hurricanes are considered to be relatively rare events in the Hawaiian Islands. Records show that strong wind storms have struck all major Hawaiian Islands. The first officially recognized hurricane in Hawaiian waters was Hurricane Hiki in August 1950. Since that time, five hurricanes have caused serious damage in Hawai'i: Nina (1957), Dot (1959), Iwa (1982), Estelle (1986), and Iniki (1992).

However, with rising global temperatures, Hawai'i is expected to experience a higher incidence of tropical storm events. In most recent history, Tropical Storm Iselle made landfall on Hawai'i Island in 2014, causing considerable damage to utility poles, roadways, and homes on the windward side of the island. In 2016, Tropical Storm Darby made landfall on Hawai'i Island, producing heavy rain and

4.0 Environmental Setting

The Draft EIS will discuss the environmental setting, potential impacts, and mitigation measures for the proposed UNK Update improvements planned for the Petition Area. The discussion below provides a description of the affected environment that will be evaluated in greater detail in the Draft EIS. For the Draft EIS, supportive technical resource surveys and investigations include:

- Natural Resources Surveys for University of Nations Expansion Property, TMK: (3) 7-5-010:085, North Kona District, Island of Hawai'i, AECOS Inc., 2020.
- Mobility Analysis Report for the University of the Nations Kona Master Plan Update, Kona, Hawai'i, Fehr & Peers, Inc., 2020. For the EIS, an updated study will be conducted to include Planning Program Phases 2 and 3.
- Preliminary Infrastructure Assessment, University of the Nations, Kona Master Plan Update, G70, 2020.
- Conceptual Infrastructure Master Plan, University of the Nations, Kona Master Plan Update, G70, 2020. For the EIS, an additional study will be conducted to include an extended civil infrastructure master plan for the proposed project.
- Water Supply Study for the Planned Expansion of University of the Nations, Kona, Hawai'i, Tom Nance Water Resource Engineering, 2020. For the EIS, an updated study will be conducted to include additional water resource investigations and potential site analysis.
- Archaeological Inventory Study of TMKs: 3-7-5-10:85 and 3-7-5-17:06, Wai'aha Ahupua'a, North Kona District, Island of Hawai'i, Retchman Consulting, 2003.
- Burial Site Component of a Preservation Plan for Three Sites in the Proposed Hualālai Village Development Area, TMKs: 3-7-5-10:85 and 3-7-5-17:06, Wai'aha Ahupua'a, North Kona District, Island of Hawai'i, Retchman Consulting, 2003.
- Archaeological Data Recovery at Ten Sites on TMKs: 3-7-5-10:85 and 3-7-5-17:06, Wai'aha Ahupua'a, North Kona District, Island of Hawai'i, Retchman Consulting, 2007.
- Preservation Plan for SIHP Site 6032 and Site 23681, TMKs: 3-7-5-10:085 and 3-7-5-17:006, Wai'aha 1st Ahupua'a, North Kona District, Island of Hawai'i, Retchman Consulting, 2013.
- Dismantling/Restoration Plan for a Portion of the Kuakini Wall (SIHP 5-10-28-6302) TMKs: (3) 7-5-010:085 and (3) 7-5-017:006, Wai'aha 1st Ahupua'a, North Kona District, Island of Hawai'i, ASM Affiliates, Inc., 2019.
- Cultural Impact Assessment for the Update to the Master Plan for the Proposed 62-Acre Hualālai Village-Pacific Islands Cultural Center Development, Wai'aha, Kona District, Island of Hawai'i, TMK (3)-7-5-10:085; 7-5-17:006, Originally Prepared by Group 70 International, Inc., Updated by ASM Affiliates, Inc., 2020.
- Ka Pa'akai O Ka 'Aina Analysis, University of the Nations, TMKs: (3) 7-5-010:085 and (3) 7-5-017:006, ASM Affiliates, Inc., 2020.

4.1 Climate

The climate on the Island of Hawai'i can be characterized as mild and subtropical. Overall, the conditions on the Kona Coast are somewhat warmer and drier, with relatively low variability. According to the University of Hawai'i Geography Department Climate of Hawai'i Interactive Mapping Tool, the temperatures at the Petition Area are very moderate with an average annual air temperature of approximately 74°F. The average monthly low temperature is around 70°F in January and the average monthly high temperature is around 77°F in August. The windward and northern regions of the Island of Hawai'i are typically wetter than the western and southern regions. The annual rainfall at the Petition Area is 30 inches with February being the driest month with 1.5 inches and September the wettest with 3 inches of rainfall. The winds on the Island of Hawai'i include trade winds, Kona winds and winds associated with hurricanes and tropical storms. Trade winds from the northeast prevail most of the year with an average wind speed of 5-10mph (Giambelluca, et al., Department of Geography, University of Hawai'i at Manoa, State of Hawai'i, 2014).

4.2 Geology and Topography

The Petition Area is located on the west coast of the Island of Hawai'i, approximately one mile southeast of the town center of Kailua-Kona, in the North Kona District. The Petition Area is within the traditional moku of Kona and ahupua'a of Wai'aha 1st on the lower western slopes of Mount Hualālai. The Island of Hawai'i is comprised of several volcanoes: Kohala, Mauna Kea, Hualālai, Mauna Loa, and Kīlauea. Of these volcanoes, only Mauna Loa and Kīlauea are considered active in addition to one active seamount, Lō'ihi located offshore. The Petition Area is situated on the western slopes of Hualālai Volcano, which is dormant with its last eruption ending sometime in 1800-1801. The Hualālai Volcano is composed of two (2) types of lava flows: 'a'ā lava flow and pāhoehoe lava flow. The 'a'ā lava flow was formed by a slow moving and very viscous molten rock. The 'a'ā flow consists of a layer of clinkers and a core of hard massive basalt that originated from Hualālai between 1,500 and 3,000 years ago. The pāhoehoe lava is a fluid type of molten rock that flows relatively quickly down the slope with no overlying soil. The pāhoehoe lava was originated from Hualālai 3,000 to 5,000 years ago. Most of the Petition Area is covered in 'a'ā and pāhoehoe lava flow.

The Petition Area is generally gently sloped at an elevation ranging from approximately 90 to 360 feet. The Petition Area rises in elevation from approximately 90 feet at Kuakini Highway to 360 feet at its highest point, with steepest slopes on the upper mauka side just below Hualālai Road (*Figure 4-1*). The overall slope of the Petition Area is approximately 5-10% and increases to as much as 25% just below Hualālai Road.

4.3 Soils

The physical attributes of Hawai'i's soils and the relative productivity of different Hawai'i soil types for agricultural production purposes are addressed in three (3) studies: (1) the U.S. Department of Agriculture Natural Resource Conservation Services (NRCS) Soil Survey, (2) the University of Hawai'i Land Study Bureau (LSB) Detailed Land Classification; and (3) the State of Hawai'i Department of Agriculture's, Agricultural Lands of Importance to the State of Hawai'i (ALISH) system.

Soil information for the Petition Area was obtained from these studies, as summarized below.

Natural Resource Conservation Service Soil Survey:

The NRCS Soil Survey for the Island of Hawai'i classifies the two primary soils of the Petition Area as: Wai'aha-Punalu'u Lava Flows Complex, 10-20% slopes, and Kainaliu Cobbly Silty Clay Loam, 10-20% slopes (*Figure 4-2*).

The Wai'aha-Punalu'u series consists of medial silt loams soils that formed in volcanic ash over pāhoehoe lava flows. The Kainaliu Cobbly Silty Clay Loam series consists of moderately deep, silty clay loams that formed in volcanic ash in 'a'ā lava flows. Both soils are located on low elevation, leeward slopes of Hualālai Volcano at elevations from sea level to 1,000 feet and slope gradients range from 2 to 40 percent. Both soils are well drained, permeability is moderately rapid in the soils and very slow in the underlying bedrock with slow runoff, and erosion hazard is slight. The typical uses identified are for grazing and homesites. On the Petition Area, the ground surface is very broken with heaps of sharp broken lava rock appearing more like 'a'ā than the smooth pāhoehoe. These fragments have been piled, apparently by hand, to facilitate cattle grazing.

Land Study Bureau Detailed Land Classification:

The LSB classification system, classifies soils based on a productivity rating. Letters indicate class of productivity with A representing the highest class and E the lowest. The LSB map classification for the Petition Area is "E"/Very Poor, or among the lowest levels of agricultural productivity.

Agricultural Lands of Importance to the State of Hawai'i:

The ALISH system classifies important agricultural lands as Prime, Unique, or Other Important Agricultural Land. Lands that do not fall into one of the three ALISH categories are listed as Unclassified and are not considered agriculturally important lands. The soils within the Petition Area are listed as Unclassified. The nearest ALISH-classified parcel is roughly three-quarters of a mile south.

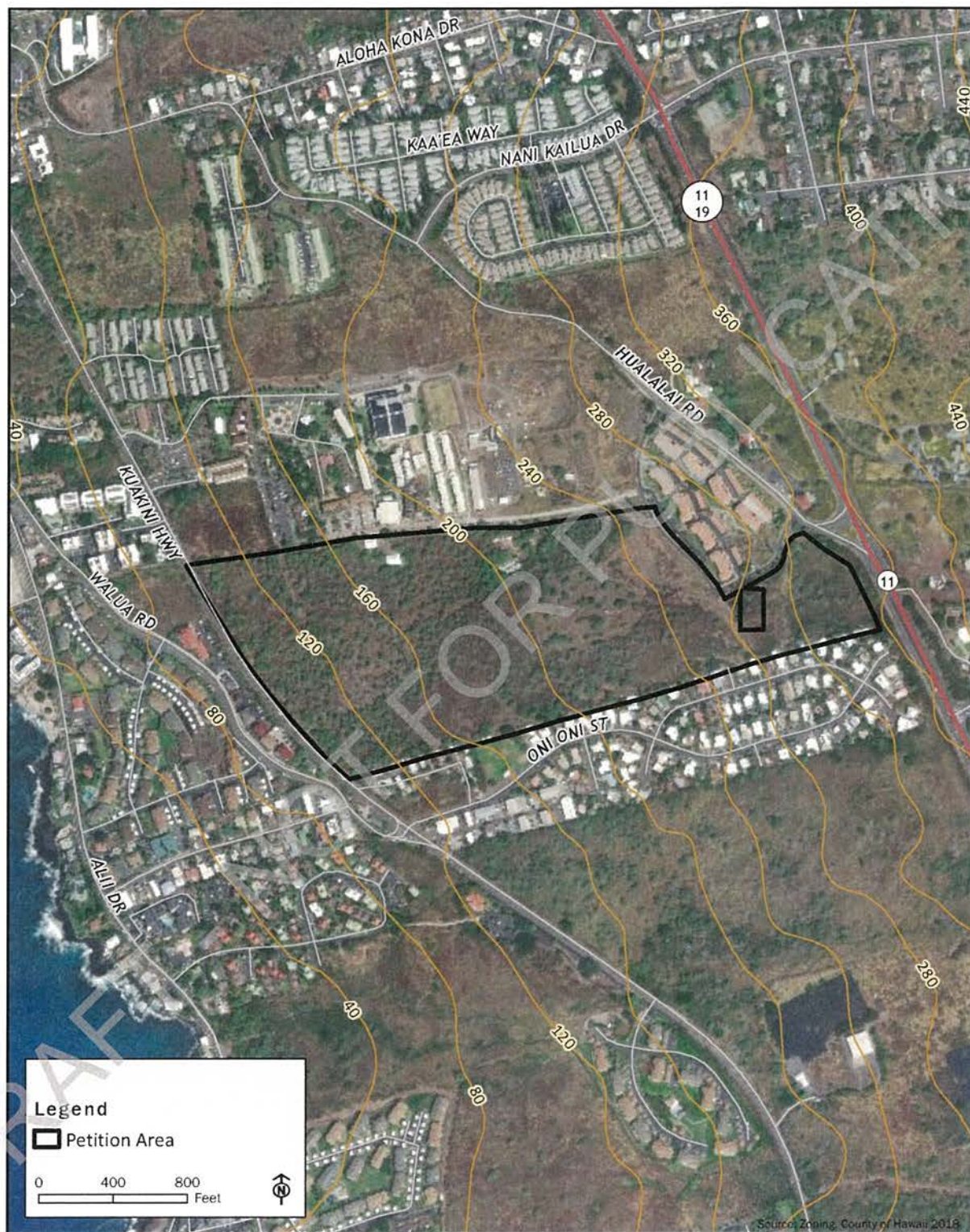


Figure 4-1: Topography Map

University of the Nations, Kona, Inc. 2020 Master Plan Update



Figure 4-2: Soils Map

University of the Nations, Kona, Inc. 2020 Master Plan Update

4.4 Surface Waters & Drainage

For the UNK Update, a Preliminary Infrastructure Assessment and a Conceptual Infrastructure Master Plan were prepared in 2020 by G70, which included an assessment of the existing and proposed drainage systems for the Petition Area. According to the assessments, U of N Kona has not reported any drainage issues on-site. The Petition Area has no perennial streams, existing drainage facilities, or defined natural drainage ways. The Petition Area generally slopes from mauka to makai in the east to west direction. Elevations on-site range from approximately 90 to 360 feet above mean sea level, with the lowest point located at the main campus entrance along Kuakini Highway. According to the NRCS Soil Survey, the soil groups present are typically well drained. It is believed that stormwater generated on the Existing Campus Site currently overland flows to the undeveloped Petition Area to the south where it is slowed by heavy vegetation and ultimately infiltrates into the ground.

In 2002, a drainage report was prepared by Ross Engineering, Inc. for U of N Kona to analyze the offsite stormwater drainage conditions that affect the Petition Area. Concentrated stormwater run-on enters the Existing Campus Site and Petition Area at four different locations from the mauka direction. Three culverts discharge runoff onto the Petition Area; an 84-inch pipe culvert crosses Hawai'i Belt Road/Queen Ka'ahumanu Highway and discharges runoff at the southeastern corner of the Existing Campus Site and a 36-inch and 30-inch culvert located at the intersection of Hawai'i Belt Road/Queen Ka'ahumanu Highway and Hualālai Road discharge runoff onto the Petition Area. On the Existing Campus Site (TMK (3) 7-5-010:003), stormwater run-on sheet flows across Hualālai Road and enters the Existing Campus Site north of the Hualālai Village Condominiums. No drainage report was found for the Hualālai Village Condominiums, but during a site visit, multiple dry wells were identified along the private road along the makai edge of the condo property adjacent to the Existing Campus Site. It is assumed that these dry wells dispose of all runoff generated and collected on the condominium site and no runoff flows onto the Petition Area.

The runoff that flows onto the Petition Area from the culverts flows through the undeveloped 62 acres toward Kuakini Highway or is infiltrated into the ground. At Kuakini Highway, there is an existing 24-inch culvert which conveys runoff across the highway. Immediately downstream of the culvert, there is a series of six (6) dry wells located on TMK (3) 7-5-018:094 (Owner: Walua Professional Center). No other culverts or drain structures were identified along Kuakini Highway. It is assumed run-on as well as runoff at the Petition Area is either disposed of by on-site or off-site drywells (across Kuakini Highway) or is slowed by heavy vegetation and the natural terrain as it infiltrates into the ground.

4.5 Groundwater Resources/Hydrology

On the Island of Hawai'i, groundwater is the primary source of drinking water. In Kona, groundwater occurs as both basal groundwater and high-level (dike-impounded perched) groundwater. The rainfall pattern of the region is responsible for the recharge of the basal aquifer that extends from the upper slopes of Hualālai to the shoreline. The basal lens in Kona is relatively thin and inconsistent due to the low rainfall input and the leakage of groundwater at the coastline. Wells drawing from basal groundwater in Kona are susceptible to salinity if they are drilled too deep or if they are over-pumped. The Petition Area is situated in the Keauhou Aquifer System (80901), which currently has an existing usage of 15.4 million gallons per day (MGD) and a sustainable yield of 38 MGD. Brackish water is another groundwater resource reserve type in Kona. Brackish water is

created as a result of seawater intrusion at the shoreline. Groundwater beneath the Petition Area occurs as a thin brackish basal lens underlain by saline groundwater of seawater salinity.

The County of Hawai'i adopted by ordinance the Water Use and Development Plan Update (HWUDP) dated August 2010 and the Commission on Water Resource Management granted approval in December 2011. The Keauhou Aquifer System Area (ASYA) was identified to be considered for further evaluation and detailed assessment. Therefore, the Keauhou Aquifer System, Hawai'i Water Use and Development Plan Update (Keauhou HWUDP), dated March 2017, guides the County in an integrated approach to land use planning and water resource development and provides an estimate of anticipated future water demand projections based on County land use/zoning policies and water use rates for the Keauhou ASYA.

The Keauhou HWUDP identifies the Petition Area as located in the Kona Water System, which extends from the Keahole-Kona International Airport south to the South Kona boundary where interconnection with the South Kona Water System is made. Historically, surface water from Wai'aha Stream was diverted into large storage tanks located in Wai'aha above Māmalahoa Highway, filtered, then piped down to Kailua-Kona by a small transmission line to large tanks above Kailua-Kona Village. The first potable water wells were placed in service in 1967 and most of the small pipelines initially installed have been replaced with larger mains. The County of Hawai'i, Department of Water Supply (DWS) is supplied by ground water sources, including 12 wells and allocates existing water use. Five-year incremental water needs for the next 20 years based on population and growth rate projections are projected by the Keauhou HWUDP. The anticipated future water demand defined for the Keauhou ASYA by the Keauhou HWUDP reflects and considers proposed improvements with appropriate State Land Use Designation approvals, including consideration of the Petition Area's proposed improvements.

The Keauhou HWUDP encourages development of future high-level wells for the DWS system in areas generally between 1,500-feet and 1,800-feet ground elevations mauka of Māmalahoa Highway, with the overall goal of sustainability throughout the region. The goal of this source development strategy is to accommodate future anticipated demands identified by the Keauhou HWUDP. According to the Keauhou HWUDP, the Petition Area is depicted to have a future anticipated demand of 100,000 Gallons Per Day (GPD) by the Conceptual Ground Water Source Development and Anticipated Water Demands Map, Aquifer Sector, Hualālai 809, Aquifer Systems, Keauhou 80901.

The Preliminary Infrastructure Assessment and Conceptual Infrastructure Master Plan included an assessment of the existing and proposed water systems for the Petition Area. The Existing Campus Site is supplied by the DWS off of the DWS 325 reservoir. There are no on-site water sources or sources of recycled or non-potable water. While the Petition Area is being developed in three phases over 30 years, a new water source(s) will be needed to support buildout of each phase and the expansion of the Petition Area. New wells may be drilled and treated to provide additional potable water on-site. For the UNK Update, a *Water Supply Study for the Planned Expansion of the University of the Nations, Kona, Hawai'i* was conducted by Tom Nance Water Resource Engineering in 2020. U of N Kona has also been in discussions with neighboring landowners to potentially form partnerships to develop new wells and water sources off-site. Any off-site water source improvements would likely be dedicated to the County and additional DWS water unit credits would be secured for the expansion of the Petition Area. A discussion of the water source necessary to support the UNK Update will be addressed in greater detail in the Draft EIS.

widespread flash floods. In 2018, Hurricane Lane passed southeast of the Hawai'i Island as a weakening Category 5 hurricane, causing severe mudslides and flash flooding.

Flooding:

The Federal Emergency Management Agency's Flood Rate Insurance Maps indicate that the Petition Area is within Zone X, which represents areas with minimal flood hazards. Zone X is defined as areas determined to be outside the 500-year flood plain (*Figure 4-4*).

Tsunami:

The Petition Area is not located within the Federal Emergency Management Area (FEMA) designated Tsunami Inundation Zone (*Figure 4-5*). Twenty-five of the tsunamis recorded in Hawai'i since 1812 have had an adverse impact on the Island of Hawai'i, seven caused major damage, and three were generated locally. The most recent tsunami to impact Hawai'i Island occurred on March 11, 2011, causing property damage at several locations on the Kona coast.

Wild-land Fires:

The greatest danger of fire is where wild-land (trees and brush) borders urban areas. Although all the Hawaiian Islands are vulnerable to wild-land fires (especially during the summer months, prolonged drought and/or high winds), the great majority of wildfires are human-caused (intentionally caused or by negligence) and start along roadsides. The numbers of such fires are increasing. Wildfires can and do also occur naturally. Hawai'i County has a Fire Prevention Bureau that works to prevent fires before they can cause injuries and property damage. The proposed project will comply with all fire code requirements.

Climate Change and Sea Level Rise:

As global temperatures increase, established patterns of weather and climate are shifting. These erratic changes in weather patterns have increased the severity of events like droughts, storms, floods, and even hurricanes, while at the same time causing these events to be more difficult to predict and protect against. The fragility of the ecosystems and unique island nature of the Hawaiian Islands make the State particularly vulnerable to the damaging effects of climate change. Among the impacts associated with climate change is the threat of rising sea levels. Recent projections of global sea level rise estimate an increase of up to 1-meter or higher above current sea levels. This is of particular concern to low-lying coastal communities and ecosystems that are exposed to a variety of coastal hazards, such as tsunamis and hurricanes. These hazards and the resulting risk to coastal areas can be exacerbated by sea level rise.



Figure 4-3: Lava Hazard Zone Map

University of the Nations, Kona, Inc. 2020 Master Plan Update

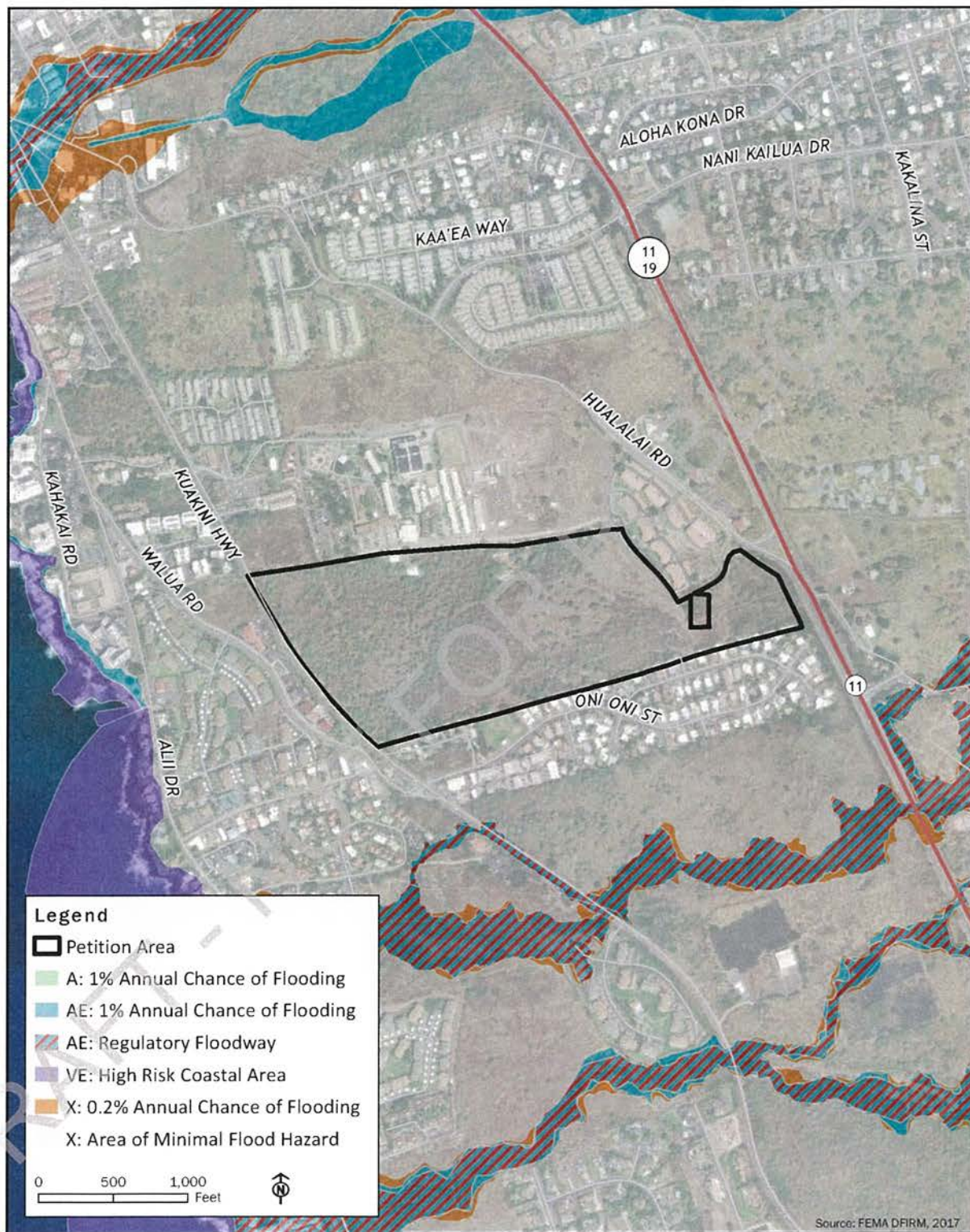


Figure 4-4: Flood Zone Map



Figure 4-5: Tsunami Inundation Zone Map

University of the Nations, Kona, Inc. 2020 Master Plan Update

4.7 Botanical Resources

The UNK Update has been designed to ensure that facility types and the physical attributes of each facility site are compatible with urban development. The Petition Area was surveyed to ensure that the physical, environmental, and cultural attributes of the property were compatible with the land uses proposed. For the UNK Update, an updated *Natural Resources Surveys for University of Nations Expansion Property North Kona District, Island of Hawai'i* was prepared by AECOS, Incorporated in 2020. A previous flora and biological study of the Petition Area was completed in 2002 (Terry & Hart, 2002). At the time of the 2002 study, all portions of the Petition Area were surveyed, and no threatened or endangered plant species were present or would be expected to be present on the Petition Area. For the updated Natural Resources Surveys Study the entire Petition Area was re-surveyed by AECOS. The botanical survey found that most natural features on the property have been extensively modified by past agricultural activities. The Petition Area was found to be characterized by a mixture of scattered kiawe (*Prosopis pallida*) and short-stature koa haole (*Leucaenaleucocephala*) with moderately dense Guinea grass (*Megathyrsus maximus*) at the upper end and more open koa haole and areas of dense herbaceous growths of coffee senna (*Senna occidentalis*) and 'uhaloa (*Waltheria americanas*) in disturbed areas. Of the total list of botanical species, the botanical resources survey recorded only four native (indigenous) plants: 'ilima (*Sida fallax*), 'uhaloa (*Waltheria indica*), 'ilie'e (*Plumbago zeylanica*), and a common sedge (*Cyperus polystachyos*). All four are widespread in the Islands and of no conservation concern, with 'uhaloa known to be common in both disturbed areas and areas of marginal growing conditions.

4.8 Fauna

For the UNK Update, an updated *Natural Resources Surveys for University of Nations Expansion Property, North Kona District, Island of Hawai'i* was prepared by AECOS, Incorporated in 2020. A previous fauna study of the Petition Area was completed in 2002 (Terry & Hart, 2002). At the time of the 2002 study, all portions of the Petition Area were surveyed, and no threatened or endangered animal species were present or would be expected to be present on the Petition Area. For the updated Natural Resources Surveys Study the entire Petition Area was re-surveyed by AECOS and a bird and mammal survey was conducted.

The Natural Resources Surveys Study recorded a total of 21 avian species. One of the species recorded, the Hawaiian Hawk (*Buteo solitarius*), which is listed as an endangered species, was observed flying over the site. Effective February 3, 2020, the Hawaiian Hawk has been delisted as an endangered species by the U.S. Fish and Wildlife Service, but remains listed by the State of Hawai'i. The remaining twenty other species recorded across the Petition Area are all commonly occurring established alien species.

The Natural Resources Surveys Study recorded five mammalian species. All of the mammalian species are deleterious to native ecosystems and the native faunal species dependent on them. No Hawaiian hoary bats were detected during the course of this survey. It is likely that this species forages over the site on a seasonal basis. The current vegetation on the site is not typical of that in which one would expect to find roosting Hawaiian hoary bats. The UNK Update is not expected to result in adverse impacts to the Hawaiian Hoary bat.

4.9 Air Quality

The U.S. Environmental Protection Agency (EPA) established the National Ambient Air Quality Standards (NAAQS) per the requirements of the Clean Air Act (last amended in 1990) to protect public health and welfare and prevent the significant deterioration of air quality. These standards account for seven major air pollutants: carbon monoxide (CO), nitrogen oxides (NO_x), ozone (O₃), particulate matter smaller than 10 microns (PM₁₀), particulate matter smaller than 2.5 microns (PM_{2.5}), sulfur oxides (SO_x), and lead (Pb). The State of Hawai'i, Department of Health (DOH), Clean Air Branch (DOH-CAB) has also established State Ambient Air Quality Standards (SAAQS) for six of these air pollutants to regulate air quality statewide. The SAAQS for carbon monoxide and nitrogen dioxide are more stringent than NAAQS. Hawai'i also has a stringent standard for hydrogen sulfide (H₂S), which is a common odorous pollutant associated with wastewater treatment facilities.

Air quality in the State of Hawai'i is generally characterized as relatively clean and low in pollution. According to the Annual Summary 2014 Hawai'i Air Quality Data, air quality monitoring data compiled by the DOH indicates that the established air quality standards for all monitored parameters are consistently met throughout the State and on the Island of Hawai'i (State of Hawai'i, DOH, 2014). DOH-CAB regularly samples ambient air quality at monitoring stations throughout the State, and annually publishes this information. The DOH has monitoring stations on the Island of Hawai'i, which mainly measure air quality impacts from the volcanoes and geothermal energy production. The closest air monitoring station to the Petition Area is the Kailua-Kona Station, which is located approximately 2 miles south. Air quality data from the Kailua-Kona Station suggests that all National and State air quality standards are currently being met.

Present air quality at the Petition Area is primarily affected by natural, industrial, agricultural, and/or vehicular sources. Natural sources that may affect the Petition Area include wind-blown dust and volcanoes. Volcanic emissions (vog) consist of sulfur dioxide (SO₂) and persistently hangs over a majority of the West Hawai'i area. Occasionally, wind patterns carry emissions from Kīlauea Volcano to the northwest, in the direction of the Petition Area. Kīlauea Volcano is recognized as the largest point source of SO₂ gas in the United States. Gaseous emissions increased dramatically in 2008 when a new vent opened at the Kīlauea Volcano's summit. Emission estimates increased to 3,000 – 5,000 tons per day (TPD) of SO₂, in contrast to previous average emission of 1,700 TPD. The 2018 eruptions at the Kīlauea summit and Lower East Rift Zone also resulted in highly elevated gas emissions. Air flow from this direction carrying vog can result in an increase in pollution.

4.10 Noise

Existing background ambient noise levels within the Petition Area are largely attributed to motor vehicle traffic along the highways bordering the Petition Area, including Kuakini Highway on the west and Queen Ka'ahumanu Highway and Hualālai Road on the east. The noise levels around the Petition Area are consistent with noise levels found in typical residential and school areas.

4.11 Utilities and Infrastructure

For the UNK Update, a Preliminary Infrastructure Assessment and a Conceptual Infrastructure Master Plan were prepared in 2020 by G70, providing an assessment of the existing and proposed infrastructure systems for the Petition Area. For the EIS, an additional study will be conducted to include an extended civil infrastructure master plan for the UNK Update.

The utilities and infrastructure necessary to support the UNK Update will be addressed in greater detail in the Draft EIS.

Water:

U of N Kona's water is supplied by DWS off of the DWS 325 reservoir. Its service zone limits are from 0 feet to the 225-foot elevation (while the existing campus is approximately 90 feet to 360 feet above sea level). There are no on-site water sources or sources of recycled or non-potable water. The campus is served from two DWS meters: a 6"x3" master FM meter located near the main campus entrance along Kuakini Highway, which connects to a 6" DWS main in Kuakini Highway, and an 8"x2" master FM meter located near the top of the spine road which connects to an 8" DWS main in the Hualālai Village lower driveway.

According to the Preliminary Infrastructure Assessment and Conceptual Infrastructure Master Plan, the anticipated additional water demands attributable to the development of the 62-acre Petition Area are shown below in *Table 4-1*:

Table 4-1: Projected Water Demand			
Use ⁴	Phase 1	Phase 2	Phase 3
P-12 Students (FTE) ¹	30,000	45,000	60,000
University Students (FTE) ¹	7,800	20,700	56,400
P-12 & University Students (Dorm) ²	20,000	110,000	140,000
Total	57,800	175,700	256,400
DWS Water Units ³	145	439	641

¹ 60 gallons per capita day (DWS Water System Standards)

² 100 gallons per capita day (DWS Water System Standards)

³ 400 gpd per water unit (DWS Water System Standards)

Additional water infrastructure improvements may be required to serve the upper reaches of the Petition Area above the 225-foot elevation service of the DWS 325 reservoir. In lieu of pumps, a new service connection to the existing DWS water main in the Hawai'i Belt Road is proposed to extend water service from the DWS 595 shaft to the upper elevations of the Existing Campus Site and Petition Area situated above the 225-foot elevation service.

Wastewater:

According to the Preliminary Infrastructure Assessment and Conceptual Infrastructure Master Plan, U of N Kona's Existing Campus Site is connected to the County of Hawai'i Department of Environmental Management's wastewater system. There is an existing 8-inch private sewer main on-site along the existing on-site Spine Road that collects wastewater from the individual campus buildings and discharges it to an existing municipal 18-inch gravity sewer main within Kuakini Highway. The County gravity sewer main flows to the Kealakehe Pump Station and continues to the Kealakehe Wastewater Treatment Plant in Kailua-Kona.

There is existing wastewater infrastructure only on the Existing Campus Site at this time, and there is no wastewater infrastructure on-site at the Petition Area. The existing 18-inch County sewer main is assumed to continue fronting the Petition Area within Kuakini Highway.

Power and Communication System:

According to the Preliminary Infrastructure Assessment and Conceptual Infrastructure Master Plan, electrical service to U of N Kona's Existing Campus Site is currently provided by Hawaiian Electric (HE) and communication services are provided by both Hawaiian Tel (HTCO) and Spectrum. As State of Hawai'i Public Utility Commission (PUC) regulated public utilities, HE and HTCO are responsible for the development of off-site facilities that meet island-wide needs, such as power generating plants and power and signal transmission lines, and facilities that serve regional needs of Kailua-Kona. Presently, the Existing Campus Site is served by these utilities off of Kuakini Highway. The HE electrical service is at the primary distribution voltage of 12.47kV, three-phase, through a single metering point. The power is further distributed at 480/277v, 208/120v, three and single phase, to the existing buildings and facilities. This electrical infrastructure is owned and maintained by U of N Kona.

Spectrum is a State of Hawai'i Department of Commerce and Consumer Affairs cable television franchisee that is the sole land-line provider of cable television service to Hawai'i Island. Although not a PUC regulated utility, Spectrum's off-site facility construction policy is to provide such facilities where the anticipated revenue from the prospective service connections warrants the expenditure. HTCO has a similar policy with regard to new developments.

Roadways and Vehicular Access:

The Existing Campus Site's primary point of access point is a driveway on Kuakini Highway. The Existing Campus Site has a series of on-site roadways and parking lots connecting the campus' different areas of interest that are linked by an existing on-site Spine Road. The Spine Road is located along the Existing Campus Site's southern property line (and common boundary with the Petition Area) and extends from Kuakini Highway to Hualālai Road.

The privately owned Hualālai Village condominiums located just mauka of the Existing Campus Site have privately-owned perimeter roads that abut the Existing Campus Site and Petition Area. U of N Kona has only limited rights to use these roads.

4.12 Traffic and Mobility Analysis

For the UNK Update, a *Mobility Analysis Report for the University of the Nations, Kona Master Plan Update, Kona, Hawai'i* was conducted in 2020 by Fehr and Peers, Incorporated. For the Draft EIS, an updated Mobility Analysis Report (MAR) will be conducted to include Planning Program Phases 2 and 3. The Existing Campus Site is currently accessible via one driveway along Kuakini Highway, approximately one-half mile north of the intersection of Kuakini Highway and Walua Road/Oni Oni Street. The driveway is a two-lane road that provides controlled access to visitors. Land uses along Kuakini Highway in the vicinity of the Petition Area include commercial, single-family residential, and multi-family residential uses. Other surrounding land uses include residential neighborhoods and agricultural uses. For the MAR, a comprehensive data collection effort was undertaken to identify existing transportation conditions in the vicinity of the Petition Area. The assessment of existing conditions relevant to the MAR included an inventory of the street system, traffic volumes on these facilities, and operating conditions at key intersections.

Existing Roadway System:

The existing key roadways providing access to or in the vicinity of the Petition Area include:

- The Existing Campus Site's driveway provides direct access from Kuakini Highway and serves as the primary internal roadway providing access to existing facilities. The two-lane roadway extends mauka and terminates just west of the Aloha Lanai Cafeteria. The posted speed limit is 15 miles per hour (mph).
- Kuakini Highway is the primary street that provides access to the Petition Area. Adjacent to the Petition Area, it is a two-lane collector roadway that extends generally from the north end of the town of Kailua-Kona to Queen Ka'ahumanu Highway. The posted speed limit is 35 mph. Kuakini Highway is under the jurisdiction of the County of Hawai'i Department of Public Works (DPW). Sidewalks are not provided on either side of Kuakini Highway. No bicycle facilities exist along Kuakini Highway within the MAR's study area. Crosswalks are provided at the intersection of Kuakini Highway and Hualālai Road.
- Hualālai Road is a two-lane local roadway that is under the jurisdiction of DPW. It runs east-west between Ali'i Drive and Queen Ka'ahumanu Highway. The posted speed limit is 25 mph. Sidewalks are provided on both sides of the roadway makai of Kuakini Highway, on the north side of the roadway between Kuakini Highway and the Regency at Hualālai, and on the south side of the roadway just makai of Queen Ka'ahumanu Highway. No bicycle facilities exist along Hualālai Road within the MAR's study area. On-street parking is not provided.
- Queen Ka'ahumanu Highway is a two-lane highway that is under the jurisdiction of the State of Hawai'i Department of Transportation. It is a major component of the Hawai'i Belt Road and runs from Hwy 19 in Kailua-Kona to Hwy 19 in Hilo. The posted speed limit within the MAR's study area is 45 mph. Neither sidewalks nor bicycle facilities are provided along the roadway. On-street parking is also not provided.
- Nani Kailua Drive is a two-lane local roadway that is under the jurisdiction of DPW. It runs east-west and extends from Hualālai Road to just mauka of Pikake Place. The posted speed limit is 25 mph. Neither sidewalks nor bicycle facilities are provided along the roadway. On-street parking is provided on both sides of the roadway.

Existing Transit Facilities and Services:

According to the MAR, the County of Hawai'i Mass Transit Agency's Hele-On Bus provides island-wide commuter and fixed-route service on the Island of Hawai'i, where it served over 800,000 riders in the fiscal year of 2016-2017. Hele-On offers fixed-route transit service in the Hilo and Kona areas Monday through Saturday, and limited commuter services to the South Kohala Resort (SKR) areas seven days a week. Within the Petition Area, the Pahala-Kona-South Kohala Route provides daily service along Queen Ka'ahumanu Highway with transit stops both north and south of the Petition Area. Detailed route schedule information, such as operating hours and frequencies, was not available.

Existing Bicycle Activity:

According to the MAR, the study area has a low level of bicycle activity. Based on the peak period traffic counts, a range of 0-16 bicyclists were observed at each intersection during the AM peak hour and a range of 0-6 bicyclists were observed at each intersection during the PM peak hour. In general, most bicyclists were traveling mauka- bound along Hualālai Road.

At the intersection of Kuakini Highway and the Existing Campus Site's driveway, the highest level of morning bicycle activity occurred from 7:15 to 8:15 AM, with a total of two (2) bicyclists traveling through the intersection. In the evening, the highest level of bicycle activity occurred from 4:15 to 5:15 PM with a total of two (2) bicyclists traveling through the intersection.

Existing Pedestrian Activity:

According to the MAR, the study area generally has a low level of pedestrian activity, except for the intersection of Kuakini Highway and Hualālai Road, where pedestrian activity is high. During the AM peak hour, 46 pedestrians were observed at the intersection of Kuakini Highway and Hualālai Road, and between zero (0) and three (3) pedestrians were observed at the other study intersections. During the PM peak hour, 32 pedestrians were observed at the intersection of Kuakini Highway and Hualālai Road, and between zero (0) and 11 pedestrians were observed at the other study intersections.

At the intersection of Kuakini Highway and the Existing Campus Site's driveway, the highest levels of pedestrian activity occurred in the morning from 7:15 to 8:15 AM with one (1) pedestrian, and in the evening from 4:15 to 5:15 PM with a total of 11 pedestrians. At the intersection of Kuakini Highway and Hualālai Road: 28 AM and six (6) PM peak hour pedestrian trips crossed the north leg of the intersection, five (5) AM and three (3) PM pedestrian trips crossed the south leg of the intersection, five (5) AM and 22 PM pedestrian trips crossed the mauka leg of the intersection, and a total of eight (8) AM trips and one (1) PM pedestrian trip crossed the makai leg of the intersection.

Existing Traffic Volumes/Lane Configurations:

Operations of the seven (7) existing study intersections were evaluated for the weekday AM and PM peak hours. Traffic counts were collected during the weekday AM and PM peak periods in October 2019 while university classes were in session. The weekday peak hours of traffic for the study area generally occurred between the hours of 7:15 to 8:15 AM and 4:15 to 5:15 PM. Existing lane configurations and signal controls were obtained through field observations and the following key observations were made:

- **Kuakini Highway/Hualālai Road:** Vehicular congestion along Kuakini Highway limits the number of vehicles that can pass through this intersection during the peak hour than would

in free-flow conditions. As fewer vehicles pass through the intersection, intersection delay is lower, and LOS is more desirable, than existing field observations indicate.

- **Queen Ka'ahumanu Highway & Nani Kailua Drive:** Vehicular congestion along Queen Ka'ahumanu Highway limits the number of vehicles that can pass through this intersection during the peak hour than would in free-flow conditions. As fewer vehicles pass through the intersection, intersection delay is lower, and LOS is more desirable, than existing field observations indicate.

Existing Intersection Levels of Service:

According to the MAR, peak hour intersection capacity analysis was performed for the study intersections and the recently collected peak hour traffic count data. *Table 4-2* below summarizes the results of the intersection operations analysis for Existing Conditions.

As shown in *Table 4-2*, the following intersections operate at less-than-desirable LOS:

- Kuakini Highway and Existing Campus Site's Driveway: LOS E (AM Peak)
- Queen Ka'ahumanu Highway and Kuakini Highway: LOS E (AM Peak)

Intersection results are generally consistent with field observations, except for the intersections of Kuakini Highway/Hualālai Road and Nani Kailua Drive/Queen Ka'ahumanu Highway. These intersections operate worse than what is shown in *Table 4-2*, primarily because congestion along Kuakini Highway and Queen Ka'ahumanu Highway limits the number of vehicles that are able to pass through the intersection during the peak hour than would pass in free-flow conditions.

Table 4-2: Existing Peak Hour Intersection Levels of Service				
Intersection	Traffic Control	Peak Hour	Existing Conditions	
			(sec/veh) ^{1,3}	LOS ^{2,3}
1. Kuakini Highway & Hualālai Road	Signalized	AM	17.4	B
		PM	19.2	B
2. Kuakini Highway & U of N Kona Driveway	SSSC	AM	38.7	E
		PM	33.0	D
3. Hualālai Road & Nani Kailua Drive	SSSC	AM	10.6	B
		PM	10.5	B
4. Queen Ka'ahumanu Highway & Nani Kailua Drive ⁴	Signalized	AM	11.1	B
		PM	11.9	B
5. Hualālai Village Driveway & Hualālai Road	SSSC	AM	11.3	B
		PM	10.4	B
6. Queen Ka'ahumanu Highway & Hualālai Road ⁴	SSSC	AM	32.9	D
		PM	23.5	C
7. Queen Ka'ahumanu Highway & Kuakini Highway	SSSC	AM	38.4	E
		PM	28.7	D

Source: Fehr & Peers, Inc., 2020 Notes:

¹ Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized intersections. The vehicular delay for the worst movement is reported for the side-street stop-controlled (SSSC) intersection, and traffic along the main roadways typically moves more efficiently.

² LOS calculations performed using the Highway Capacity Manual (HCM) method.

³ Unacceptable seconds of delay per vehicle and LOS highlighted in **bold**.

⁴ Congestion along Queen Kaahumanu Highway limits the number of vehicles that can pass through this intersection. Actual intersection operations operate worse than indicated.



Figure 4-6: Existing Peak Hour Traffic Volumes and Lane Configurations (Fehr & Peers, Inc., 2020)

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4.13 Socio-Economic Characteristics

The U.S. Census reported that the population of the County was 185,079 in 2010. The overall population increased by approximately 9% between 2000 and 2010 according to the U.S. Census 2010. The Petition Area is located in the U.S. Census Bureau's Holualoa Census Designated Place (CDP). In 2010, the Holualoa CDP population was 8,538 compared to 6,107 in 2000.

Table 4-3 below summarizes the population and characteristics of the Holualoa CDP compared to the County and State. The median age for the Holualoa CDP is 43.5. The 2010 U.S. Census reported 3,372 households in the Holualoa CDP with an average of 2.7 persons per household. The permanent population of North Kona is very ethnically diverse, with about 25% of the population being Hawaiian or Part-Hawaiian. The median income for a household in the Holualoa CDP was reported as \$85,811, which is higher than the average median income for the County. About 8.6% of the population is below the poverty line.

Table 4-3: Population Characteristics				
Area	Population (2010)	Median Age (Years)	Persons/ Household	Ethnicity (percent)
Holualoa CDP	8,538	43.5	2.7	White: 55.6% Asian: 19.7% Hawaiian: 5.3% Other/Mixed: 19.4%
County of Hawai'i	185,079	40.9	2.7	White: 33.7% Asian: 22.2% Hawaiian: 8.5% Other/Mixed: 35.6%
State of Hawai'i	1,360,301	38.6	2.89	White: 24.7% Asian: 38.6% Hawaiian: 5.9% Other/Mixed: 30.8%

Source: (U.S. Census Bureau, 2010)

According to the 2010 U.S. Census, the local economy within the Holualoa CDP is primarily based on accommodation and food services, followed by retail, trade, finance, real estate, professional/management/administrative, and construction. Within the Holualoa CDP, approximately 60% of the population is employed, 5.7% unemployed, and 30% not in the labor force (based upon the employment status of the population 16 years or older).

The State of Hawai'i projects a 95% increase in multi-national immigration, with increasing numbers of English as a second language students entering the schools. The cultural diversity of North Kona is evident in the non-white population which includes Japanese, Chinese, Filipinos, Portuguese, Mexicans, Africans, Vietnamese, Native Americans, Eskimos, Aleuts, Koreans, Micronesians, Samoans, Guamanians, and other Pacific Islanders. Of these, 17% speak a language other than English, with 43% able to speak only limited English. Many of those able to speak English speak a different language at home.

4.14 Public Facilities and Services

Educational Facilities:

The State of Hawai'i Department of Education (DOE) runs the State's public schools. The Board of Education considers the County the Hawai'i District. Within this district, the Kailua-Kona urban area is part of the Kealakehe Complex subsection.

The following Kealakehe Complex, DOE public schools service the Petition Area:

- Hōlualoa Elementary School
- Kealakehe Elementary School
- Kealakehe Intermediate School
- Kealakehe High School
- Innovations Public Charter School
- Kanu o ka 'Āina New Century Public Charter School
- West Hawai'i Explorations Public Charter School

Recreational Facilities:

There are many recreational facilities and public parks in the greater Kailua-Kona region. They are run by the U.S. National Park Service, State of Hawai'i Department of Land and Natural Resources (DLNR), or County of Hawai'i Parks and Recreation.

Some of the parks closest to the Petition Area are:

- Hale Halawai Park to the north on Ali'i Drive.
- Kamakahonu Beach to the north next to Kailua Pier.
- Old Kona Airport State Recreation Area, County of Hawai'i, Kailua Beach, Kekuaokalani Gymnasium, and Kona Community Aquatic Center located to the north on Kuakini Highway.
- Kaloko-Honokōhau National Historic Park to the north on Queen Ka'ahumanu Highway.
- Pāhoehoe Beach Park and Magic Sands Beach Park to the south on Ali'i Drive.
- Hillcrest Park located to the south on Oni Oni Street.

Police:

The Petition Area is located in the Hawai'i Police Department Area II, Kona Patrol District. The Kona Patrol District encompasses 834 square miles and is between the South Kohala District at Ka'au'au Point and the Ka'ū District at Kaulanamauna. Its officers operate from a central station in Kealakehe and from district stations in Keauhou and Captain Cook, as well as a mini-station in Kailua Village. The central Kona Station is located at 74-611 Hale Māka'i'i Place, Kailua-Kona, an approximately 3.2-mile drive north from the Petition Area.

Fire:

The Hawai'i County Fire Department protects the County from fire and fire hazards. The Department also provides emergency medical services, rescue services, extrication services, and emergency hazardous material mitigation. The Kailua-Kona Fire Station, Hawai'i County Fire Station #7, West Battalion, is located approximately 1.5-miles north from the Petition Area.

Emergency Medical Services:

The Kona Community Hospital services the Kona community, and is located in Kealahou approximately 9.4 miles north of the Petition Area. Other health care facilities in the vicinity of the Petition Area include Kaiser Permanente Kona Medical Office approximately 4-miles to the north, and West Hawai'i Community Health Center (Kealahou) approximately less than 0.5-mile to the north. In addition, Aloha Kona Urgent Care, a healthcare clinic associated with U of N Kona, is located less than 0.6-mile to the south from the Petition Area.

Solid Waste Management:

The County of Hawai'i Department of Environmental Management Wastewater/Solid Waste Division operates two County landfills, one in Kona (Pu'uana'hulu Landfill) and the other in Hilo (Hilo Landfill). There are also several solid waste transfer stations located around the island. The nearest transfer station is the Kealahou Transfer Station and Recycling Center in Kailua-Kona, located an approximately 3-miles drive north from the Petition Area.

4.15 Archaeological Resources

For the UNK Update, a *Cultural Impact Assessment for the Update to the Master Plan for the Proposed 62-Acre Hualālai Village-Pacific Islands Cultural Center Development, Wai'aha, Kona District, Island of Hawai'i, TMK (3)-7-5-10:085; 7-5-17:006* was conducted by ASM Affiliates, Incorporated in 2020. The 2020 Cultural Impact Assessment is an update to a previous Cultural Impact Assessment conducted for the Petition Area by G70 in 2003. According to the 2020 Cultural Impact Assessment, there have been a number of archaeological and cultural studies conducted for the Petition Area and surrounding lands, including studies within the Wai'aha Ahupua'a and the coastal *kula* areas of Kailua-Kona (Table 4-4). These studies have included archaeological inventory surveys (AIS), archaeological data recovery projects, subsurface testing, and burial treatment planning. These studies have identified a range of both late Precontact and early Historic residential sites, many of which were associated with elite members of Hawaiian society. Also prevalent in the region are features associated with transportation, opportunistic and more formalized agriculture, temporary and permanent habitation, burials, and ceremony. Collectively, the findings of previous archaeological and cultural investigations conducted within and in the general vicinity of the Petition Area allow for a holistic portrayal of past land use and settlement patterns for Kailua-Kona's *kula* lands and other contributing factors to the overall cultural landscape.

Table 4-4: Previous Archaeological and Cultural Studies Conducted

Year	Author	Type of Study
1994	Head et al.	Archaeological Inventory Survey
1996	Walker et al.	Archaeological Data Recovery
2000	Rechtman	Archaeological Inventory Survey
2002	Corbin and Rosendahl	Archaeological Assessment Survey*
2002	Rosendahl	Burial Site Testing Report*
2003	McKeague	Cultural Impact Assessment*
2003	Clark and Rechtman	Archaeological Inventory Survey*
2003	Rechtman	Burial Treatment Plan*
2007	Rechtman and Loubser	Data Recovery Report*
2013	Rechtman	Preservation Plan*
2019	Barna	Dismantling/Restoration Plan*
2020	ASM Affiliates, Inc.	Cultural Impact Study*
2020	ASM Affiliates, Inc.	Ka Pa'akai O Ka 'Aina Analysis*

* Previous Archaeological and Cultural Studies Conducted within the Petition Area.

1994 Archaeological Inventory Survey:

In 1994, Paul H. Rosendahl, Inc. (PHRI) conducted an *Archaeological Inventory Survey for the Ali'i Drive Sewer Project, Lands of Pua'a 2nd and 3rd, and Wai'aha 1st and 2nd, North Kona District, Island of Hawai'i (TMK: 7-5-18:7,8)*. The 1994 AIS was conducted for the Ali'i Drive Sewer Project on parcels located makai of Kuakini Highway, in close proximity to the Petition Area. As a result of the 1994 AIS, a total of 20 archaeological sites comprised of at least 38 associated features were identified. A variety of formal site types were documented during the study including but not limited to mounds, alignments, walls, enclosures, trails, and lava blisters and caves, and were assigned functional interpretations relating to agriculture, temporary and permanent habitation, transportation, animal husbandry, landscape clearance, and potential ceremonial and burial functions. It was recommended by the 1994 AIS that data recovery be conducted at 17 of the sites, all of which were assessed as significant under Criterion D and five of which were recommended for preservation. The remaining three sites were recommended for no further work, and it was proposed that although they contained only limited potential with regards to future potential research, they be integrated into the then-proposed landscaping of the project area. It was determined that while construction activities for the then-proposed development did not threaten the integrity of 17 of the sites, three could not be avoided.

1996 Archaeological Data Recovery Report:

In 1996, PHRI conducted an *Archaeological Data Recovery Report for the Ali'i Drive Sewer Project Mitigation Program – Phase II, Lands of Pua'a 2nd and 3rd, and Wai'aha 1st and 2nd, North Kona District, Island of Hawai'i (TMK: 7-5-18:7,8)*. The 1996 Data Recovery Report was conducted in follow-up to the 1994 AIS prepared for the Ali'i Drive Sewer Project on the parcels located makai of Kuakini Highway, in close proximity to the Petition Area. Data recovery was conducted at the selected sites identified during the 1994 AIS prepared by PHRI. Data recovery was conducted on three archaeological sites that were purported to be unavoidable during construction activities: Site 15507, two modified outcrops and a terrace; Site 15511, a small lava tube and two additional adjacent caves; and Site 15526, originally assigned as a coral and waterworn cobble- paved area

with scattered midden and reinterpreted during the Phase II work as a platform. A total of 20 units (four each in Sites 15507 and 15511 and 12 in Site 15526) were excavated within the data recovery sites. Cultural material and portable remains (e.g. charcoal, *kukui*, gourd, and coconut fragments, marine shell, lithic and volcanic glass debitage and shatter, basalt hammerstones, possible adze fragments, echinoid and coral abraders, a bone awl and pick, fishhooks, shell ornament, historic glass and metal fragments, and a stone pendant) were recovered along with varying amounts of mammal, bird, turtle, lizard, rat, mouse, pig, and fish bone. Additionally, and more importantly, human skeletal remains were recovered from all three sites, although the remains recovered from 15511 and 15526 were likely deposited secondarily as a result of natural processes rather than being in an *in situ* context. The human skeletal remains associated with Site 15507, however, were determined to be representative with an articulated individual *in situ* and were ultimately recommended for preservation in place.

2000 Archaeological Inventory Survey:

In 2000, Rechtman Consulting, LLC conducted an *Archaeological Inventory Survey of TMK: 3-7-5-18:08, Wai'aha 1st Ahupua'a, North Kona District, Island of Hawai'i*. The 2000 AIS was also conducted for one of the parcels located makai of Kuakini Highway, in close proximity to the Petition Area. Small portions of the parcel had been previously surveyed by PHRI as a part of the previous 1994 AIS conducted by PHRI and 1996 Data Recovery Report. Of the 29 sites previously recorded, 28 were extant. Of these, one (Site 15525) was reevaluated as non-cultural. Twelve of the remaining sites were assessed as likely deriving from the Precontact Period: two were agricultural in nature (Sites 21992 and 22065), nine were associated with habitation (Sites 15517, 15518, 15521, 15524, 21991, 22067, 22068, 22069, and 22070), and one was a habitation/burial site (Site 15507). Three of the identified sites (Sites 21194, 21196, and 22063) were concluded to date to the late Precontact/early Historic Period and may have been associated with one another. The 2000 AIS opined that these three sites appeared to be of religious significance, and noted the presence of human remains at one of them (Site 22063). Twelve of the 28 sites dated to the Historic Period, all of which consisted of stone walls or enclosures likely associated with cattle ranching practices during the early to mid-twentieth century.

2002 Archaeological Assessment Survey:

In 2002, PHRI conducted an *Archaeological Assessment Survey of U of N Bencorp Development, Land of Wai'aha 1st and 2nd, North Kona District, Island of Hawai'i (TMK: 3-7-5-17:6; 3-75-18:73)* within the Petition Area. As a result of the fieldwork, 28 archaeological sites encompassing 45 features were documented, and a single previously identified site, the Kuakini Wall (Site 6302), was relocated. Other recorded feature types included walls, terraces, mounds, modified outcrops, platforms, enclosures, and lava blister caves. Identified site types were assigned various functions including habitation, ranching, agricultural, and burial.

2002 Burial Site Testing Report:

Later in 2002, PHRI conducted an *Interim Report: Testing of Possible Burial Features Archaeological Inventory Survey – Phase 1, U of N Bencorp Development, Lands of Wai'aha 1st and 2nd, North Kona District, Island of Hawai'i (TMK: 3-7-5-17:6; 3-75-18:73)*. The 2002 Burial Site Testing Report was conducted within the Petition Area and included subsurface testing of a sample of possible burial features. Eleven features at eleven different sites were tested for the presence of burials, however this investigation yielded negative results. A small amount of cultural material including a coral abrader, adze fragment, and marine shell fragments were documented during these excavations but appeared to never have been collected.

2003 Archaeological Inventory Survey:

In 2003, Rechtman Consulting, LLC conducted an *Archaeological Inventory Study of TMKs: 3-7-5-10:85 and 3-7-5-17:06, Wai'aha Ahupua'a, North Kona District, Island of Hawai'i*. The 2003 AIS was conducted within the Petition Area. As a result of the 2003 AIS, 25 previously unrecorded sites and a single previously recorded site were identified (Table 4-5). Site types identified during the study were both Historic and Precontact in nature and were grouped into seven categories: Historic ranching related sites and boundary walls, Precontact habitation sites, trails, ceremonial sites, game boards, burials, and agricultural sites. As part of the investigation, twenty-two 1 x 1 meter test units (TUs) were excavated at ten sites (Sites 23668, 23670 Feature B, 23672 Features A and B, 23673 Feature A, 23675, 23676, 23677, 23681 Feature A, 23683, 23684, 23685, and at 23686 Features 183, 187, 189, 201, 204, 239, 262, 266, 271, and 297). Subsurface testing of multiple sites/features yielded numerous examples of cultural material, including volcanic glass flakes and shatter, charcoal fragments, groundstone, waterworn, fire cracked basalt, branch and waterworn coral, marine shell (*Cellana* sp., *Conus* sp., *Drupa* sp., *Nerita* sp., *Echinoidea* sp., *Cypraea* sp., *Strombina* sp., *Venus* sp., and *Cantharus* sp.), *kukui*, an unidentified seed, shark teeth, a mostly intact *lūhe'e* lure, and dog, rodent and fish bone. Additionally, human skeletal remains were identified during excavation of Sites 23683, 23684, and 23685.

All sites were assessed as significant under Criterion D, with eleven being recommended for no further work (Sites 23662 through 23669, 23679 and 23680, and 23682). Four of the sites were assessed as significant under both Criteria D and E and recommended for preservation (Sites 23681 and Sites 23683 through 23685). One of the sites was assessed as significant under Criteria A and D, and also recommended for preservation (Site 6302). Ten sites were recommended for data recovery (Sites 23670 through 23678 and 23686).

2003 Burial Treatment Plan:

Later in 2003, Rechtman Consulting, LLC prepared a *Burial Site Component of a Preservation Plan for Three Sites in the Proposed Hualālai Village Development Area (TMKs: 3-7-5-10:85 and 3-7-5-17:06) Wai'aha Ahupua'a, North Kona District, Island of Hawai'i*. The 2003 Burial Treatment Plan was prepared for the three burial sites located within the Petition Area (Sites 23683 through 23685) identified during the 2003 AIS that were assessed as significant under Criteria D and E. All three sites consisted of square or rectangular stone platforms constructed of 'a'ā and/or pāhoehoe boulders and cobbles. According to the 2003 AIS, unlike the other two burial sites that were determined to function solely as burial monuments, Site 23684 consisted of a platform and an attached enclosure, and it was concluded by the 2003 AIS that both features may have been utilized for habitation purposes prior to the internment of the deceased individual. Site 23683 was also previously subject to burial testing by the 2002 Burial Site Testing Report, but yielded negative results. As part of the fieldwork conducted during the 2003 AIS, a 1 x 1 meter test unit was excavated in the central interior portion of the platform, and the presence of a burial was confirmed. Similarly, single 1 x 1-meter test units were excavated in the central interior sections of the Site 23684 and Site 23685 platforms, yielding identical results. In the case of Sites 23684, pockets of deliberately and carefully cached branch coral were observed throughout the architectural layer, and cultural material (e.g., marine shell, coral, and waterworn pebbles) were observed in strata below the architectural layer. With respect to Site 23685, a possible hearth was identified, the remains of which included a scant amount of cultural materials including various marine shell, *wana* (sea urchin), and *kukui* (candlenut; *Aleurites mollucana*). Immediately following the discovery of human skeletal remains in all three test units, excavation ceased, the remains were stabilized and left in their original positions and were reburied (along with any identified cultural material and/or artifacts) using excavated soils, and the architectural layer was rebuilt on top of the burial as close to original specifications as possible.

The 2003 Burial Treatment Plan received approval from DLNR's State Historic Preservation Division (DLNR-SHPD). The approval called for Sites 23683, 23684 and 23685 to be preserved in place through the establishment of a minimum 20-foot permanent preservation easement buffer for each respective site. These preservation easements should be defined by stone walls (traditionally Hawaiian in appearance) constructed of dry-stacked local basalt boulders and cobbles and discretely core-filled with smaller cobbles. It was also suggested that inconspicuously situated narrow gated openings be incorporated into each easement wall to facilitate access for site maintenance and appropriate visitation by cultural and/or lineal descendants, and that appropriate native foliage be planted along the exterior perimeter of the easement walls. An additional 10-foot buffer zone beyond the 20-foot buffer was also set aside as a no construction zone as part of the plan for the installation of three interpretive/cautionary signs, one to be placed immediately adjacent to each respective walled preservation easement. Finally, the approval of the 2003 Burial Treatment Plan called for the preparation and submittal of a formal landscaping plan to the DLNR-SHPD, Burial Sites Program for approval, which would lay out measures that the respective sites be cleared of all non-native/non-Polynesian introduced vegetation prior to their reconstruction.

2007 Archaeological Data Recovery Report:

In 2007, Rechtman Consulting, LLC conducted an *Archaeological Data Recovery at Ten Sites on TMKs: 3-7-5-10:85 and 3-7-5-17:06, Wai'aha Ahupua'a, North Kona District, Island of Hawai'i* within the Petition Area. As shown below in Table 4-5, nine of the ten sites subject to the data recovery were inferred to have been utilized for habitation (four with permanent habitation and five with temporary habitation) and one was associated with agricultural use. All of the sites dated to the Precontact Period. The primary objectives of the data recovery centered around establishing the sequence of Precontact land use within the Petition Area and within the general *kula* lands of Kona, refining the precise nature of data recovery sites associated with habitation, and refining the age estimate and functional interpretation of the documented agricultural features. The 2007 Archaeological Data Recovery Report proposed that conducting data recovery of these sites would establish whether short-term habitation and associated opportunistic agriculture was indeed followed by recurrent habitation and associated formal agriculture, and finally by more consistent habitation with associated household gardens and animal pens.

The 2007 Archaeological Data Recovery Report included thorough redocumentation of the data recovery sites, the process of which included clearance of vegetation to assess the then-current conditions of the sites, site photography, and the illustration or update of existing site plan views from the 2003 AIS to show the placement of the excavation units, and subsurface testing to determine the presence or absence of buried cultural deposits. As part of the fieldwork, a total of 39 Excavation Units (EU) and 17 Test Units (TU) were excavated. These units ranged in configuration from 1 x 1 meters, 1 x 2 meters, and 2 x 2 meters, and generally, multiple units were excavated into each site. With respect to the habitation sites (Sites 23670 through 23678), there were a total of 22 EU and 7 TU excavated. For Site 23686, 17 EU and 10 TU were excavated. As a result of excavations, a wide assemblage of cultural material was collected, including intact and fragmented marine shell (e.g. *Cypraea* sp., *Conus* sp., *Drupa* sp., *Cellana* sp., *Morula* sp., *Isognomon* sp., *Fimbria* sp., *Brachiodontes* sp., *Turbo* sp., *Nerita* sp., *Mitra* sp., *Terebra* sp., *Cantharus* sp., *Chama* sp., *Venus* sp., *Nassarius* sp., *Strombina* sp., *Serpuloris variabilis*, *Thais* sp., *Cymatium* sp., *Fimbria* sp., and an unidentifiable bivalve fragment), echinoderms, a crustacean fragment, and both branch and waterworn coral pieces. Lithic assemblages identified during fieldwork included worked and unworked volcanic glass flakes and shatter, fire-cracked basalt, basalt flakes, waterworn and groundstone basalt fragments. Additionally, a variety of faunal remains were recovered including worked and unworked bones (e.g. rodent, pig, dog, cow, bird, and some which were unidentifiable) as well as bird, fish, dog, cow, and shark teeth. A variety of portable remains (artifacts) were also

recovered during data recovery excavations, including coral abraders, intact and fragmented echinoderm abraders, a fine-grained basalt adze fragment, a *lūhe'e* lure, an awl manufactured from unidentifiable materials, a bone awl, a .166 lead pellet, an iron horseshoe nail, a steel nail, a steel nut, rusted iron fragments, and fragments of brass buttons. Fragments of *kukui* (candlenut; *Aleurites moluccana*) and an unidentifiable seed and nut were also recovered during excavations, as were numerous charcoal samples: 17 of which were submitted for radiocarbon assaying.

Following the synthesis of field and laboratory results, it was proposed in the 2007 Archaeological Data Recovery Report that the data recovery sites were collectively representative of four relatively arbitrary time periods, which they assigned as Phases A through D, with each interpreted as more extensive than the one preceding: Phase A from A.D. 1400 to A.D. 1460, Phase B from A.D. 1460 to A.D. 1580, Phase C from A.D. 1580 to A.D. 1680, and Phase D from A.D. 1680 to A.D. 1850. Phase A occupation encompassed Site 23686 Features 247, 293, and 294; Phase B occupation pertained to Site 23676, Site 23673 Features A and B, and Site 23671; Phase C related to Site 23686 Features 250, 254, 282, and 289, possibly Site 23674, Site 23672 Features A and B, and potentially Site 23674; and Phase D occupation was concluded to be associated with nine excavated features, including Site 23675, Site 23670 Features A, B, and C, Site 23678, Site 23677 Features A and B, Site 23686 Feature 251, and potentially also the *kuaiwi* associated with Site 23686.

2013 Preservation Plan:

In 2013, Rechtman Consulting, LLC prepared a *Preservation Plan for SIHP Site 6032 and Site 23681 (TMKs: 3-7-5-10:085 and 3-7-5-17:006) Wai'aha 1st Ahupua'a, North Kona District, Island of Hawai'i* for two sites (Sites 6032 and 23681) located within the Petition Area and initially documented during the 2003 AIS. The first preservation site identified by the 2013 Preservation Plan is a 340-meter-long section of the Kuakini Wall (Site 6302), which was likely constructed during Governor Kuakini's administration (A.D. 1820-1844), coinciding with the latter portion of Phase D occupation. Initially, the wall served to protect cultivated agricultural fields mauka of the wall from feral animals; however, according to the 2013 Preservation Plan, the function of the Kuakini Wall likely transformed over time, and in later years served primarily to protect coastal settlements situated makai of the wall. Site 6302 was assessed by the 2003 AIS as significant under Criteria A, C, and D, and was determined to be eligible for listing (but is not formally listed) in the National Register of Historic Places (NRHP). Previous preservation measures were centered primarily around avoidance and protection (conservation) of the site, although the 2013 Preservation Plan recommends provisions for stabilization/restoration, dismantling/restoration, and the installation of interpretive/cautionary signage at intervals around the twenty-foot permanent preservation easement buffer.

The second preservation site identified by the 2013 Preservation Plan consists of an agricultural *heiau* (Site 23681; shrine), which is a traditional ceremonial site referred to as *heiau ho'ouluulu 'ai* or *heiau ho'ouluulu ua* where Hawaiians would conduct rituals to ensure agricultural fertility and/or to induce rain. The proposed permanent preservation measures for Site 23681 are avoidance and protection (conservation), which are to be achieved through the establishment of a twenty-foot preservation easement buffer. The 2013 Preservation Plan recommends that this permanent buffer be marked by a stone wall (traditionally Hawaiian in appearance) constructed of dry-stacked local basalt boulders and cobbles and discretely core-filled with smaller cobbles, and recommends that an inconspicuously situated narrow gated opening be present to allow access for site maintenance and appropriate visitation.

2019 Dismantling/Restoration Plan:

In 2019, ASM Affiliates, Inc. prepared a *Dismantling/Restoration Plan for a Portion of the Kuakini Wall (SIHP 5-10-28-6302) TMKs: (3) 7-5-010:085 and (3) 7-5-017:006, Wai'aha 1st Ahupua'a, North Kona District, Island of Hawai'i*. The 2019 Dismantling/Restoration Plan was prepared for the Kuakini Wall (Site 6302) located within the Petition Area and outlines measures to be followed during the process of dismantling and restoring collapsed portions of and three breaches in Site 6302. Refer to *Figures 4-8 and 4-9*.

DLNR-SHPD Review and Approval Status

The 2003 AIS received final acceptance from SHPD by letter dated November 17, 2003 (Log No. 2003.2356, Doc No. 0311PM04). The 2003 Burial Treatment Plan received final acceptance from SHPD by letter dated August 20, 2019 (Log No. 2019.01527, Doc No. 1908CJ001). In addition, the 2013 Preservation Plan received final acceptance from SHPD by letter dated June 19, 2014 (Log No. 2014.2843 and Doc No. 1406MV15).

ASM Affiliates, Inc. is in consultation with DLNR-SHPD regarding final acceptance of the 2007 Archaeological Data Recovery Report, which was originally submitted to SHPD in October 2007 and resubmitted on August 30, 2019. In addition, ASM Affiliates, Inc. will be submitting the 2019 Dismantling/Restoration Plan to DLNR-SHPD for review and acceptance.

To implement the 2013 Preservation Plan, the UNK Update includes planning for the construction of rock walls around the permanent preservation buffers of the identified burial and preservation sites, which would complete the implementation of the 2003 Burial Treatment Plan and 2013 Preservation Plan.

Table 4-5: Archaeological Sites Recorded (ASM Affiliates, Inc., 2020)

Site No.	Formal Type	Functional Type	Age	Significance	Treatment
6302	Wall	Kuakini Wall	Historic	a, c, d	Preservation
23662	Enclosure	Ranching	Historic	d	No further work
23663	Wall	Ranching	Historic	d	No further work
23664	Wall	Ranching	Historic	d	No further work
23665	Wall	Landscape Marker	Historic	d	No further work
23666	Wall	Landscape Marker	Historic	d	No further work
23667	Wall	Landscape Marker	Historic	d	No further work
23668	Lava Blister	Temporary Habitation	Precontact	d	No further work
23669	Modified Outcrop	Temporary Habitation	Precontact	d	No further work
23670	Platform Complex	Permanent Habitation	Precontact	d	Data Recovery
23671	Platform	Temporary Habitation	Precontact	d	Data Recovery
23672	Enclosure Complex	Temporary Habitation	Precontact	d	Data Recovery
23673	Platform/Enclosure	Permanent Habitation	Precontact	d	Data Recovery
23674	Platform/Enclosure	Temporary Habitation	Precontact	d	Data Recovery
23675	Platform	Temporary Habitation	Precontact	d	Data Recovery
23676	Platform	Temporary Habitation	Precontact	d	Data Recovery
23677	Platform/Enclosure	Temporary Habitation	Precontact	d	Data Recovery
23678	Enclosure	Temporary Habitation	Precontact	d	Data Recovery
23679	Trail	Trail	Precontact	d	No further work
23680	Trail	Trail	Precontact	d	No further work
23681	Platform/Enclosure	Ceremonial	Precontact	d, e	Preservation
23682	Game Board	Game Board	Precontact	d	No further work
23683	Platform	Burial	Precontact	d, e	Preservation
23684	Platform/Enclosure	Burial	Precontact	d, e	Preservation
23685	Platform	Burial	Precontact	d, e	Preservation
23686	Complex	Agricultural	Precontact	d	Data Recovery

*SIHP site numbers are preceded by the State, Island, and U.S.G.S. Quad Prefix.



Figure 4-7: Photo of a Portion of the Kuakini Wall on the Petition Area (ASM Affiliates, Inc., 2020)

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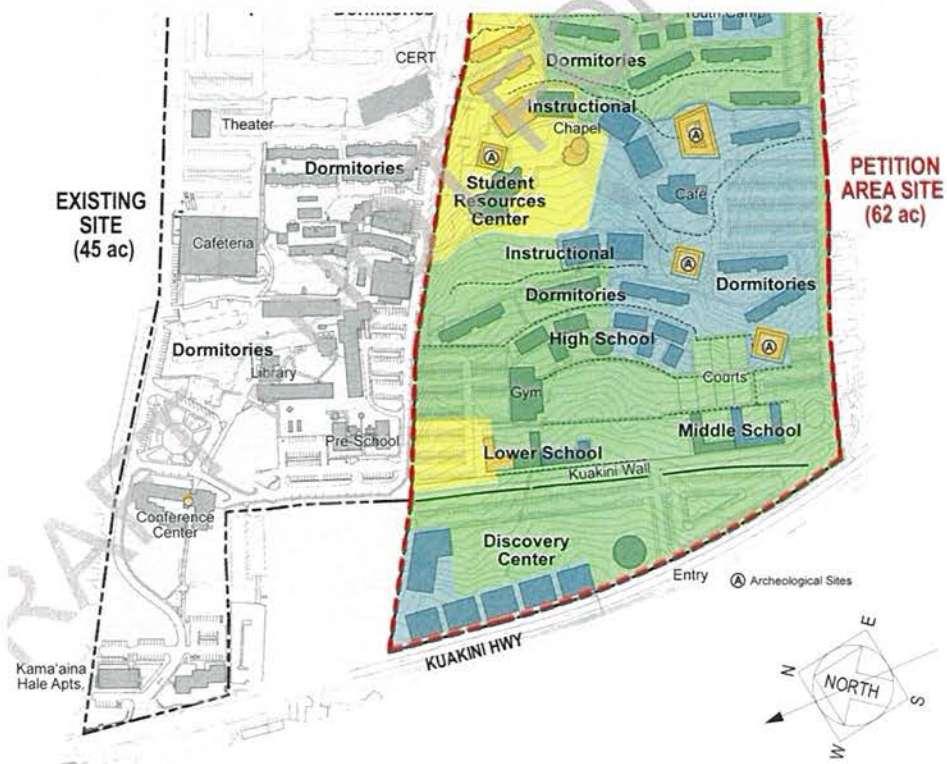


Figure 4-8: Archaeological, Preservation Plan, and Burial Sites

University of the Nations, Kona, Inc. 2020 Master Plan Update

4.16 Historical and Cultural Resources

2020 Cultural Impact Assessment:

As discussed above the 2020 Cultural Impact Assessment prepared by ASM Affiliates, Inc. is an update to a previous Cultural Impact Assessment conducted for the Petition Area by G70 in 2003. The methodology for the 2020 Cultural Impact Assessment was primarily based upon the following scope:

1. A review and summary of historical documentation for purposes of identifying potential traditional cultural properties, features, resources, beliefs, and practices within or near the Petition Area.
2. An analysis of information provided in archaeological reports and known oral traditions of areas near or within the Petition Area as a means of identifying traditional land use activities, cultural resources, and associative practices and beliefs.
3. Compilation and summary of information obtained from informal discussions and formal interviews with identified knowledgeable individuals regarding historic and traditional practices that are site-specific and inclusive of the ahupua'a of Wai'aha.
4. A report that summarizes the information obtained from research conducted from which an evaluation of the potential cultural impacts related to the Petition Area will be provided. As necessary, recommendations to mitigate potential impacts will also be included.

As part of the 2020 Cultural Impact Assessment, various agencies and organizations (e.g., The Office of Hawaiian Affairs (OHA), Hawai'i Island Burial Council, Queen Lili'uokalani Trust, etc.), community members, and cultural/lineal descendants with ties to Wai'aha were contacted in order to identify traditional cultural properties, practices, and contemporary cultural uses associated with the Petition Area and surrounding lands. A total of thirty-four individuals were contacted for consultation based on their potential to provide intimate knowledge of Wai'aha, in particular nā kupuna, nā kumu hula, and nā kua 'āina. Twenty-one individuals responded to the request, although several declined to be interviewed, directed consultation to other individuals (besides themselves), or expressed that they did not have intimate knowledge of Wai'aha.

According to the 2020 Cultural Impact Assessment, historical documentation indicates that as early as the 15th century during the reign of 'Ehukaimalino, the mokuoloko, the interior land district of Kona with its vast natural resources was a preferential location for royal residence, particularly between the regions of Lanihau to Keauhou. Numerous native oral traditions and foreign accounts illustrate that the ahupua'a of Wai'aha was part of a larger and significant political and population center that was primarily sustained by a variety of dryland agricultural practices.

Wai'aha was also a favored retreat for Emma Naea Rooke and her husband, Alexander Kalanikualihohihohekapu 'Iolani (Kamehameha IV), who acquired land in the upland regions of the ahupua'a, and their son Prince Albert Edward Kauikeaouli Leiopapa a Kamehameha. Upon the king's death in 1865, the Dowager Queen Emma purchased the land of Wai'aha from the estate of her late husband, where she retained a home on the estate until her death in 1885. Several recorded oral accounts, one composed by the Queen herself, speak of the verdant uplands of Wai'aha and the general Kona region in a poetic and honorific tribute through the compositions of *nā kanikau*, lamentation chants that marked the death of the young Prince Albert, who died at the age of four from acute appendicitis.

According to the 2020 Cultural Impact Assessment, sources suggest that by the late 1890s, much of the land within the Wai'aha ahupua'a was utilized by the Kona Sugar Company to support the

sugarcane industry that was emerging within the region. Following the closure of the plantation and the mill site in 1926, much of the land within Wai'aha, including a large portion of the Petition Area, was purchased by Manuel Gomes as part of an immense cattle and ranching operation.

The upper slopes of Wai'aha are utilized today for ranching and diversified agriculture and coffee production. The coastal regions are part of an immense industry that is primarily focused on tourism with a wide variety of vacation timeshares and visitor accommodations, serving as a venue for major sporting events like the Billfish Tournament and Ironman Triathlon.

Ka Pa'akai O Ka 'Aina Analysis:

For the UNK Update, a *Ka Pa'akai O Ka 'Aina Analysis*, University of the Nations, TMKS: (3) 7-5-010:085 and (3) 7-5-017:006. Wai'aha 1st Ahupua'a, North Kona District, Island of Hawai'i was completed in 2020 by ASM Affiliates, Inc. to examine the project's potential effect on or impairment of valued cultural, historical, or natural resources in the Petition Area, including traditional and customary native Hawaiian rights. The Ka Pa'akai Analysis is based on the Hawai'i Supreme Court's decision in *Ka Pa'akai v. Land Use Commission*, 94 Hawai'i 31, 74, 7 P.3d 1068, 1084 (2000), which sets forth the State's (and its agencies') duty to protect traditional and customary practices and resources under the Hawai'i Constitution. Under the *Ka Pa'akai v. Land Use Commission*, prior to an agency taking action that may impact native Hawaiian traditional and customary practices, the agency must make specific findings of fact and conclusions of law as to:

1. *The identity and scope of valued cultural, historical, or natural resources in the petition area, including the extent to which traditional and customary native Hawaiian rights are exercised in the petition area;*
2. *The extent to which those resources, including traditional and customary native Hawaiian rights, will be affected or impaired by the proposed action; and*
3. *The feasible action, if any, to be taken by the LUC to reasonably protect native Hawaiian rights if they are found to exist. Const. Art. 12, § 7. (94 Hawai'i 31, 7 P.3d 1068)*

The Ka Pa'akai Analysis identifies the valued cultural, historical, and natural resources present within the Petition Area, and identifies the extent to which any traditional and customary native Hawaiian rights are, or have been, exercised. In addition, historical archival information was investigated, and prior cultural studies that included consultation and oral-historical interviews were reviewed and summarized by the Ka Pa'akai Analysis. Next, the Ka Pa'akai Analysis provides a discussion describing the extent to which the valued cultural, historical or natural resources and customary native Hawaiian rights will be impacted by the UNK Update. Finally, the Ka Pa'akai Analysis summarizes these findings and recommends feasible actions and mitigative measures that may be taken by the Land Use Commission to reasonably protect native Hawaiian rights, if they are found to exist within the Petition Area.

The previous archaeological studies conducted within the Petition Area have identified significant, valued cultural resources, including sites traditionally used for ceremonial, habitation, agricultural, burial, and transportation purposes. Although the 2020 Cultural Impact Assessment did not identify any specific past or ongoing traditional or customary practices occurring within the Petition Area, concerns were expressed by the consulted parties regarding the presence of burials on the Petition Area, the possibility of encountering additional *iwi kupuna* during development activities, and the potential effects that the proposed development would have on the ability of the descendent community to care for those ancestral remains. According to the Ka Pa'akai Analysis this concern is legitimate given that the proposed development will alter the traditional cultural landscape of the Petition Area and as a result have an effect on the valued cultural resources located therein. Such

landscape alteration also has the potential to adversely affect the ability of the descendant communities to access and care for their ancestral remains. As a part of the UNK Update, several measures have already been undertaken by U of N Kona to reasonably mitigate and protect the cultural resources located on the Petition Area and to ensure the rights of the descendant community to access and care for their *iwi kupuna* are not impinged. These mitigation measures included archaeological data recovery, and the establishment of permanent preservation easements with associated access rights for any identified lineal and cultural descendants to the three known burial sites, a *heiau*, and the Kuakini Wall. Also, at the recommendation of OHA, U of N Kona has agreed to preserve a portion of a historic trail across the Petition Area. According to the Ka Pa'akai Analysis, if all of the conditions and measures (both interim and permanent) set forth in the 2003 Burial Treatment Plan and 2013 Preservation Plan are adhered to and implemented as part of the UNK Update, then there will be no anticipated adverse impacts to the three burial sites (Sites 23683, 23684, and 23685) and the two preservation sites (Sites 6302 and 23681). To further avoid potential impacts to valued cultural resources, the LUC can condition any approvals to include the recommended archaeological/cultural precautionary monitoring measures as additional mitigation during all ground-disturbing development activities. An expanded discussion on the Ka Pa'akai Analysis will be evaluated in the Draft EIS, including any potential impacts and mitigative measures.

4.17 Visual Resources

The Hawai'i County General Plan (2005) has identified the backdrop of Hualālai Volcano as the predominant visual attribute of the Kona region. Its steep green slopes can be viewed from the Kona coast, and from higher elevations spectacular vistas can be seen of the coastline, ocean, and horizon. The Keahuolu coastline and the Holualoa-Keauhou viewplane from Kuakini Highway going mauka and makai are other notable sites of natural beauty identified by the General Plan that are visible from the Petition Area. An expanded discussion on the visual resources will be evaluated in the Draft EIS, including any potential impacts and mitigative measures.

5.0 Potential Impacts and Mitigation Measures

The Draft EIS will include a description of the environment in the vicinity of the UNK Update as it exists before the action's commencement. Impacts to the natural and/or human environment for all phases of the UNK Update will be considered, along with indirect and cumulative impacts. Technical studies and investigations will describe existing conditions and provide an evaluation of potential impacts to the Petition Area's flora and fauna, archaeological and cultural resources within the area, water supply and traffic flow. Storm water drainage, infrastructure needs, and impacts to municipal services will also be analyzed in the forthcoming Draft EIS. Impacts will be described as short-term, long-term and cumulative.

5.1 Short-Term Impacts

Short-term impacts would occur during the construction period. Noise from demolition and construction equipment, dust from grading, erosion from grading and excavation are typical impacts. The ability to stage and store construction equipment and trucks on-site will help to minimize traffic impacts stemming from construction.

Short-term economic benefits anticipated during construction would include direct, indirect, and induced employment opportunities, which benefits would increase when multiplier effects are considered, although not at a level that would generate significant statewide economic expansion.

The Draft EIS will more specifically assess the probable short-term impacts. Construction-generated impacts will be minimized and mitigated through adherence to Best Management Practices (BMPs), National Pollutant Discharge Elimination System and construction permit requirements, and other relevant regulations. The types of BMPs and controls to be implemented during construction periods will be described in the forthcoming Draft EIS.

5.2 Long-Term Impacts

Long-term impacts are those probable changes that would occur following implementation of the UNK Update. Each environmental and human resource described in the Draft EIS will include a discussion of possible long-term impacts. Minimization and mitigation measures can be implemented to ensure no significant impacts will occur as a result of the UNK Update. The Draft EIS will more specifically assess the probable long-term impacts of the UNK Update.

5.3 Indirect and Cumulative Impacts

Cumulative effects or impacts are impacts that result from the incremental effects of an activity when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertake such other actions. Indirect impacts or secondary effects are impacts that are associated with an activity but do not result directly from the activity. Projects that exist or are planned in the region will be assessed for the potential to add to the direct and indirect (secondary) impacts of the UNK Update. The Draft EIS will more specifically assess the probable indirect and cumulative impacts of the UNK Update.