Chapter 3

Alternatives Considered

Chapter 3

Alternatives Considered

The purpose of the Master Plan Update is to revise the land use plan for the Petition Area to allow for the expansion of the Existing Campus. The following sections summarize alternatives to the Master Plan Update.

3.1 No Action Alternative

Under the "No Action Alternative," the Petition Area would remain in its current vacant state and no new buildings or facilities to support U of N Kona would be constructed. The "No Action Alternative" would not adequately address U of N Kona's current and projected space and activity needs. Under this alternative, current and future students would be limited to facilities and activities at the Existing Campus, which is not equipped with enough dormitories or student facilities to accommodate future enrollment projections. Ultimately, housing in the nearby vicinity could be impacted by the overflow of students and staff members.

The "No Action Alternative" would not adequately address U of N Kona's current and projected space and activity needs. Without the expanded campus, U of N Kona would be limited to the Existing Campus and would lack the dormitories and facilities needed to support its projected enrollment. Under this scenario, the "No Action Alternative" would not allow the U of N Kona to grow to its projected enrollment levels and would fail to meet the long-term vision of the U of N Kona.

If no action is taken, U of N Kona would not satisfy the conditions of the 2003 Decision & Order (*Appendix A)* and may be at risk of the LUC involuntarily reverting the Petition Area back to the State Land Use Agricultural District. Furthermore, the "No Action Alternative" would not be consistent with the Petition Area's LUPAG Map designation as described in the County of Hawai'i General Plan or the policies guiding future land use development in the Kona Community Development Plan. The LUPAG Map designates the Petition Area as MDU use (*Figure 1-7*). As described in the General Plan, areas designated as MDU uses are described as "village and neighborhood commercial and single family and multiple family residential and related functions (multiple family residential – up to 35 units per acre)." Areas designated as Medium Density include urban centers that provide physical, social, governmental, and economic concentrations so that total activities of the community can be more readily and easily conducted. As shown in *Figure 1-4,* the area in the nearby vicinity of the Petition Area is generally urban and consists of residential and commercial development. The Master Plan Update would follow in keeping with the area's urban usage and meet the LUPAG Map designation of the Petition Area. Although the County is currently undergoing its comprehensive review of the General Plan, the Draft General Plan maintains the MDU designation for the Petition Area.

The Kona Community Development Plan contains policies to avoid past and current trends of sprawling lot-density developments, disconnected subdivisions and business centers, and a general decline in the quality of life for people. Consistent with the LUPAG Map designation, the Petition Area is located within the Kona Urban Area identified in the Kona Community Development Plan, which is dedicated for future growth (*Figure 1-8)*. If no action is taken, the Petition Area would remain vacant and would be inconsistent with guidelines and policies related to future growth in the Kailua-Kona region.

In comparison to the Master Plan Update, the "No Action Alternative" would no longer require additional infrastructure services such as water and wastewater services. However, the "No Action Alternative" would fail to accommodate current and future enrollment projections. For these reasons, the "No Action Alternative" is not considered a reasonable solution and is therefore dismissed from further consideration.

3.2 Alternative Development Density

The Master Plan Update is planned in three (3) phases, with 5-10 years allocated for each phase of development. The following section summarizes and evaluates a lower and higher density build out of the Petition Area.

3.2.1 Lower Density Development Alternative

Planning for a "Lower Density Development Alternative" could entail developing just Phase 1 or Phase 1 and 2 of the Master Plan Update.

Phase 1 of the Master Plan Update has been designed to accommodate U of N Kona's most current needs. In comparison to the full buildout of the Master Plan Update, developing Phase 1 would result in an approximate 40% reduction in terms of building footprint in comparison to the full buildout of the Master Plan Update. Although Phase 1 would be of lower density than the full build out of the Master Plan Update, thereby minimizing the overall use of the Petition Area, Phase 1 would not accommodate future enrollment projections beyond the next 5-10 years. Additionally, recreational and athletic facilities including the Athletic Complex, Fields, Tennis Courts, Gym, Pool, Multipurpose Complex, and Theatre are planned for Phases 2 and 3. Developing Phase 1 alone would not provide much needed recreational facilities for the greater Kailua-Kona community.

Another "Lower Density Development Alternative" could entail developing Phase 2 of the project. However, Phase 1 of the project is ancillary to Phase 2; if Phase 1 is not developed prior to or in conjunction with Phase 2, Phase 2 would not be equipped with the proper infrastructure support. Therefore, moving forward with the development of Phase 2 alone is not feasible and was dismissed from the "Lower Density Development Alternative".

Phase 1 and 2 of the Master Plan Update would enhance the learning and training facilities at U of N Kona. Developing Phase 1 and 2 would result in an approximate 13% reduction in terms of building footprint in comparison to the full buildout of the Master Plan Update. Development of Phase 1 and 2 would increase the overall usage of the Petition Area by providing some of the needed space to accommodate future growth and also provide much needed athletic and meeting spaces in greater Kailua-Kona region.

In comparison to the full build-out of the Master Plan Update, planning for a "Lower Density Development Alternative" would reduce the overall scale and build-out of the Petition Area, which would reduce potential noise and privacy concerns to neighboring homeowners. However, because the Petition Area is not supplied with water or wastewater services, in order to support a "Lower Density Alternative", infrastructure improvements such as a new sewer connection under Kuakini Highway and other improvements to provide water to the Petition Area would still be required. Accordingly, a lower density alternative would require the same infrastructure improvements needed to support the full Master Plan Update, but would not fully accommodate future growth over the next 30 years, and otherwise not fully optimize the Petition Area. For these reasons, the "Lower Density Development Alternative" has been dismissed from further consideration.

3.2.2 Higher Density Development Alternative

Under this alternative, the plan for the Petition Area would be developed to a greater density than the Master Plan Update. Planning the Petition Area to a greater density could include increasing the height and capacity of instructional buildings and dormitories, or adding additional instructional buildings and dormitories.

The Master Plan Update has been thoughtfully designed to embrace elements of sustainability and its architecture, open space, and landscape will work together to foster a Hawaiian sense of place that is reflective of the Kailua-Kona region, both in terms of its natural attributes and its cultural history. Increasing the height and capacity of buildings and dormitories would infringe upon open space throughout the Petition Area and increase the footprint of U of N Kona. As such, views and vistas may be impacted with larger buildings and additional infrastructure services would be needed to accommodate a greater capacity.

Developing the Petition Area to a greater density would allow U of N Kona to carry a larger enrollment on a per quarter basis. Increasing the enrollment could potentially increase noise and traffic to unacceptable levels, and put a strain on infrastructure services within the greater Kailua-Kona region. Furthermore, developing the Petition Area to a greater density may not comply with the LUPAG's Map designation for the Petition Area. For these reasons, a "Higher Density Development Alternative" was dismissed from further consideration.

3.3 Alternative Land Uses

Consistency with 2003 State Land Use District Boundary Amendment

The Petition Area could be developed to encompass a range of viable urban land uses, including residential or commercial uses. Original plans for the Petition Area approved in the 2003 Decision & Order called for the development of the Hualālai Village condominiums, a multi-function cultural center, and a five-acre educational facility. The Hualālai Village project was planned in four phases. Phase 1 was planned to include 103 residential units outside the Petition Area, and Phases 2 to 4 was planned to include 297 residential units within 31 acres of the Petition Area. The condominiums were planned to be equipped with a recreation center, exercise facilities, and a pool. The condos were to be sold to U of N Kona affiliates and the general public. The Cultural Center was planned to be a first-class tourist attraction, intended to present the authentic story of the native Hawaiian culture, its historical relationship with the introduction of Christianity, and its impact upon the monarchy and the people of Hawai'i. The Cultural Center was planned to include an outdoor water feature, an educational living museum complex, a restaurant, and shops. The Cultural Center was projected to serve between 500 to 1,100 visitors per day. A parking area was planned to accommodate 15 buses and 840 cars for visitors. Profits generated from the cultural center were intended to flow back to U of N Kona to support its educational activities. The educational facility was planned for approximately 5 acres of the Petition Area to allow for the expansion of the U of N Kona.

Although the Hualālai Village project was approved by the LUC, after U of N Kona acquired the Petition Area, the plan for the Petition Area was revised to meet the long-term vision of the U of N Kona. Although reverting to the Hualālai Village project would provide greater economic opportunities for U of N Kona, it would not accommodate U of N Kona's future enrollment trajectory and growth and would fail to meet the long-term vision of the U of N Kona.

Agriculture

Another potential land use alternative evaluated for the Petition Area was agricultural use. Although U of N Kona currently operates a small-scale farm and research center on the Petition Area, the research farm's main purpose is to support education in nutrition, farming, and agricultural techniques, and is not intended to support large scale agricultural production. Furthermore, the LSB classification of the soils located on the Petition Area indicates that the soils are poorly suited for agricultural productivity Additionally, the Petition Area was granted a State Land Use District Boundary Amendment from the State Land Use Agricultural District to the State Land Use Urban District. U of N Kona would have to file a motion to revert the Petition Area back to the Agricultural District if U of N Kona were to pursue agricultural activity. Overall, the ability to pursue agricultural opportunities on the Petition Area is limited, and doing so would not accommodate U of N Kona's future enrollment trajectory and growth. The State Land Use Agricultural District is also inconsistent with the County General Plan and Kona Community Development Plan.

Both "Alternative Land Uses" for the Petition Area would not accommodate U of N Kona's future enrollment trajectory. Commercial or residential opportunities at the Petition Area would increase daily usage to and from the Petition Area, and could result in increased impacts to noise, traffic, and public services and infrastructure. Although agricultural opportunities would reduce the overall intensity of the usage of the Petition Area, the soils located on the Petition Area are not suitable for agriculture. For these reasons, both agriculture and alternative urban land uses have been dismissed from further consideration.

3.4 Alternative of Deferral of the Proposed Action

Under the "Alternative of Deferral of the Proposed Action," the Master Plan Update would be deferred and the Petition Area would remain vacant and undeveloped despite U of N Kona's need for the expansion. Current and future students would be limited to facilities and activities at the Existing Campus, which is not equipped with enough dormitories or student facilities to accommodate future enrollment projections. Ultimately, housing in the nearby vicinity could be impacted by the overflow of students and staff members. Alternative of Deferral of the Proposed Action would not allow the U of N Kona to timely expand the Existing Campus to accommodate its projected near-and long-term enrollment levels and would fail to meet the long-term vision of the U of N Kona.

Similar to the "No Action Alternative", if the Master Plan Update is deferred to, U of N Kona would not satisfy the conditions of the 2003 Decision & Order (*Appendix A)* and may be at risk of the LUC involuntarily reverting the Petition Area back to the Agricultural District. Furthermore, deferring the Master Plan Update would not be consistent with the County's LUPAG map designation in the County of Hawai'i General Plan or the policies guiding future land use development in the Kona Community Development Plan. The LUPAG designates the Petition Area as MDU (*Figure 1-7)*, and the Kailua-Kona Community Development Plan locates the Petition Area within the Kona Urban Area slated for future growth (*Figure 1-8)*. Deferring further action would not be consistent with policies guiding land use and growth in the Kailua-Kona region.

Deferring further growth at U of N Kona would not provide the needed space and facilities to accommodate its projected future enrollment. If U of N Kona defers further action, public facilities and services including housing, schools, and recreational facilities in the nearby vicinity of the Petition Area may be strained. Deferring further action would also be inconsistent with the 2003 Decision & Order, the County General Plan, and Kona Community Plan. For these reasons, deferral of the Master Plan Update has been dismissed from further consideration.

Chapter 4

Environmental Setting

Chapter 4

Environmental Setting

This chapter describes the existing environmental, cultural, economic, and social characteristics and conditions of the Petition Area, and discusses the potential impacts of the Master Plan Update. Strategies to minimize and mitigate any significant impacts are further discussed in this chapter. The technical studies and reports that have been prepared in support of this Draft EIS include the following:

- 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., 2023.
- Preliminary Infrastructure Assessment, University of the Nations, Kona Master Plan Update, G70, 2023.
- Water Supply Study for the Planned Expansion of University of the Nations, Kona, Hawai'i, Tom Nance Water Resource Engineering, 2023.
- 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, Rechtman 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.
- Acoustic Study for the University of the Nations, Kona, Kailua-Kona, Hawaii. Y. Ebisu & Associates, 2023.

4.1 Climate

Existing Conditions

The climate on Hawai‘i Island 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 and surrounding the general vicinity of 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 Hawai‘i Island are typically wetter than the western and southern regions. The annual average rainfall in the general area of the Petition Area is 30 inches. February is typically the driest month, averaging 1.5 inches of rainfall and September is typically the wettest averaging 3 inches of rainfall. The winds on Hawai‘i Island 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 5-10 miles per hour (mph) (Giambelluca, et al., Department of Geography, University of Hawai‘i at Manoa, State of Hawai‘i, 2014).

Potential Impacts and Mitigation Measures

In Hawai‘i, the annual and daily variation of temperature depends to a large degree on the elevation above sea level, the distance inland, and exposure to trade winds. Short-term construction related activity during the phased build out of the Petition Area is not anticipated to adversely affect current climate conditions. Upon completion of construction, it is not anticipated the Master Plan Update will adversely affect climate conditions in the greater Kailua-Kona region. No further mitigation is proposed.

4.2 Geology and Topography

Existing Conditions

Hawai‘i Island 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 now considered dormant; its last eruption ended sometime between 1800-1801. Hualālai Volcano is composed of two types of lava flows: ‘a‘ā lava flow and pāhoehoe lava flow. The ‘a‘ā lava 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 originated from Hulalālai 3,000 to 5,000 years ago. The ground surface covering the Petition Area is mainly overgrown with non-native vegetation, however there are a few 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.

The Petition Area rises in elevation from approximately 90 feet at Kuakini Highway to approximately 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.

Figure 4-1 **Topography**

Potential Impacts and Mitigation Measures

Short-term construction related activity will involve land disturbing activities that may result in minor soil erosion. Construction is planned in three phases to minimize the total amount of exposed soil. Overgrown vegetation will be cleared, and grading will be minimal and consist primarily of site preparation and excavation to level out the existing surface. As a general rule, cut material from grading will remain on-site and the amount of cut and fill will be balanced to minimize the need to import fill or to export excavated material. Grading, grubbing and stockpiling permits will be obtained from the County and a National Pollution Discharge Elimination System (NPDES) Permit will be obtained from the State of Hawai'i, Department of Health (DOH), Clean Water Branch (CWB) prior to the start of construction. During construction, soil erosion will be minimized through compliance with the Hawai'i County Code Chapter 10 – Erosion and Sediment Control. Construction Best Management Practices (BMPs) will be implemented and may include, but not limited to, temporary sediment basins, temporary diversion berms or ditches, silt fences, dust screens, storm drain inlet protection, hydroseeding for temporary ground cover, stabilized construction entrances, and truck and equipment wash-down areas. Periodic water spraying of soils may be conducted to minimize air-borne dirt particles from reaching adjacent properties. Implementing BMPs will mitigate potential impacts throughout the phased buildout of the Petition Area.

Upon completion of construction, permanent BMPs will be implemented throughout the Petition Area to reduce stormwater runoff typically associated with the increase in impervious surface areas. Permanent BMPs may include, but not be limited to, landscaping steep and open space areas and implementing "golf course sumps," lava swales, and injection wells, where feasible. Upon completion of construction, the Master Plan Update is not anticipated to have a long-term adverse effect on the geology or topography of the Petition Area.

4.3 Soils

Existing Conditions

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 Hawai'i Island 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*).

Figure 4-2 **Soils Map**

The Waiʻaha-Punaluʻu 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 ʻaʻā lava flows. Both soils are mainly found in lower elevations on the 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 soils and very slow in underlying bedrock. Both soils are typically used for grazing and homesites. The ground surface covering the Petition Area is mainly overgrown with non-native vegetation, however there are a few heaps of sharp broken lava rock appearing more like ʻaʻā 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 Hawaiʻi:

The ALISH Classification System was developed and compiled in 1977 by the State Department of Agriculture with assistance from the NRCS, U.S. Department of Agriculture and the College of Tropical Agriculture, University of Hawaiʻi. This classification system was developed to identify three classes of agriculturally important lands for the State of Hawaiʻi as part of a national effort to inventory important farmlands. Lands not considered for classification within this system are developed urban lands over ten acres, natural or artificial bodies of water over ten acres, public use lands, forest reserves, lands with slopes in excess of thirty five percent, and military installations except undeveloped areas over ten acres.

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 covering the Petition Area are listed as Unclassified. The nearest ALISH-classified parcel is roughly three-quarters of a mile south.

Potential Impacts and Mitigation Measures

Short-term construction related activity will involve land disturbing activities that may result in minor soil erosion. Construction is planned in three phases to minimize the total amount of exposed soil on-site. Non-native overgrown vegetation will be cleared, and grading will be minimal and consist primarily of site preparation and excavation to level out the existing surface. As a general rule, cut material from grading will remain on-site and the amount of cut and fill will be balanced to minimize the need to import fill or to export excavated material. Grading, grubbing and stockpiling permits will be obtained from the County and a NPDES Permit will be obtained from the State DOH, CWB prior to the start of construction. During construction, soil erosion will be minimized through compliance with the Hawaiʻi County Code Chapter 10 – Erosion and Sediment Control. Construction BMPs will be implemented and may include, but not be limited to, temporary sediment basins, temporary diversion berms or ditches, silt fences, dust screens, storm drain inlet protection, hydroseeding for temporary ground cover, stabilized construction entrances, and truck and equipment wash-down areas. Periodic water spraying of soils may be conducted to minimize air-borne dirt particles from reaching adjacent properties. Implementing BMPs will mitigate potential impacts throughout the phased buildout of the Petition Area.

Upon completion of construction, permanent BMPs will be implemented throughout the Petition Area. Permanent BMPs may include, but not be limited to, landscaping steep and open space areas and implementing "golf course sumps," lava swales, and injection wells, where feasible. Implementing permanent BMPs will mitigate potential soil erosion with the Master Plan Update. Upon completion of construction, the Master Plan Update is not anticipated to have a long-term adverse effect on soils covering the Petition Area.

Although U of N Kona operates a small farm and research center at the Petition Area, the small research farm's main purpose is to support education in nutrition, farming, and agricultural techniques, and is not intended to support large-scale agricultural production. Furthermore, agricultural potential for the Petition Area is generally poor due to the ground surface that covers the Petition Area. As classified by the LSB, the Petition Area is rated "E", very poorly suited for agricultural productivity. The Petition Area is also unclassified under the ALISH Classification System and is not considered agriculturally important lands. Due to the low potential for agricultural productivity, it is not anticipated the Master Plan Update will infringe upon agricultural lands that may be of importance to the County or the State.

4.4 Surface Waters and Drainage

Existing Conditions

The Petition Area is located within the Hualalai Aquifer Sector Area (ASEA), which is comprised of the Keauhou Aquifer System Area (ASYA) and Kiholo ASYA. The Petition Area is located within the Keauhou ASYA. According to the Hawai'i County Water Use and Development Plan Update and Hawai'i Water Use and Development Plan Update, Keauhou Aquifer System, surface water in the Keauhou Aquifer System Area is extremely limited. Wai'aha Stream is the only perennial stream located within the nearby area, due to the high permeability of basaltic lava flows from Mauna Loa and Hualālai volcanoes. In the wettest part of the rain belt, a few small springs may occur, such as Wai'aha Springs. The high permeability of soils in the Kailua-Kona region means that surface runoff enters the ocean only during substantial storm events. The few small springs that do occur, such as Wai'aha Springs, occurs as seepage of groundwater perches on soil and ash beds. However, such springs are minor and intermittent. Data for surface waters throughout the Keauhou ASYA is unavailable as surface water is extremely limited.

In support of the Master Plan Update, a *Preliminary Infrastructure Assessment* and a *Conceptual Infrastructure Master Plan* were prepared in 2023 by G70 (*Appendix C).* According to the assessment, no perennial stream, existing drainage facilities, or defined natural drainage ways were identified at the Petition Area. Additionally, a previous drainage study was completed by Ross Engineering Inc. in 2002 to analyze the offsite stormwater drainage conditions that affect the Petition Area. The drainage report found that concentrated stormwater run-on enters the Petition Area at three different locations from the mauka direction (*Figure 4-3):* an 84-inch pipe culvert crosses Queen Ka'ahumanu Highway and discharges runoff at the southeastern corner of the Petition Area and a 36-inch and 30-inch culvert at the intersection of Queen Ka'ahumanu Highway and Hualālai Road discharge runoff on the Petition Area.

Stormwater runoff that flows on the Petition Area from the mauka culverts flows to an existing 24-inch culvert which conveys runoff across Kuakini Highway. Immediately downstream of the culvert, there is a series of six drywells located on TMK (3) 7-5-018:094 (owner: Walua Professional Center). No other culverts or drainageways were identified along Kuakini Highway. It is assumed run-on as well as runoff at the Petition Area is either disposed of by onsite or off-site drywells (across Kuakini Highway) or is slowed by heavy vegetation and infiltrates into the ground.

Potential Impacts and Mitigation Measures

Short-term construction related activity could increase stormwater runoff generated at the Petition Area, which may temporarily affect nearby surface waters. To minimize the potential for increased stormwater runoff generated at the Petition Area, construction is planned in three phases to minimize the amount of area exposed during construction. Contractors will follow State DOH and County regulations to minimize the potential for increased stormwater runoff during construction. A NPDES Permit will be obtained from the State DOH, CWB prior to the start of construction. Furthermore, BMPs described in *Section 4.2* will be employed to mitigate the potential for increased stormwater runoff.

The drainage plan has been designed in accordance with the County of Hawai‘i standards and is phased over the buildout of the Petition Area (*Figure 4-4a-4-4c)*. For areas of 100 acres or less, drainage systems are to be designed for return periods of 10 years for runoff conditions or 50 years for sump conditions. Due to potential sumps at the Petition Area, the 50-year return rate has been utilized.

The Master Plan Update is anticipated to increase runoff generated at the Petition Area, which could cause adverse effects to areas downslope or nearshore waters. To mitigate the increase in runoff, Low Impact Development (LID) strategies and BMPs will be implemented to capture and retain stormwater runoff at the Petition Area. LID strategies consist of stormwater management methods that promote conservation of existing natural features and use of localized small-scale stormwater systems intending to mimic natural hydrologic patterns, while minimizing stormwater infrastructure. LID that may be implemented include:

- Minimizing impervious surface areas and using permeable surfaces where possible, including sidewalks and roadway/driveway paving.
- Retaining and incorporating the natural topography.
- Minimizing grading and disturbed areas.
- Designing narrow roadways and minimizing driveway lengths and widths.
- Designing sidewalks on one side of the street.
- Planting trees to accommodate future tree growth.
- Using source controls of stormwater for pollutant control and groundwater recharge.
- Minimizing conventional infrastructure (curb and gutter, drain inlets/catch basins, and culverts).

Utilizing onsite lava rock in sumps, swales, trenches, shallow drywells, and detention and retention basins.

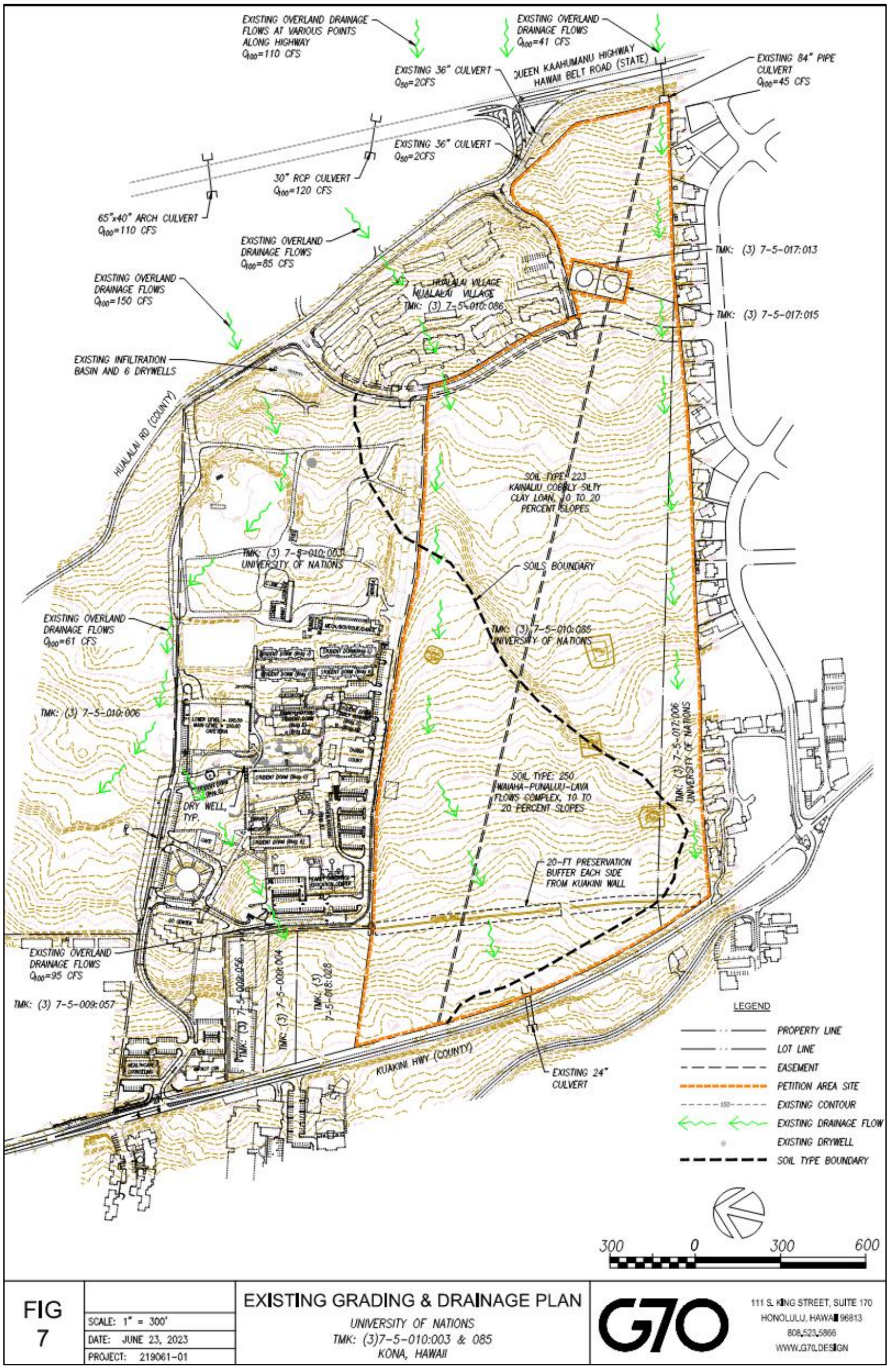

Figure 4-3 **Existing Drainage Flow Pattern**

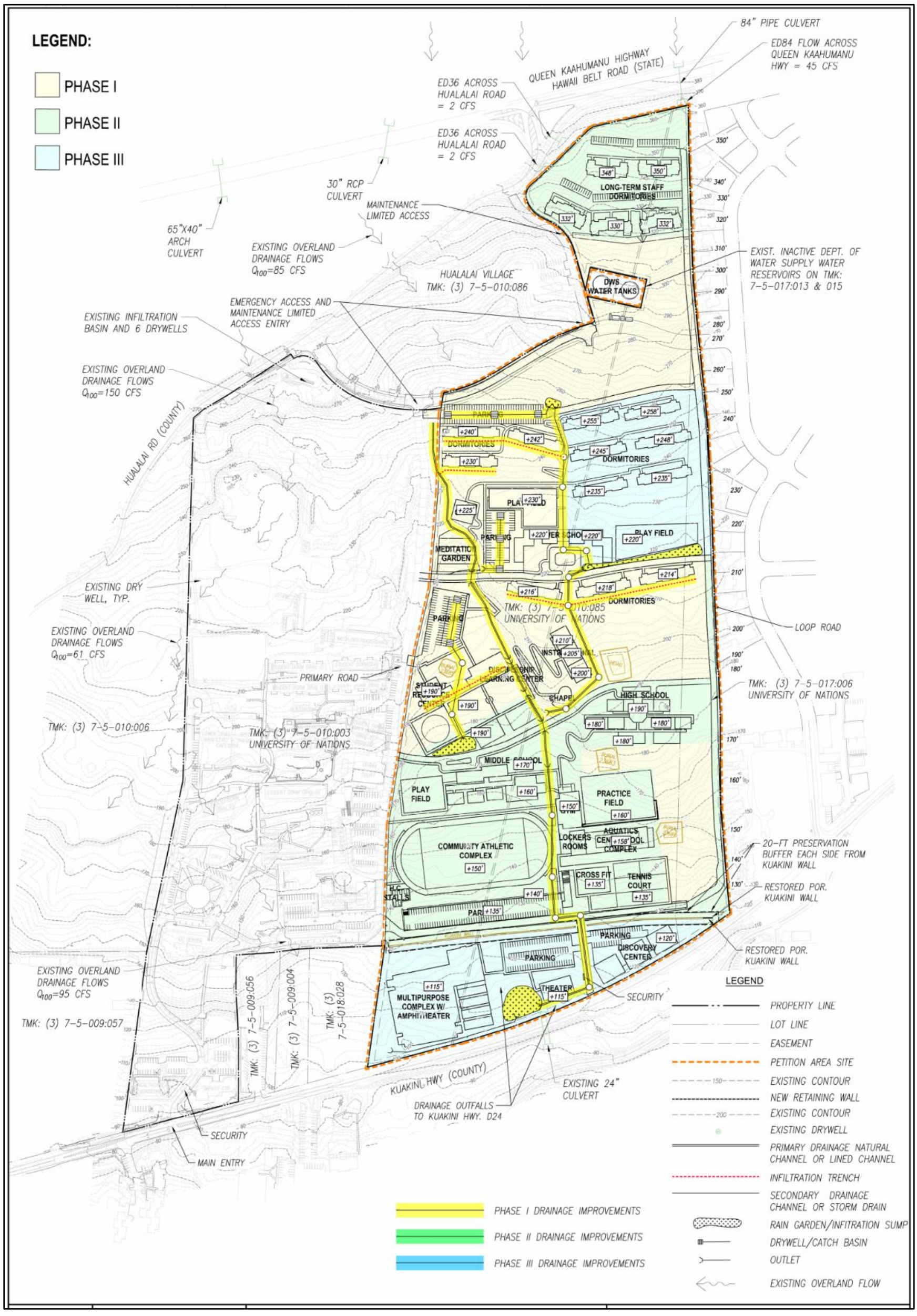

Figure 4-4a **Proposed Drainage Plan Phase 1**

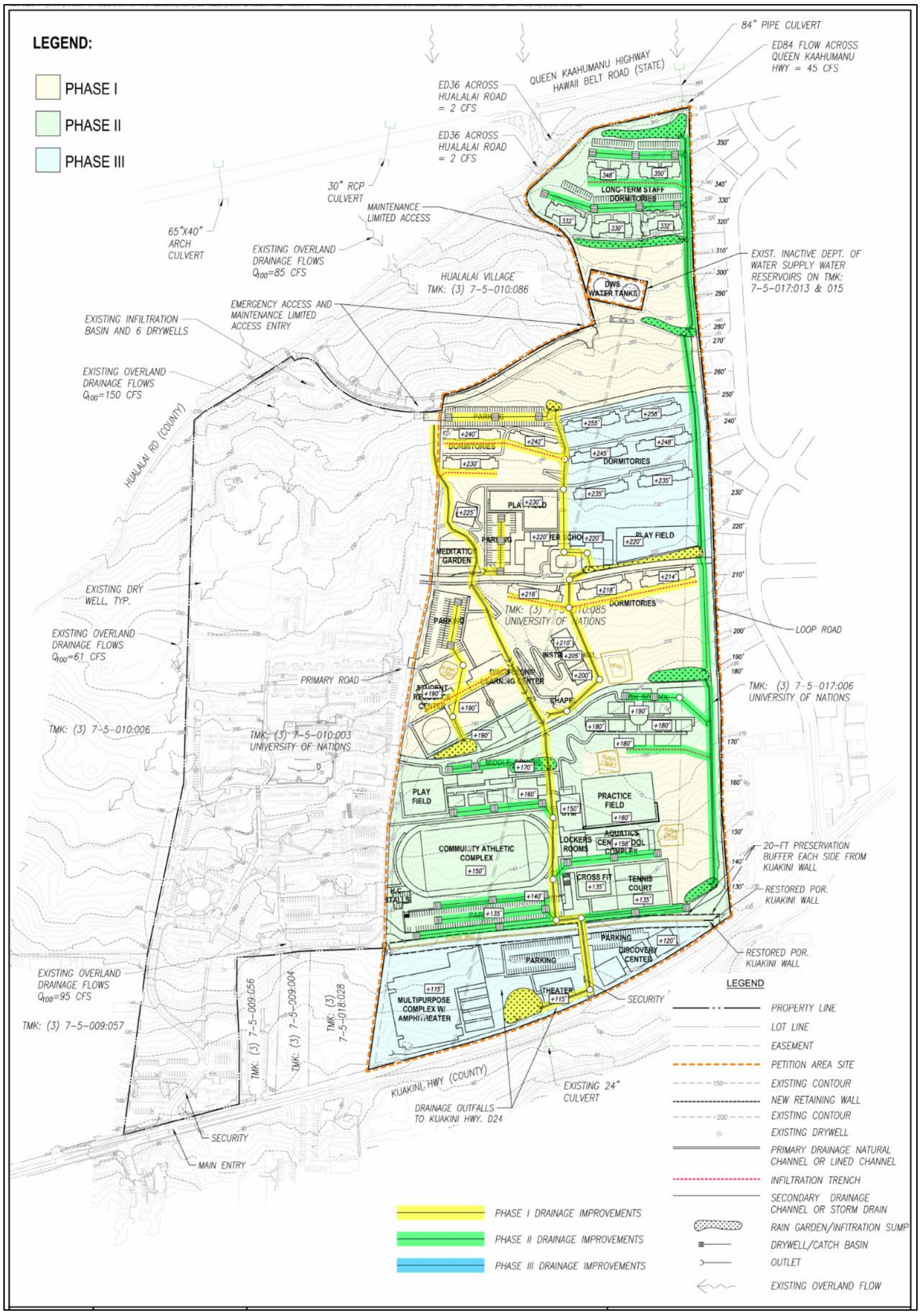

Figure 4-4b **Proposed Drainage Plan Phase 2**

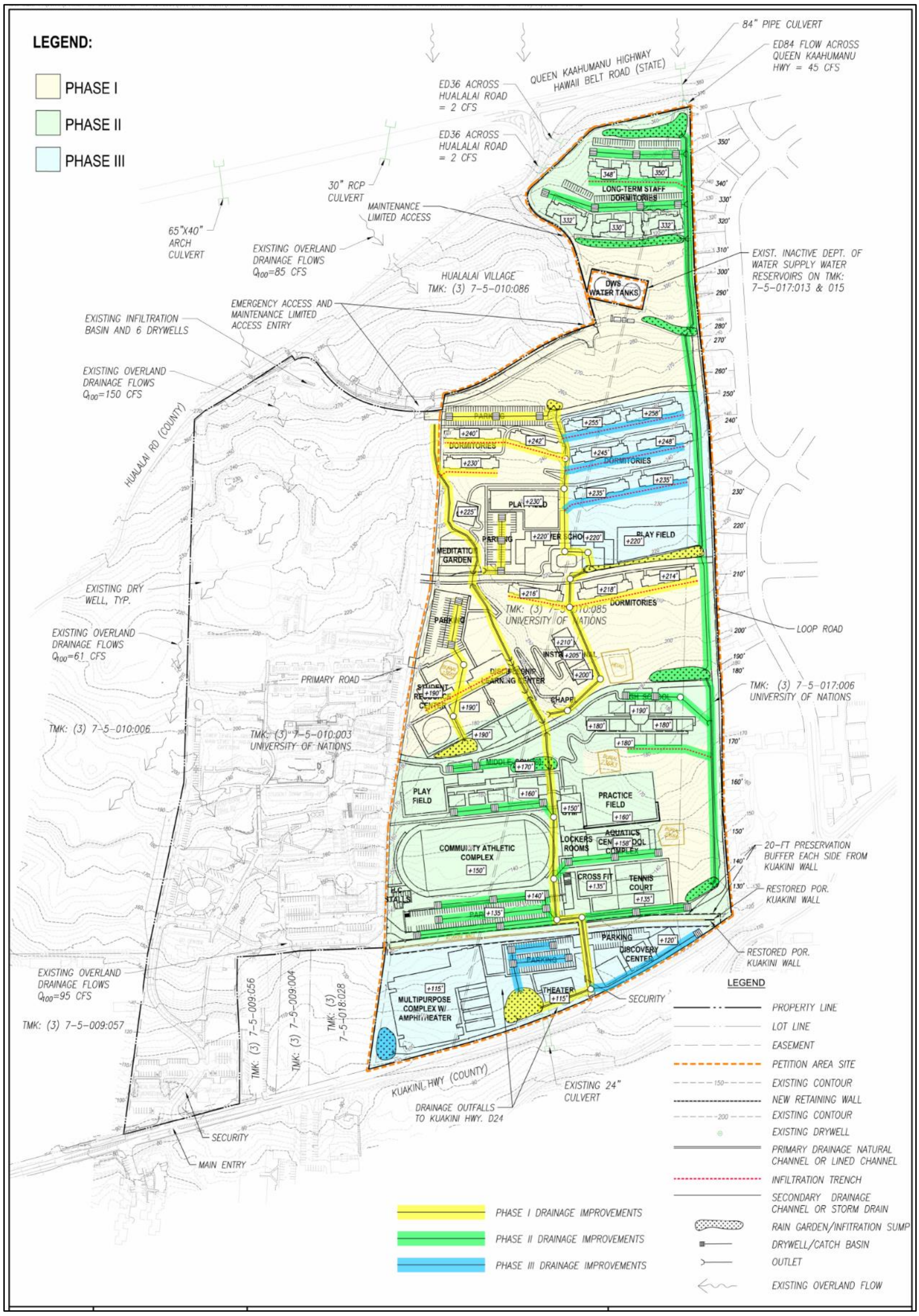

Figure 4-4c **Proposed Drainage Plan Phase 3**

Implementation of LID will improve stormwater runoff management. Sizing and selection of LID will be site-specific depending on the land use and characteristics of individual developed drainage areas, with the intent to detain, retain, and infiltrate post-development runoff onsite.

For any larger stormwater events, excess stormwater runoff will be discharged to conveyances located along the central spine road and along the southern perimeter road. These drainage conveyances are envisioned to be natural unlined channels where possible, since natural channels provide disposal of runoff through fractured rock subgrade to attenuate peak flows and runoff volumes, and provide ground water recharge. road.

With an integrated stormwater management approach, it is not anticipated that the Master Plan Update will substantially increase stormwater runoff generated at the Petition Area, and the implementation of such measures will reduce overall runoff and impacts to nearshore waters.

4.5 Groundwater Resources/Hydrology

Existing Conditions

On Hawai'i Island, groundwater is the primary source of drinking water. In the Kona area, 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. 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 adopted by ordinance the Hawaii County Water Use and Development Plan Update dated August 2010, and the State Commission on Water Resource Management (CWRM) granted approval in December 2011. According to the Hawaii County Water Use and Development Plan Update, the Petition Area is situated within the Hualalai ASEA, which is comprised of the Keauhou ASYA and the Kiholo ASYA. The Petition Area is located within the Keauhou ASYA. The Hualalai ASEA has a sustainable yield of 56 millions of gallons per day (MGD). Within the Hualalai ASEA, there are a total of 65 production wells, including 21 municipal, 18 irrigation, 1 industrial, and 25 other wells. The Hawaii County Water Use and Development Plan Update called for further evaluation of the Keauhou ASYA.

In March 2017, the Hawai'i County Water Use and Development Plan Update, Keauhou Aquifer System was finalized. The plan provides an integrated approach to land use planning and water resource development, and an estimate of future water demand projections based on County land use/zoning policies and water use rates for the Keauhou ASYA. Notably, the future water demand for the Keauhou ASYA includes the water needed to support the urban land use designation of the Petition Area, under the previous plan. According to the Hawai'i County Water Use and Development Plan Update, Keauhou Aquifer System, the Petition Area is situated within the Keauhou ASYA, which has a sustainable yield of 38 MGD. There are 47 production wells in the Keauhou ASYA, including 16 municipal, 12 irrigation, 1 industrial, 5 agricultural, and 13 wells drilled but categorized as unused.

Within the Hualalai ASEA, the County of Hawai'i Department of Water Supply (DWS) operates the Kona Water System, which is split into the North and South Kona Water System. The Kona districts were

without any County water systems until funds were provided by the Legislature in 1951. Historically, surface water from Waiʻaha Stream was diverted into large storage tanks located in Waiʻaha 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 began operations in 1967 and most of the small pipelines initially installed have been replaced with larger mains. The Kona Water System is supplied by ground water sources, including 12 wells.

The Existing Campus is supplied by water from DWS, but the Petition Area currently is not. The Hawaiʻi County Water Use and Development Plan Update, Keauhou Aquifer System encourages development of future high-level wells for DWS systems 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.

Potential Impacts and Mitigation Measures

Short-term construction related activity could increase stormwater runoff and soil erosion, which may potentially decrease percolation to groundwater. To minimize the potential for increased stormwater runoff and soil erosion, construction is planned in three phases to minimize the amount of area exposed during construction. Contractors will follow State DOH and County regulations to minimize the potential for increased stormwater runoff during construction. A NPDES Permit will be obtained from the State DOH, CWB prior to the start of construction. Furthermore, BMPs described in *Section 4.2* will be employed.

Fully built out, it is anticipated approximately 107,500 gallons of water per day (gpd) will be needed to support the Master Plan Update. The total projected water demand includes the projected demand for irrigation purposes and U of N Kona submitted a request to DWS to obtain all water, including potable and non-potable from the DWS public water system. DWS has indicated that a new water source will be required to serve the Petition Area. Two potential locations have been identified for a new well and related infrastructure (*Figure 4-5* and *Figure 4-6)*. The discussion below presents further details of each potential location to develop a new well.

Well Development on TMK (3) 7-5-003:023: Wheelock Property

Upon completion of the Keōpū Deep Monitor Well (State No. 3855-001), fresh artesian water was encountered approximately 400 feet below sea level. In 2017, a second monitor well (No. 3855-002) was developed about 60 feet away from the Keōpū Deep Monitor Well and completed to isolate the artesian water from the overlying brackish and saline water. Once isolated in this manner, the static water level stood at 28 feet above sea level and varied with the ocean tide. A 48-hour constant rate test was conducted with the well averaging 820 GPM. The drawdown was essentially constant and recovery was very rapid. It is important to note that there was no evidence in the drawdown or recovery of a boundary effect. Such an effect might have occurred if the water body tapped by the well was of modest areal extent. The pumped water salinity was constant and comparable to the DWS wells that draw high-level groundwater from locations above Māmalahoa Highway. Specific conductance was about 140µS/cm and chlorides were less than five (5) MG/L. Further, isotope analysis confirmed that the artesian water at depth below sea level was the same as the high-level groundwater pumped by the inland DWS wells. The pump test demonstrated that a viable source of drinking water from the artesian water at depth could be developed at this location.

Although the areal extent of the developable artesian water at depth is unknown at the current time, the distance to a well on the Wheelock property is modest enough (approximately 1,200 feet) to

warrant drilling of an exploratory well and, if successful, completing it as a production well of 700 gallons per minute (GPM) capacity.

The advantage to this location is the modest infrastructure improvements that would be required to integrate the well into the DWS system. The well water could be delivered downslope into the existing DWS 20-inch transmission main in Queen Ka'ahumanu Highway; and the pumping lift (*i.e.*, required electrical power) would be about half the requirement of DWS' high-level wells above Māmalahoa Highway.

Well Development on TMK (3) 7-5-017:044: Bolton Property

The U of N Kona is engaged in discussions with a private well developer for a new potential well located on TMK (3) 7-5-017:044. At this particular location, the well would be drilled to tap into the fresh water at depth below sea level. Within the Kailua-Kona region, four other test holes were drilled to a depth below sea level (State Well Nos. 3858-001 and 3858-002 at Keōpū on State land; State Well No. 4159-001 in the DWS tank site at 600-foot elevation along Hina Lani Street; and State Well No. 3959-001 at Kamakana). At each of these sites, fresh water was encountered between 400 and 1,000 feet below sea level. State Well No. 3858-002 was pump tested for 48 hours at 820 GPM. The water pumped from the four well sites discussed previously were identical to the wells tapped by DWS above Mamalahoa Highway. The new potential well on TMK (3) 7-5-017:044 could be successfully developed to produce more than 1.0 million gallons per day. In the event that such a well does not produce potable water or has a yield too low to warrant development, a new well on the Wheelock property would need to be further explored.

The identified locations for potential new well development will draw upon the Keauhou ASYA and any new potable well withdrawals from this groundwater aquifer must consider potential adverse effects to the downgradient brackish basal groundwater lens. The Keauhou ASYA has been and continues to be carefully monitored as the Kona area has grown rapidly and been urbanized beginning in the late 1900s, which led to the diminishing of resources, including water. As of June 2022, the existing groundwater pumpage within the Keauhou ASYA is 14.452 million gallons per day (MGD), which constitutes approximately 38% of the total sustainable yield. The Master Plan Update is estimated to demand approximately .107 MGD, which will increase the total groundwater pumped within the Keauhou ASYA by less than 1%. Past and continued monitoring of DWS' inland potable wells have shown no adverse effects to basal groundwater and it is not anticipated withdrawal of water at either of the two identified locations will affect the flowrate and salinity of the brackish basal lens in the nearshore area due to the fresh water body at depth below salt water. Additionally, the total increase in demand is not anticipated to impact the total water availability for the County or impact the Department of Hawaiian Home Lands' ability to provide water its homesteads. Although the total increase in demand is not anticipated to affect groundwater resources, to offset the increase in demand, water meters, similar to those installed throughout the Existing Campus, will be installed throughout the Petition Area to detect leaks and monitor water consumption rates. Xeriscape landscaping techniques will also be integrated into the landscape design. An additional potable well will provide water for future growth and urban activities in the North Kona area, as a portion of the water from the well will be dedicated to the County.

Due to the location of the identified well sites, which sit approximately 4.5 and 5 miles from the Kaloko-Honokōhau National Park, and the amount of water needed to support the Master Plan Update, it is not anticipated that the drawing of water at these two sites will affect freshwater flow to the coastline at the National Park or within the nearby vicinity of the National Park, or affect biota and Native Hawaiian traditional and customary practices.

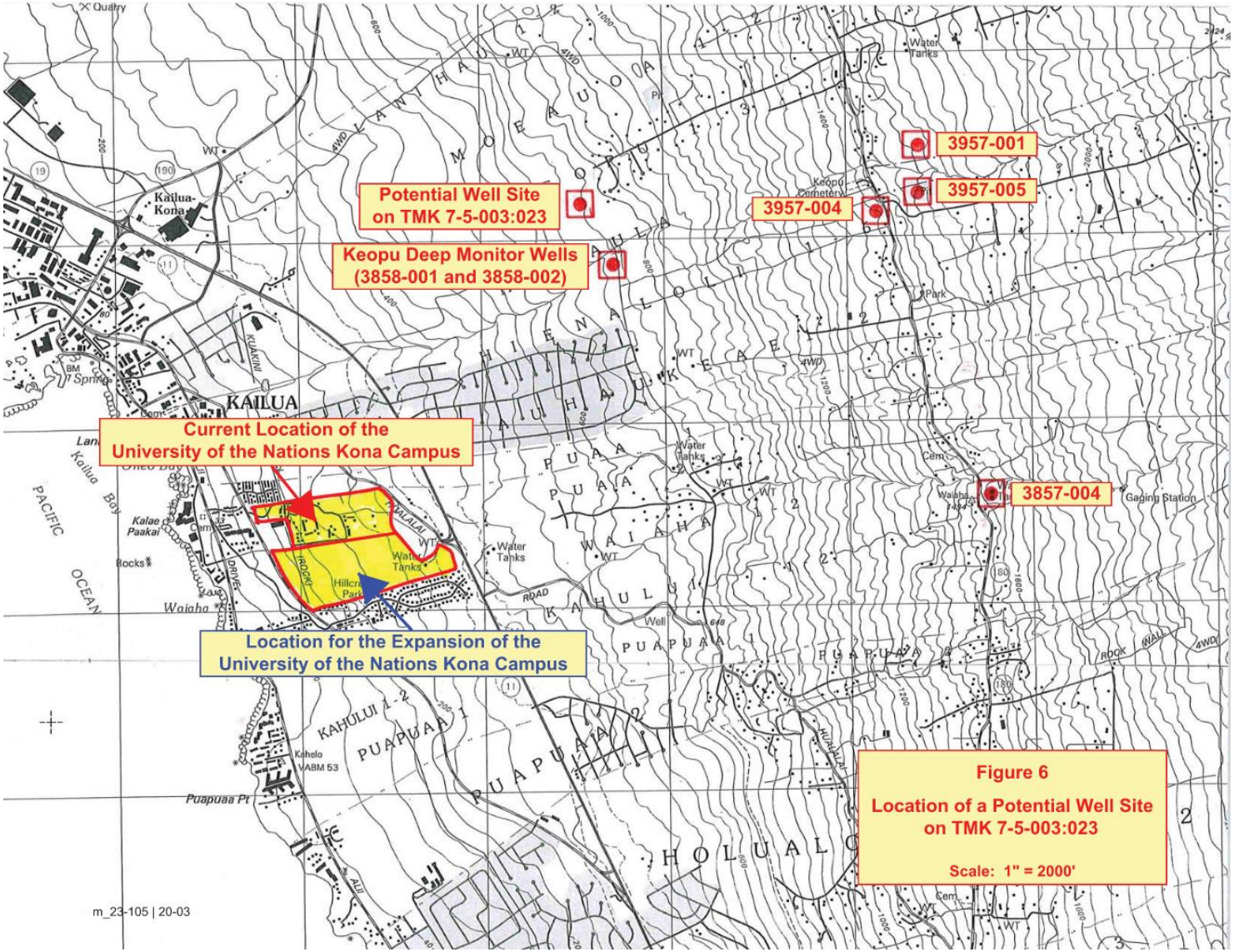

Figure 4-5 **Location of Wheelock Well**

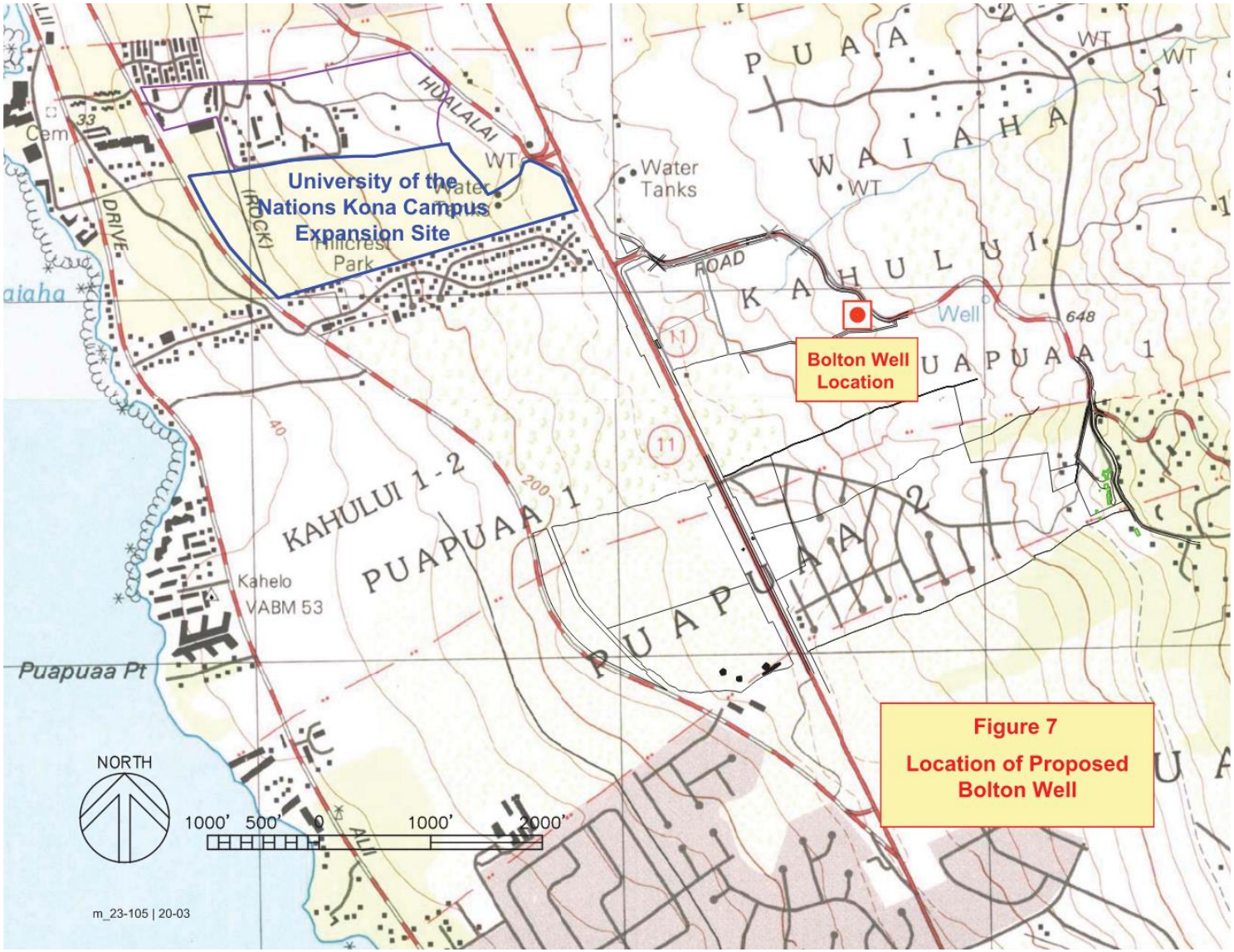

Figure 4-6 **Location of Bolton Well**

4.6 Natural and Manmade Hazards

4.6.1 Earthquakes

Existing Conditions

On Hawai'i Island, the majority earthquakes are linked to volcanic activity and the movement of magma within the Kīlauea Volcano or Mauna Loa Volcano. Other earthquakes are the result of exerted pressures released by magma that never reaches the surface. 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. Most recently, a 4.8 magnitude earthquake occurred on February 14, 2023 off the southeast coast of Hawai'i Island. 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).

Potential Impacts and Mitigation Measures

Hawai'i Island is at risk for high magnitude earthquakes with volcanic activity from the Kīlauea Volcano and Mauna Loa Volcano. Buildings and facilities to support the Master Plan Update will comply with applicable building code standards as set forth in Chapter 5 of the Hawai'i County Code to mitigate potential building damage that may be caused by seismic activity. Staff will receive proper training to assist students and others on campus in the event of an earthquake. The Master Plan Update is not anticipated to increase the seismic vulnerability within the Kailua-Kona region.

4.6.2 Lava Hazards

Hazard zones from lava flows are based mainly on the location and frequency of both historic and prehistoric eruptions. "Historic eruptions" include those for which there are written records, beginning in the early 1800's, and those that are known from oral traditions of native Hawaiians. Knowledge of prehistoric eruptions is based on geologic mapping and dating of the old flows of each volcano. The USGS divided and mapped Hawai'i Island in nine hazard zones according to the level and degree of potential lava flow hazards.

Existing Conditions

Based on the USGS mapping of lava flow hazards, the Petition Area is within lava hazard Zone 4 (*Figure 4-7)*, indicating a moderate hazard. Zone 4 includes all of the Kailua-Kona region and the entire 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 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. Based on the probability of lava flows in Zone 4, there is a low concern for lava affecting the Petition Area.

Potential Impacts and Mitigation Measures

Although Hawai'i Island is at risk of lava flow hazards from the Kīlauea Volcano and Mauna Loa Volcano, the Petition Area does not lay within the rift zones of the current active volcanoes. Additionally, Hualālai Volcano is considered dormant and was last active over 200 years ago. It is not anticipated the Master Plan Update will increase the area's vulnerability to lava flow hazards. Due to the location of the U of N Kona, the U of N Kona may be used as an evacuation site or shelter in an emergency.

4.6.3 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. Once categorized as a hurricane, the intensity of the hurricane is measured by the Saffir-Simpson Hurricane scale. The scale ranges from category 1 (low) to 5 (high). Tropical storms are categorized as an organized system of strong thunderstorms with defined circulation and maximum sustained winds of 33 to 63 knots (39 to 73 mph) (NOAA, 2015). Tropical depressions are systems of clouds and thunderstorms with wind speeds of up to 38 mph (NOAA, 2015).

Existing Conditions

Hurricanes are considered to be relatively rare events throughout the Hawaiian Islands. Records show that strong windstorms 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). Hurricane Iniki (1992) was the strongest and most destructive hurricane to hit the Hawaiian Islands, with major impacts to the Island of Kaua'i. Wind speeds were recorded at 130 mph with gusts reaching 160 mph. Approximately 13,000 homes were damaged.

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 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.

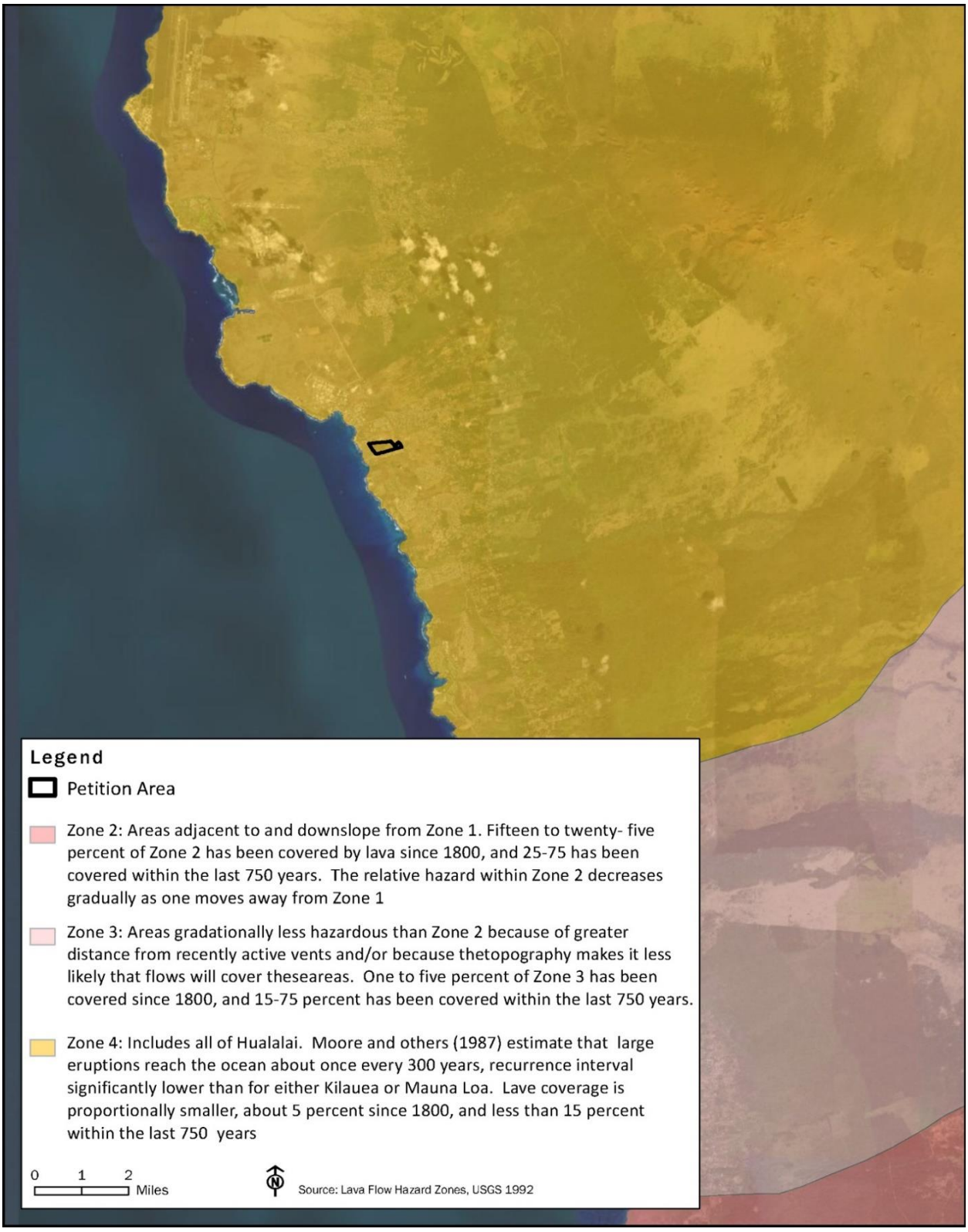

Figure 4-7 **Lava Hazards**

Potential Impacts and Mitigation Measures

Although the Petition Area has not been directly impacted by a major hurricane or tropical storm, the future threat of hurricanes in the area cannot be estimated beyond the fact that hurricanes and tropical storms will most likely continue to frequent the Hawaiian Islands. Buildings and facilities will comply with applicable building code standards as set forth in Chapter 5 of the Hawai'i County Code. Staff members will receive proper training to assist students and others on campus if a hurricane or tropical storm watch or warning is issued. The Master Plan Update is not anticipated to increase the area's vulnerability to hurricane events or tropical storms. The U of N Kona may also be used as a shelter in an emergency.

4.6.4 Flooding

Existing Conditions

The Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Maps (FIRM) indicate that the Petition Area is within Zone X (*Figure 4-8)*, which represents areas with minimal flood hazards. Zone X is defined as areas determined to be outside the 500-year flood plain. Areas designated as Zone X are outside of the 0.2 percent annual chance floodplain because these are areas considered to have very low potential for flooding.

Potential Impacts and Mitigation Measures

The Petition Area ranges from 90 to 360 feet above sea level and is located within Zone X, an area designated with a very low potential of flooding. No significant impacts from flooding are anticipated to occur at the Petition Area during the phased construction of the Master Plan Update or upon completion. The Petition Area is not located within a Special Flood Hazard Area, as determined by FEMA. The Master Plan Update will comply with applicable standards articulated in Chapter 27 of the Hawai'i County Code. Additionally, LID measures will be implemented throughout the Petition Area, where feasible, to mitigate potential stormwater runoff generated at the site. The Master Plan Update is not anticipated to increase the area's vulnerability to flood hazards.

4.6.5 Tsunami

Tsunamis are series of long-period sea waves that result from large-scale sea floor displacement associated with large earthquakes below or neath the ocean floor (NOAA, 2018). An estimate reported that 80% of tsunamis are the result of earthquakes. Although it is unknown when the next tsunami will strike, tsunami warning centers are able to detect the earthquakes that may generate tsunamis.

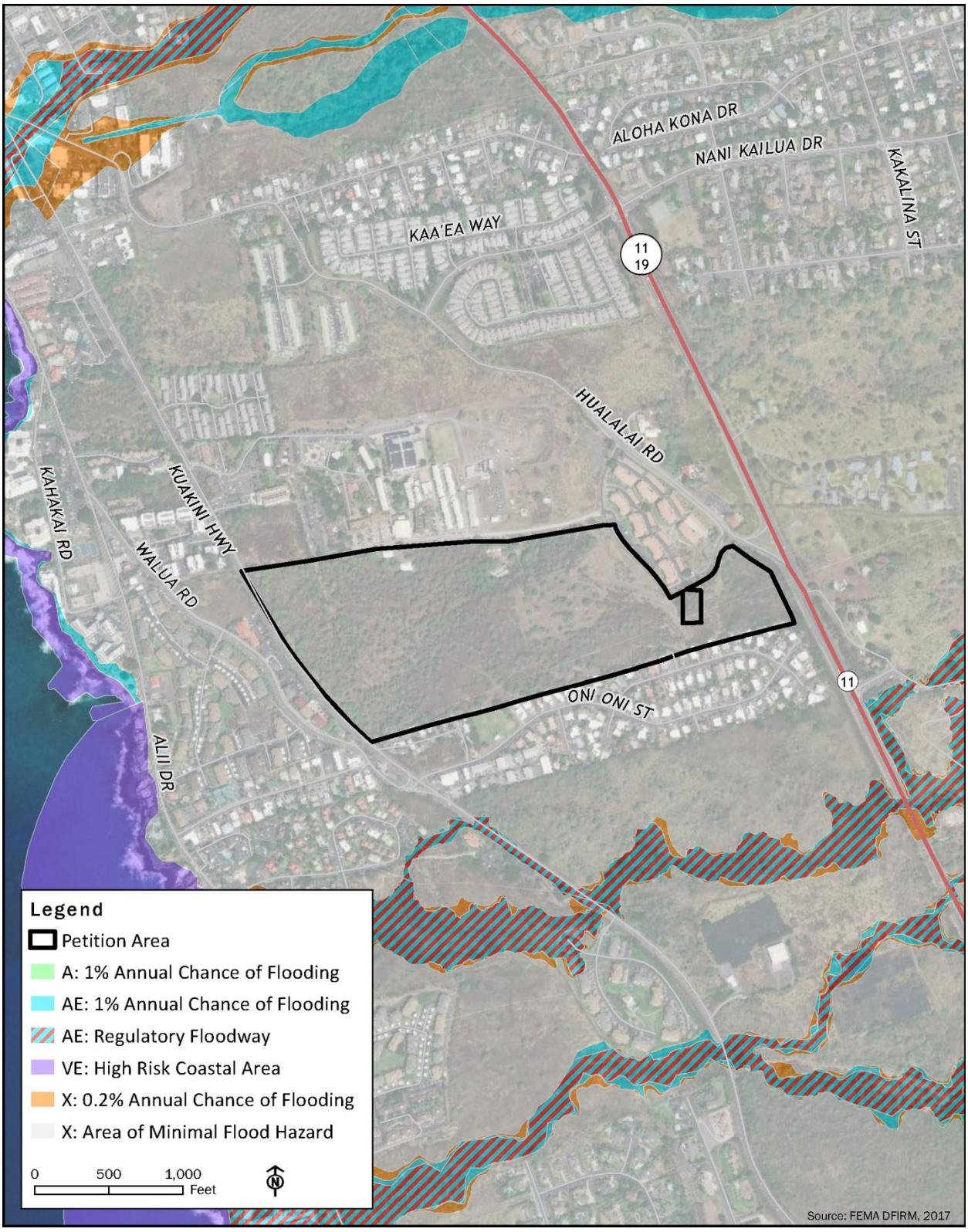

Figure 4-8 **Flood Hazards**

Existing Conditions

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 devastating tsunami that hit the State occurred in 1946. The tsunami came in with no warning as there were no seismological stations on the Hawaiian Islands. There were over 170 recorded deaths on the Island of Hawai'i, mainly in Laupāhoehoe and Hilo where wave heights averaged at 30 feet. The most recent tsunami to impact Hawai'i Island occurred on March 11, 2011, causing property damage at several locations on the Kona coast. The Petition Area is not located within the FEMA designated Tsunami Inundation Zone (*Figure 4-9*).

Potential Impacts and Mitigation Measures

In general, all coastal areas of the Island of Hawai'i are vulnerable to hazards from a tsunami. Although the Petition Area is located outside the Tsunami Inundation Zone, the proximity to the Tsunami Inundation Zone may prompt evacuation. The U of N Kona will take the appropriate measures to train staff to evacuate students and others on campus in the event of a tsunami. The Master Plan Update is not anticipated to increase the area's vulnerability to tsunami threats.

4.6.6 Wildfires

Existing Conditions

In the State of Hawai'i, wildfires are most prominent in developed areas, alongside roadways, and near infrastructure that abuts undeveloped areas. The majority of wildfires that break out are caused by human error or arson, especially near developed areas, power line right of ways, roadsides, and sprawling dry nonnative grasslands surrounding communities. Once ignited, wildfires can spread rapidly through and around residential areas, threatening both property and life. Wildfires in lesser developed areas, fallow agricultural lands, and in areas of higher elevation can also spread and threaten natural areas and native and protected species. (Hawai'i Wildfire Management Organization, 2016).

The North Kona area is at risk of wildfires due to its terraneous environment covered by highly ignitable invasive grasses, warm weather, and history of human-caused fires. The Hawai'i Wildfire Management Organization developed a Community Wildfire Protection Plan (CWPP) for the North Kona area to bring awareness to the hazards wildfires may have on the community. The CWPP mapped past wildfire incidents in the North Kona area (*Figure 4-10).* Similar to trends of wildfires in the State, majority of wildfire incidents that have occurred in the North Kona area are human-caused and have been ignited along roadsides. Past wildfire incidents reflect that numerous smaller wildfires (less than 100 acres) and several larger wildfires (over 1000 acres) have taken place in the North Kona area.

Within the North Kona area, the Petition Area is located in an area identified as a High Hazard Zone with respect to wildfires (*Figure 4-11*). Due to the warm and dry climate coupled with a history of human-caused wildfires, the majority of the lower lands in North Kona area are in a High Hazard Zone. Historically, five wildfires have been recorded within the nearby vicinity of the Petition Area. All five wildfires were recorded over 10 years ago. One of the wildfires was considered to be a significant wildfire that burned approximately 25 acres. The other four wildfires recorded near the Petition Area burned less than five acres.

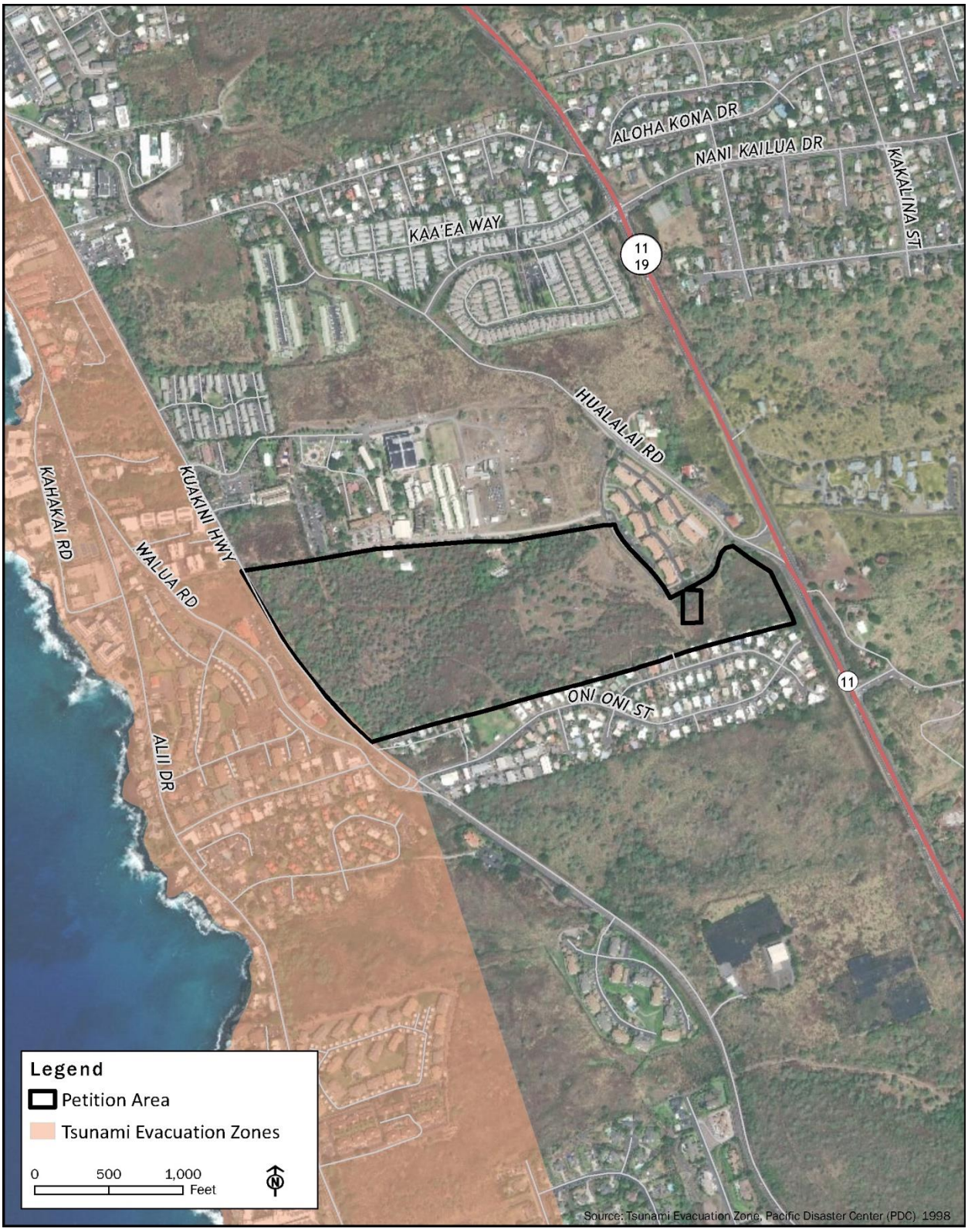

Figure 4-9 **Tsunami Evacuation Zones**

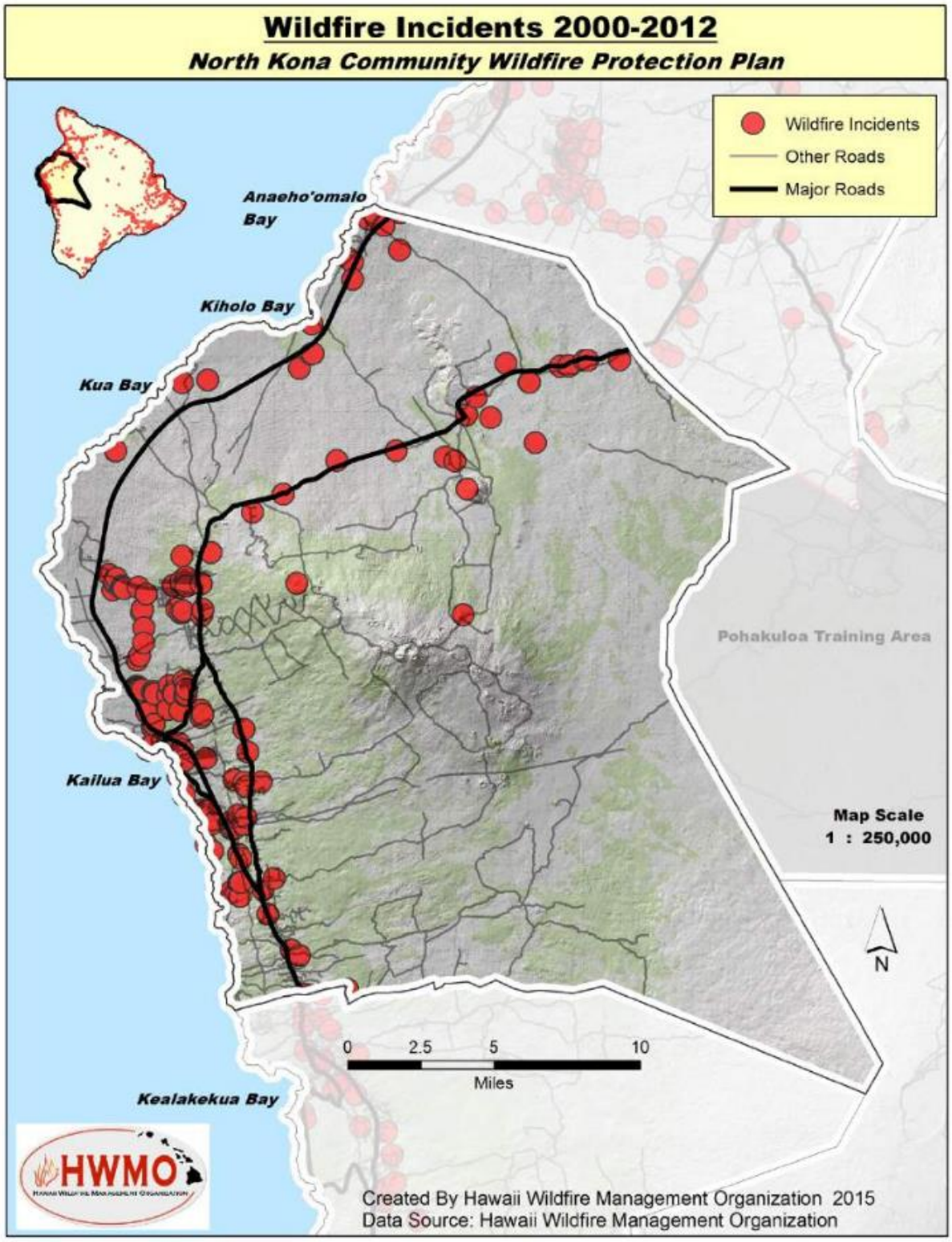

Figure 4-10 **North Kona Wildfire Incident Map**
Source: Hawaii Wildfire Management Organization, 2016

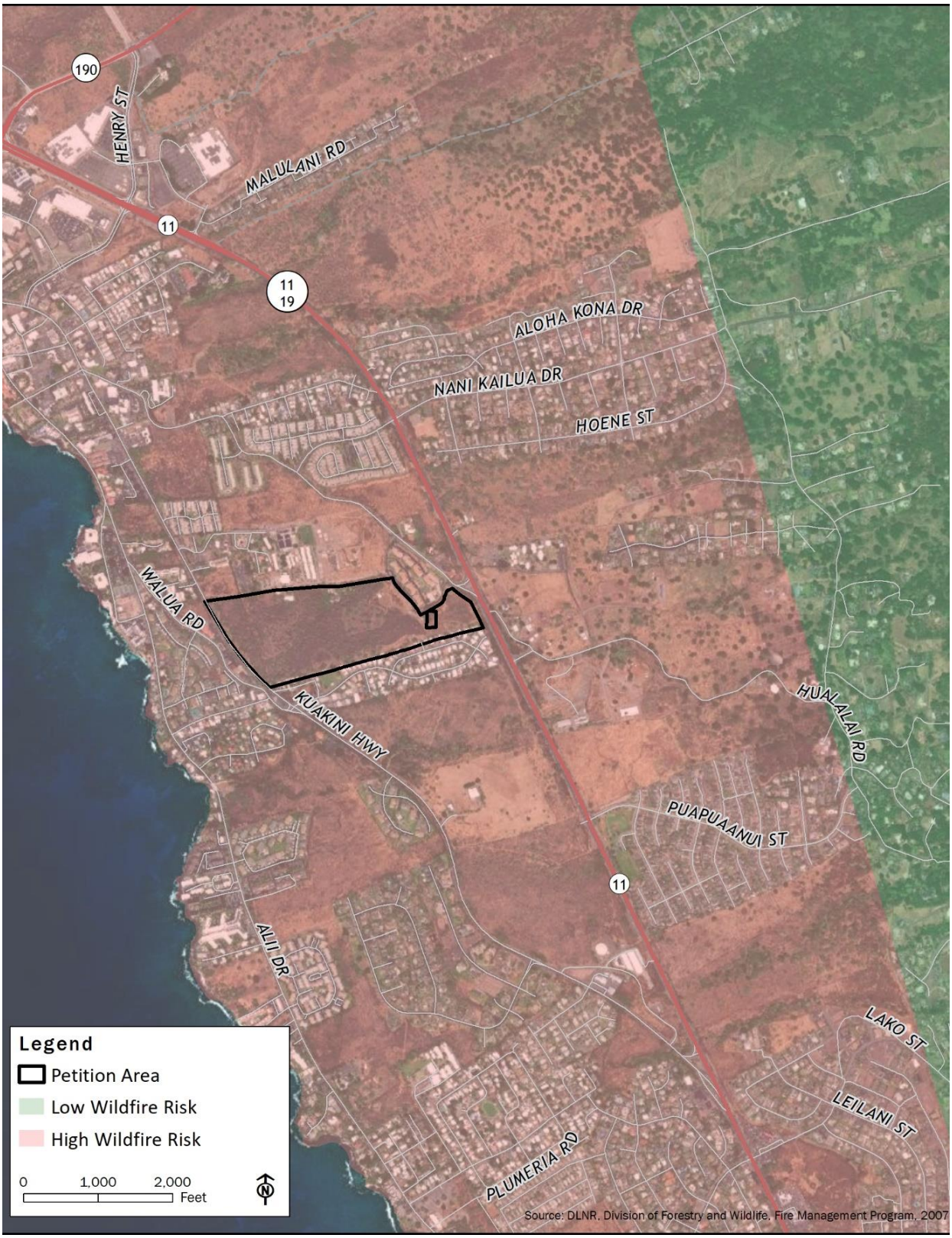

Figure 4-11 **Wildfire Risk Map**

The July 2023 Fire Chief's Report recorded four fires – two brush fires and two structure fires – in the month of July. Of the four fires reported, one brush fire and one structure-related fire were reported in the West Hawai'i response area. The brush fire was located along Highway 190 in Pu'uanahulu and burned approximately one acre. The structure fire took place at a residential property. No injuries or deaths were reported due to the fires.

Potential Impacts and Mitigation Measures

During the phased buildout of the Petition Area, the existing dry and overgrown non-native vegetation on the Petition Area will be cleared, which will reduce the risk for fire ignition and fire spread. Recognizing the high risk of wildfires in the Kailua-Kona region, the Petition Area will be landscaped with native, drought-tolerant plants that will further protect the campus from wildfire ignition and spread. Furthermore, new buildings will comply with all fire code requirements, and roadways throughout the Petition Area will be built in accordance with fire accessibility requirements.

Should any fires breakout during construction, the Hawai'i Fire Department (HFD) will be called immediately to mitigate the risk of a large wildfire. Further discussion regarding HFD services is provided in *Section 4.13.4.* With mitigation measures in place, it is not anticipated that the full buildout of the Petition Area will increase the risk of wildfires in the Kailua-Kona region.

4.6.7 Climate Change and Sea Level Rise

Existing Conditions

Rapid anthropogenic climate change is a well-established fact within the scientific community. 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.

The National Oceanic and Atmospheric Administration (NOAA) recently revised their sea level change projections through 2100 considering up-to-date scientific research and measurements. Mean sea level rise (SLR) scenarios for Hawai'i based on NOAA projections are depicted in *Figure 4-12.* An important conclusion of this regional climate assessment is that NOAA recommends the revised *Intermediate* rate for planning and design purposes in Hawai'i. The *Intermediate* rate projects that sea level in Hawai'i will rise 2.3 feet by 2070. Given the recent upwardly revised projections and the potential for future revisions, consideration may also be given to the *Intermediate-High* rate for planning and design purposes, which projects that sea level in Hawai'i will rise 3.4 feet by 2070.

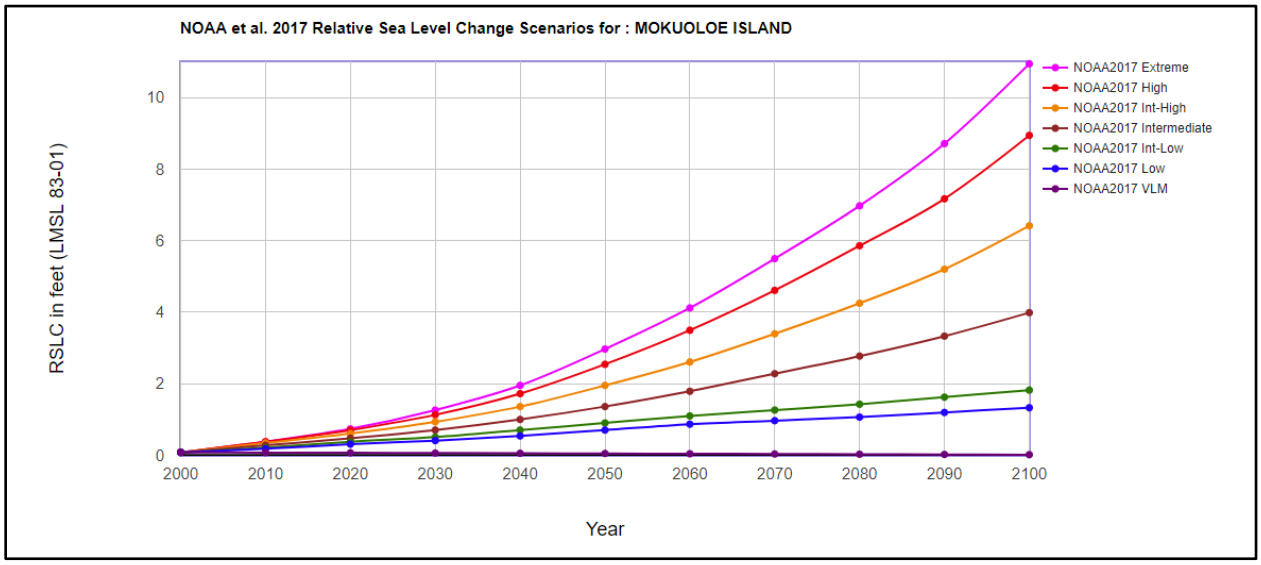

Figure 4-12 **Hawai‘i Sea Level Rise Projections (Adopted from NOAA, 2017)**

In 2017, the Hawai‘i Climate Commission published the Sea Level Rise Vulnerability and Adaptation Report for Hawai‘i, which discusses the anticipated impacts of projected future SLR on coastal hazards, and the potential physical, economic, social, environmental, and cultural impacts of SLR in Hawai‘i (Hawai‘i Climate Change Commission, 2017). The report combines data from the Intergovernmental Panel on Climate Change (IPCC) Assessment Report 5 (IPCC 2014), NOAA, the National Aeronautics and Space Administration, and the best-available peer-reviewed scientific research articles. The IPCC Assessment Report 5 describes possible climate futures based on how much greenhouse gases (GHG) are emitted. The “business as usual” scenario predicts up to 3.2 feet of global SLR by the year 2100. As such, questions remain around the exact timing of that rise due largely to uncertainties around future behavior of Earth’s cryosphere and global GHG emission trajectories. For this reason, it is vital to track the magnitude and rate of SLR as new projections emerge, plan for 3.2 feet of SLR now, and be ready to adjust that projection upward. The Hawai‘i Sea Level Rise Viewer model developed by the University of Hawai‘i Pacific Islands Ocean Observing System (PacIOOS) models the potential impacts that a 3.2-foot rise in sea level would have on coastal hazards, include passive flooding, annual high wave flooding, and coastal erosion. The footprints of these three hazards were combined to define the projected extent of chronic flooding due to SLR, referred to as the Sea Level Rise Exposure Area (SLRXA) (PacIOOS, 2018).

The Existing Campus and Petition Area are located mauka of Kuakini Highway, outside the 3.2-foot SLRXA (*Figure 4-13)*, and at low risk of being affected by rising sea levels.

Potential Impacts and Mitigation Measures

Although the Petition Area will not be directly impacted by 3.2-feet of sea level rise, green building design strategies will be implemented, where feasible. Green building design strategies may include but are not limited to, water and energy saving features, and implementing photovoltaic panels and green roofs. Additionally, LID measures are also planned for the Master Plan Update, which include xeriscape landscaping techniques and permeable pavements and sidewalks. Incorporating green building design strategies will help reduce the carbon footprint of the U of N Kona, which in return has an effect on future climate conditions. A breakdown of GHG emissions projected with the Master Plan Update is further discussed in *Section 4.7.*

Figure 4-13 **3.2-Foot Sea Level Rise Exposure Area**

4.7 Air Quality and Greenhouse Gases

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 (O_3), particulate matter smaller than 10 microns (PM_{10}), particulate matter smaller than 2.5 microns ($PM_{2.5}$), sulfur oxides (SO_X), and lead (Pb). The State DOH, Clean Air Branch (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 (H_2S), which is a common odorous pollutant associated with wastewater treatment facilities.

Existing Conditions

Air quality in the State is generally characterized as relatively clean and low in pollution. DOH CAB regularly samples ambient air quality at monitoring stations throughout the State, and publishes this information annually. According to the Annual Summary 2022 Hawai'i Air Quality Data, data taken from air monitoring stations throughout the State indicate criteria pollutant levels remain below Federal and State ambient air quality standards (State of Hawai'i, DOH, 2022).

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 ambient 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 volcanic emissions (vog) from Kīlauea Volcano. Vog is comprised mainly of water vapor (H_2O), carbon dioxide (CO_2), and sulfur dioxide (SO_2), and may hang over the Petition Area depending on the wind direction. Kīlauea Volcano can emit anywhere between 500 to 14,000 metric tons of sulfur dioxide (SO_2) per day during periods of sustained eruption. During the 2018 eruption at Kīlauea's Lower East Rift Zone, SO_2 emissions were over 100,000 metric tons per day. High rates of SO_2 emissions may result in voggy conditions, which lead to an increase in air pollution.

Potential Impacts and Mitigation Measures

A greenhouse gas analysis was conducted using the California Emissions Estimator Model (CalEEMod) to analyze the potential increase of GHG emissions that may be produced with the Master Plan Update. The full greenhouse gas analysis is located in *Appendix E*.

Construction related activity during the phased build out of the Master Plan Update is anticipated to generate short-term impacts to air quality. Construction-related activity includes clearing, grading, excavation, concrete work, stockpiling, and transport of building materials and construction spoils and debris. Over a 30-year construction period, it is estimated project construction will produce approximately 114,000 metric tons of CO_2 emissions or roughly 3,800 metric tons of CO_2 emissions annually. Annual global CO_2 emissions estimate the construction industry accounts for approximately 6% of global CO_2 emissions or roughly 2.3 gigatons of CO_2 emissions annually.

The impacts of GHG emissions are inherently indirect and cumulative, when comparing the annual amount of emissions generated from construction for the Master Plan Update to the annual global amount of emissions produced by the construction industry. GHG emissions generated from the construction of the Master Plan Update is not anticipated to significantly contribute to the total annual amount of CO_2 emissions generated by the construction industry.

Although construction is temporary, U of N Kona will source materials locally, as supply allows, to reduce emissions generated from the transportation of goods and materials. Additionally, U of N Kona may recycle and reuse construction materials from renovation or demolition of other projects in the nearby vicinity. Short-term construction related activity will comply with provisions of the State DOH's Ambient Air Quality Standards, HAR §11-59 relating to Ambient Air Quality Standards and HAR §11-60.1-33 relating to Fugitive Dust.

As recommended by the CAB, a dust control management plan will be developed prior to the start of the construction period. The dust control management plan will identify and outline mitigation measures for dust associated with construction related activity. The full build out of the Master Plan Update is planned in three (3) phases to minimize the amount of airborne, visible fugitive dust-generating materials and activities. BMPs will be implemented and may include, but not be limited to, locating potential dust-generating equipment in areas of the least impact, minimizing airborne and visible fugitive dust from shoulders and access roads, and controlling airborne and visible fugitive dust from debris being hauled away from the Petition Area.

Using the CalEEMod, GHG emissions associated with the Master Plan Update were projected. Upon completion of the Master Plan Update and over the next 100 years, it is anticipated operations at the Petition Area will produce approximately 17,625 metric tons of CO_2 emissions annually. Although the Master Plan Update will contribute to an increase in GHG emissions, at a local and global scale, impacts of GHG emissions are inherently indirect and cumulative. It is not anticipated the Master Plan Update will substantially increase GHG emissions that may cause or contribute to any appreciable impact to local or regional air quality. Furthermore, U of N Kona will implement measures to reduce GHG produced at the U of N Kona. Sustainable measures to mitigate GHG emissions produced at the U of N Kona will include the expansion of solar energy production throughout the Petition Area with the implementation of solar PV panels on buildings, implementation of low flow plumbing fixtures; and buildings designed to achieve Leadership in Energy and Environmental Design (LEED) objectives.

4.8 Biological Resources

A *Natural Resources Survey for the University of the Nations Expansion Property* was prepared by AECOS, Inc. in January 2020 (*Appendix F).* Previously, a biological survey of the Petition Area was prepared 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 or animal species were identified or were expected to be identified at the Petition Area. For the updated survey, the entire Petition Area was re-surveyed, and a bird and mammal survey was conducted. A map of the Petition Area was loaded on a Trimble 6000 Series GNSS unit providing real time feedback on location and adequacy of coverage during the pedestrian survey. Findings from the 2002 and 2020 survey are presented below.

4.8.1 Botanical Resources

Existing Conditions

The upper portion of the Petition Area is covered by a mixture of scattered kiawe (*Prosopis pallida*) and short-stature koa haole (*Leucaenaleucocephala*), with moderately dense Guinea grass (*Megathyrsus maximus*). Portions of the Petition Area that have been disturbed mainly contain koa haole and areas of dense herbaceous coffee senna (*Senna occidentalis*) and ʻuhaloa (*Waltheria americanas*) (*Figure 4-14).* Four native (indigenous) plants were recorded during the survey: ʻilima (*Sida fallax*), ʻuhaloa (*Waltheria indica*), ʻilieʻe (*Plumbago zeylanica*), and a common sedge (*Cyperus polystachyos*). All four native plantings are widespread across Hawaiʻi and are of no conservation concern. *Appendix F* contains a full list of the plant species observed in the 2020 survey as well as the 2002 survey.

Results from the 2020 survey were compared to the 2002 survey. The 2002 survey identified 35 plant species, whereas the 2020 survey identified 49 species. Although the 2002 survey provides no indication of qualitative abundance, 15 (43%) of the recorded plant species identified in the 2002 survey were not recorded in the 2020 survey. The 2020 survey indicated a higher percentage (61%) of "rare" plant species, meaning a plant species was encountered no more than two or three times over the course of the survey. Unlike the 2020 survey, the 2002 survey identified Christmasberry and weeping fig trees that presumably could still be present and rare on the site. It is not unusual that the 2002 and 2020 surveys differed as species are likely to change over time. Moreover, not all rare species are going to be encountered in a pedestrian survey.

The 2020 survey did not identify plant species that are currently protected or proposed for protection under either the federal or State of Hawaiʻi endangered species programs.

Potential Impacts and Mitigation Measures

Short-term construction related activity will involve clearing and preparing the site. The plant species identified in the 2002 and 2020 survey are consistent with those found in urban environments, which are common non-native introduced species and scattered weedy growth. Clearing the Petition Area is not anticipated to adversely affect threatened or endangered plant species. To avoid the unintentional introduction or transportation of invasive plant species during the short-term construction period, construction equipment, materials, and personnel will be cleaned of excess soil and debris to minimize the risk of spreading invasive species. The plan for the Petition Area has been revised to fulfill the long-term vision of the U of N Kona and to reduce extensive grading. As much as possible cut material from grading will remain on-site and the amount of cut and fill will be balanced to minimize the need to import fill or to export excavated material. Balancing cut and fill material will minimize the movement of soils from off-site locations that may contain invasive fungal pathogens or invasive plant parts that could harm the native ecosystem.

The plan for the Petition Area has been revised to better integrate the campus into the Kailua-Kona region. As such, the revised plan incorporates large green and open spaces that will be landscaped with native plantings and landscaping elements representative of the natural and cultural landscape. Xeriscape techniques will also be included in the landscape to reduce the risk of wildfire and to complement the dry climate of the Kailua-Kona region. Fully built out, the Master Plan Update will improve the existing landscape and complement the Kailua-Kona region.

Figure 4-14 **Vegetation Covering the Petition Area (Source: AECOS, 2020)**

4.8.2 Bird Species

Existing Conditions

A bird and mammal survey was conducted as part of the 2020 Natural Resource Study. Eight equidistant avian point in count stations were established. A single eight-minute avian point-count was made at each of the eight stations using Leica 8 x 42 binoculars. Additionally, the entire Petition Area was surveyed for species and habitats not detected during station counts.

The survey recorded a total of 349 individual birds of 21 avian species. Four species (the Japanese White-eye (*Zosterops japonicus),* Zebra Dove (*Geopelia striata)*, Java Sparrow (*Lonchura oryzivora),* and Saffron Finch (*Sicalis flaveola))* accounted for 50 percent of all birds recorded. The most frequently recorded species was the Japanese White-eye, which accounted for 19 percent of the total number of individual birds recorded.

The Hawaiian Hawk (*Buteo solitarius*), which is listed as an endangered species, was observed flying over the Petition Area. Effective February 3, 2020, the Hawaiian Hawk has been delisted as an endangered species by the USFWS but it remains listed by the State of Hawai'i and protected under the Migratory Bird Treaty Act.

Findings from the bird survey are consistent with the location of the Petition Area and the vegetation present. All but one of the species recorded during the survey are alien to the Islands. The remaining species recorded are all commonly occurring, established alien species.

Potential Impacts and Mitigation Measures

Prior to the start of construction, the Petition Area will be surveyed to ensure Hawaiian Hawk nests are not present at the site. If Hawaiian Hawk nests are found, construction activity will cease, and the Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW) will be notified.

Although not detected during the survey, Hawaiian Petrel (*Pterodroma sandwichensis),* Band-rumped Storm Petrel (*Hydrobates castro),* and Newell's Shearwater (*Puffinus newelli)* may over-fly the Petition Area between April and November, each year. The petrel and storm-petrel are listed as endangered, and the shearwater as threatened under both federal and State of Hawai'i endangered species statutes. The primary cause of mortality for these three ground nesting seabirds is thought to be predation by alien mammalian species at nesting colonies (USFWS, 1983; Simons and Hodges, 1998; Ainley et al., 2001). Collision with man-made structures is the second most significant cause of mortality of these seabirds. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. When disoriented, seabirds can collide with man-made structures and, if not killed outright, dazed or injured birds become pretty to feral mammals. Neither nesting colonies nor appropriate nesting habitat for the Hawaiian Petrel, Band-rumped Storm Petrel, and Newell's Shearwater occur within or near the Petition Area.

Short-term construction related activity will be limited to daytime hours and will not occur throughout the night to mitigate the need for lighting that could potentially disorient seabirds. If nighttime construction activity or equipment maintenance is needed, lighting will be shielded and placed high enough to allow lights to be pointed directly at the ground. Lighting that is installed as part of the buildout of the Petition Area will be shielded and in compliance with Hawai'i County Code § 14-50, which requires the shielding of exterior lights to lower ambient glare reaching the astronomical observatories located on Mauna Kea and to minimize disorientation and downing of seabirds. The Master Plan Update is not anticipated to increase threats to endangered or threatened bird species.

4.8.3 Mammalian Species

Existing Conditions

The mammal survey recorded five mammalian species, all of which are deleterious to native ecosystems and the native faunal species dependent on them. No Hawaiian hoary bats or ʻōpeʻapeʻa (*Lasiurus cinereus semotus)*, or species currently proposed for listing or listed under the federal or State of Hawaiʻi endangered species statutes were detected during the course of the survey. It is likely that the Hawaiian hoary bat forages over the Petition Area on a seasonal basis. However, the current vegetation covering the Petition Area is not typical of that in which one would expect to find roosting Hawaiian hoary bats.

Although no rodents were recorded during the course of the survey, it is likely that one or more of the four established alien Muridae found on the Island of Hawaiʻi – European house mouse (*Mus musculus domesticus),* roof far (*Rattus rattus),* brown rat (*Rattus norvegicus),* and black rat (*Rattus exulans hawaiiensis)* – use various resources within the general vicinity of the Petition Area on a seasonal basis. These human commensal species are drawn to areas of human habitation and activity. All of these introduced rodents are deleterious to native ecosystems and the native faunal species dependent on them.

Potential Impacts and Mitigation Measures

The findings of the mammalian survey are consistent with the location and vegetation of the Petition Area. It is not anticipated the Master Plan Update will threaten the Hawaiian hoary bat as the current vegetation covering the Petition Area is not suitable or preferred for the species to roost in.

Although not detected during the survey, the Federal and State listed Blackburn's Sphinx Moth (BSM) (*Manduca blackburn)* has a historic range of encompassing the Petition Area. Larvae of the moth feed on many non-native hostplants including tree tobacco (*Nicotiana glauca)* which is known to grow in disturbed soils. Although tree tobacco was not present during the course of the survey, before the clearing of non-native vegetation, the area will be surveyed to ensure tree tobacco is not present. Should tree tobacco be present, DLNR DOFAW will be contacted to determine proper inspection for the presence of the BSM.

The Master Plan Update is not anticipated to have an adverse effect on mammalian species. Stray and domestic animals will most likely continue to pass through the Petition Area during and after the buildout of the Master Plan Update.

4.8.4 Protected Species and Critical Habitats

Existing Conditions

With one exception, as discussed in *Section 4.7.2,* no plant or animal species currently protected or proposed for protection under either the federal or state endangered species programs were detected at the Petition Area during the course of the survey. Additionally, no federally delineated Critical Habitat for any species on, or close to, the Petition Area were identified during the course of the survey.

Potential Impacts and Mitigation Measures

Neither short-term construction related activity nor the full buildout of the Master Plan Update are anticipated to adversely affect federal or state listed endangered species or federally delineated Critical Habitat.

4.8.5 Jurisdictional Waters

Existing Conditions

No wetlands or streams that may raise an issue of federal jurisdiction (waters of the U.S.) were detected throughout the course of the survey of the Petition Area.

Potential Impacts and Mitigation Measures

No short-term or long-term adverse effects to wetlands or streams are anticipated with the Master Plan Update. No further mitigation is proposed.

4.9 Noise

An *Acoustic Study for the University of the Nations Kona, Kona, Hawai'i (Appendix G)*. was completed in support of the Master Plan Update. The Acoustic Study assessed potential impacts from existing and future traffic related noise as well as potential impacts from activities at the U of N Kona.

Existing Conditions

Traffic and background ambient noise measurements were obtained in May 2023 at seven different locations at and in the surrounding area of the Petition Area (*Figure 4-15).* Existing background ambient noise levels at the Petition Area are largely attributed to birds and intermittently loud distance noise sources from aircrafts. Existing background noise levels drop to levels below 50 decibels A (dBA) with steady noise levels at approximately 45 dBA.

Existing traffic noise levels at the Petition Area along Queen Ka'ahumanu Highway are in the "Significant Exposure, Normally Unacceptable" category, and at or greater than 65 Day Night Average Sound Level (DNL) at the first row of existing homes within approximately 140 feet from the centerline and on the mauka and makai sides of the Highway. Along Kuakini Highway, where the majority of front row receptors are commercial or resort use, existing traffic noise levels are in the "Moderate Exposure, Normally Acceptable" category at distances beyond 68 to 82 feet from the centerline of that roadway. The existing traffic noise levels at the Petition Area along Hualālai Road are also in the "Moderate Exposure, Normally Acceptable" category and less than 65 DNL 13 to 18 feet from that roadway's centerline.

Further northwest of the U of N Kona, noise levels affecting the Kama'āina Hale Apartments likely exceed the Federal Highway Administration (FHA)/Housing and Urban Development (HUD) 65 DNL standard. Exceedances of the 65 DNL standard probably occur across Kuakini Highway. Existing traffic noise levels also exceed the FHA/HUD 65 DNL standard at the intersection of Nani Kailua and Queen Ka'ahumanu Highway.

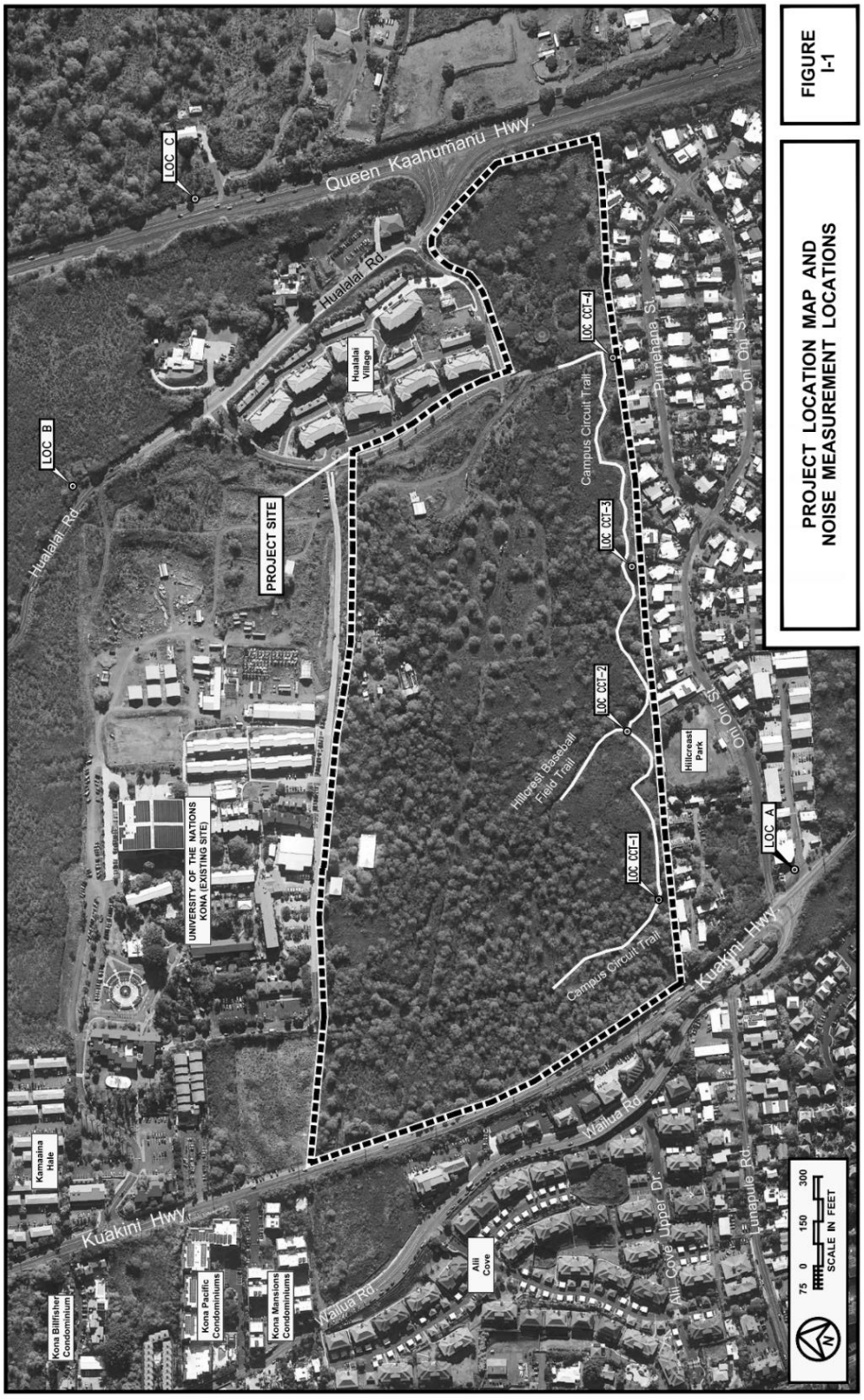

Figure 4-15 **Noise Measurement Locations (Source: Acoustic Study for the University of the Nations, Kona, 2023)**

Potential Impacts and Mitigation Measures

Temporary noise impacts may occur during construction of the Master Plan Update, particularly during earth moving activities. The quality of the acoustic environment may be degraded to unacceptable levels during periods of construction. However, adverse impacts from construction related activity is not anticipated to be in the "public health and welfare" category due to the temporary nature of construction, and due to the administrative controls available for regulation of construction noise. Mitigation measures to reduce adverse impact from construction noise include use of properly muffled construction equipment and compliance with State DOH construction noise regulations. Construction will not occur on Sundays and holidays, during the early morning, and during the late evening and nighttime periods.

Upon completion of construction, existing traffic noise levels along Queen Ka'ahumanu Highway and Kuakini Highway are expected to remain the dominant noise sources in the vicinity of the Petition Area. Project related traffic is not anticipated to significantly increase noise levels along Queen Ka'ahumanu Highway or Kuakini Highway. Project related traffic is anticipated to increase by 0.6 DNL along Kuakini Highway; and 0.1 DNL along Queen Ka'ahumanu Highway. The increase in noise levels are not considered to be significant and traffic noise mitigation measures are not proposed. Non-project traffic is anticipated to increase future traffic noise levels by 1 to 2 DNL along Queen Ka'ahumanu Highway and Kuakini Highway, Existing areas where noise levels currently exceed the FHA/HUD 65 DNL standard will remain as such.

The potential noise from activities associated with the Master Plan Update could disturb neighboring residences along the southern boundary of the Petition Area, however it is not anticipated noise levels will exceed the acceptable 55 DNL level. Residences to the south, where background noise levels are relatively low, could be affected by campus activities at the Petition Area. Neighboring residences west of the Petition Area (across Kuakini Highway) are less likely to be affected by campus activities at the Petition Area due to the larger buffer distance and higher background noise levels associated with traffic along Kuakini Highway. Predicted DNL levels from campus activities at the Petition Area are presented in *Table 4-1*. The DNL values are typically lower than the average noise levels during a period of noisy activity because the DNL metric is based on annually averaged (over the calendar year) sound levels rather than average noise levels during the activity period.

Table 4-1: Comparisons of Measured Background and Normalized Activity DNL Values at Southern Property Boundary

Campus Activity Area	Hours of Active Noise	Activity DNL Value	Total Days of Use Per Year	Average DNL
Lower School Play Field	3.96	58.4	250	48.9
Lower School Play Field	3.96	58.4	250	48.9
Middle School Play Field	3.96	58.4	250	48.9
High School Play Field	8.00	52.3	300	46.7
Community Athletic Complex	6.00	64.4	300	57.5
Tennis Courts	4.00	52.3	150	40.7

Using the predicted DNL values for campus activities at the Petition Area, DNL values at the four survey locations along the southern boundary of the Petition Area (see *Figure 4-15)* were generated and are presented in *Table 4-2.* DNL values at the four survey locations were compared to measured background noise levels. Where the total normalized DNL values are not at least 5 DNL lower than the background noise levels, neighbors may be affected by noise generated from campus activities at the Petition Area and exceed the Community Threshold and result in a noise complaint as depicted in *Table 4-2*. To mitigate potential impacts to neighbors south of the Petition Area, sound attenuating walls in the vicinity of the Lower School's South Play Field, and High School Practice Field will be further evaluated. Although the Community Athletic Complex is anticipated to generate noise up to 57.5 DNL, due to its location on the northern end of the Petition Area, adjacent to the Spine Road, it is not anticipated noise generated from the Community Athletic Complex will affect neighbors south of the Petition Area. Although neighbors along the southern property boundary may be affected by campus activities, it is not anticipated noise levels will exceed the acceptable 55 DNL level. U of N Kona will notify neighbors that efforts are being made to control noise and ensure the community is aware of any events that may generate noise.

Table 4-2: Comparisons of Measured Background and Normalized Activity DNL Values at Southern Property Boundary

Location	Background Noise DNL	DNL from All Sources	DNL from Outdoor Activities	Threshold Exceeded
CCT-1	47.4	49.7	47 DNL from H.S. Practice Field	Yes
CCT-2	45.4	47.1	44 DNL from H.S. Practice Field	Yes
CCT-3	49.3	50.6	50 DNL from L.S. Play Field	Yes
CCT-4	44.4	38.8	35 DNL from L.S. Play Field	No

4.10 Utilities and Infrastructure

4.10.1 Water

Existing Conditions

The *Preliminary Infrastructure Assessment and Conceptual Infrastructure Master Plan* (*Appendix C)* included an assessment of the water supply at the U of N Kona. The Existing Campus is supplied by water from DWS, but the Petition Area currently is not.

Water is supplied to the Existing Campus from the DWS 325 reservoir. The DWS 325 reservoir supplies water to areas located in elevations ranging from 0 feet to 225 feet above msl in the Kailua-Kona region. The Existing Campus is served by two DWS meters. A 6"x3" master femtometer (FM) meter operated by DWS is located near the existing driveway along Kuakini Highway. This meter connects to a 6" main in Kuakini Highway that supplies water to the Existing Campus. The second meter is an 8"x2" master FM meter located near the top of the existing spine road. This meter connects to an 8" main in the Hualālai Village lower driveway. Both mains are maintained and managed by DWS. Although the 6"x3" meter is assigned to the Existing Campus and the 8"x2" meter is assigned to the Petition Area, both meters are currently supplying water to the Existing Campus. The water system is looped, and the master meters reflect two service connection points to the existing DWS system (*Figure 4-16)*.

Water is distributed throughout the Existing Campus via a system of private water lines. The age of the existing onsite system is not known, but the U of N Kona was founded in the late 1970s and it is therefore assumed that the infrastructure to support the U of N Kona was developed no later than 1980. The 8"x2" meter was installed in 2013 to provide a second point of connection and to maintain adequate pressure and flow for the Petition Area, however supplies water to the Existing Campus.

U of N Kona installed water meters on approximately 17 buildings and 21 irrigation zones throughout the Existing Campus to collect data relative to water consumption. U of N Kona tracked water consumption throughout the Existing Campus and found:

- The average per capita water consumption rate for residents is approximately 30 gallons per capita daily (gpcd) or less.
- The average per capita water consumption rate for daily users is approximately 12 to 14 gpcd.
- The average rate of water utilized for irrigation is approximately 8,600 gpd or 1,000 gallons per irrigated acre.
- The cafeteria consumes approximately 2 gpcd.
- The average water consumption for a resident dorming population of 1,158 averaged approximately 39 gallons per resident per day.

Notably, the installation of water meters throughout the Existing Campus identified leakages contributing to the overall rate of water consumed at the U of N Kona. The identified leakages have been fixed and U of N Kona is currently in conformance with the amount of water allocated from DWS.

Potential Impacts and Mitigation Measures

After installing water meters and tracking water consumption, the U of N Kona requested and was granted approval by DWS to reduce the per capita water demand rate for the Master Plan Update based on the tracking of existing water consumption. *Table 4-3* compares DWS' standard per capita water demand rate and the recently approved per capita rate based on existing water consumption at the U of N Kona.

Table 4-3: Comparison of Per Capita Water Demand

Criteria	Unit	DWS Standard Rate	U of N Kona Adjusted Rate
Residential (including cafeteria)	gpd	80	40
Day Visitors (including K-12 students, staff and volunteers)	gpd	60	20

Based on the future enrollment at the U of N Kona and the approved reduced demand rate as shown in *Table 4-3,* the daily water demand rate was calculated and is shown in *Table 4-4.*

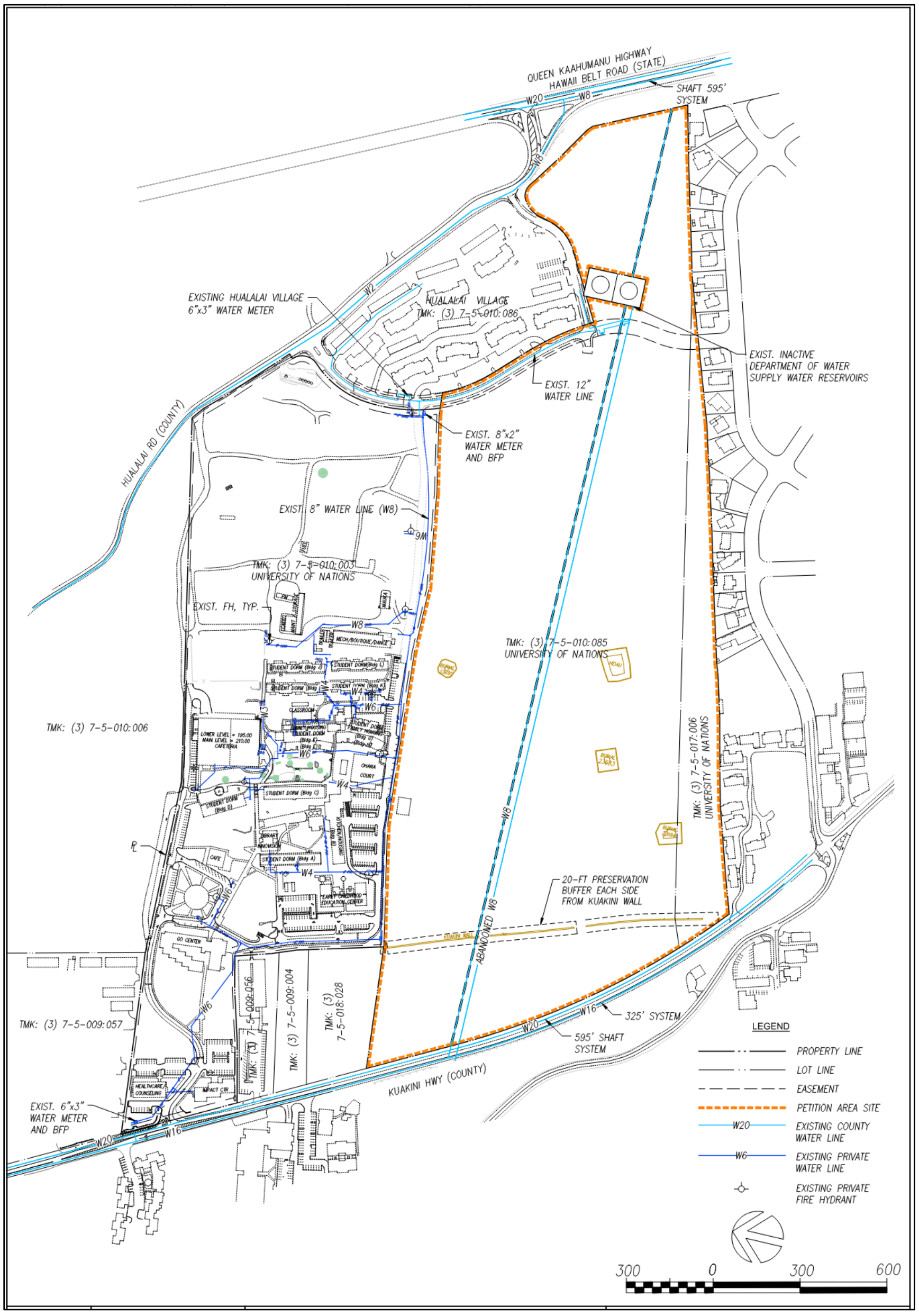

Figure 4-16 **Existing Water Distribution**

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Fully built out, it is anticipated approximately 107,500 gallons of water per day will be needed to support the Master Plan Update. The total projected water demand includes the projected demand for irrigation purposes and U of N Kona submitted a request to DWS to obtain all water, including potable and non-potable from the DWS public water system. To support the Master Plan Update, two potential locations have been identified for a new well and related infrastructure (*Figure 4-5* and *Figure 4-6)*. A discussion of the potential location of a new well is located in *Section 4.5.* To offset the increase in demand, water meters, similar to those installed throughout the Existing Campus, will be installed throughout the Petition Area to detect leaks and monitor water consumption rates. Xeriscape landscaping techniques will also be integrated into the landscape design.

The proposed schematic water distribution for the Petition Area has been designed in accordance with Hawai'i County DWS Water System Standards. Infrastructure improvements are phased based on the phasing of the Master Plan Update shown in *Figure 4-17a* to *Figure 4-17c*. It is recommended the Petition Area be equipped with looped mains, wherever possible, 8-inches in diameter to provide adequate fire flow, with main valves not greater than 500 feet apart and approved fire hydrants not located farther than 300 feet apart. Due to the gap between the upper and lower reservoir service area elevations, a portion of the Petition Area will require a connection to the DWS 595 system, which has service limits of 272 to 502 feet msl. Water service between the limits of the DWS 325 and DWS 595 reservoirs will be served from the upper reservoir via pressure reducing valves.

Table 4-4: Domestic Water Demand

	Current		Phase 1		Phase 2		Phase 3	
	Pop.	**Gallons**	**Pop.**	**Gallons**	**Pop.**	**Gallons**	**Pop.**	**Gallons**
Daily Users								
PK-12 Students	148	2,960	110	2,200	155	3,100	175	3,500
University Students	17	340	11	228	6	116	-	-
Staff	322	6,440	282	5,635	225	4,500	200	4,000
Guests	5	100	3	67	2	34	-	-
Subtotal	492	9,840	406	8,130	387	7,750	375	7,500
Residents								
PK-12 Students	146	5,840	230	9,193	314	12,546	400	16,000
University Students	463	18,520	706	28,248	949	37,977	1,200	48,000
Staff	280	11,200	386	15,424	491	19,648	600	24,000
Guests	20	800	112	4,496	205	8,192	300	12,000
Subtotal	909	36,360	1,434	57,361	1,959	78,362	2,500	100,000
Total Domestic		46,200		65,491		86,112		107,500

Irrigation water requirements are included in the projected water demand shown in *Table 4-4.*

The U of N Kona is in the process of securing the water needed to support the Master Plan Update. Notably, the future water demand for the Keauhou ASYA includes the water needed to support the urban land use designation of the Petition Area, under the previous plan. Furthermore, the location and size of water lines proposed for the Petition Area will be confirmed during final site planning and design. At the appropriate time, a Water Development Agreement will be entered into between the developer of the well and the Water Board An additional potable well will provide water for future growth and urban activities in the North Kona area, as a portion of the water from the well will be dedicated to the County. See *Section 5.6* for further discussion.

4.10.2 Wastewater

Existing Conditions

According to the *Preliminary Infrastructure Assessment and Conceptual Infrastructure Master Plan (Appendix C)*, the existing sanitary system at the U of N Kona discharges wastewater to a sewer manhole on Kuakini Highway, near the existing driveway (*Figure 4-18).* Wastewater is then conveyed to the Kealakehe Wastewater Treatment Plant where it is treated and then discharged to a constructed wetland located immediately south of Honokohau Small Boat Harbor. In September 2023, a lawsuit was filed against the County alleging that the Kealakehe Wastewater Treatment Plant has been operating in violation of the Clean Water Act. The lawsuit seeks injunctive relief requiring the County to comply with the Clean Water Act, including obtaining a NPDES permit, and asks that civil penalties be imposed on the County.

Potential Impacts and Mitigation Measures

In 2019, DEM's Wastewater Division approved a wastewater exemption request to allow U of N Kona to reduce sewer generation rates, conditioned on the installation and reporting of wastewater flows with U of N Kona water meter readings and invoices. Flow measurements from November 2022 to May 2023 suggest that wastewater flows are typically 60% to 80% of water usage. The total projected wastewater flow for the Master Plan Update is shown in *Table 4-5.* The wastewater flow was recently submitted to the Division of Environmental Management's Wastewater Division for review.

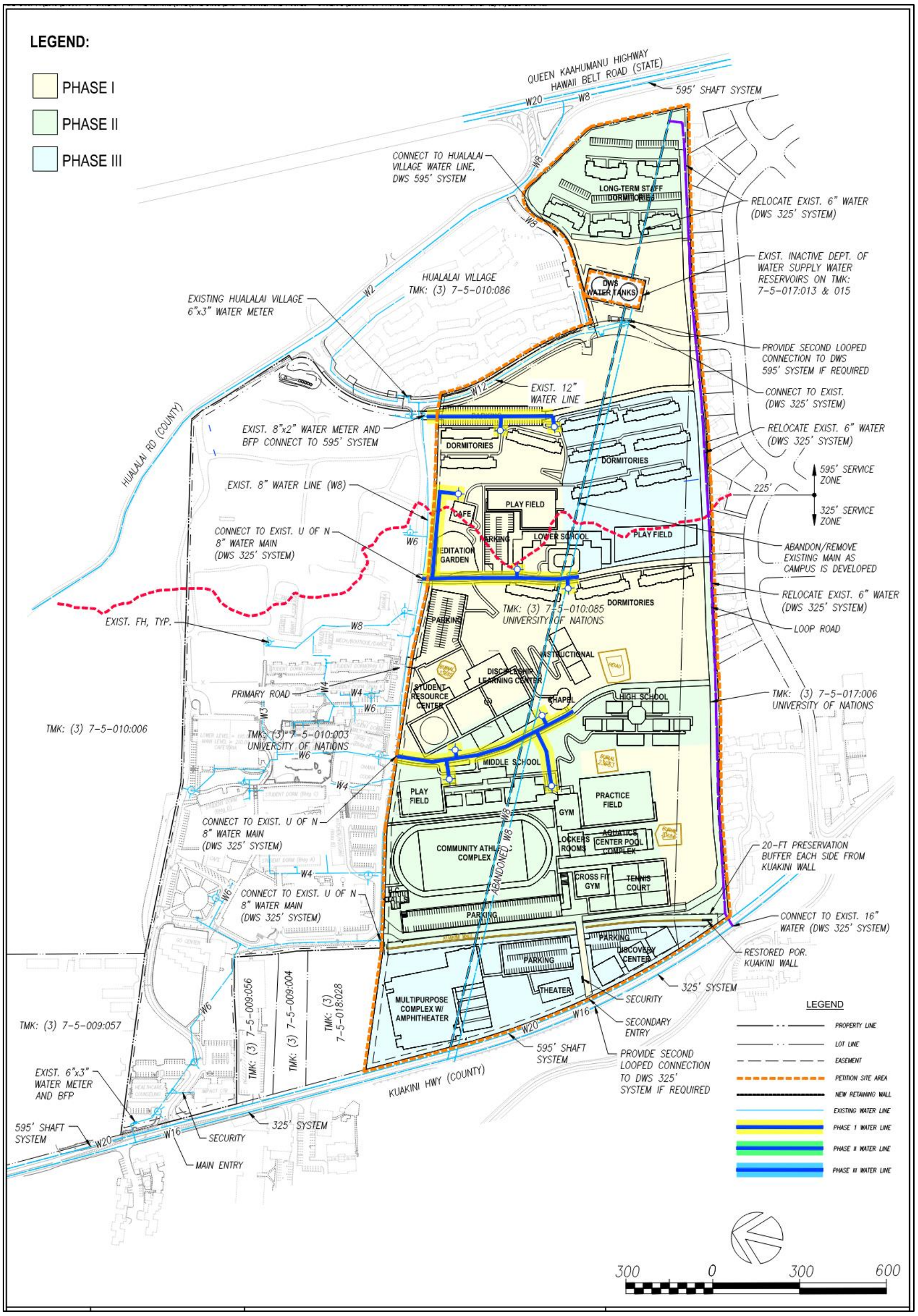

Figure 4-17a **Proposed Water Distribution Phase 1**

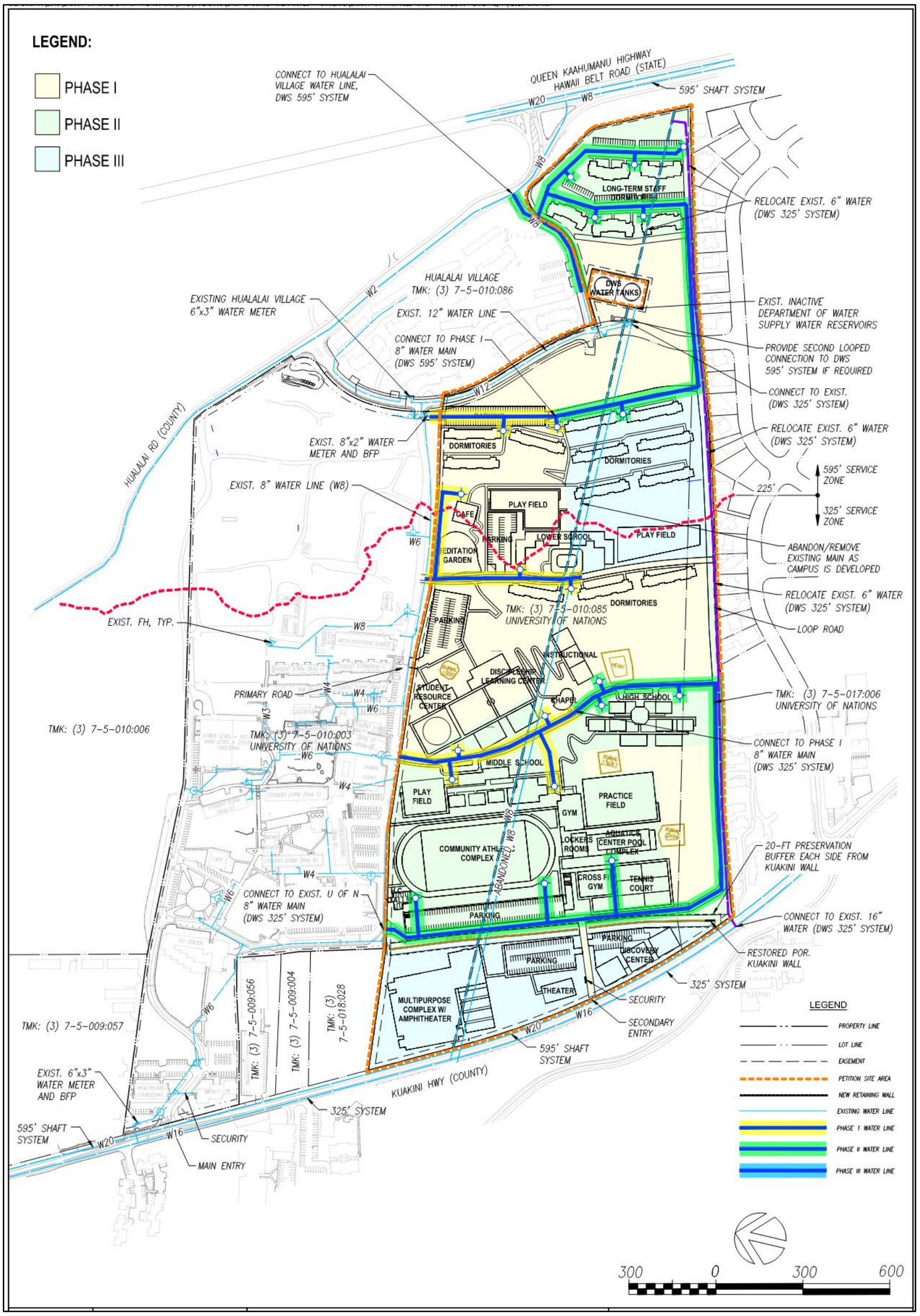

Figure 4-17b **Proposed Water Distribution Phase 2**

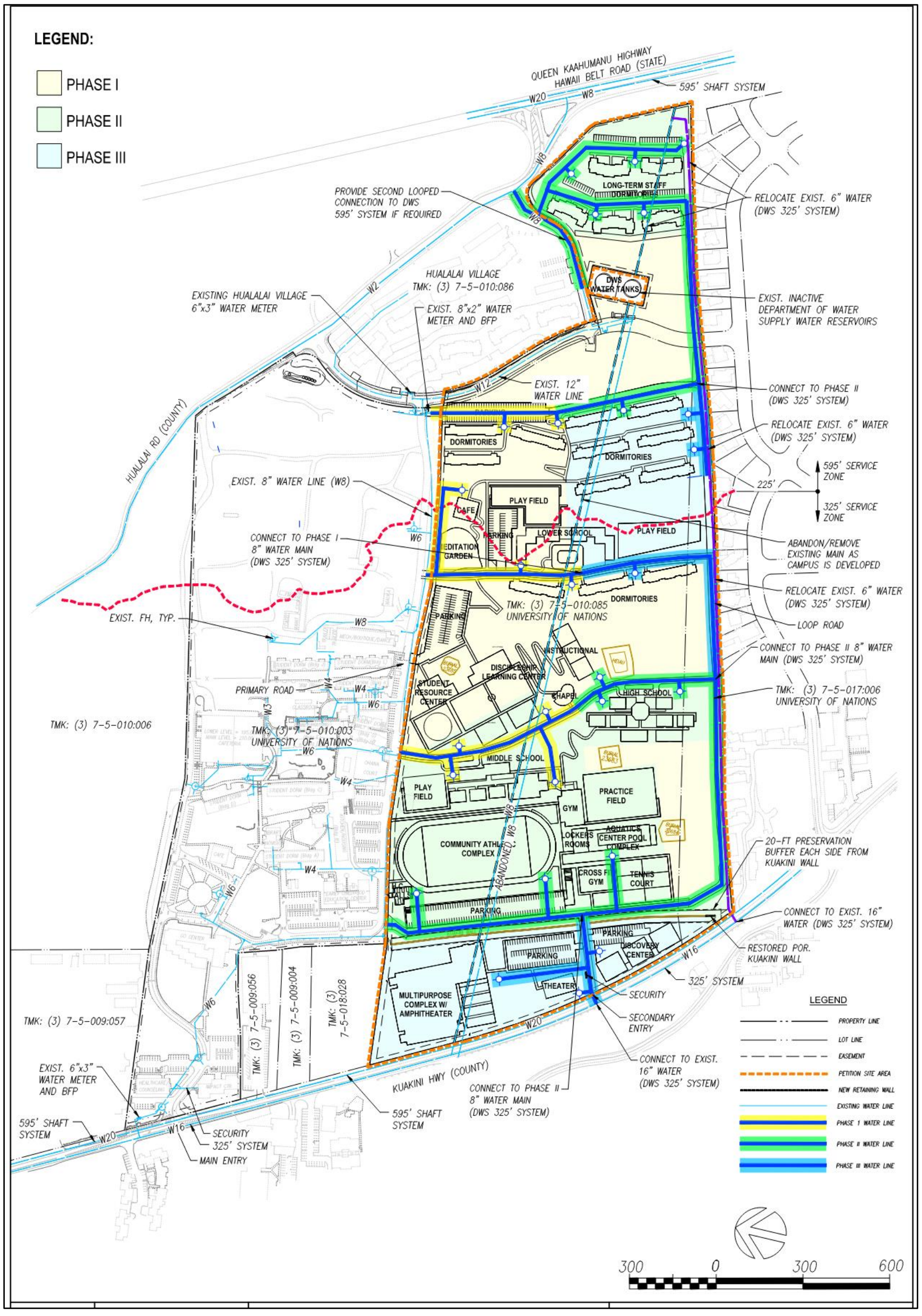

Figure 4-17c **Proposed Water Distribution Phase 3**

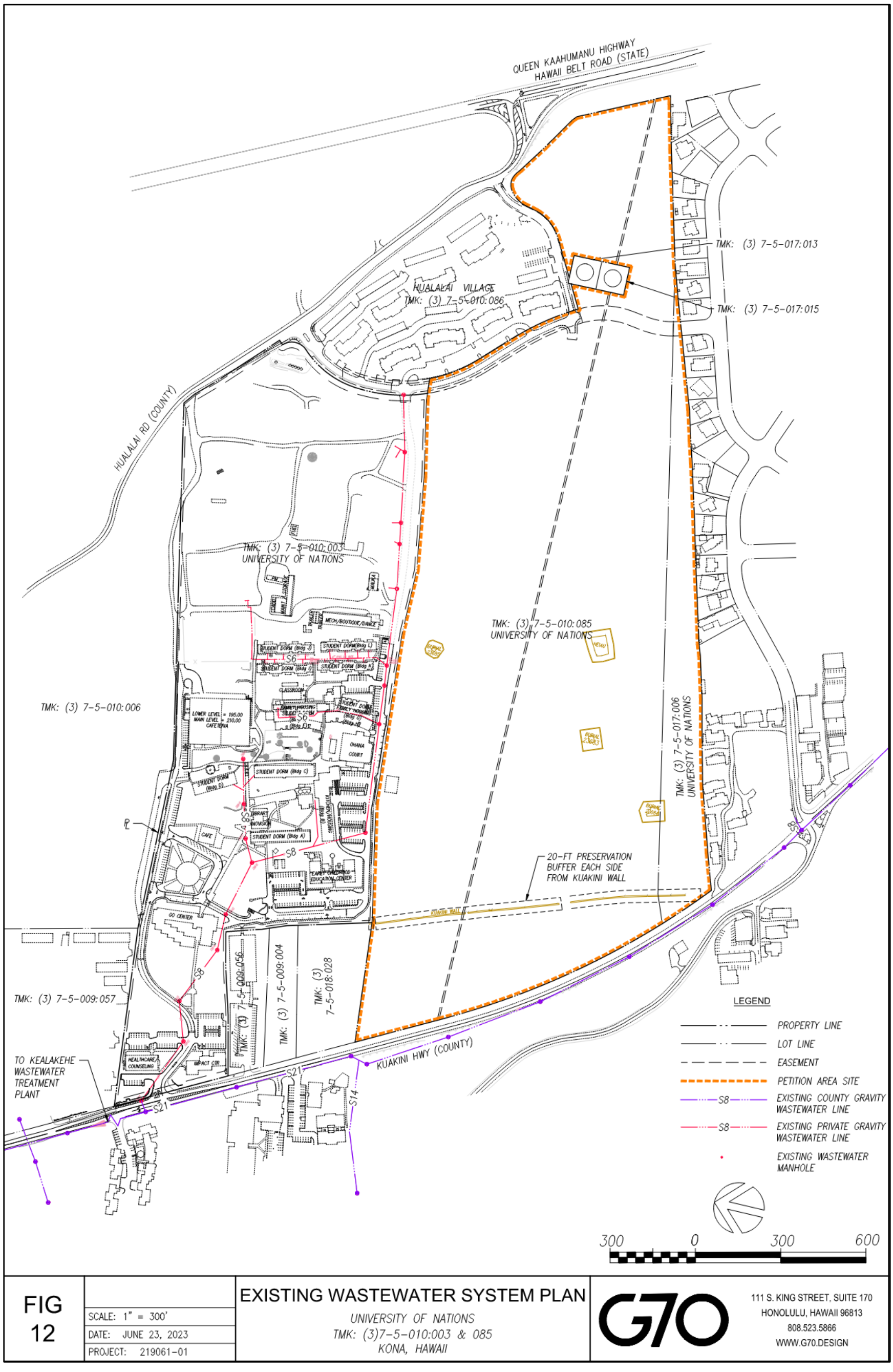

Figure 4-18 **Existing Wastewater Distribution**

Table 4-5: Wastewater Projections								
	Current		Phase 1		Phase 2		Phase 3	
	Persons	Flow	Persons	Flow	Persons	Flow	Persons	Flow
Daily Users								
PK-12 Students	148	2,368	110	1,760	155	2,480	175	2,800
University Students	17	272	11	182	6	92	-	-
Staff	322	5,152	282	4,508	225	3,600	200	3,200
Volunteers	5	80	3	54	2	27	-	-
Subtotal	492	7,872	406	6,504	387	6,200	375	6,000
Residents								
PK-12 Students	146	4,088	230	6,435	314	8,782	400	11,200
University Students	463	12,964	706	19,774	949	26,584	1,200	33,600
Staff	280	7,840	386	10,797	491	13,754	600	16,800
Volunteers	20	560	112	3,147	205	5,734	300	8,400
Subtotal	909	25,452	1,434	40,153	1,959	54,854	2,500	70,000
Total Domestic		33,324		46,657		61,053		76,000

Infrastructure improvements are phased based on the phasing of the Master Plan Update shown in *Figure 4-19a* to *Figure 4-19c.* Sanitary wastewater will continue to be discharged from U of N Kona to the Kuakini Highway sewer manhole, and then conveyed and treated at the Kealakehe Wastewater Treatment plant. The Kealakehe Wastewater Treatment Plan currently has the capacity to service the Master Plan Update at full build out. U of N Kona does not anticipate that the lawsuit files against the County under the Clean Water Act will affect the County's ability to provide wastewater service, as the lawsuit does not seek to close down the Kealakehe Wastewater Treatment Plan.

The Master Plan Update is not anticipated to adversely impact the County's wastewater service for the Kailua-Kona region. U of N Kona will continue to consult with DEM as legal proceedings continue and during the phased buildout of the Master Plan Update to ensure the Kealakehe Wastewater Treatment Plant has the capacity to serve the Master Plan Update as there may be other projects, including but not limited to projects listed in Section 1.6, requiring services at the Kealakehe Wastewater Treatment plant.

4.10.3 Power and Communication System

Existing Conditions

Electrical service to the U of N Kona 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. 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.

Potential Impacts and Mitigation Measures

A service request to HE will be submitted in support of the Master Plan Update, at the appropriate time. The upgrade of the existing service will occur for each phase of the Master Plan Update. A service request will be submitted to HE at the appropriate time, and the required infrastructure will be installed.

A service request to HTCO or Spectrum will be submitted in support of the Master Plan Update. The upgrade of the existing service will occur for each phase of the Master Plan Update. A service request will be submitted to either HTCO or Spectrum at the appropriate time, and the required infrastructure will be installed.

No impacts to existing power and communication systems are anticipated; and no further mitigation is recommended.

4.11 Hazardous Substances

Existing Conditions

The State DOH's Solid and Hazardous Waste Branch regulates the generation, treatment, storage, and disposal of hazardous waste. The State DOH's Hazard Evaluation and Emergency Response (HEER) office provides leadership, support, and partnership in preventing, planning for, responding to, and enforcing environmental laws relating to the release or threats of release of hazardous substances. Specific facilities, sites, or areas in which HEER has investigated or may investigate are tracked in the public records accessed through iHEER. Public records revealed no reported spills or releases at the Petition Area.

The Petition Area is not listed for action under the federal Comprehensive Environmental Response Compensation, and Liability Act (CERCLA) information systems database. CERCLA is commonly referred to as the "Superfund" program that is responsible for cleaning up contaminated lands and responding to emergencies, oil spills, and natural disasters (EPA, 2023). The database tracks the location of identified hazardous waste sites.

Potential Impacts and Mitigation Measures

Short-term construction-related activities will involve heavy equipment that requires the use of fuels and lubricants. Construction operators will comply with County, state, and federal laws to minimize and mitigate inadvertent spills or the release of fuels or lubricants.

The handling of regulated solid waste associated with the Master Plan Update is discussed in *Section 4.14.6.* No long-term adverse effects are anticipated from any on-site hazardous substances.

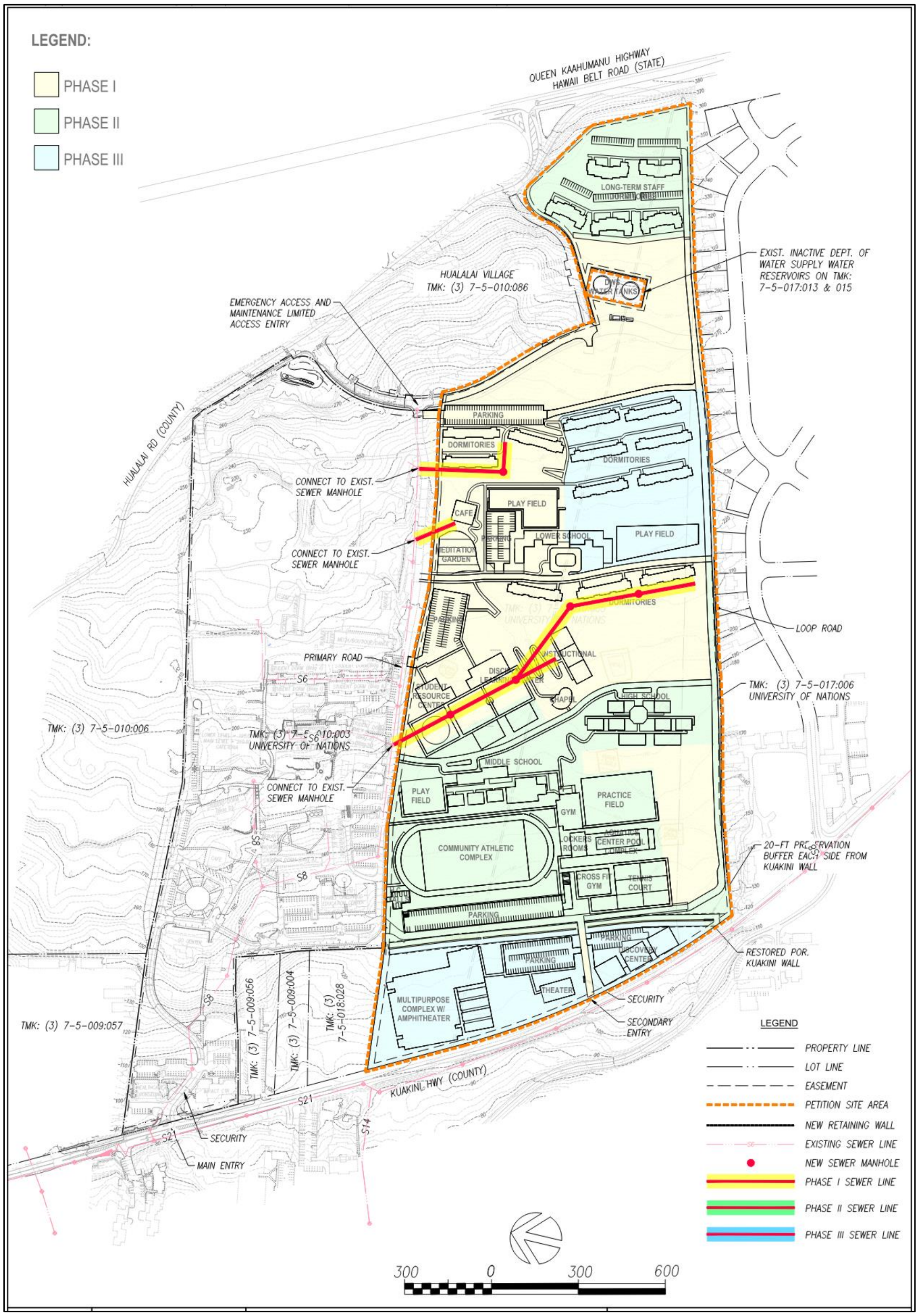

Figure 4-19a **Proposed Wastewater Distribution Phase 1**

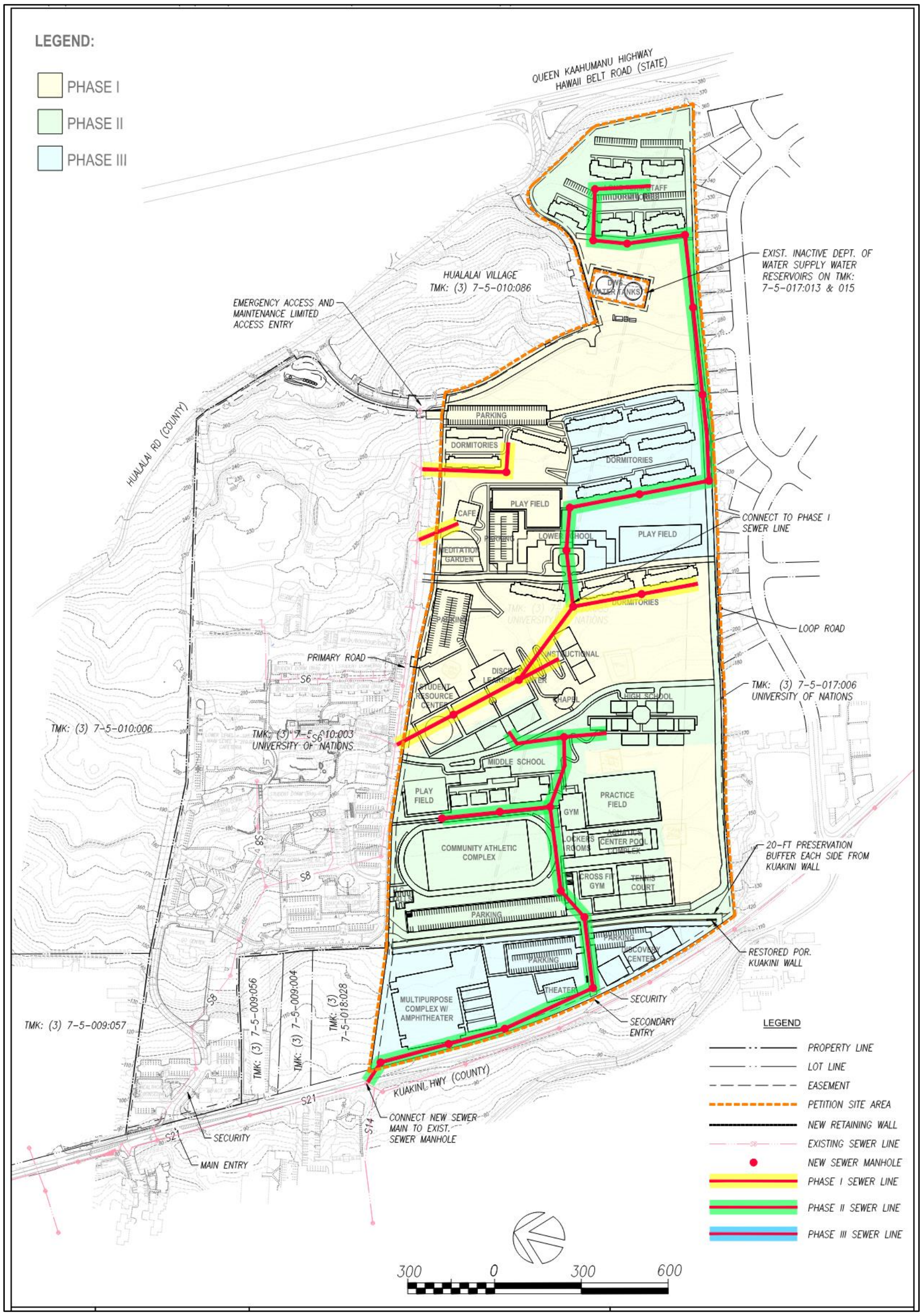

Figure 4-19b **Proposed Wastewater Distribution Phase 2**

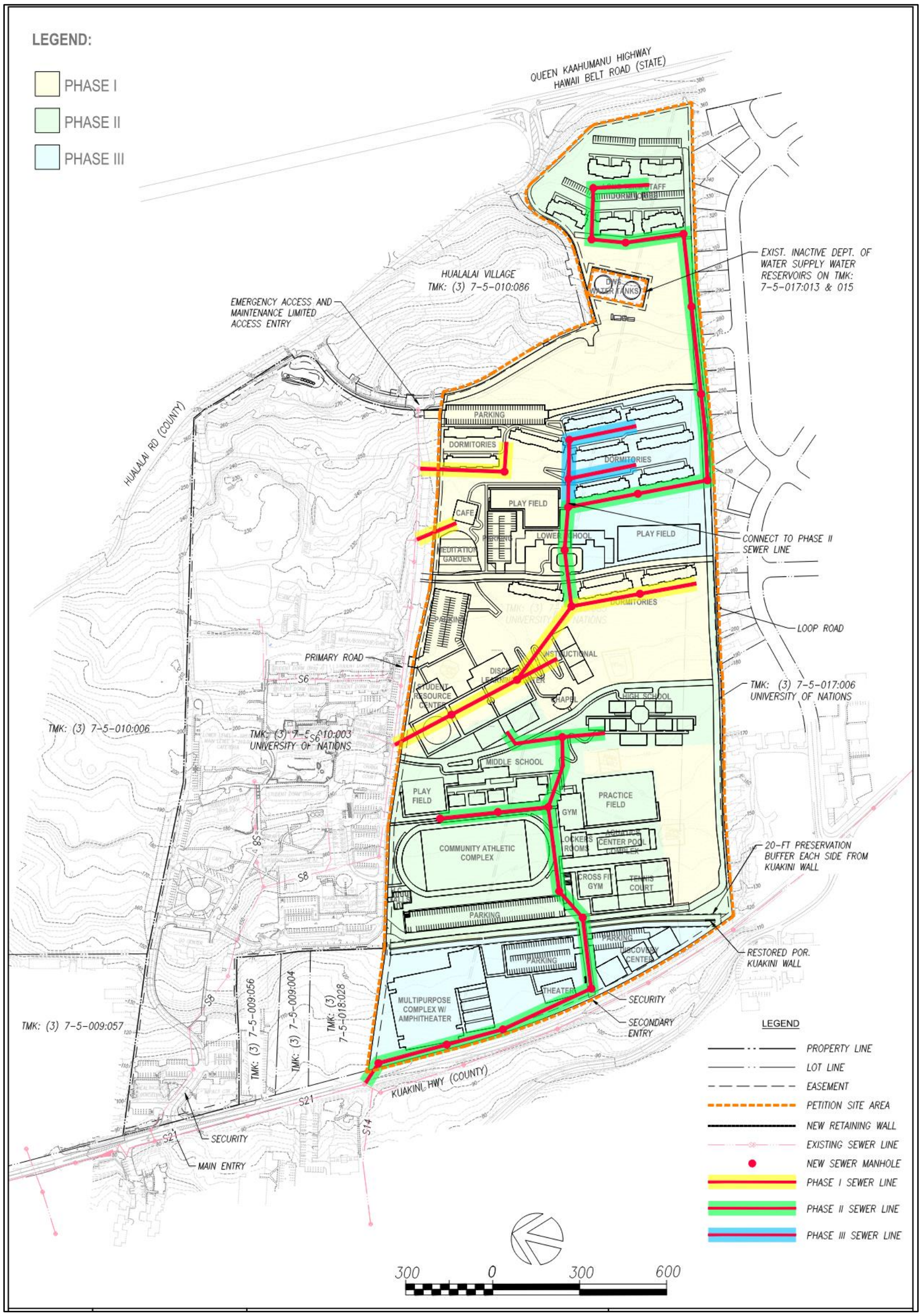

Figure 4-19c **Proposed Wastewater Distribution Phase 3**

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4.12 Traffic and Mobility Analysis

A *Mobility Analysis Report for the University of the Nations Kona Master Plan Update, Kona, Hawai'i* (MAR) was completed in December 2023 by Fehr and Peers, Incorporated (*Appendix H*). The MAR was completed to assess traffic conditions with and without each phase of the Master Plan Update. For the MAR, a comprehensive data collection effort was undertaken to identify existing transportation conditions in the vicinity of the U of N Kona. A total of nine (9) intersections (eight (8) existing and one (1) future location) were evaluated during the weekday morning (AM) and evening (PM) peak hours to study existing traffic conditions and evaluate future traffic conditions with and without the Master Plan Update (*Figure 4-20*).

Existing Conditions

The U of N Kona is currently accessible via a driveway located along Kuakini Highway. An access gate located approximately 125 feet east of Kuakini Highway controls access into the Existing Campus.

Existing Roadway System

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

- The existing driveway provides direct access from Kuakini Highway and serves as the primary internal roadway throughout the U of N Kona. The roadway terminates just west of the Aloha Lanai Cafeteria. The roadway has speed bumps and is currently two lanes. The posted speed limit is 15 miles per hour (mph).
- Kuakini Highway is the primary street that provides access to the Existing Campus. Adjacent to the Petition Area, is a two-lane collector roadway that extends generally from the north end of Kailua-Kona town 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 vicinity of the U of N Kona. 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 the south side of the roadway just makai of Queen Ka'ahumanu Highway. No bicycle facilities exist along Hualālai Road within the vicinity of the U of N Kona. 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 (DOT). It is a major component of the Hawai'i Belt Road and runs from Highway 19 in Kailua-Kona to Highway 19 in Hilo. The posted speed limit within the vicinity of the U of N Kona 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

The County of Hawai'i Mass Transit Agency 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 areas seven days a week. Within the vicinity of the U of N Kona, the Pahala-Kona-South Kohala Route provides daily service along Queen Ka'ahumanu Highway with transit stops both north and south of the U of N Kona.

Existing Bicycle Activity

Bicyclists can access the U of N Kona from Kuakini Highway at the existing driveway. No bicycle facilities exist along Kuakini Highway within the vicinity of the U of N Kona.

The study area has a low level of bicycle activity. Based on the peak period traffic counts, a range of 0-2 bicyclists were observed at each intersection during the AM and PM peak hours. The highest level of bicycle activity occurred in the vicinity of the U of N Kona from 3:35 to 4:35 PM.

Existing Pedestrian Activity

Pedestrians can access the U of N Kona from Kuakini Highway at the existing driveway. A pedestrian sidewalk runs along the east side of Kuakini Highway, beginning at the existing driveway and terminates approximately 150 feet north of the driveway. A pedestrian crosswalk exists approximately 600 feet north of the existing driveway and provides connectivity across Kuakini Highway.

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, 12 pedestrians were observed at the intersection of Kuakini Highway and Hualālai Road, and between zero (0) and nine (9) pedestrians were observed at the other study intersections. During the PM peak hour, 37 pedestrians were observed at the intersection of Kuakini Highway and Hualālai Road, and between zero (0) and seven (7) pedestrians were observed at the other study intersections.

Existing Traffic Volumes/Lane Configurations

Operations of the eight (8) existing study intersections were evaluated for the weekday AM and PM peak hours (*Figure 4-20)*. Traffic counts were collected during the weekday AM and PM peak periods in April 2023 while classes at the U of N Kona were in session. The weekday peak hours of traffic generally occurred 7:15 to 8:15AM and 3:15 to 4:15PM.

Field observations identified the following key operational issues at the following intersections:

- **Kuakini Highway/Hualālai Road:** Vehicular congestion along Kuakini Highway limited the number of vehicles that can pass through this intersection during the peak hour than would in free-flow conditions.
- **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.

- **Queen Ka‘ahumanu Highway & Lako Street:** Though not located within the MAR’s study area, delays at this intersection cause substantive amounts of queuing in the southbound direction along Queen Ka‘ahumanu Highway. This queuing spills back into the intersection of Queen Ka‘ahumanu Highway and Kuakini Highway and can disrupt intersection operations.
- **Queen Ka‘ahumanu & Hualālai Road:** Making a left turn from Hualālai Road during the morning hours was observed as challenging. Northbound queues originating from Nani Kailua often spill back and contribute to the congestion at the intersection with Hualālai Road.
- **Queen Ka‘ahumanu Highway & Kuakini Highway:** Queues extending almost to the point of spillback to Kuakini Highway were observed. The southbound flow remained consistent. Making a left turn from Kuakini Highway to Queen Ka‘ahumanu Highway during peak hours was observed as challenging.

Existing Intersection Levels of Service:

The operations of roadway facilities are described with the term level of service (LOS). LOS is a qualitative description of traffic flow based on factors including speed, travel time, delay, and freedom to maneuver. Six (6) levels are defined, from LOS A, with the least congested operating conditions, to LOS F, with the most congested operating conditions.

- A peak hour intersection capacity analysis was performed for the study intersections using the peak hour traffic data collected in April 2023. As described in *Table 4-6,* the Petition Area is served by both signalized and unsignalized intersections, defined as side-street-controlled (SSSC) intersections within the vicinity of the U of N Kona. The LOS ratings for signalized intersections are based on average control delay per vehicle. Control delay includes the initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. The LOS ratings for unsignalized intersections are based on the average control delay expressed in seconds per vehicle. For SSSC intersections, control delay is calculated for each minor-street-stopped movement and the major street left turns; not for the intersection as a whole. *Table 4-7* below summarizes the results of the intersection operations within the vicinity of the Petition Area.

Table 4-6: 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	33.5	C
		PM	28.0	C
2. Kuakini Highway & North Campus Entrance	SSSC	AM	27.4	D
		PM	31.1	D
3. Hualālai Road & Nani Kailua Road	SSSC	AM	10.6	B
		PM	9.7	A
4. Queen Kaʻahumanu Highway & Nani Kailua Drive	Signalized	AM	47.7	D
		PM	35.8	D
5. Hualālai Road & Hualālai Village North Driveway	SSSC	AM	10.6	B
		PM	10.1	B
6. Queen Kaʻahumanu Highway & Hualālai Road	SSSC	AM	32.6	D
		PM	22.4	C
7. Queen Kaʻahumanu Highway & Kuakini Highway	SSSC	AM	**37.9**	**E**
		PM	27.4	D
8. Hualālai Road & Hualālai Village South Driveway	SSSC	Hualālai Village South Driveway is currently closed. This access is assumed to be used as emergency access only under plus project conditions.		

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 Eastbound left-turn movement operates at LOS F during AM, and LOS E during PM peak hours.

As shown in *Table 4-6*, the following intersections operate at less-than-desirable LOS:

7. Queen Kaʻahumanu Highway and Kuakini Highway: LOS E (AM Peak)

Intersection results are generally consistent with field observations. The intersections of Kuakini Highway/Hualālai Road and Nani Kailua/Queen Kaʻahumanu Highway could occasionally operate worse than average conditions, primarily because congestion along Kuakini Highway and Queen Kaʻahumanu Highway limits the number of vehicles that can pass through the intersection during the peak hour than would pass in free-flow conditions.

Table 4-7: Projected Peak Hour Intersection Levels of Service

Intersection	Traffic Control	Peak Hour	Phase 1					Phase 2					Phase 3				
			Conditions Without Master Plan Update		Conditions with Master Plan Update		Change in Delay	Conditions Without Master Plan Update		Conditions With Master Plan Update		Change in Delay	Conditions Without Master Plan Update		Conditions With Master Plan Update		Change in Delay
			Sec/Veh[1, 3]	LOS	Sec/Veh[1, 3]	LOS		Sec/Veh[1, 3]	LOS	Sec/Veh[1, 3]	LOS		Sec/Veh[1, 3]	LOS	Sec/Veh[1, 3]	LOS	
Kuakini Highway & Hualālai Road[5]	Signalized	AM	37.7	D	39.5	D	1.8	41.1	D	43.2	D	2.1	44.6	D	46.9	D	2.3
		PM	31.5	C	32.4	C	0.9	35.6	D	38.9	D	3.3	42.3	D	50.0	D	7.7
Kuakini Highway & North Campus Entrance	SSSC	AM	32.1	D	33.9	D	1.8	34.5	D	**38.5**	E	4.0	**37.4**	E	**46.4**	E	**9.0**
		PM	**38.7**	E	**41.4**	F	2.7	**42.9**	E	**48.9**	E	**6.0**	**48.3**	E	**60.1**	F	**11.8**
Hualālai Road & Nani Kailua Road	SSSC	AM	10.9	B	10.9	B	0.0	11.1	B	11.1	B	0.0	11.3	B	11.4	B	0.1
		PM	9.9	A	9.9	A	0.0	10.0	B	10.0	B	0.0	10.1	B	10.2	B	0.1
Queen Kaʻahumanu Highway & Nani Kailua Driveway	Signalized	AM	**114.6**	F	**114.6**	F	0.0	**136.2**	F	**136.2**	F	0.0	**160.4**	F	**160.4**	F	0.0
		PM	**105.0**	F	**105.3**	F	0.3	**129.3**	F	**129.9**	F	0.6	**156.7**	F	**158.4**	F	1.7
Hualālai Road & Hualālai Village North Driveway	SSSC	AM	10.9	B	10.9	B	0.0	11.0	B	11.0	B	0.0	11.2	B	11.2	B	0.0
		PM	10.3	B	10.3	B	0.0	10.4	B	10.4	B	0.0	10.6	B	10.6	B	0.0
Queen Kaʻahumanu Highway & Hualālai Road	SSSC	AM	**49.4**	E	**49.4**	E	0.0	**58.4**	F	**58.4**	F	0.0	**70.4**	F	**70.4**	F	0.0
		PM	28.8	D	28.8	D	0.0	31.7	D	31.7	D	0.0	**35.0**	E	**35.0**	E	0.0
Queen Kaʻahumanu Highway & Kuakini Highway	SSSC	AM	**58.2**	F	**59.9**	F	1.7	**70.8**	F	**74.6**	F	3.8	**92.9**	F	**102.0**	F	**9.1**
		PM	**38.2**	E	**39.5**	E	1.3	**43.5**	E	**46.6**	E	3.1	**50.8**	F	**58.2**	F	**7.4**
Hualālai Road & Hualālai Village South Driveway	Hualalai Village South Driveway is currently closed. This access is used as an emergency access only.																
Kuakini Highway and South Campus Entrance	SSSC	AM	-	-	13.6	C	-	-	-	14.2	B	-	-	-	15.2	C	-
		PM	-	-	16.0	C	-	-	-	17.3	C	-	-	-	19.1	C	-

1 Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized intersections. This 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 were performed using the Highway Capacity Manual (HCM) method.

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

4 Delay increases of more than five seconds or degradation from LOS A, B, C, or D to E/F are colored in red.

5 Eastbound left-turn movement operates at LOS F during AM and PM peak hours.

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Figure 4-20: **Project Site and Study Intersections (Fehr & Peers, Inc., 2020)**

Potential Impacts and Mitigation Measures

Traffic Improvements

During the short-term construction period, construction related vehicles will utilize the existing driveway along Kuakini Highway. To mitigate additional traffic during the short-term construction period, delivery and transportation of construction materials will be scheduled Monday through Friday during off hours throughout the day.

A second access point off Kuakini Highway via a new unsignalized intersection and driveway leading to the U of N Kona is planned as part of the Master Plan Update. The MAR recommends that the new access point be constructed with an exclusive left-turn lane on the southbound approach and the south leg be striped to accommodate a refuge lane serving the westbound left-turn vehicles. Due to the relatively low volume of vehicles on this roadway and the limited land uses served by this roadway, it is not anticipated there will be vehicular site access or operational issues with the implementation of the second access point. Adding a second access point to the U of N Kona will distribute traffic and minimize the potential for intermittent congestion during peak hours.

To evaluate the long-term potential traffic impacts with the Master Plan Update, future traffic conditions without the Master Plan Update were compared to future traffic conditions with the Master Plan Update. This is done to determine if the addition of traffic generated with the Master Plan Update is expected to result in a significant impact on the surrounding roadways. Based on previous studies conducted for the County of Hawai‘i, the minimum desired operating standard for a signalized intersection is LOS D for the overall intersection. Additionally, the Hawai‘i DOT strives to universally maintain LOS D intersection operations. The *Draft, Hawai‘i DOT Best Practices for Traffic Impact Report* defines a significant impact when the operations of an intersection, turning movement, or roadway segment changes from LOS D or better to LOS E or F. Additionally, when evaluating intersection approach LOS at any location, other factors should be considered in the analysis, such as traffic volumes and potential secondary impacts to pedestrian, bicycle, and transit travel.

At a signalized intersection, if the addition of project generated traffic is expected to degrade acceptable service levels (LOS D or better) to unacceptable service levels (LOS E or F), then the project is considered to have a direct impact. Alternatively, if the intersection LOS is determined to be LOS E or F without the project and the projects adds traffic to the intersection or location, causing the delay to increase by five (5) seconds or more, then this result would be characterized as a cumulative impact.

For unsignalized intersections, the criterion for a direct impact is similar to that of signalized intersections as described above, but one or more signal warrants must also be met. However, if a project adds traffic to a location that includes a controlled approach that already operates at an unacceptable level (LOS E or F) and one or more volume-based signal warrants are met, then the project is determined to have a significant impact.

Although the County of Hawai‘i and HDOT do not publish impact criteria for pedestrian, bicycle, and transit impacts, for the MAR, these impacts are evaluated based on whether the Master Plan Update would: 1) conflict with the existing or planned pedestrian, bicycle, or transit facilities and services, or 2) create substantive walking, bicycling, or transit use demand without providing adequate and appropriate facilities for non-motorized mobility.

Special events held on campus may generate a substantial amount of vehicular traffic traveling to and from the U of N Kona if demand is not managed. To mitigate the additional volume of traffic with special events held on campus, is the MAR recommends a transportation management plan (TMP), which will include a transportation demand management (TDM) program to reduce potential temporary impacts to intersections within the vicinity of the U of N Kona during special events. Potential TDM strategies include the use of event shuttle/buses, dynamic event parking pricing, remote parking, and incentives to encourage attendees to carpool to and from the event. Additionally, the MAR recommends that a manual traffic control and focus enforcement be implemented to help manage special event traffic to minimize traffic around the nearby area.

Future traffic conditions within the vicinity of the Petition Area were generated with and without the Master Plan update. Future traffic conditions without the Master Plan Update were generated using the travel demand forecasting model (TDFM) which uses land use and socioeconomic data to assign traffic across the planned roadway network. Without implementation of the Master Plan Update, future conditions reflect traffic increases due to regional growth and development. Future traffic conditions with each phase of the Master Plan Update were generated using a three-step process: 1) project trip generation, 2) trip distribution, and 3) trip assignment. *Table 4-7* compares the projected LOS at the study intersections with and without the Master Plan Update.

Results indicate that under Phase 1, the following intersection are anticipated to operate at a less than desirable level during the AM and PM peak hours:

2. Kuakini Highway and North Campus Entrance (LOS F, PM peak)
4. Queen Kaʻahumanu and Nani Kailua Drive (LOS F, AM and PM peak)
6. Queen Kaʻahumanu Highway and Hualālai Road (LOS E, AM peak)
7. Queen Kaʻahumanu Highway and Kuakini Highway (LOS F, AM peak and LOS E, PM peak)

Under Phase 2, the following intersections are anticipated to operate at a less than desirable level during the AM and PM peak hours:

2. Kuakini Highway and North Campus Entrance (LOS E, AM and PM peak)
4. Queen Kaʻahumanu and Nani Kailua Drive (LOS F, AM peak and PM peak)
6. Queen Kaʻahumanu Highway and Hualālai Road (LOS F, AM peak)
7. Queen Kaʻahumanu Highway and Kuakini Highway (LOS F, AM Peak and LOS E, PM peak)

Upon completion of Phase 3, the following intersections are anticipated to operate at a less than desirable level:

2. Kuakini Highway and North Campus Entrance (LOS E, AM peak and LOS F, PM peak)
4. Queen Kaʻahumanu and Nani Kailua Drive (LOS F, AM and PM peak)
6. Queen Kaʻahumanu Highway and Hualālai Road (LOS F, AM peak and LOS E, PM peak)
7. Queen Kaʻahumanu Highway and Kuakini Highway (LOS F, AM and PM peak)

Based on the results from the TDFM, the Master Plan Update may impact services at the intersection of Kuakini Highway and North Campus Entrance, and Queen Ka‘ahumanu Highway and Kuakini Highway. To determine whether significant impacts would occur at either of these intersections a signal warrant analysis was performed using the Eight-Hour Vehicular Volume and Peak-Hour Vehicular Volume from the *Manual of Uniform Control Devices*. *Table 4-8* summarizes the signal warrant analysis.

Table 4-8: Signal Warrant Analysis

Intersection	Warrant	Scenario		
		Year 2030 + P	Year 2040 + P	Year 2050 + P
2. Kuakini Highway & North Campus Entrance	8-Hour Vehicular Volumes Warrant	Not Met	Not Met	Not Met
	Peak-Hour Vehicular Volumes	Not Met	Not Met	Not Met
7. Queen Ka‘ahumanu Highway & Kuakini Highway	8-Hour Vehicular Volumes Warrant	Not Met	Not Met	Not Met
	Peak-Hour Vehicular Volumes	Not Met	Not Met	Not Met

The intersections of Kuakini Highway and North Campus Entrance and Queen Ka‘ahumanu Highway and Kuakini Highway did not meet any of the signal warrants in any phase of the Master Plan Update. Although no significant impact were identified, the MAR provides the following recommendations.

2. Kuakini Highway & North Campus Entrance

This intersection does not meet the need for a traffic signal; however, the MAR recommends that the south leg be restriped and a refuge lane for the westbound left turning traffic be implemented to improve operations at this intersection.

7. Queen Ka‘ahumanu Highway & Kuakini Highway

This intersection does not meet the need for a traffic signal; however, the MAR recommends conditions at this intersection be evaluated prior to construction of Phase 2 and Phase 3 to determine if a traffic signal is warranted.

Although the Master Plan Update is not anticipated to directly impact traffic at the intersection of Queen Ka‘ahumanu Highway and Hualālai Road, the MAR recommends traffic conditions at this intersection are evaluated prior to the construction of Phase 2 and Phase 3 to determine if a traffic signal is warranted.

On-Site Vehicle Circulation and Parking

As part of the Master Plan Update, several on-site internal campus roadways will be extended. Three new north-south roadways are proposed to connect buildings and facilities throughout the Petition Area to the spine road (east-west campus roadway). The spine road will serve to integrate the Existing Campus and Petition Area into a single campus. The. To manage travel speeds along on-site vehicular roadways, the MAR recommends stop signs and other traffic calming devices be included at key points along these roadways.

Vehicular parking will continue to be provided at the U of N Kona. The MAR recommends that the parking supply provided in each phase of the Master Plan Update maintain (or reduce if feasible) the current ratio of parking spaces to the number of campus students, faculty, staff, and visitors. Reduced parking supplies are a key incentive to minimizing the number of vehicle trips generated by land uses, but they must be supported by services and facilities to accommodate non-automobile travel such as, but not limited to, increased transit accessibility, bicycle lanes, and dedicated walking paths.

Off-Site and On-Site Pedestrian and Bicycle Circulation and Transit Access

Existing facilities for pedestrians, bicycles, and transit users were inventoried to evaluate the quality and scope of existing facilities. Additionally, the Bike Plan Hawai‘i Master Plan (2012), Statewide Pedestrian Master Plan (2013), and County of Hawai‘i Transit Multi-Modal Transportation Master Plan (2018) were assessed to determine if the Master Plan Update is expected to conflict with the existing or planned improvement to pedestrian and bicycle facilities, or if the Master Plan Update is expected to generate a substantial demand which could warrant additional transit service. If the Master Plan Update was found to conflict with the existing plans or generate a substantial demand for additional transit services, then the Master Plan Update would be determined to have a project-specific impact to non-motorized modes of transportation.

Implementation of the Master Plan Update will not conflict with any existing pedestrian or bicycle facilities and will not preclude the implementation of any planned pedestrian or bicycle facilities within the vicinity of the U of N Kona. The Master Plan Update is anticipated to generate some bicycle and pedestrian trips to and from the U of N Kona. Most of these trips would occur along Kuakini Highway by students, staff, and visitors. As project generated pedestrian and bicycle trips are anticipated to be low, no significant impacts are anticipated. However, using the Federal Highway Administration guidelines and the Fehr & Peers proprietary Crosswalk+ tool, off-site pedestrian and bicycle improvements that may be implemented at the intersection of Kuakini Highway and the existing driveway include:

- A raised sidewalk or path separated from traffic by a raised asphalt berm should be installed between the existing sidewalk on the east side of Kuakini Highway from the existing sidewalk’s terminus near the site to the existing crosswalk located approximately 600 feet north of the existing driveway.
- Addition of a high-visibility crosswalk, adequate nighttime lighting levels, and crosswalk warning signs on the north and east legs of Kuakini Highway & North Entrance and Kuakini Highway & South Entrance.
- The existing striped triangle on the east leg of the intersection should be converted to a raised median to provide a pedestrian refuge area.

- A Pedestrian Hybrid Beacon could also be installed on the north leg of the intersection, however, a warrant would need to be conducted to determine whether it would be necessary. If it is not warranted, a Rectangular-Flashing Beacon could be added.

The Bike Plan Hawai'i identifies three high priority projects within the vicinity of the Petition Area:

1. Hualālai Road from Kuakini Highway to Old Mamalahoa: Signed Shared Path
2. Kuakini Highway from Lake Street to Hualālai Road: Bike Lane
3. Queen Ka'ahumanu Highway from Henry Road to Kuakini Highway: Signed Shared Path

The proposed bike lane along Kuakini Highway will enhance bicycle connectivity to and from the entrance and the planned second entrance to the U of N Kona.

Direct connections between buildings and parking lots will be provided via unrestricted pedestrian and bicycle pathways. Pedestrians and bicyclists will share paths and crosswalks. Unrestricted pedestrian and bicycle pathways are anticipated to provide adequate connectivity, however the MAR provides the following recommendations to improve on-site circulation for pedestrians and bicyclists:

- A shared-use path should be included on one side of both on-site campus roadways to further enhance pedestrian and bicycle connectivity and safety throughout campus.
- An enhanced bicycle facility should be included along the makai north-south campus roadway between the northern and central roadways.
- Pedestrian-level lighting is recommended along any shared-use path or pedestrian-only sidewalk or path.
- Raised crosswalks should be provided at several locations on the new spine road where higher levels of pedestrian activity are anticipated.
- Provide secure bike parking to encourage the use of non-motorized travel.

The Master Plan Update is anticipated to generate a relatively low number of transit riders and no impacts to transit facilities or services are anticipated and no modifications to transit stop locations or services are required. The nearest bus stop requires transit patrons to walk or bike approximately 2,000 feet from the U of N Kona. It is recommended a multi-use connection directly to Hualālai Road be provided to reduce the overall distance transit riders would walk or bike to access the U of N Kona.

4.13 Socio-Economic Characteristics

Existing Conditions

The population on the Island of Hawai‘i has grown rapidly beginning in the 1970s. Much of the population growth is due to the growth of the West Hawai‘i and South Hilo Regions. In 2021, the U.S. Census reported that the population of the County was approximately 200,468.

The Island of Hawai‘i is comprised of nine (9) districts: the Puna District, South Hilo District, North Hilo District, Hāmākua District, North Kohala District, South Kohala District, North Kona District, South Kona District, and the Ka‘ū District. The Petition Area is located within the North Kona District. According to the Kona Community Development Plan, the North Kona District has seen a substantial population increase beginning in the 1980s to 2000 and has grown at nearly twice the rate of the South Kona District. Puna was the largest growing district, followed by the North Kona District followed Puna in terms of population growth. In 2021, the U.S. Census reported that the population of the North Kona District was approximately 40,931. The North Kona District accounted for approximately 20.4% of the County’s total population in 2021. The Kona Community Plan and the Kailua Kona Master Plan project that the North Kona District will continue to increase its share of the countywide population.

Within the North Kona District, the Petition Area is located in the U.S. Census Bureau’s Hōlualoa Census Designated Place (CDP). The North Kona District is comprised of six (6) CDPs, which include Honalo, Kealakekua, Hōlualoa, Kahalu‘u-Keauhou, Kalaoa, and Kailua. In 2021, the Hōlualoa CDP population was approximately 4,959. The Hōlualoa CDP accounted for approximately 12.5% of the North Kona district’s total population in 2021.

Table 4-9 summarizes the population and characteristics of the Hōlualoa CDP compared to the North Kona District, the County, and the State. The 2021 American Community Survey reported that the median age for the Hōlualoa CDP is 49.9, which is slightly higher than the median age of the North Kona District, the County, and the State. The 2021 American Community Survey reported approximately 1,823 households in the Hōlualoa CDP with an average of 2.7 persons per household. The median income for a household in the Hōlualoa CDP was reported as $99,554, which is higher than the average median income for the North Kona District and the County. About 1.8% of the population in the Hōlualoa CDP falls below the poverty line.

According to the 2021 American Community Survey, the local economy within the Hōlualoa CDP is primarily based on educational services, health care and social assistance, retail trade, and the arts, entertainment, recreation, and accommodation and food services sectors. Within the Hōlualoa CDP, approximately 63% of the population is employed, 2% unemployed, and 34% not in the labor force (based upon the employment status of the population 16 years or older).

Table 4-9: Population Characteristics					
Area	**Population (2021)**	**Median Age (Years)**	**Persons/ Household**	**Median Household Income**	**Ethnicity (percent)**
Hōlualoa CDP	8,538	49.9	2.7	$99,554	White: 57% Asian: 24% Pacific Islander: 1% Two or more races: 12%
North Kona District	37,875	43.2	2.8	$80,125	White: 41% Asian: 19% Pacific Islander: 11% Two or more races: 18%
County of Hawai'i	200,461	44.0	2.7	$69,473	White: 30% Asian: 22% Pacific Islander: 12% Two or more races: 31%
State of Hawai'i	1,441,553	40.2	2.8	$84,857	White: 22% Asian: 37% Pacific Islander: 10% Two or more races: 26%

Source: (American Community Survey, 2019)

Potential Impacts and Mitigation Measures

Construction of the Master Plan Update will require the purchase of goods and services. As the availability of materials and supplies allows, U of N Kona will purchase materials and supplies locally and recycle and reuse construction materials from renovation or demolition of other projects in the nearby vicinity. Inherently, the need to purchase goods and services to support the buildout of the Petition Area will help sustain a healthy economy in the State and in the County.

Expansion of the Existing Campus will accommodate future growth in enrollment at the U of N Kona. Upon completion of the Master Plan Update, the U of N Kona will carry approximately 1,775 students and approximately 1,100 faculty and staff members. Growth at the U of N Kona will increase the demand for goods and services. Although growth in enrollment will increase the demand for goods and services, it is not anticipated that such growth will lead to potential shortages or price hikes, and an increase in demand for goods and services may generate additional jobs and revenues in the County and the State

The projected growth at U of N Kona is in alignment with projected growth patterns in the North Kona District. Although U of N Kona will increase the population in the North Kona District, growth at the U of N Kona is not anticipated to substantially increase population to an extent that would strain public facilities or services. Growth at the U of N Kona is in alignment with policies and plans guiding urban growth in the Kailua-Kona region. As described in the County General Plan, the LUPAG Map designates the Petition Area as Medium Density Urban. Furthermore, the Kona Community Development Plan locates the Petition Area within Kona Urban Area slated for future growth. The Master Plan Update would adhere to the plans and policies guiding growth of urban opportunities in the Kailua-Kona region. Continued urban growth will yield an overall positive economic benefit for the local economy.

4.14 Public Facilities and Services

4.14.1 Educational Facilities

Existing Conditions

The State of Hawai‘i Department of Education (DOE) runs the State’s public schools. The Petition Area is located within the Kealakehe Complex subsection, which is part of the Honokaa-Kealakehe-Kohala-Konawaena Complex Area on Hawai‘i Island.

The following DOE public schools are located within the Kealakehe Complex:

4. Hōlualoa Elementary School – 76-5957 Mamalahoa Highway
5. Kealakehe Elementary School – 74-5118 Kealaka‘a Street
6. Kealakehe Intermediate School – 74-5062 Onipa‘a Street
7. Kealakehe High School – 74-5000 Puohulihuli Street
8. Innovations Public Charter School – 75-5815 Queen Ka‘ahumanu Highway
9. Kanu o ka ‘Āina New Century Public Charter School – 64-1043 Hi‘iaka Street
10. West Hawai‘i Explorations Public Charter School – 73-4500 Kahilihili Street

Potential Impacts and Mitigation Measures

The Master Plan Update will provide a new K-12 school in the Kailua-Kona region. The Lower School, which includes Kindergarten to Grade 5, will be operating upon completion of Phase 1. Additional facilities supporting the Lower School will be completed upon Phase 3. The Middle School, which includes Grade 6 to Grade 8, and High School, which includes Grade 9 to Grade 12, will be completed during the second phase of the Master Plan Update.

4.14.2 Recreational Facilities

Existing Conditions

There are many recreational facilities and public parks in the greater Kailua-Kona Region. They are run by the U.S. National Park Service, DLNR, or County of Hawai‘i Parks and Recreation.

Some of the parks in the vicinity of the Petition Area include:

- 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, 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.

Potential Impacts and Mitigation Measures

The Master Plan Update addresses current and projected space and activity needs at the U of N Kona. As part of the Master Plan Update, an athletic complex, which will include a soccer field, outdoor courts, a gymnasium and a pool, and a multi-purpose complex, and a theatre will provide much needed facilities to support recreational opportunities for current and future students. The planned recreational facilities will be made available for the community to utilize as the U of N Kona is planning on hosting competitive sporting events and various community events. Overall, the additional recreational facilities will provide the greater Kailua-Kona community with much needed recreational spaces.

4.14.3 Police

Existing Conditions

The Petition Area is located in the Hawai‘i Police Department Area II, Kona Patrol District. The Kona Patrol District encompasses approximately 834 square miles of patrolling areas from the South Kohala District at Waikaloa to the Ka‘ū Distrct 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 Mākai‘i Place, Kailua-Kona, an approximately 3.2-mile drive north from the Petition Area.

Potential Impacts and Mitigation Measures

Short-term construction related activity is not anticipated to increase the demand for police services within the Kailua-Kona region. In the long term, the Master Plan Update is not anticipated to adversely affect police services within the Kailua-Kona region. Furthermore, on-campus security conducts routine patrol and surveillance at the Existing Campus and will extend their patrol and surveillance to the Petition Area. No further mitigation is proposed.

4.14.4 Fire

Existing Conditions

HFD provides fire protection and suppression, pre-hospital emergency medical services, land and sea search and rescue, hazardous materials response, ocean safety, fire prevention, and public education for the County. Hawai‘i Island is equipped with 20 County-operated fire stations and 18 volunteer fire stations. The Kailua Fire Station, Hawai‘i County Fire Station #7, West Battalion, is the identified fire station serving the Petition Area in case of an emergency and is located approximately 1.5-miles north from the Petition Area.

Each month, HFD issues the Fire Chief’s Report, which includes a recap of the total number of calls and types of calls HFD responded to. Additionally, the Fire Chief’s Report includes a total count of the number of calls and types of calls HFD responds to since the beginning of the calendar year. As of July 2023, HFD responded to a total of 17,902 calls. *Table 4-10* breaks down the different types and number of those calls. *Figure 4-21* illustrates the number and type of incidents from January to July.

Table 4-10: Total Calls for Calendar Year 2023		
Type	**Total**	**Percentage**
Fire	630	4%
Overpressure, Rupture, Explosion – no fire	3	0%
Rescue and Emergency Medical Services (EMS)	12,992	73%
Hazardous Conditions (no fire)	175	1%
Service Call	1,173	7%
Good Intent Calls	2,701	15%
False Alarm/False Calls	208	1%
Severe Weather	6	0%
Special Incident Type	10	0%
Other	4	0%
Total	**17,902**	**100%**

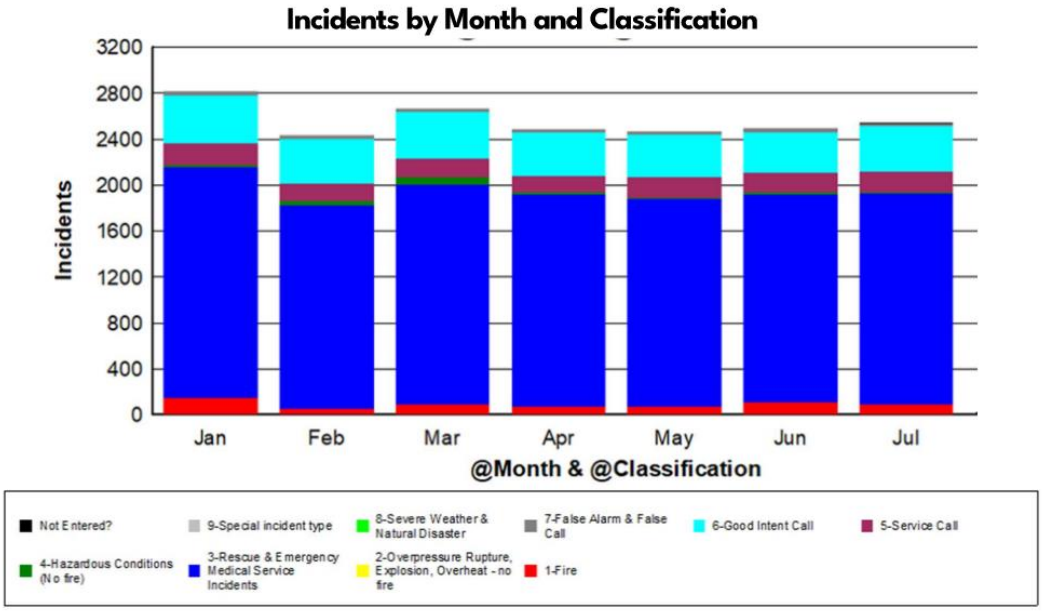

Figure 4-21: **Incidents Reported from January to July 2023 (Fire Chief's Report, July 2023)**

Table 4-11 provides an overview of the total number of calls the County Fire Department responded to over the last five (5) years. It is projected that the County Fire Department will respond to a total of approximately 31,000 calls in the 2023 calendar year.

Table 4-11: Total Number of Calls Received from 2018-2023						
Year	2018	2019	2020	2021	2022	Est. 2023
Total Calls	25,331	26,869	25,015	27,398	29,594	31,000

Potential Impacts and Mitigation Measures

Short-term construction related activity is not anticipated to increase the demand for fire services. As discussed in *Section 4.6.6,* should any fires break out during the short-term construction period, HFD will be called immediately.

Although growth at the U of N Kona could increase the demand for fire services, the plan for the Petition Area will implement measures to reduce the risk of wildfire ignition and spread. Measures to reduce the risk of wildfires include clearing the Petition Area of overgrown non-native vegetation, using of xeriscape landscaping techniques, selecting native, drought-tolerant plants, keeping trees and shrubs properly pruned, and removing leaf clutter and other dead and dried debris. Buildings will comply with all fire code requirements and building materials will be carefully selected to reduce the risk of wildfire spread.

Additionally, operations at the U of N Kona generally do not include activities that require rescue and EMS services, and it is not anticipated the Master Plan Update will generate an increased demand on rescue and EMS services. HFD will review the Master Plan Update for conformance with Federal, State, and County regulations. With measures in place to reduce the risk of a wildfire ignition and spread, the Master Plan Update is not anticipated to adversely affect, or impact services provided by HFD.

4.14.5 Emergency Medical Services

Existing Conditions

EMS provides pre-hospital emergency medical care throughout the State of Hawai‘i. Hawai‘i County is equipped with 16 ambulance units, with ambulance units distributed at fire stations throughout the entire island. The Kailua Fire Station, Hawai‘i County Fire Station #7, West Battalion, which is the identified fire station serving the Petition Area, is equipped with an EMS unit.

The Kona Community Hospital is the main hospital servicing the Kailua-Kona region and is located in Kealakekua approximately 9.4 miles south of the Petition Area. Kona Community Hospital is a Level III trauma center and is equipped to handle emergency resuscitation and stabilization, emergency surgery, and intensive care. EMS dispatchers coordinate the transportation of patients to the Kona Community Hospital. Other health care facilities in the vicinity of the Petition Area include Kaiser Permanente Kona Medical Office approximately 4-miles to the north, West Hawai‘i Community Health Center (Kealakehe) approximately less than 0.5-mile to the north, and Queen’s Medical Center Medical Clinic approximately 1.2 miles 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 of the Petition Area.

Potential Impacts and Mitigation Measures

Short-term construction related activity is not anticipated to increase the demand for EMS within the Kailua-Kona region. Although growth at the U of N Kona could increase the demand for medical services, U of N Kona will continue to operate an on-campus health center for its students, staff, and faculty. Students, staff, and faculty will be advised of nearby health centers should further medical

attention be needed. With medical services provided at the U of N Kona and with the availability of nearby health centers, the Master Plan Update is not anticipated to adversely affect emergency medical services provided within the Kailua-Kona region.

4.14.6 Solid Waste Management

Existing Conditions

According to the *Preliminary Infrastructure Assessment* (*Appendix C*) the County operates a network of twenty-one (21) recycling and transfer stations, transfer stations, and two landfills. The County does not have a curbside pickup system and instead depends on waste collection companies to transport waste to the nearest transfer station. The County then transfers waste from the transfer station to either the South Hilo Sanitary Landfill or the West Hawai'i Sanitary Landfill in Pu'uanahulu. The Petition Area is located between two existing transfer stations, the Kealakehe Transfer Station (3.1 miles to the northwest) and the Keauhou Transfer Station (7.1 miles to the southeast). The West Hawai'i Sanitary Landfill in Pu'uanahulu receives solid waste from U of N Kona.

Potential Impacts and Mitigation Measures

Short-term construction related activity during the phased development of the Master Plan Update will generate construction waste on site. Construction-related waste will be properly disposed of and not left on the site. Should there be any environmental accidents during the buildout of the Petition Area, the State DOH HEER office will be contacted.

The County has completed its *2019 Integrated Solid Waste Management Plan Update*, which evaluates the County's existing waste management practices and programs and provides short-term and long-term recommendations to improve the County's waste management system. U of N Kona is committed to meeting recommendations in the *2019 Integrated Solid Waste Management Plan Update* and will implement recycling and trash bins at the U of N Kona for students, faculty, and staff to properly discard waste.

The *2019 Integrated Solid Waste Management Plan Update* estimates the total Hawai'i Island population at 201,389 persons and total disposal weight (including recycling) for the 2017-2018 period at 283,021 pounds, or about 1.4 pounds per person each day. Based on the estimates, solid waste disposal generated by the Master Plan Update is projected in *Table 4-12.*

Table 4-12: Solid Waste Projection

	Current		Phase 1		Phase 2		Phase 3	
	Capita	Solid Waste	Capita	Solid Waste	Capita	Solid Waste	Capita	Solid Waste
Dormers	909	0.8	1,434	1.7	1,959	2.9	2,500	4.7
Day Users	492	0.4	406	0.5	387	0.5	375	0.7
Total, tons/day		1.2		2.2		3.5		5.4

Fully built out, the Master Plan Update is not anticipated to adversely affect or impact the County's waste service facilities. The West Hawai'i Sanitary Landfill in Pu'uanahulu will continue to receive solid waste from U of N Kona.

4.15 Archaeological Resources

An *Archaeological Inventory Survey of TMKs 3-7-5-010:085 and 3-7-5-017:006* was prepared for the Petition Area by Rechtman Consulting in 2003 (*Appendix I.1).* Additionally, there have been a number of archaeological studies conducted for surrounding lands, including studies within the Wai‘aha Ahupua‘a and the coastal kula areas of Kailua-Kona (*Table 4-13*). These studies have included archaeological inventory surveys, 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 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 4-13: 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	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*

* Previous archaeological and cultural studies conducted within the Petition Area.

A summary of the archaeological studies conducted within and near the Petition Area is presented below.

Existing Conditions

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: (3) 7-5-18:7,8)* (1994 AIS). 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. A total of 20 archaeological sites comprised of at least 38 associated features were identified. A variety of formal site types were documented 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. The 1994 AIS recommended 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 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 prepared 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: (3) 7-5-18:7,8)* (1996 Data Recovery Report). 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 three archaeological sites that were purported to be unavoidable during construction (Site 15507, Site 15511, and Site 15526). 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 bones. 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 prepared an *Archaeological Inventory Survey of TMK: (3) 7-5-18:08, Wai'aha 1st Ahupua'a, North Kona District, Island of Hawai'i* (2000 AIS). The 2000 AIS included a survey of one parcel 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 1994 AIS 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 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 prepared an Archaeological Assessment for the Petition Area. As a result, 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 subsurface testing of a sample of possible burial features based on the findings from the 2002 Archaeological Assessment. 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 prepared 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* (2003 AIS) (*Appendix I.1*). As part of the investigation, twenty-two 1 x 1 meter test units 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 23686 Features 183, 187, 189, 201, 204, 239, 262, 266, 271, and 297). Subsurface testing yielded numerous examples of cultural material, including volcanic glass flakes and shatter, charcoal fragments, groundstone, waterworn and 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 bones. Additionally, human skeletal remains were identified during excavation of Sites 23683, 23684, and 23685. The 2003 AIS identified 25 previously unrecorded sites and a single previously recorded site (*Table 4-14 and Figure 4-22*). The sites identified were both Historic and Precontact in nature and were further grouped into seven categories: Historic ranching related sites and boundary walls; Precontact habitation sites; trails; ceremonial sites; game boards; burials; and agricultural sites.

All sites were assessed as significant under Criterion D, with eleven sites (Sites 23662 through 23669, 23679, 23680, and 23682) recommended for no further work. Sites 23681, 23683, 23684, and 23685 were assessed as significant under both Criteria D and E and recommended for preservation. Site 6302, the Kuakini Wall, was assessed as significant under Criteria A, C, and D, and further recommended for preservation. The remaining ten sites were recommended for data recovery (Sites 23670 through 23678 and 23686). The 2003 AIS received final acceptance from SHPD by letter dated November 17, 2003 (Log No. 2003.2356, Doc No. 0311PM04) (*Appendix I.2*).

Table 4-14: 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.

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* (2003 Burial Treatment Plan) (*Appendix I.3*). The 2003 Burial Treatment Plan was prepared for the proper treatment of the three burial sites (Sites 23683, 23684, and 23685) identified in the 2003 AIS.

Site 23683 is a platform located in the west-central portion of the Petition Area (*Figure 4-21*). The platform measures approximately 6.7 meters long by 5.4 meters wide and 1.6 meters above the surrounding bedrock ground surface at its northeast corner. The platform is constructed of 'a'ā and pahoehoe boulders and cobbles stacked along its exterior north, south, and east edges. A raised bedrock outcrop abuts the western edge of the platform. The platform's surface is paved with small 'a'ā and pahoehoe cobbles. The site was evaluated to be in a good state of repair, although portions of the exterior walls have collapsed. Although Site 23683 yielded negative results when burial testing was conducted in 2002, the 2003 AIS found that the platform's formal attributes appeared similar to the burial sites in North Kona, and it was recommended the site be re-evaluated for the presence or absence of a burial. Burial testing conducted in 2003 revealed human skeletal remains were indeed present at Site 23683. Upon discovery of the skeletal remains, excavation immediately ceased. Although the remains were not moved from their original position, the remains were stabilized and re-buried with the soil excavated. Based upon the identified remains, it is suggested that the platform was built solely as a burial monument subsequent to the interment of the deceased individual.

Site 23684 consists of a platform attached to the north side of a square enclosure located in the southwest corner of the Petition Area (*Figure 4-22*). The platform measures approximately 7 meters long by 3.5 meters wide. The platform is constructed of 'a'ā cobbles and boulders along its exterior edges with small cobbles atop the surface. The platform is in fairly stable condition except for the northwest corner which has collapsed. Notably a branch coral was found amongst the rubble scatter in the northwest corner. Burial testing conducted at the platform required removal of a 70-centimeter-thick architectural layer which consisted of small to large sized 'a'ā cobbles mixed with organic materials. Pockets of branch coral were also identified and recorded to return to their appropriate places upon completion of the testing. Testing at the site revealed human skeletal remains were present. Although the remains were not moved from their original position, the remains were stabilized and re-buried with the soil excavated. The platform and enclosure may have been used for habitation purposes prior to the internment of the deceased individual.

Site 23685 *(Figure 4-22)* consists of a platform located in the north-central portion of the Petition Area. The platform measures approximately 3.8 meters long and 3.0 meters wide and is constructed of formerly stacked, but now mostly collapsed pahoehoe cobbles and boulders. The platform forms a roughly circular monument with a slightly rounded top surface paved with small cobles. The platform abuts a pahoehoe bedrock outcrop along its northern edge. Unlike the other two identified platforms, Site 23685 has a very formal appearance. Testing at Site 23685 revealed human skeletal remains were present. The burial appeared to be an intrusive pit excavated into the cultural soil, which indicates the individual was interred subsequent to the area being used as a habitation feature. Although the remains were not moved from their original position, they were stabilized and re-buried with the soil excavated. All artifacts recovered from the testing were returned to their rightful places.

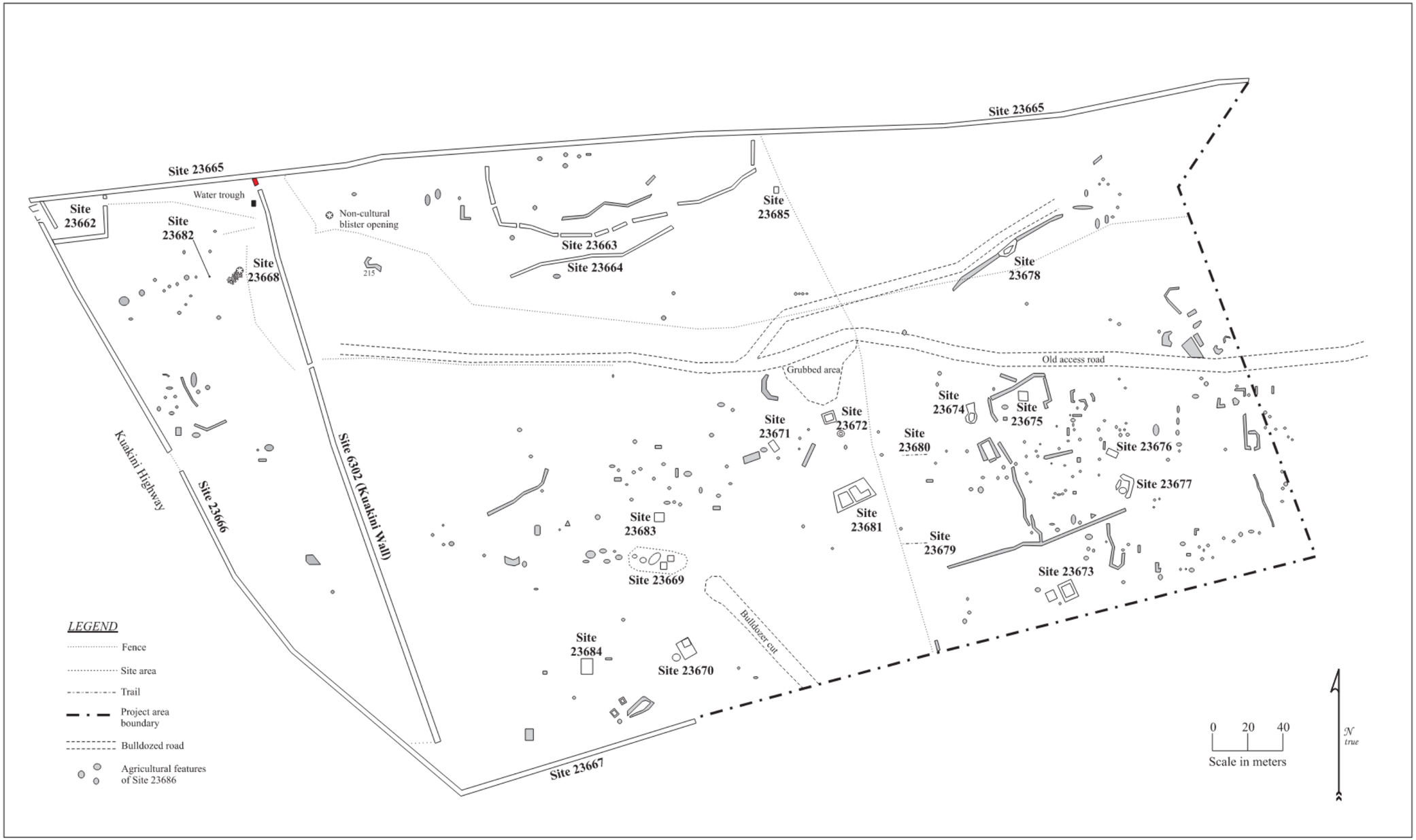

Figure 4-22 **Archaeological Sites (Rechtman, 2003)**

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Upon the discovery of human skeletal remains SHPD was notified immediately. Based on the results of the burial testing, a search for lineal and cultural descendants was conducted and consisted of the following:

1. Review of documentary research relating to the Petition Area and its general vicinity;
2. Publication of appropriate public notices in newspaper of local and statewide distribution; and
3. Consultation with local community representatives, the Hawai'i Island Burial Council (HIBC), the Office of Hawaiian Affairs (OHA), and SHPD.

Additionally, land claims within the ahupua'a of Wai'aha 1st and 2nd were reviewed to identify land claims that may have crossed the Petition Area, and if land claims crossed the Petition Area, to identify individuals who may be a lineal descendant.

Appropriate public notices requesting any information concerning the unmarked graves were published in the West Hawaii Today, Hawaii Tribune Herald, Honolulu Advertiser, and Ka Wai Ola o OHA. The public notices contained the location of the project, a contact person, and the intent to preserve the identified remains in place. Although the public notices did not receive any responses, one individual identified as a potential cultural descendant through work conducted for the CIA in support of the Master Plan Update .

In August 2003, Josephine Kamoku was contacted to discuss the potential of being a descendant of iwi kupuna identified at the Petition Area. Although she explained that she could not establish direct ties to the Petition Area, as a kupuna of the general area, she shared mana'o relative to the treatment of burial sites and indicted that the burial sites should be preserved within rock wall enclosures with native plants.

2007 Archaeological Data Recovery Report:

In 2007, Rechtman Consulting, LLC prepared 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* (2007 Archaeological Data Recovery Report) (*Appendix I.5*) for the Petition Area. As shown below in *Table 4-15*, 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. That process included clearance of vegetation to assess the then-current conditions of the sites, site photography, 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 shells (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, and 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 *lūheʻe* 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 were 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, potentially 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. *Table 4-15* provides a summary of the time periods and their associated features.

Table 4-15: Summary of Site and Feature Function Types Through Time (Rechtman Consulting, LLC)

Phase	Date Range (AD)	Sites/ Features (n)	Hale Mua (n)	Hale Noa (n)	Terrace Wall (n)	Helau (n)	Unknown Agricultural (n)	Kualwi (n)	Cattle Enclosure (n)
A	1400-1460	2	1	-	-	-	1	-	-
B	1460-1580	5	3	1	1	-	-	-	-
C	1580-1680	7	2	2	1	1	1	-	-
D	1680-1850	9	1	3	-	3	-	1	1

Phase A

Site 23686 contains Features 293 and 294 that are associated with the earliest dated evidence of occupation within the Petition Area. Both features are located near the southwestern corner of the Petition Area and are identified as being related to agricultural activities. Both features have been disturbed by modern day activities and are covered in recent refuse such as glass, plastic and metal containers, and automobile parts. The Features also have a similar architectural layer comprised of ʻaʻā cobbles and small boulders, roughly 40 centimeters thick. Considering the generally similar size, shape, architectural attributes, and deposits from Features 293 and 294, it is proposed that the two are roughly contemporary. Although both Features appear similar, Feature 239 appears to have been more elaborate and used more extensively than Feature 294. It is proposed that the differences probably have more to do with different functions, intensity of use, and/or persistence of use than with time differences. Items recovered from Feature 239 indicate that the structure was most likely used by men cultivating fields away from the main habitation area. Feature 294 was probably used for a shorter period or as temporary sleeping quarters. The evidence of both Features suggests that the initial fifteenth century AD occupation of the Petition Area was restricted and temporary.

Phase B

Features associated with the second oldest period of occupation within the Petition Area include:

11. Site 23676 Platform
12. Feature B enclosure of Site 23673
13. Feature A platform of Site 23673
14. Site 23671 Platform
15. Feature 247 terrace within Site 23686

The remains of certain animal species and artifacts associated with the second oldest period of occupation and an analysis of the cultural history of Hawaiʻi indicates that the Petition Area was associated with male related activities. The recovery of a burnt shark tooth from Site 23676 provides further evidence as Malo (1951) notes that prior to 1819, shark meat was *kapu* (taboo or prohibited) for Hawaiian women. Additionally, tuna remains within the Feature B enclosure of Site 23673 suggests that this feature was used by high status males as tuna was particularly favored by men of high status (Malo, 1951). The recovery of pig, dog, and bird remains from Site 23676 provides further evidence as all of these foods were consumed by men or used as offerings to the family ancestor spirits in the *hale mua* (house where the husband ate his food) (Handy and Handy 1972: 24, 252, 256, 387). Furthermore, the shell lure found from Site 23676 is known to be a composite of a fishing tool that was crafted by men.

Although Feature A platform of Site 23673 lacks male-related evidence, its proximity to Feature B enclosure of Site 23673 and its similar rectangular shape to Site 23676 suggests Feature A platform of Site 23673 functioned as a cooking area for male consumption. Feature B enclosure of Site 23673 was a *hale mua*, where men consumed and discarded their food. It is suggested that that Feature A of Site 23673 is where food was prepped and cooked, and was then taken to Feature B of Site 23673 to be consumed. The more isolated location of Site 23676 and the animal remains recovered from that Site indicates the food was prepared, consumed, and discarded on site.

The appearance of Site 23671 platform and Feature 247 terrace wall, which lay approximately 180 meters northwest of Site 23673, suggests the features could have served as the foundation of a *hale noa* (sleeping hut). Based on the evidence, the two main categories of features that were used during Phase B includes the *hale mua* (male eating house) and *hale mua* kitchen and the *hale noa* (sleeping house).

Phase C

Features associated with the third phase of occupation within the Petition Area includes:

16. Feature 250 pavement within Site 23686
17. Feature 254 terrace within site 23686
18. Site 23674 articulated platform and circular enclosure
19. Feature A enclosure of Site 23672
20. The smaller Feature B enclosure of site 23672
21. Feature 286 pavement within Site 23686
22. Feature 282 pavement within Site 23686

Although Site 23674 has not been dated, its placement between Features 250/254 mauka and Site 23672 makai suggests Site 23674 belongs to the same period. Features 282 and 289 falling on the mauka end of the same line tentatively suggests that they date to Phase C.

The recovery of items and considerations of feature shape and size suggests that Features 250 and 254 within Site 23686 and Site 23674 platform were cooking areas utilized by men. Site 23674 seems to be a more substantial and permanent *hale mua* than Feature 250 based on the size, weight, and variety of items. Additionally, Feature B of Site 23672 could have also been associated with male-related activities. The dark grayish brown fine silt suggests that a substantial oven associated with a *hale 'aina*, a temporary shed where men cooked meals for women and children, could have been built into the surface (Handy and Handy 1972: 302). Often times, the *hale 'aina* would be located near the *hale noa*, the common sleeping house. The two shark teeth recovered from Feature B of Site 23672 could have been introduced while men were preparing food.

Based on the comparatively large size of the walled enclosure (Handy and Handy 1972:291) and the absence of male-related items, the nearby Feature A of Site 23672 suggests the Feature was part of a *hale noa* where everybody slept.

The size and even surface of Feature 282 platform suggests that it could have been a *heiau* platform. Similar to a *hale mua, heiau* were placed at the approach toward a settlement, the front of a household cluster (Valeri 1985: 174), or agricultural plots. The *hale noa* dating back to Phases B and C and the identified *heiau* were all on the mauka side. Based on these identifications, it is further suggested that the agricultural settlement within the project area was approached from the mauka side. The south to north orientation of the terrace walls dating to Phases B and C could also be significant in this regard to providing a front facing fence as people approached the *hale noa* (Site 23671) and *hale mua* (Site 23674) from the interior. Feature 389 yielded a more restricted range of items suggesting the feature could have been a convenient stopping and snacking point on the way to agricultural plots.

Four main categories of features were used during Phase C, which includes the *hale mua*, the *hale noa* and the possibility of a *hale noa* kitchen, an agricultural platform, and a possible *heiau*. The increase in different kinds of features between the late sixteenth to mid seventeenth century suggests settling in and increasingly permanent use of the Petition Area. However, in comparison to earlier and later Phases, Phase C represents an overall drop in the mass and variety of resources exploited.

Phase D

The features that are associated with the fourth phase of occupation includes:

23. Site 23675 enclosed platform
24. Site 23670A lower tier platform
25. Site 23670B upper tier platform
26. Site 23670C platform
27. Site 23678 oval enclosure
28. Site 23677A enclosure
29. Site 23677B platform
30. Feature 251 enclosure within site 23686
31. Feature 23686 Kuaiwi

3.2 Feature 291

Recovery of pig and dog bones from Site 23675 suggests a *hale mua,* where men cooked, consumed, and discarded their food, was present within the site. Site 23675 appears to be in the vicinity of the earlier but smaller cooking structures at Feature 250 and Site 23674.

The tiered Site 23670A and B platform suggests the structure was once part of a *heiau.* Unlike the *heiau* identified in Phase B and C, which were located on the mauka end of the Petition Area, the Phase D *heiau* appears to be located in the makai portion of the Petition Area. This suggests that the main approach to the agricultural settlement rotated 180° during Phase D.

Feature 291 appears to be a wall that runs more-or-less perpendicular to the coast line. The perpendicular orientation of the wall suggests that new divisions emerged within the Petition Area during Phase D. Built within Feature 291 is the oval-shaped Site 23678. Based off the absence of male-related items and the medium sized structure, it is suggested this enclosure was once part of a *hale noa.* However, the high average weight of items recovered, and the high variety of items identified (approximately 21 different items) exceed the specifications of a typical *hale noa.* It is further suggested that this *hale noa* had increased and intensified its occupation.

Features A and B of Site 23677 appear to be features associated with what was once a second *hale noa.* Although both features are separated, the Feature B wall shows that these two features are part of the same structure. Recovered remains suggest that cooking occurred on this platform. Similar to Site 23678, Site 23677 had a cooking area within. The cooking areas being part of the *hale noa* structures at Sites 23677 and 23678 of Phase D contrasts with the earlier Phase C Site 23672 proposed *hale noa* where the cooking area was a spatially separate structure.

Cattle bones were recovered from the rectangular Feature 251 enclosure. The size of the enclosure, together with the absence of items apart from the cow carcass, suggests that the enclosure served as a cattle pen. Cattle was introduced to Hawai‘i in 1793 and by 1810 herds of cattle roamed across the island. By 1812, *kapu* against capturing feral cattle was lifted, marking the beginning of fully fledged ranching activities. Captured animals were taken into stone-walled paddocks. Cattle ranching became an important asset to Hawai‘i’s economy, and by the late 1800s cattle ranches grew in the Kona District (Kelly 1980).

Based on the available evidence, five main categories of features were used during Phase D, which includes a *hale mua,* two *hale noa* that contained kitchens, a *kuakini* (wall) associated with a *hale noa,* a *heiau,* and a cattle enclosure. Except for the *heiau,* Phase D features were sandwiched between two walls that appear to define boundaries between plots and/or homestead units. The presence of walls within the Petition Area suggests that a permanent cropping system replaced a shifting system of rotating cultivation by the eighteenth century.

Data recovery suggests the first use (Phase A or AD 1400-1460) was for short term habitation and associated opportunistic agriculture. Following Phase A, formal agriculture and recurrent habitation occurred during Phases B and C (1460-1680). Phase D (AD 1680-1850) is marked by consistent habitation and animal pens. Recovered remains suggests changing trends in gender presence and activities. Throughout time, it is worth recognizing that sites and features shifted makai to mauka. Phase A features were located in the southwestern, makai portion of the Petition Area, whereas Phase D occupational features expanded to the north, mauka of the Petition Area.

2013 Preservation Plan:

A *Preservation Plan for SIHP Site 6032 and Site 23681 (TMKs: (3) 7-5-10:085 and (3) 7-5-17:006) Waiʻaha 1st Ahupuaʻa, North Kona District, Island of Hawaiʻi for Sites 6032 and 23681* (2013 Preservation Plan) (*Appendix I.6*) was prepared by Rechtman Consulting, LLC in 2013 to identify measures to properly preserve Site 6302 and 23681.

Site 6032 is the State Inventory of Historic Places (SIHP) designation for the Kuakini Wall. Known as the Great Wall of Kuakini, archaeological documentation indicates that construction of the wall began in the early 1800s as a response to the growing number of feral animals running rampant throughout Kona. Although no record exists of former Governor Kuakini ordering the wall to be built, its final configuration is attributed to him. Other archival research (Thurston 1882) identifies a wall being built on a 5-acre property in 1825 and extending north, suggesting that Kuakini Wall was not built as a single construction but rather likely incorporated many preexisting property boundary walls along its course. Over time, it is believed that the function of the wall shifted from protecting fields from feral animals to protecting coastal settlement areas makai of the wall. Notably, maps filed with Māhele records for Kuleana parcels bordering Kuakini Wall mark Kuakini Wall in the vicinity of the Petition Area.

Approximately 340 meters of Kuakini Wall is located on the Petition Area. The section of the wall extends in the north/south direction on the lower portion of the Petition Area (*Figure 4-22).* This portion of Kuakini Wall is constructed in a core-filled method (*Figure 4-23).* Three gaps were identified along this portion of the wall (*Figure 4-24*). The first gap occurs along the northern end of the wall and is approximately 3 meters wide, and the second gap occurs 110 meters south of the northern end and is also approximately 3 meters wide. Both gaps are believed to be created by the Gomes Ranch to help funnel cattle waste towards Site 23662 and other pasture areas. The third gap occurs at the wall's southern end approximately 20 meters from the southern boundary of the Petition Area. This gap was most likely created for the construction of Sites 23666 and 23667. A wire fence connects the southern end of Kuakini Wall to Site 23666 creating a large paddock between the two walls.

Figure 4-23 **Portion of Kuakini Wall (ASM Affiliates, 2020)**

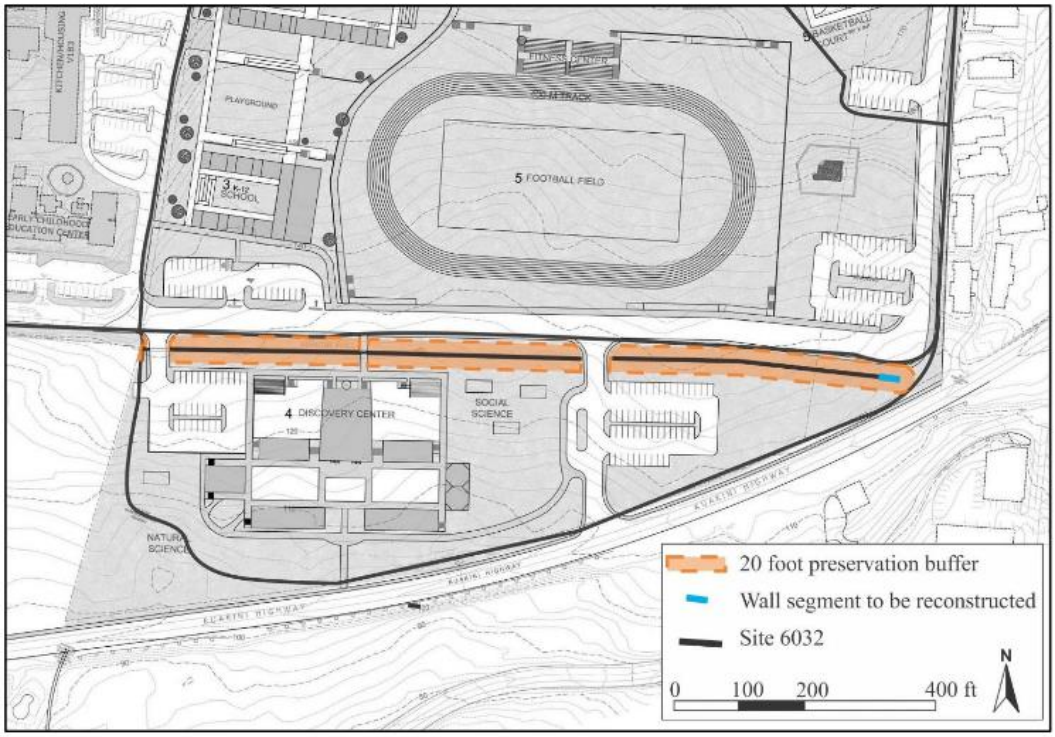

Figure 4-24 **Dismantling, Stabilization, and Restoration of Site 6032 (Rechtman, 2019)**

Site 23681 is located in the southern central portion of the Petition Area (*Figure 4-21).* The site consists of two features and is interpreted as an agricultural *heiau* or shrine, where Hawaiians would conduct rituals to ensure agricultural fertility and/or to induce rain. Feature A is a platform constructed within the northeast corner of a double enclosure (Feature B). Both features are constructed of ʻaʻā cobbles and boulders.

Feature A is a large rectangular platform measuring approximately 9.1 meters long by 5.3 meters wide. The platform is approximately .7 meters above the ground surface and is mostly intact with the exception of some collapse in the southwest corner and along the northern edge. Feature B consists of a double enclosure located to the south and west of Feature A. The enclosure measures approximately 19 meters long and 15 meters wide. A partially terraced central dividing wall creates two enclosure areas within Feature B. The interior of the western area of Feature B measures approximately 12 meters by 5 meters and the eastern interior area measures approximately 12 meters by 10 meters. Notably, the eastern enclosure area is slightly terraces above the western area.

The size and shape of the agricultural *heiau* identified at the Petition Area resembles other agricultural *heiau* identified in the greater North Kona area.

Potential Impacts and Mitigation Measures

As part of the design of the Master Plan Update, the following measures have been incorporated to preserve identified archaeological features at the Petition Area.

2003 Burial Treatment Plan

To properly preserve Site 23683, 23684, and 23685, the three identifies sites will be preserved in place. Preservation in place will be achieved through the establishment of defined preservation easements. During the short-term construction period, a temporary 50-foot buffer zone marked by orange construction fencing will be established around each identified burial site. A qualified archaeologist will ensure the proper placement of the fence, which will be verified with SHPD. No construction activity will take place within the 50-foot buffer zone. The 2003 Burial Treatment Plan received approval from SHPD on August 20, 2019 (Log No.2019.01527, Doc No. 1908CJ001 (*Appendix I.4*)).

To provide long-term preservation for Site 23683, 23684, and 23685, a 20 feet buffer zone will be established around each site. The 20-foot buffer zone will be defined by stone walls constructed of local basalt boulders and cobbles. A narrow-gated opening will be left through the enclosing walls to allow access for descendants. A landscaping plan incorporating native foliage will be prepared and submitted to SHPD for review. A small sign informing the public of the culturally sensitive site will be placed adjacent to the stone wall. Beyond the 20-foot buffer zone defined by a stone wall, an additional 10-foot buffer zone will be established as a no construction zone. Access to the burial site for appropriate cultural activities would be permitted to any lineal and/or cultural descendant who has been formally recognized by the Hawaiʻi Island Burial Council (HIBC) in accordance with the administration procedures contained within HAR §13-300-35. A long-term perpetual easement will be executed that would set forth requirements and restrictions related to physical improvements, signage, maintenance, and access by lineal or cultural descendants.

The Master Plan Update has been carefully designed to ensure appropriate buffer zones are established around Site 23683, 23684, and 23685. With buffer zones established and with the construction of stone walls and appropriate signage, it is not anticipated the Master Plan Update will adversely affect Sites 23683, 23684, or 23685.

2007 Archaeological Data Recovery Report

The 2007 Archaeological Data Recovery Report was prepared based on the strategies established in the Data Recovery Plan (Rechtman 2004) for the mitigation of ten sites (Site 23670, 23671, 23672, 23673, 23674, 23675, 23676, 23677, 23678, and 23686). Excavations were taken at each site recommended for data recovery and the excavations were then tested to gain further information on the identified features. Testing identified dates and possible duration of occupation as well as the function of the sites. The information obtained will contribute to the growing corpus of knowledge of the Pre-contact use of Kona's kula zone. The 2007 Data Recovery Report was originally submitted to SHPD in October 2007 and was resubmitted in August 2019. The Report is currently under review for review and acceptance.

2013 Preservation Plan

A Preservation Plan was prepared by Rechtman Consulting LLC in 2013. The Preservation Plan identifies measures to preserve Site 6302 and 23681. The 2013 Preservation Plan received final acceptance from SHPD by letter dated June 19, 2014 (Log No. 2014.2843 and Doc No. 1406MV15) (*Appendix I.7).*

Site 6302

The 2013 Preservation Plan outlines a multi-modal approach to preserve Kuakini Wall and calls for the preservation of stabilized intact portions of the wall, restoration and stabilization for collapsed portions of the wall, and reconstruction of the southern portion of the wall. Additionally, the preservation plan calls for the widening of the northern most breach for infrastructure improvements and the creation of a new 40-foot wide breach for accessibility purposes (*Figure 4-24)*. In support of the multi-modal approach to preserve Kuakini Wall, a Dismantling/Restoration Plan outlines measures to preserve and restore the wall.

Preservation during the short-term dismantling, stabilizing, and reconstruction phase will be achieved through the establishment of twenty-foot buffer zone measured from the mauka and makai faces of the wall. Orange construction fencing will be placed along the preservation boundary during the dismantling, stabilization, and reconstruction phases. Proper placement of the orange construction fencing will be checked by a qualified archaeologist and verified in writing to SHPD. The preservation site relative to construction zones will be plotted on construction plans and reviewed prior to the start of dismantling. No construction, land modification, or other unauthorized activities would be permitted to occur within the buffer zone. Invasive landscaping in the buffer zone will be removed by hand.

Long-term preservation for Kuakini Wall will be achieved through the establishment of a permanent preservation easement recorded with the Bureau of Conveyances. Upon completion of construction, the orange construction fencing will be removed and interpretive signage with information about Kuakini Wall will be placed along the 20-foot buffer.

Site 23681

The agricultural *heiau* identified at the Petition Area will be preserved as a stabilized ruin, and signage informing of the cultural and historic significance of the *heiau* will be posted. A twenty-foot buffer zone will be defined by the construction of a stone wall comprised of local basalt boulders and cobbles. The appearance of the wall will be built in typical traditional Hawaiian dry stacked fashion with a hidden concrete core for stability. The wall will be a minimum of three feet in height and two feet in width. An

inconspicuously situated narrow gated opening will be left through the enclosing of the wall to allow access for appropriate visitation and maintenance purposes.

Orange construction fencing will be placed along the permanent preservation boundary during the construction of the stone wall. Proper placement of the orange construction fencing will be checked by a qualified archaeologist and verified in writing to SHPD. The preservation site relative to the construction zone will be plotted on construction plans and reviewed prior to the start of dismantling. Absolutely no construction activity will occur within the preservation area. Upon completion, the orange construction fencing will be removed, and the preservation buffer will be treated as a permanent preservation measure.

Invasive vegetation will be removed by hand within the preservation buffer and collapsed portions of the *heiau* will be restacked, if necessary. If any vegetation is introduced into the buffer zone it will consist of shallow rooted native and Polynesian-introduced species.

Long-term preservation will be achieved through the establishment of a permanent preservation easement that will be recorded with the Bureau of Conveyances and will be attached to the property deed. The buffer zone will be delineated by a vegetation transition. Additionally, a cautionary sign will be established along the preservation buffer zone boundary to inform the public of the *heiau*.

2019 Dismantling and Restoration Plan

In support of the 2013 Preservation Plan, 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* (2019 Dismantling/Restoration Plan) (*Appendix I.8*) was prepared by ASM Affiliates.. The 2019 Dismantling/Restoration Plan was submitted to SHPD in 2019 and is currently under review for acceptance.

The 2013 Preservation Plan calls for the preservation of stabilized intact portions of the wall, restoration and stabilization for collapsed portions of the wall, and reconstruction of the southern portion of the wall. Additionally, the preservation plan calls for the widening of the northern most breach for infrastructure improvements and the creation of a new 40-foot wide breach for accessibility purposes.

A qualified archaeologist, under the direction of a Principal Investigator will present on-site to observe and document the dismantling of the wall for the creation of the new 40-foot wide breach and will conduct periodic monitoring, once a week. The archaeological monitor will keep a daily log of activities performed and discoveries made. A scaled plan view drawing of the portions of the wall to be dismantled will be prepared and the archaeological monitor will meet with the construction team prior to any dismantling work. Portions of the wall that are planned to be dismantled will be cleared of vegetation, and then photographed prior to dismantling. During the dismantling phase, all rocks taken from the existing gap and the new breach will be removed by hand and retained for stabilization and reconstruction. Exterior rocks will be staged separately from the interior fill so that they can be used to face the repaired and reconstructed sections.

Dismantling for the new 40-foot wide breach will be conducted first, followed immediately by stabilization of the newly created wall ends. Once dismantling is completed for the new breach, the newly created wall ends will be photographed, and scaled cross-section drawings will be prepared. The stabilized wall ends will be crafted similar to the dismantled ends. Once stabilization of the new wall ends has been completed, the remaining rocks obtained during dismantling efforts will be used to reconstruct the missing portion of the wall beginning at its current southern termination and extending

southward, as far as the amount of rock material will allow. If rock material remains, other partially collapsed sections of the wall will then be stabilized using excess rocks. The appearance of the stabilized portions of the wall will match that of the existing wall. All sections of the wall that require stabilization will be photographed prior to and after any such work is completed.

Upon completion, the orange construction fencing will be removed, and the preservation buffer will be treated as a permanent preservation measure. Should any previously undocumented, non-burial historic properties be identified during the dismantling, stabilization, and reconstruction of the Kuakini Wall, SHPD will be notified immediately, and all work will cease until further recommendation and mitigation is prepared. Undocumented cultural deposits will be mapped, photographs will be taken, scaled profile drawings and plan views will be prepared, and soils (if applicable) will be described in detail. Upon completion of the dismantling, stabilization, and reconstruction of the Kuakini Wall, a dismantling/restoration report will be prepared and submitted to SHPD for review and acceptance.

Long-term preservation will be achieved through the establishment of a permanent preservation easement that will be recorded with the Bureau of Conveyances and will be attached to the property deed. The buffer zone will be delineated by a vegetation transition. Additionally, cautionary signs will be established along the preservation buffer zone boundary to inform the public.

The previous archaeological studies conducted at the Petition Area have identified significant, valued cultural resources, including sites traditionally used for ceremonial, habitation, agricultural, burial, and transportation purposes. U of N Kona recognizes the significant features associated with the Petition Area and has incorporated the identified preservation measures into the design of the Master Plan Update. With interim and permanent preservation measures implemented during the buildout of the Petition Area, it is not anticipated historic archaeological features will be disturbed. An archaeological monitor will be present during the buildout of the Petition Area, and an archaeological monitoring plan will be prepared in accordance with HRS §13-279-4 and submitted to SHPD for review and acceptance prior to construction. Additionally, in the event of an inadvertent discovery of ancestral remains during the phased buildout of the Master Plan Update, SHPD will be notified immediately, and all work will cease until further mitigation is recommended. Should *iwi* need to be moved or touched, an identified cultural monitor, lineal/cultural descendant, or someone with knowledge of Hawaiian ancestry will work in conjunction with a qualified archaeological monitor to complete the task.

4.16 Cultural Resources and Practices

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; (3) 7-5-17:006* was prepared by ASM Affiliates in 2020 in support of the Master Plan Update., (2020 CIA) (*Appendix J*). The 2020 CIA is an update to a previous cultural impact assessment conducted for the Petition Area by G70 in 2003. The methodology for the 2020 CIA 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. Preparation of a report that summarizes the information obtained from research conducted from which an evaluation of the potential cultural impacts related to the Petition Area. As necessary, recommendations to mitigate potential impacts will also be included.

As part of the 2020 CIA, various agencies and organizations, including The Office of Hawaiian Affairs (OHA), Hawai‘i Island Burial Council, Queen Lili‘uokalani Trust, 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.

Existing Conditions

Traditional Land Uses

The Petition Area is located on the lower western slopes of Hualālai within the ahupua‘a of Wai‘aha in the moku o loko (interior district) of Kona on the Island of Hawai‘i (Pukui et al, 1974:219). The moku o loko of Kona is one of six interior land districts that divide up the Island of Hawai‘i, originally called Lononuiākea. Due to the vast expanse of land acreage, the Kona district is partitioned into a northern and southern region, with Pu‘u Ohau, a cinder cone between Kealakekua and Keauhou, demarcating the boundary (Clark 1985:107). The Petition Area is located within the Northern District of Kona. The Northern Kona District stretches from Keahualono to Pu‘u Ohau, and contains approximately 82 ahupua‘a (Pukui 1983:198). The ahupua‘a of Wai‘aha, which translates to “gathering water”, is noted in many oral traditions and written records as an area that is abundant with mountainous and coastal resources.

The gentle sloping contours of the Wai‘aha uplands were a complement to its level coastal plains, with the former providing an ideal environment for the cultivation of dryland kalo (*Colocasia esulenta, taro*). The general soil characteristics of decomposing lava mixed with organic material provided ideal terrain conditions for planting ‘uala (*Ipomoea batatas, sweet potato*), ‘ulu (*Artocarpus altilis, breadfruit*), wauke (*Broussonetia papyrifera, paper mulberry*), and ipu (*Lagenaria siceraria, gourd*), thereby providing adequate food, clothing, and storage resources. Toward the uplands, open vistas expanded for miles, unveiling a diversified landscape of forest and fruit trees, which included koa *(Acacia koa subsp. Koa*), kou (*Cordia subcordata*), hala (*Pandanus tectorius, screwpine*), and ‘ōhi‘a ‘ai (*Syzygium malaccense, mountain apple*). As shared in the *‘ōlelo no‘eau*, Kona, mauna uliuli, Kona mauna ulupō, the lands of Kona are distinguished by its green mountains and dense forest. (Abbot: 1974, 174; Handy, Handy, & Pukui: 1972, 522-523; Pukui: 1983, 199)

Historical Background

The moku o loko of Kona is associated with the akua (god) Lono, who is considered to be the source of agriculture, fertility, and abundant rains. The land use practices, and cultural protocols associated with agriculture practices, in Kona have been well documented. As provided in an overview of historical

references and native accounts, honorific tributes to the akua Lono were a part of the cultural practices within the district that were perpetuated from time antiquity:

> *The most interesting mythological and legendary materials relating to Kona have to do directly or indirectly with the god Lono…the origin of the Makahiki rain and harvest festival. From Kona, we have the written record of a myth of Kumuhonua (Earth Foundation, 36 generations before Wākea and Papa, who was the first man fashioned by the gods.), whose writer says that Lono was a fisherman and yet ends his story by stating that the events related occurred before men peopled the earth. Lono is credited with introducing the main food plants, taro, breadfruit, yams, sugarcane, and bananas to Hawai'i and also 'awa (Handy, Handy, & Pukui: 1972, 522).*

> *The sweet potato and gourd were suitable for cultivation in the drier areas of the island. Lono was important in these areas, particularly in Kona on Hawai'i and 'Ulupalakua on Māui. At both of these places, there were temples dedicated to Lono. The sweet potato was particularly the food of the common people. The festival in honor of Lono, preceding and during the rainy season, was essentially a festival for the whole people, in contrast to the war rite in honor of Kū which was a ritual identified with Kū as god of battle (Handy, Handy, & Pukui: 1972, 14)*

Various oral traditions recount the lineage of Līloa and 'Ehunuikaimalino, ali'i nui (ruling stewards) of Hawai'i Island during the Consolidation Period (1180-1450 A.D.) During this period, the establishment of political consolidation through applied concepts of sovereignty and hereditary rule by particular families was emphasized, thereby providing opportunities for individual islands to become politically, economically, and socially prosperous (Barrere: 1971, 1-5; Kelly: 1983; 1; Kamakau: 1992 (c), 170; Lake: Ms.). The ascension of Līloa's son, 'Umialīloa, in the mid-15th century marks the end of the Consolidation Period. It was 'Umialīloa who established peace and prosperity on the Island of Hawai'i. Through subsequent generations, 'Umialīloa is the progenitor for other ali'i nui including the aforementioned Kalaninui'īamamao, the father of Kalani'ōpu'u, who was the father of Kīwala'ō and uncle to Kamehameha I. Oral traditions recount that it was Kalani'ōpu'u who placed the kapu for the war akua (god) Kūka'ilimoku with Kamehameha instead of Kīwala'ō, which had a significant impact on the socio-political events that lead to the eventual and successful campaign and reign of Kamehameha I.

Pre-Contact to the Early 1800s

Since the time of 'Umialīloa, the abundance of resources made the district of Kona a favorable place of residence for ali'i with lands designated for agricultural production, aquaculture cultivation, and habitation. In Precontact and early Historic times, the people of Kona lived primarily in small settlements along the coast with access to fresh water, where they subsisted on marine resources and agricultural products. The agricultural field system exemplified the adaptation of traditional native planters to various climatic, terrain, and soil conditions. There are four traditional vegetation zones in Kona that characterize the natural landscape from makai to mauka, consisting of the kula, kalu'ulu, 'āpa'a, and 'ama'u zones. The Petition Area is located along the coastal edge of the Kona Field System within the kula zone. The kula zone is the lowest elevation zone, ranging from sea level to 150 meters in elevation, traditionally associated with habitation and cultivation of sweet potatoes, paper mulberry, and gourds. The natural environment of the kula lands immediately mauka of Kailua Bay were described to Reverend William Ellis by Reverend Asa Thurston when a group traversed through the upland region:

> *The houses, which are neat, are generally built on the seashore, shaded with coconut and kou trees, which greatly enliven the scene…Small gardens were seen among the barren rocks on which the houses are built, wherever soil could be found sufficient to nourish the sweet potato, the watermelon, or even a few plants of tobacco, and in many places these seemed to be growing literally in the fragments of lava, collected in small heaps around the roots (Ellis: 1979, 31).*

The cultivation of the kula lands was much more labor-intensive and often did not yield the same quantity or quality in agricultural production as compared to its wetland counterpart. Moreover, the only major tributary stream serving the ahupua'a is the Wai'aha Stream. The headwaters of the stream lie in the upper mountain regions of Hualālai. With only a limited water supply stemming from intermittent rainfall, a series of underground dike systems, and the outflow of the stream, there was an applied approach to water conservation and management to ensure that drought conditions were not prevalent. Thus, to effectively manage the area's water supply, innovative irrigation and dryland agricultural production methods were derived in order to provide a yield of food and water that could sustain the expanding population within the region.

Journal entries describing the Kailua-Kona region in the early 1800s describe the growing population and agricultural features of the area. The journal of Reverend Ellis describes the verdant landscape of the surrounding kula lands, including those of Wai'aha:

> *Leaving Kairua, we passed through the villages thickly scattered along the shore to the southward. The country around looked unusually green and cheerful, owing to the frequent rains, which for some months past have fallen on this side of the island. Even the barren lava, over which we traveled, seemed to veil its sterility beneath frequent tufts of tall waving grass, or spreading shrubs and flowers. The sides of the hills laid out for a considerable extent in gardens and fields, and generally cultivated in potatoes, and other vegetables were beautiful (Ellis: 1979, 78-79).*

As such, the district became a population center with increased patterns of settlement through the Post-Contact period.

Transition in the Early 1800s

The last seven years of Kamehameha's life were in Kailua at his principal residence of Kamakahonu near the heiau of Ahu'ena, thereby shifting political and spiritual governance from O'ahu back to Hawai'i Island. Following the death of Kamehameha I in 1819, Kaluaikonahale John Adams Kuakini was appointed by the Queen Ka'ahumanu to the position of kia'āina (governor) for the Island of Hawai'i. Governor Kuakini was the younger brother of Ka'ahumanu and the son of Namahana and Ke'eaumoku. Although trained in the traditional cultural practices of the Kū priesthood, Kuakini was one of the first ali'i that mastered the English language, even prior to the arrival of missionaries in 1820.

In 1837, Kuakini built his permanent residence, now known as Hulihe'e Place, and constructed Moku'aikaua, the first and oldest Christian church in Hawai'i. Also during this time, the Pā a Kuakini (wall of Kuakini) was constructed along the entire length of North and South Kona to protect the productive agricultural uplands from being inundated from free-roaming domesticated animals. A stone building was also built by Kuakini to be used as a cotton factory, but dwindled within a year. Kuakini had a definitive role in shaping the natural and social landscape of Kona by promoting various

construction endeavors designed to enhance the quality of life for his people during the time directly following the overthrow of the traditional kapu system (Kame'elehiwa 1992; Winnie 1928).

Remaining loyal to the traditional ways of the people but respecting Ka'ahumanu's new affirmation to the Christian faith, Kuakini was considered to be a pono ali'i by traditional Hawaiian standards, maintaining a commitment to address the needs of the people while preserving and protecting the natural resources within the Kailua-Kona region. After his death in December 1844, Kuakini bestowed his position of Kia'āina and all of his lands to his keiki hānai, William Pitt Leleiōhoku. Leleiōhoku's inheritance included Hulihe'e Palace, which was later passed to Princess Ruth Ke'elikōlani, upon his death in 1848.

Notably, the early 1800s marked the arrival of the British missionary William Ellis and members of the American Board of Commissioners for Foreign Missions (ABCFM). Seeking communities to establish church centers for the growing Calvinist mission, William Ellis and members of the ABCFM began to establish political and social relationships with ruling ali'i.

Disposition of Wai'aha at the Time of the 1848 Māhele

In 1848, during the reign of Kauikeaouli (Kamehameha III), the Māhele, a western concept of land tenure, was derived into legislation, which created a massive reformation of the existing land system in Hawai'i. It was the first time a system of separation and identification of the associative rights of the king and the chiefs to the land was established. The result of the Māhele led to the division and distribution of land, thus creating a system of possession rights and private title to land. During this process, all lands were placed into one of three categories: Crown Lands (for the occupant of the throne), Government Lands, and Konohiki Lands (lands for the lesser chiefs and landlords).

The lands of Wai'aha were divided into two sections. Wai'aha 1st was the most northern section and comprised of approximately 260 acres (*Figure 4-25)*. Conversely, Wai'aha 2nd was the southern section, comprised of approximately 170¼ acres (*Figure 4-24)*. The area fronting the cove at Wai'aha, between the point of Kalaeloa on the north and Kā'ilipunahele on the south, once belonged to Grace Kama'iku'i Rooke. Grace Kama'iku'i Rooke was the daughter of John Young and Mary Kuamo'o, who later adopted her niece, Queen Emma, who had a strong affinity for the ahupua'a of Wai'aha.

Land Commission Awards and Māhele Claims

As lands were divided and distributed, all lands that were identified as Crown Lands, Government Lands, and Konohiki Lands were "subject to the rights of native tenants." This meant the Privy Council adopted resolutions, which authorized the Land Commission to award fee simple titles to all native tenants who could demonstrate that they either occupied or improved any portion of these lands.

Awards issued by the Land Commission to the maka'āinana were called Kuleana awards or Kuleana lands. Native and foreign testimonies were provided to verify the legitimacy of an applicant that claimed residency upon a particular piece of land prior to 1839. Although the maka'āinana did not have to pay a commutation fee, they did have to pay for the survey of their awarded parcels. During the Māhele, 14,195 kuleana claims were filed and 8,421 of those claims were awarded. The total acreage of those lands included in these claims equated to approximately 28,658 acres, which consisted of only lands under direct cultivation and did not include lands that were fallow (Kame'eleihiwa: 1992, 295-297; Chinen: 1958).

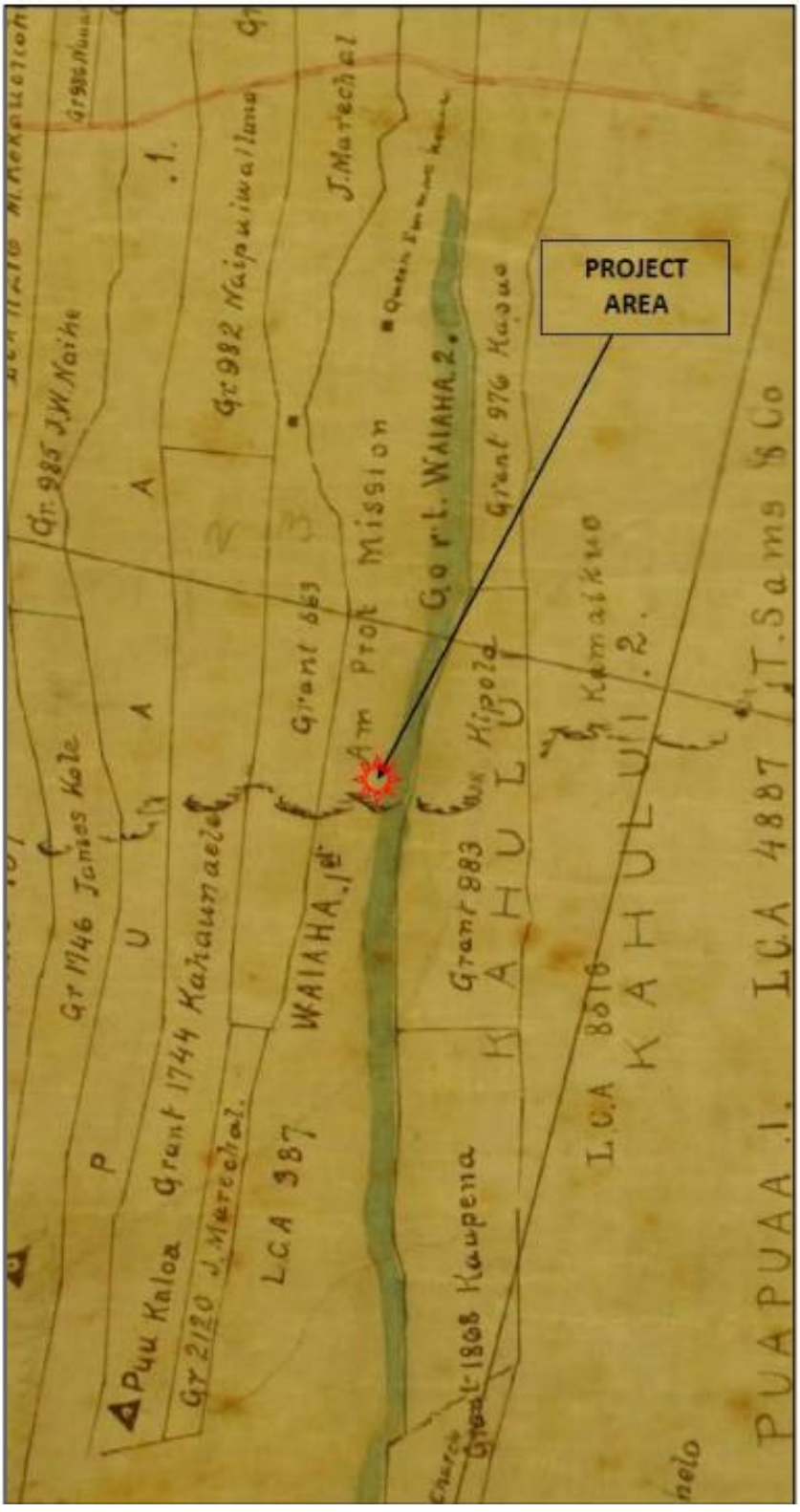

Figure 4-25 **Wai'aha 1st and Wai'aha 2nd Ahupua'a (J.S. Emerson, Circa 1981) (ASM Affiliates, 2020)**

Land Commission Awards and Māhele Claims

The lands of Waiʻaha 1st were initially awarded to the ABCFM as LCA 387 after a petition was sent to the Ministry of the Interior requesting that a commutation for a fee simple title be granted for these lands. Additionally, four native tenants presented and were awarded a Land Commission Award within the Ahupuaʻa of Waiʻaha 1st (*Table 4-16).* Three of the kuleana awards are situated west of the Petition Area near the shoreline, while the remaining kuleana award parcel is located well to the east in the upper reaches of the Waiʻaha ahupuaʻa.

Table 4-16: Land Commission Awards in the Ahupuaʻa of Waiʻaha 1st

Awardee	LCA	Royal Patent	Register: (N): Native (F): Foreign	Testimony: (N): Native (F): Foreign	Acres
ABCFM	387	1600	(F) 47v.2	(F) 142v.3	281.80
Kalae	7481	3682	(N) 442v.8	(N) 513v.4	1.61
Kalama	7241-B	6672	(N) 419v.8	(N) 514.4	0.29
Kaulua	7083	N/A	(N) 418v.8	N/A	0.16
Lumaawe	6699	N/A	(N) 413v.8	(N)549v.4	1.00

Post Māhele Period: The Advent of the Contemporary Agricultural Production

In 1899, the Kona Sugar Company established itself in the Kailua-Kona region with the intent to become an emerging leader in the Hawaiʻi's sugar industry. In 1901, the plantation built its first sugar mill, which was situated at an elevation of 764 feet in Waiʻaha. The Kona Development Company constructed and operated an 11-mile railroad line that extended from Keōpuka, South Kona to the mill site that was situated at Waiʻaha. The railroad line was built at approximately the 700- foot elevation level. Stone trestles were constructed as high as 20 feet. Sugarcane was transported from the upland fields to the railway via triggered cables, whereupon it was hauled to the railroad site just above Kailua. The plantation and the mill site operated for approximately 27 years until closing in 1926.

Development of Trade, Cattle, and Ranching Industry

The town of Kailua developed into a major seaport with an embayment that provided a safe anchor. Kailua served as a major port-of-call for initial shipping vessels and steam ships. Boat days became an intricate part of the social fabric for the area, as it served as a primary means of shipping goods, products, and livestock being cultivated, processed or raised within the Kailua-Kona region.

The development of large parcels of kula lands encouraged and expanded import of cattle from Scotland, Australia and England. This was aided by the tug and barge system at Kaiakeakua (Kailua) Bay, which improved the transportation of cattle. In 1918, there were approximately 10 major ranching operations that tended to nearly 14,000 cattle. By the 1920s, three of these ranches emerged along the Kona coast as the primary producers of cattle: the Frank Greenwell Ranch at Honokōhau, Hualālai Ranch, and the Arthur Greenwell Ranch in South Kona.

Land Ownership

According to land records, lands within Waiʻaha were partially held in title by Thomas Gouveia, a local rancher and butcher. Ownership was then transferred to Josephine Duarte and Sam Liftee. In 1952, Josephine Duarte and Sam Liftee sold the property to Manuel Gomes.

In an interview conducted with Joseph Gomes, the son of Manuel Gomes, he further shared that his father was able to purchase the lands within Waiʻaha as ranching began to evolve, and cattle were pushed to the uplands where pastures could provide adequate food and water for them. In August 2000, the parcels encompassing the Petition Area were conveyed to PACU Bencorp (subsequently named U of N Bencorp) for the benefit of the U of N Kona via the Gomes Family Limited Partnership.

Potential Impacts and Mitigation Measures

Based upon the information obtained from the review of historical documentation, archaeological reports, oral traditions, informal discussions, and formal interviews, the 2020 CIA recognizes that the native Hawaiian epistemological approaches to land use that continue to be perpetuated are:

1. *Recognizing that all ʻāina (translated as "that which feeds", but commonly applied as a definition for "land") is born of Papahānaumoku (Earth Mother).*
2. *Acknowledging that although traces of a physical imprint and its integrity of traditional cultural properties, resources, features, beliefs, and practices may no longer remain, there is a thriving spiritual imprint that remains in the form of mana, the spiritual essence of those kūpunu and nā mea loea that have come before.*
3. *Understanding place names, such as Waiʻaha, illustrate a collective history of a geographical region, reiterate community and familial genealogy, characterize and describe the natural resources within a prescribed physical space, and define recognized cultural mores and values of the existing community.*

As recommended by the 2020 CIA, the plan for the Petition Area has been thoughtfully designed to foster a place that is reflective of the Kailua-Kona region, both its natural attributes and cultural history. U of N Kona acknowledges the historic cultural and archaeological features identified at the Petition Area and has carefully designed the Master Plan Update to preserve the identified historic cultural and archaeological features. As such, buildings are intentionally situated at a distance from identified cultural and archaeological sites to ensure the proper preservation and protection of the sites. Additionally, a unified architectural theme will be established to reflect a distinct sense of place.

Interim and permanent preservation measures identified in the 2003 Burial Treatment Plan, the 2007 Archaeological Data Recovery Report, the 2013 Preservation Plan, and the 2019 Dismantling/Restoration Plan described in *Section 4.15* will be implemented under the supervision of a qualified archaeologist. Additionally, native plants and landscaping elements representative of the natural and cultural landscape will be integrated throughout the Petition Area.

With interviewees expressing concerns for the handling of iwi, should there be a reason for iwi to be moved or touched, an identified cultural monitor, lineal/cultural descendant, or someone with knowledge of Hawaiian ancestry, will work in conjunction with a qualified archaeological monitor to complete the task. In the event of an inadvertent discovery of ancestral remains, SHPD will be notified immediately, and all construction activity will cease until further mitigation is recommended. An archaeological monitor will be present during the buildout of the Petition Area and an archaeological monitoring plan will be prepared in accordance with HRS §13-279-4 and submitted to SHPD for review and acceptance prior to construction. As part of the EIS process, U of N Kona will continue to consult with appropriate agencies and organization including but not limited to SHPD, SHPD Burial staff, HIBC, OHA, and other interested native Hawaiian organizations.

4.17 Ka Pa‘akai o Ka ‘Aina Analysis

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. (Ka Pa‘akai Analysis) (*Appendix K*) 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 and practices. The Ka Pa‘akai Analysis is based on the Hawai‘i Supreme Court's decision in *Ka Pa‘akai O Ka ‘Aina 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* case, 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 subject land, including the extent to which traditional and customary native Hawaiian rights are exercised in the subject land;*
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 agency to reasonably protect native Hawaiian rights if they are found to exist.*

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 and practices may be impacted by the Master Plan Update, and recommends feasible actions and mitigative measures that may be taken by the Land Use Commission to reasonably protect native Hawaiian rights and practices, to the extent they are found to exist within the Petition Area.

Existing Conditions

The cultural significance of the Kona District and the ahupua‘a of Wai‘aha in the conscience of native Hawaiians is illustrated in several oral traditions associated both with the moku o loko and the ahupua‘a as being an area of residence for ruling ali‘i (often referred to as "chiefs" but are considered living akua who bear the kuleana of developing and practicing appropriate land and coastal stewardship practices). Numerous native 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. Generally speaking, Kona is associated with the god Lono, who is considered to be the source of agriculture, fertility, and abundant rains.

As previously discussed, the extensive agricultural production is characterized as one of the most significant cultural features of the Kona district. The Petition Area is situated within the Kula zone, which was traditionally associated with habitation and cultivation of sweet potatoes, paper mulberry, and gourds. Agricultural features such as clearing mounds, planting mounds, planting depressions, modified outcrops, pavements, enclosures, and planting terraces are common throughout much of the Kula zone. Within Kona's arid Kula zone, elaborate irrigation methods were developed to provide an adequate supply of freshwater to agricultural parcels.

In the Precontact and early historic times, the people of Kona lived primarily in small settlements along the coast with access to fresh water, where they subsisted on marine resources and agricultural products. Within Kona's coastal fisheries, the waters are instilled with innumerable streaks of blue-green hues, indicating the varying ocean depths and channels that are abundant with schools of

pelagic fish such as a'u (*Istiophoridae,* marline or spearfish), *ono (Acanthocybium solandri,* wahoo), *aku (Katsuwonus pelamis,* bonito or skipjack), *ahi (Thunnus albacares,* yellow-fin tuna), *mahimahi (Coryphaena hippurus,* dolphin-fish), *kāhala (Seriola dumerilii,* amberjack or yellow-tail), and *ulua (Family carangidae,* jack crevalle). In addition to the fish, Kona is also recognized for its fringing reef that teem with a wide variety of nearshore marine species.

Following the Pre-contact and early historic period, the arrival of the ABCFM led to the ever-growing population of Westerners, which led to socioeconomic and demographic changes and promoted the establishment of land ownership. The Māhele 'Āina of 1848 distributed land, thus creating a system of possession rights and private title to land. The lands of Wai'aha were divided into two sections, Wai'aha 1st and Wai'aha 2nd. Wai'aha 1st was initially awarded to the ABCFM (LCA 387) after a petition was sent to the Ministry of the Interior by the ABCFM with a request that a fee simple title be granted for these lands. Notably LCA 387 also awarded additional lands to the ABCFM. Within the Wai'aha 1st ahupua'a, five native long-standing residents made claims for lands (*Table 4-15).* The awarded lands totaled approximately 3.06 acres and ranged from 0.16 to 1.61 acres. None of the awarded lands are located within the Petition Area.

By the late 1890s, lands within Wai'aha were utilized by the Kona Sugar Company. After closing its doors in 1926, lands within the ahupua'a of Wai'aha 1st and Wai'aha 2nd were purchased by Manuel Gomes, who transformed the area into cattle and ranching operations. The upper slopes of Wai'aha are utilized today for ranching, diversified agriculture, and coffee production and the coastal regions are part of a growing urban environment.

Consultation

As part of the 2003 Cultural Impact Assessment, various agencies and organizations, 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 associate 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.

There were three primary guiding principles that were the theme of consultation. The first being that 'āina is born of Papahānaumokua (Earth Mother). This guiding principle is the foundation from which the cultural values of aloha 'āina and mālama 'āina are derived. Also, it is necessary to acknowledge that although traces of a physical imprint and its integrity of traditional cultural properties, resources, features, beliefs, and practices may no longer remain, there is a thriving spiritual imprint that remains in the form of mana, the spiritual essence of those kūpuna and nā mea loea that have come before. Finally, it is necessary to understand that place names, like Wai'aha, illustrate a collective history of a geographical region, reiterate community and familial genealogy, characterize and describe the natural resources within a prescribed physical space, and define recognized cultural mores and values of the existing community.

Collectively, the individuals relayed similar concerns regarding the potential impacts of the Master Plan Update on the known archaeological and burial sites, and the potential for encountering previously unidentified burials. Also expressed was the concern for proper stewardship of the lands by the landowner in order to maintain its cultural integrity, and the need for involvement in the design of the Master Plan Update by cultural and lineal descendants, particularly kūpuna. These concerns and recommendations, expressed in 2003 when previous surveys were conducted, were then used to formulate a set of project-specific recommendations.

Potential Impacts and Mitigation Measures

The archaeological research conducted at the Petition Area combined with the cultural-historical information collected for the CIA attests to the presence of significant cultural resources within the Petition Area. These significant cultural resources include sites and features associated with specific historical activities such as agriculture, temporary and permanent habitation, transportation, animal husbandry, ceremony, and burial. Identification of resources has demonstrated cultural use of the Petition Area that spanned both the Precontact and Historic periods. Given the kaleidoscope of historical and cultural features identified at the Petition Area, the Master Plan Update has been carefully designed to preserve the identified historic cultural and archaeological features. As such, buildings are intentionally situated at a distance from identified cultural and archaeological sites to ensure the proper preservation and protection of the sites. Additionally, a unified architectural theme will be established to reflect a distinct sense of place.

Although the 2003 CIA did not identify any specific past or ongoing traditional or customary practices occurring at the Petition Area, concerns were expressed by those consulted in connection with the Ka Pa‘akai Analysis regarding the presence of burials, given the archaeological findings identified at the Petition Area and the possibility of encountering additional unidentified *iwi kupuna* during the buildout of the Master Plan Update, and the potential effects that the proposed development would have on the ability of the descendant community to care for those ancestral remains. Access to the burial site for appropriate cultural activities will be permitted to any lineal and/or cultural descendant who has been formally recognized by the HIBC in accordance with the administration procedures contained within HAR §13-300-35. A long-term perpetual easement will be executed that would set forth requirements and restrictions related to physical improvements, signage, maintenance, and access by lineal or cultural descendants.

To properly protect the cultural resources identified at the Petition Area, interim and permanent preservation measures identified in the 2003 Burial Treatment Plan, the 2007 Archaeological Data Recovery Report, the 2013 Preservation Plan, and the 2019 Dismantling/Restoration Plan described in *Section 4.15* will be implemented under the supervision of a qualified archaeologist. With interviewees expressing concerns for the handling of *iwi*, should there be a reason for iwi to be moved or touched, an identified cultural monitor, lineal/cultural descendant, or someone with knowledge of Hawaiian ancestry, will work in conjunction with a qualified archaeological monitor to complete the task.

The Master Plan Update has been thoughtfully designed to foster a place that is reflective of the natural attributes and cultural history of the Wai‘aha ahupua‘a and the greater Kailua-Kona region. As such, buildings are intentionally situated at a distance from identified cultural and archaeological sites to ensure the proper preservation and protection. Additionally, at the recommendation of OHA, a portion of the historic trail will be preserved. With measures in place to properly preserve and allow lineal descendants access, it is not anticipated the Master Plan update will impinge access on the descendant community to access and care for their *iwi kupuna*. Given the Petition Area has known burial sites and the concerns expressed by those consulted regarding the potential to encounter additional burial sites during construction, an archaeological monitor will be present during the buildout of the Master Plan Update and an archaeological monitoring plan will be prepared in accordance with HRS §13-279-4 and submitted to SHPD for review and acceptance prior to construction.

4.18 Visual Resources

Existing Conditions

The Petition Area is located in the North Kona District on the lower western slopes of Mount Hualālai. As pointed out in the Hawai'i County General Plan, the steep slopes of Mount Hualālai provide a green backdrop when viewed from the coast, and spectacular views of the coastline, ocean and horizon from higher elevations. Mount Hualālai is identified as a natural beauty site within the North Kona district.

The Petition Area is bordered by Kuakini Highway on the west, Hualālai Village on the east, the University's Existing Campus Site on the north, and the Kona Hillcrest subdivision on the south. View planes running mauka and makai from both Kuakini Highway and Queen Ka'ahumanu Highway are identified as natural beauty sites within the North Kona district. Mauka and makai views of the Keahuolu coastline and the Holualoa-Keauhou view plane are other notable natural beauty sites identified by the General Plan that are visible from the Petition Area. Current views from adjacent properties and roads overlook the undeveloped Petition Area which is currently covered with overgrown dense vegetation and overhead utility lines (*Figures 4-26 – 4-29)*.

Figure 4-26 **Makai View from the Intersection of Hualālai Road and Queen Ka'ahumanu Highway**

Figure 4-27 **Makai View of the Petition Area from Queen Ka‘ahumanu Highway**

Figure 4-28 **Mauka View of the Petition Area from Kuakini Highway**

Figure 4-29 **Entrance to the Petition Area from Hualālai Village**

Potential Impacts and Mitigation Measures

As described in *Chapter 2*, buildings and facilities were relocated throughout the Petition Area to better integrate the site's natural topographic features and to reduce extensive grading. Buildings and facilities proposed in the Master Plan Update will not impose upon mauka and makai viewplanes from Kuakini Highway and Queen Ka'ahumanu Highway. Buildings and facilities planned for the Petition Area will not exceed the height of existing buildings at the Existing Campus, nor will they exceed building heights established for the zoning district that will be sought from the County following completion of the environmental review process and approval of the Master Plan Update by the LUC. Furthermore, buildings may be designed within the natural topography, including by featuring entrances to the first floor from the makai side of the building and entrances to the second floor from the mauka side. Utilizing the natural topography of the Petition Area will preserve views of Mount Hualālai, which the County General Plan identifies as a natural beauty site.

Although the Master Plan Update requires clearing the Petition Area and the construction of new campus facilities, it has been carefully designed to reflect the Kailua-Kona region. Buildings and facilities have been carefully relocated to preserve mauka and makai views. Furthermore, native plants representative of the natural and cultural landscape will be integrated throughout the Petition Area and will improve the visual environment as the Petition Area is currently covered with overgrown non-native vegetation. The Master Plan Update is not anticipated to adversely affect visual resources.