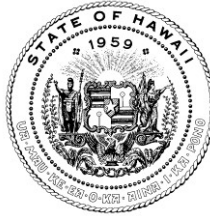


DAVID Y. IGE
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

09/29/22

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
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CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

Ms. Mary Alice Evans, Director
Environmental Review Program
Office of Planning and Sustainable Development
Department of Business, Economic Development and Tourism
235 S. Beretania Street, Room 702
Honolulu, Hawai'i 96813

Dear Ms. Evans:

Subject: Upolu Well and Agricultural Water Distribution System/Agricultural Park Draft Environmental Assessment and Anticipated Finding of No Significant Impact, TMK (3rd.) 5-5-006:002, North Kohala District, Hawai'i Island

With this letter, the State Department of Land and Natural Resources (DLNR) transmits the Draft Environmental Assessment (DEA) that assesses the potential effects of constructing and operating the Upolu Well and Agricultural Water Distribution System/Agricultural Park. The DLNR, as the proposing and approving agency, anticipates that the proposed action is not likely to have a significant effect and therefore is issuing a notice of an Anticipated Finding of No Significant Impact (AFONSI), subject to the public review provisions of HAR Section 11-200.1-20. Please publish a notice of the DEA and AFONSI in the next edition of The Environmental Notice.

We are also providing the action summary, significance criteria, and other required information via the Environmental Notice online submittal platform.

If there are any questions, please contact Mr. Brandon Kim, Project Engineer, at 587-0248 or via email to brandon.j.kim@hawaii.gov.

Sincerely,

A handwritten signature in cursive script that reads "Suzanne D. Case".

SUZANNE D. CASE
Chairperson

From: webmaster@hawaii.gov
To: [DBEDT OPSD Environmental Review Program](#)
Subject: New online submission for The Environmental Notice
Date: Monday, October 3, 2022 11:47:29 AM

Action Name

'Upolu Well and Agricultural Water Distribution System/Agricultural Park

Type of Document/Determination

Draft environmental assessment and anticipated finding of no significant impact (DEA-AFNSI)

HRS §343-5(a) Trigger(s)

- (1) Propose the use of state or county lands or the use of state or county funds

Judicial district

North Kohala, Hawai'i

Tax Map Key(s) (TMK(s))

(3) 5-5-006:002

Action type

Agency

Other required permits and approvals

Grading, Grubbing and Driveway Permits (County Department of Public Works DPW) Building Permits and Plan Approval (County DPW and County Planning Department) Use and Occupancy Approval and Agreement (State Department of Transportation) Pump Installation Permit (State Commission on Water Resources Management CWRM) Well Abandonment Permit (CWRM) National Pollutant Discharge Elimination System Permit (State Department of Health) Chapter 6e, HRS, Historic Property Effects Determination (State Historic Preservation Division)

Proposing/determining agency

Hawaii State Department of Land and Natural Resources

Agency contact name

Brandon Kim

Agency contact email (for info about the action)

brandon.j.kim@hawaii.gov

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[Map It](#)

Was this submittal prepared by a consultant?

Yes

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10 Hina Street
Hilo, HI 96720
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[Map It](#)

Action summary

State agencies plan to convert an existing USGS observation well on State land near 'Upolu Road to a well supplying water for farming, dairying and ranching, to help replace water lost when the Kohala Ditch was severely damaged. Pump tests show the well can supply 384,000 gallons per day. A 20-foot tall, 660,000-gallon reservoir and water lines running to the east and west would be built. The State may operate the system or lease it to a private operator. Farmers or cooperatives would privately design and fund simple facilities to convey the water to their use areas. The initial phase involves no significant impacts to native biota, water quality or sustainable yield, traffic, archaeological sites, or cultural practices. The program's future phases may convert part of the property to an Agricultural Park and expand the Park to nearby State properties, if sufficient water and demand exist. Follow-up HRS 343 compliance would evaluate future phase actions, impacts and mitigation.

Reasons supporting determination

Chapter 11-200.1-13, Hawai'i Administrative Rules, outlines those factors agencies must consider when determining whether an Action has significant effects:

- (a) In considering the significance of potential environmental effects, agencies shall consider and evaluate the sum of effects of the proposed program on the quality of the environment.
- (b) In determining whether an action may have a significant effect on the environment, the agency shall consider every phase of a proposed program, the expected impacts, and the proposed mitigation measures. In most instances, an action shall be determined to have a significant effect on the environment if it may:
 - (1) Irrevocably commit a natural, cultural, or historic resource;

No valuable natural or cultural resources would be committed or lost by the proposed program, which would not adversely affect significant historic sites or native species or habitat. No cultural resource or practices on the project site will be affected, and mitigation measures will reduce impacts to adjacent natural and cultural resources to minimal levels.

(2) Curtail the range of beneficial uses of the environment;

The proposed program expands agricultural opportunities on current and former farm lands and in no way curtails beneficial uses of the environment.

(3) Conflict with the State's environmental policies or long-term environmental goals established by law;

The State's long-term environmental policies are set forth in Chapter 344, HRS. The broad goals of this policy are to conserve natural resources and enhance the quality of life. The proposed program is minor, environmentally beneficial, and fulfills aspects of these policies calling for an improved social environment by enhancing agricultural activities in a sustainable manner without causing environmental harm. It is thus consistent with all elements of the State's long-term environmental policies.

(4) Have a substantial adverse effect on the economic welfare, social welfare, or cultural practices of the community and State;

The proposed program will benefit the social and economic welfare of the community and State by supporting farming, dairying and ranching in a traditionally agricultural community.

(5) Have a substantial adverse effect on public health;

The proposed program will not have any adverse effect on public health.

(6) Involve adverse secondary impacts, such as population changes or effects on public facilities;

Secondary effects include a potential expansion of agricultural uses on current and former farmland, in keeping with State and County plans for the area. Minimal in-migration that could unduly burden local services is expected.

(7) Involve a substantial degradation of environmental quality;

The proposed program is minor and environmentally benign and would thus not contribute to environmental degradation with adherence to Best Management Practices.

(8) Be individually limited but cumulatively have substantial adverse effect upon the environment or involves a commitment for larger actions;

The proposed program is not related to activities in the region in such a way as to produce adverse cumulative effects or involve a commitment for larger actions.

(9) Have a substantial adverse effect on a rare, threatened, or endangered species, or its habitat;

The project site and all potentially affected properties have been utilized for over a century for various forms of agriculture. No rare, threatened or endangered plant species are present at the project site. Direct or indirect impacts to rare, threatened or endangered species of fauna will not occur in association with the water system improvements, with planned restrictions of the timing of woody vegetation removal.

(10) Have a substantial adverse effect on air or water quality or ambient noise levels;

Slight increases in noise and effects to air quality will occur during construction, but they will be temporary and mitigated to non-significant levels. Sedimentation will be controlled through project BMPs developed as part of grading and engineering plans.

(11) Have a substantial adverse effect on or be likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, sea level rise exposure area, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters;

Although the proposed program is located in an area with slight volcanic and substantial seismic risk, the entire Island of Hawai'i shares this risk. The proposed program is not imprudent to undertake and will employ design and construction standards for the water system improvements that are appropriate to the seismic zone. The property is not located in a flood zone or any other hazardous area, and it would not affect any such area. Due to the elevation of the project site at over 300 feet above sea level, there is no risk to the water system from sea level rise. The proposed expanded farming component of the program is resilient to most hazards.

(12) Have a substantial adverse effect on scenic vistas and viewplanes, during day or night, identified in county or state plans or studies;

The proposed program would not adversely impact any scenic sites or viewplanes.

(13) Require substantial energy consumption or emit substantial greenhouse gases.

Water system improvements would involve unavoidable minor carbon emissions to construct, and operation of the well would involve substantial energy use. The State is exploring use of renewable resources and particularly locally available wind energy to power well pumping. The proposed program would not be expected to contribute significantly to global climate change.

Attached documents (signed agency letter & EA/EIS)

- [Draft-EA-Upolu-Well-and-Agricultural-Water-System.pdf](#)
- [AFONSI-Upolu-Well-Improvements_DEA_OPSP-ERP-Ltr-part-1-signed.pdf](#)

Action location map

- [Upolu-Well-and-Water-System-TMK.zip](#)

Authorized individual

Ron Terry

Authorization

- The above named authorized individual hereby certifies that he/she has the authority to make this submission.

**‘Upolu Well and Agricultural Water
Distribution System/Agricultural Park
Draft Environmental Assessment**

TMK (3) 5-5-006:002 and surrounding lands
North Kohala District, Hawai‘i Island, State of Hawai‘i

October 2022

Hawai‘i State Department of Land and Natural Resources
1151 Punchbowl St., Rm 131
Honolulu, HI 96813

DRAFT ENVIRONMENTAL ASSESSMENT

‘Upolu Well and Agricultural Water Distribution System/Agricultural Park

TMK (3) 5-5-006:002 and surrounding lands
North Kohala District, Hawai‘i Island, State of Hawai‘i

**PROPOSING/
APPROVING AGENCY:**

Hawai‘i State Department of Land and Natural Resources
1151 Punchbowl St., Rm 131
Honolulu, HI 96813

CONSULTANT:

Geometrician Associates LLC
10 Hina Street
Hilo, Hawai‘i 96720

CLASS OF ACTION:

Use of State Land and State Funds

This document is prepared pursuant to:
The Hawai‘i Environmental Protection Act,
Chapter 343, Hawai‘i Revised Statutes (HRS), and
Title 11, Chapter 200.1, Hawai‘i Department of Health Administrative Rules (HAR).

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APPENDIX 4 Archaeological Literature Review of TMK: (3) 5-5-006:003

SUMMARY OF THE PROPOSED PROGRAM, ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

The Engineering Division of the Department of Land and Natural Resources (DLNR) is cooperating with the Department of Agriculture (DoA) and other State agencies to develop the existing U.S. Geological Survey (USGS) 'Upolu Observation Well J-B (State Well ID 7451-02) and convert it for use as an agricultural well supplying water for farming, dairying and ranching uses. The well is located on State land on the 44.5-acre TMK (3) 5-5-006:002 on 'Upolu Road, north of Akoni Pule Highway, in the North Kohala District of the Island of Hawai'i. The well site and surrounding areas are vegetated with grass and clumps of trees, reflecting their long-time use for low-intensity grazing. Based on the results of recent pump tests and existing well dimensions, the plan is to run the pump 16 hours per day and supply 384,000 gallons per day. An approximately 20-foot tall, 660,000-gallon reservoir would be built mauka of the well along 'Upolu Road. Transmission lines would run from the reservoir to the east and west boundaries of the property. The full action under consideration by the State is currently envisioned as a program that involves in its first phase development of the well, storage and transmission facilities within the subject property and making this water available to existing farms in the area. The DoA or another State agency may choose to operate the system itself, or more likely, it may lease the water system to a private operator. Individual farmers or cooperatives would privately design and fund simple distribution facilities to convey the water to areas of agricultural water demand. The program also envisions potential future phases. If there is sufficient additional water after existing agricultural uses, and there is also demand for more land with available agricultural water, a part or all of the subject property may be developed into an Agricultural Park, with lots for lease. If appropriate, additional lands within the adjacent 404-acre TMK (3) 5-5-006:003, and perhaps other nearby properties, may also be included in the Agricultural Park.

For installation and use of the agricultural well and associated infrastructure, impacts are very limited in type and scale. No rare, threatened or endangered species, native ecosystems, water quality or sustainable water use, archaeological sites, or cultural practices are present or would be affected. Erosion and sedimentation impacts will be avoided by adherence to Best Management Practices. No ongoing traffic or scenic impacts would occur. Impacts are confined to very minor construction-phase noise, air quality and traffic effects that are mitigable. There would be no new impacts from ongoing use of irrigation water on existing farms, dairies and ranches. Future activities in an Agricultural Park, should there be both sufficient water and demand for leases, would occur on former or current agricultural lands and would likely be commensurate with agricultural impacts in other parts of North Kohala: occasional dust, odors, and slow farm vehicles on adjacent roadways, along with those effects to soil and water from fertilizers, animal waste nutrients and herbicides that accompany agriculture. The type of impacts and mitigation required to minimize them would be evaluated in follow-up Chapter 343, Hawai'i Revised Statutes documents, as appropriate and if warranted, as specific uses are proposed.

PART 1: PROJECT DESCRIPTION, PURPOSE AND NEED AND ENVIRONMENTAL ASSESSMENT PROCESS

1.1 Project Description and Location

The Engineering Division of the Department of Land and Natural Resources (DLNR) is cooperating with the Department of Agriculture (DoA) and other State agencies to develop the existing U.S. Geological Survey (USGS) ‘Upolu Observation Well J-B (State Well ID 7451-02) and convert it to an agricultural well to supply water for farming, dairying and ranching uses (Figures 1-2). The well is located on State land on the 44.5-acre TMK (3) 5-5-006:002 on ‘Upolu Road (Figure 3), north of Akoni Pule Highway, in the North Kohala District of the Island of Hawai‘i. The land is now leased to Boteilho Hawaii Enterprises, Inc. for agricultural purposes. The site contains a former reservoir that was drained prior to 1976, which together with a former flume right-of-way are presently reserved and excluded from the lease, yielding a net leased area of 39.28 acres. The well is at a ground elevation of 567 feet above mean sea level and is 632 feet deep. The well, hereinafter called the DoA ‘Upolu Irrigation Well, is owned by the USGS, which is currently transferring ownership to the State of Hawai‘i. The site and surrounding areas are vegetated with grasses and clumps of trees, reflecting their long-time use for low-intensity grazing (Figure 4).

Recent pump tests for the well demonstrated its potential to reliably supply up to 475 gallons per minute (gpm) (684,000 gallons per day [gpd]), without adversely affecting any other wells or water resources. Based on these results and the well dimensions, the project design parameters are to run the pump 16 hours per day and supply 384,000 gpd. An approximately 20-foot tall, 660,000-gallon reservoir would be built at *mauka* of the well along ‘Upolu Road (see Site Plans in Figure 5). The tank is sized to accommodate the water produced from the well after 16 hours of pumping. The influent line would run from the well *mauka* to the new reservoir, parallel to ‘Upolu Road. The effluent line will run from the reservoir and split into east and west transmission lines running parallel to ‘Akoni Pule Highway. The east line would stub out at the property boundary, and the west line would cross ‘Upolu Road and stub out at the adjoining State-owned property’s (TMK 5-5-006:003) western property line. These improvements would include about 360 linear feet (LF) of high density polyethylene (HDPE) pipe from the well to the tank, 1,800 LF of HDPE for the west line, and 550 LF of HDPE for the east line, for a total of approximately 2,710 LF. Water facilities would occupy about 23 acres of the property. The project also includes sealing an adjacent abandoned observation well (‘Upolu Observation Well J-A, State Well ID 7451-01) in conformance with the current *Well Construction and Pump Installation Standards* of the State Commission on Water Resource Management (CWRM) The DoA or another State agency may choose to operate the system itself, or more likely, it may lease the water system to a private operator.

As discussed in detail in Section 1.2, the DoA conducted a market study survey of nearby farmers to determine the financial feasibility of owning and/or operating the system. The study found farmers within the potential supply area currently need more than 500,000 gpd and have moderate to high interest in obtaining water. Many of the farmers previously had access to water from the private Kohala Ditch. The concept is that individual farmers or cooperatives would privately design and fund simple distribution facilities from the water line stub outs to convey water to areas of agricultural water demand. End users would be accountable for tracking their individual uses and compensating the owner/operator of the water system accordingly. At each stub-out there will be a meter to measure usage. Users of the water system

Figure 1. USGS Map

Source: 1995 USGS Hawi 1:24,000 Topo Map



Figure 2. Aerial View of Project Region



Figure 3. TMK Map

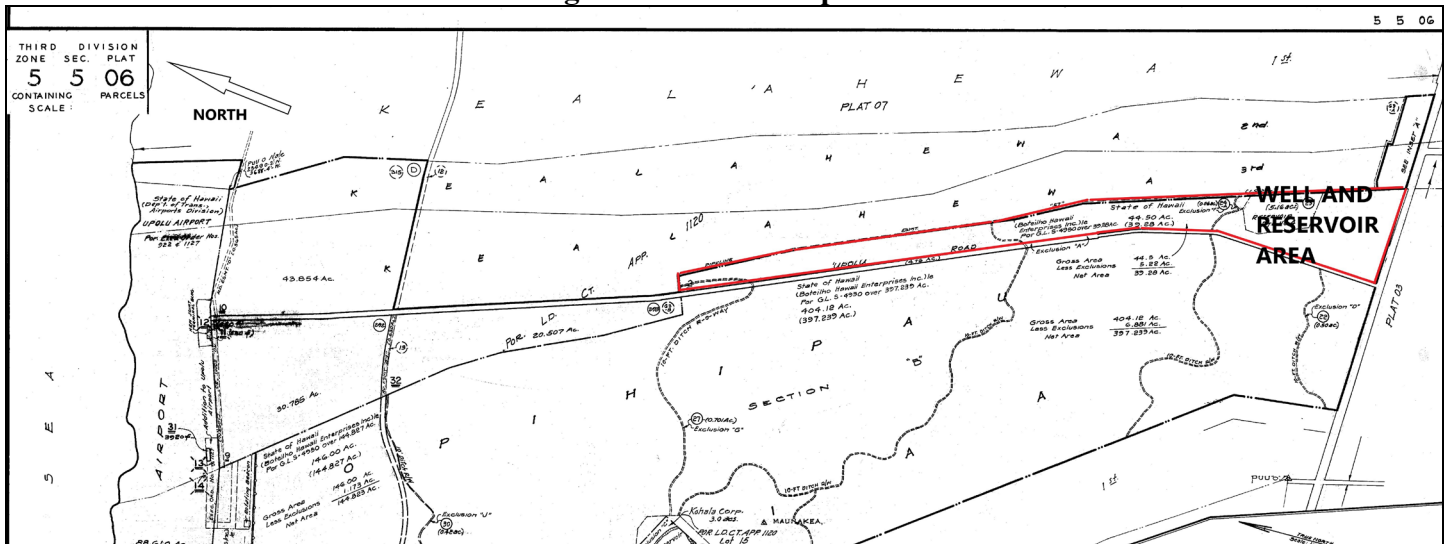
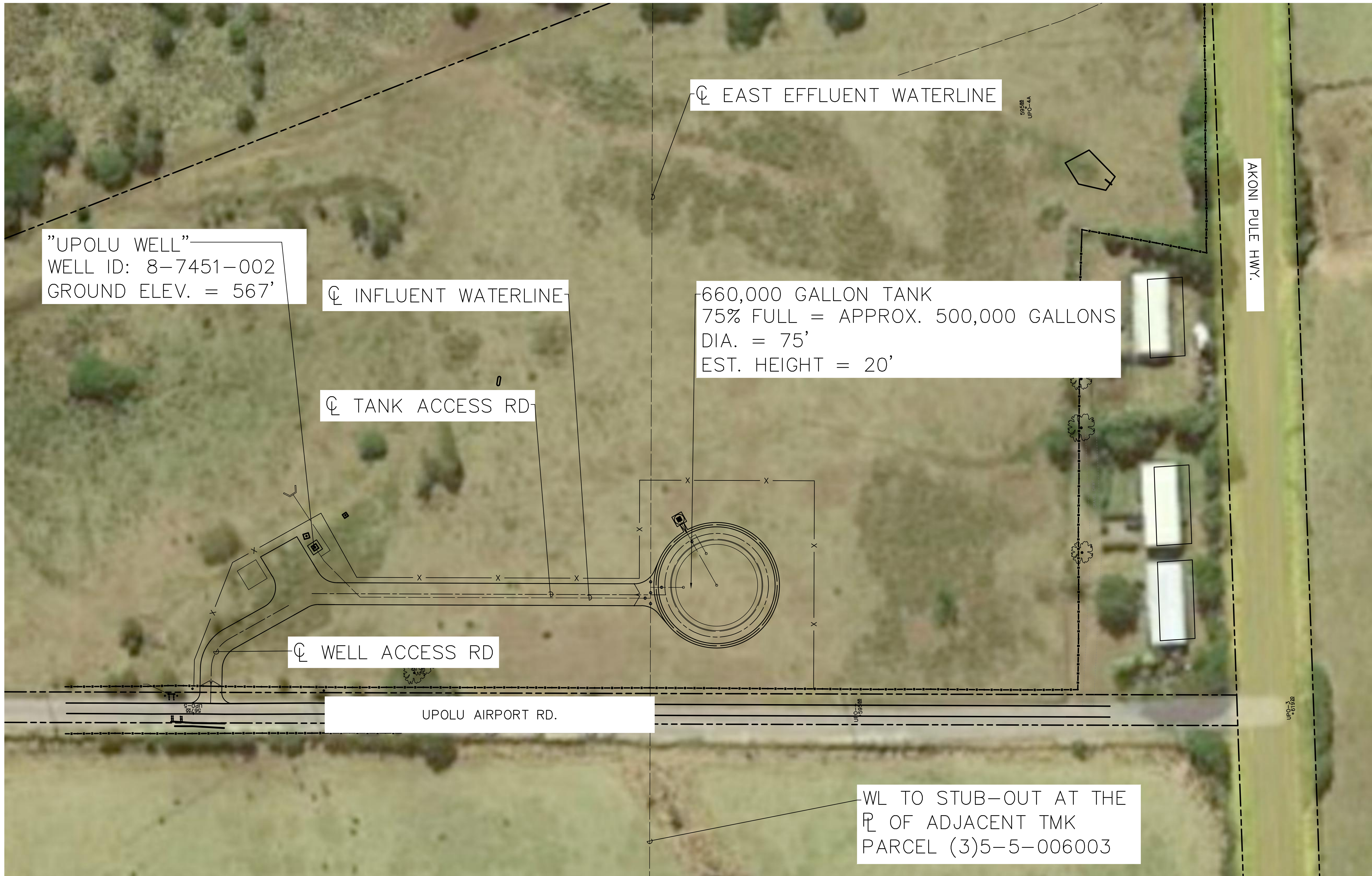


Figure 4. Project Site Photos



a. Mauka end of subject parcel ▲ ▼ b. Makai end of parcel





SITE PLAN
SCALE - 1" = 40'

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will provide their own lateral service connection at the stub-out. Water usage will be based on the readings from the meters. Establishment of irrigation water rates awaits further cost data, but there could be varying irrigation rates depending on area of use and water delivery costs. The State would require that all water use be for agricultural purposes only.

The full action under consideration by the DoA is currently envisioned as a *program*¹ that involves in its first phase development of the well, storage and transmission facilities within the subject property and making this water available to existing farms in the area. The program also envisions potential future phases. If there is sufficient additional water after existing farmer uses, and there is also demand for more land with available agricultural water, a part or all of the 44.5-acre subject property may be developed into an Agricultural Park, with lots for lease. If appropriate, additional lands within the adjacent 404-acre TMK (3) 5-5-006:003, and perhaps other nearby properties, may also be included in the Agricultural Park. This programmatic EA describes the project components, potential impacts, and mitigation measures of the first phase in detail, and more conceptually addresses future conditions. Impacts from future activities in an Agricultural Park, should there be both sufficient water and demand for leases, would be evaluated in follow-up Chapter 343, HRS documents, as appropriate and if warranted, as specific uses are proposed.

1.2 Background

Agriculture in North Kohala has experienced long periods of equilibrium followed by radical changes, shifting from highly labor-intensive and productive traditional agriculture, to monolithic sugar cane plantations, to diverse farming and grazing on dozens of farms and ranches. One constant has been the importance of water.² In early times, taro *lo'i* (pondfields) and *'auwai* (irrigation ditches) were intricately designed to take advantage of flowing streams. In the sugar cane era, the Kohala Ditch was a critical element. The 16-mile system of ditches, 57 tunnels, flumes, and reservoirs was an engineering feat begun in 1905 and completed in 18 months by over 600 laborers working day and night. The Kohala Ditch delivered abundant water to the drier regions of Kohala from multiple input points designed to maximize the amount of irrigation water. The system had the capacity to convey an average of 30 to 40 million gallons per day (MGD) at high flow. The reliable delivery of large quantities of irrigation water doubled sugar cane productivity and was the basis of the industry's success for many decades.

Sugar production in Kohala ceased in 1975, but the Kohala Ditch continued to flow. In 1988, Chalon International of Hawaii (later Surety Kohala Corporation or SKC) purchased the land assets of Kohala Sugar Company. Included in the purchase were the portions of Kohala Ditch. SKC subsidized the continued operation of the ditch system while exploring options for its new holdings. Even after its decision to divest its Kohala holdings, SKC subsidized the operation of the aging ditch system.

¹ Programmatic EAs, as discussed in HAR 11-200.1-18 (c), set out the broad view of environmental impacts and benefits for a proposed program which has future components that are not yet certain or fully defined as to scope, scale or location. When such components become better defined, subsequent HEPA reviews can be conducted. A programmatic review at the beginning has value because it can provide a starting point for analyzing direct, indirect, and cumulative impacts. It allows an agency to subsequently tier to this analysis, and analyze narrower, site- or proposal-specific issues, avoiding repetitive broad level analyses in subsequent tiered reviews.

² This section borrows extensively from the *Draft North Kohala Agricultural Water Study* (Waimea Water Services n.d.), the *Statewide Agricultural Land Use Baseline 2015* (Melrose et al 2015) and the *2020 Update to the Hawai'i Statewide Agricultural Land Use Baseline* (Perroy and Collier), text from which has been condensed and supplemented by other material.

With sugar gone but rich land and abundant water still available, smaller agricultural entities emerged. Maintenance of the Kohala Ditch at a minimum functional level was still worthwhile. The Kohala Ditch Company thus continued to operate at a reduced capacity, maintaining the ditch system and distribution lines as a caretaker. Costs had to be spread out over customers consuming only a fraction of former use, and significant capital investment was not justified. In 2006, a pair of substantial earthquakes, one measuring 6.7 magnitude, severely damaged the ditch system. Flumes collapsed or were buried by landslides, whole tunnels were filled with debris, trails were destroyed, and the main intake and many smaller ones were damaged. Agriculture that had relied on the system started to suffer, but the economic realities prevented the Kohala Ditch Company from making necessary repairs. Grants, community efforts and government aid helped reactivate the Ditch. But the emergency:

“...brought clarity to the fact that agriculture in Kohala needs reliable water sources to thrive. Through the emergency, it also became evident that much of the other infrastructure was reaching the end of its service life and, there was no mechanism for repair or growth... Kohala is at a crossroads. In order for agriculture to flourish, systems will be needed to provide water like those that were only available to large scale producers in the past. (Waimea Water Services n.d.:4)”

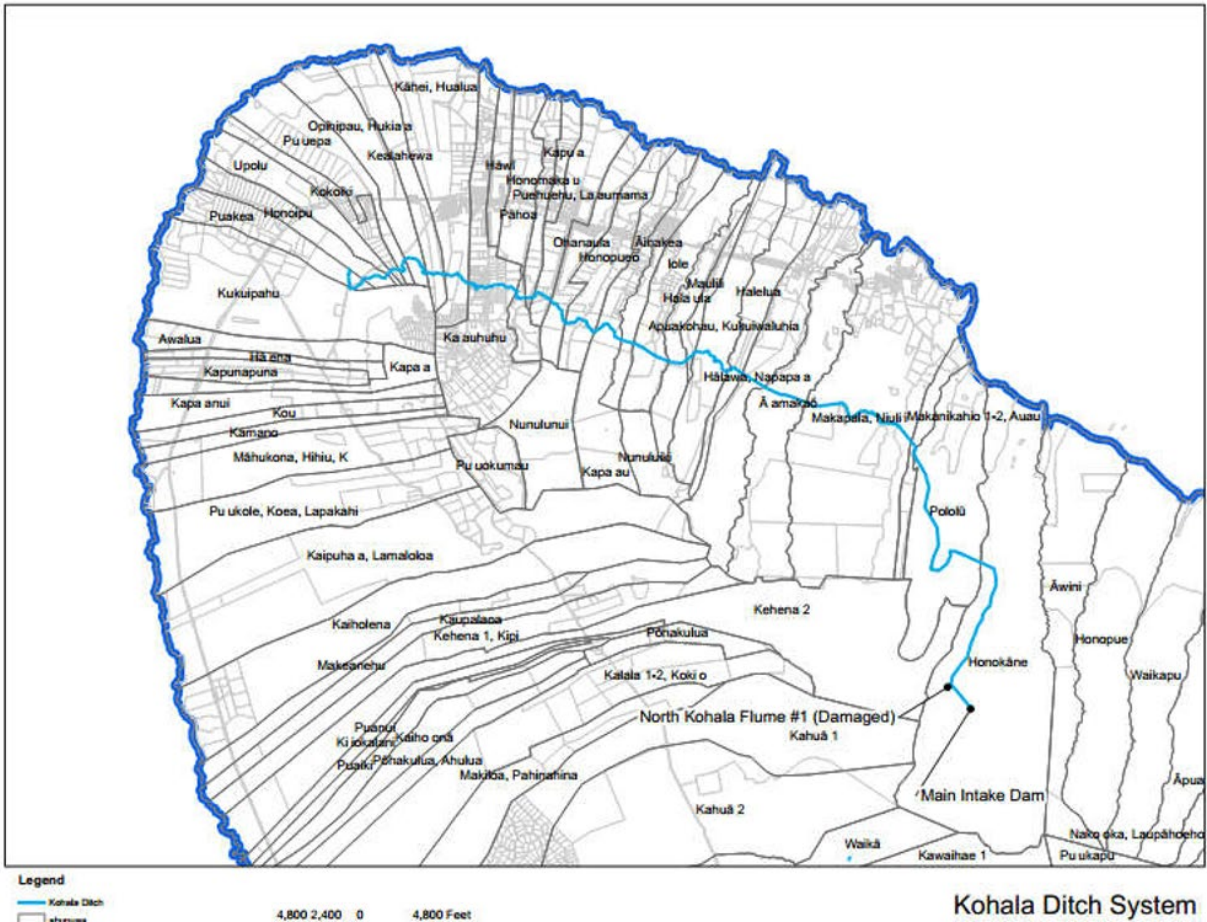
After the 2006 earthquake, the primary source of water became the Honokane Stream intake, which is a registered diversion that formerly supplied up to 35 million gallons per day. However, Kamehameha Schools, the owner of the land that the intake sits on, limited the flow to approximately 7 million gallons per day. This reflected both the low farming demand and priorities that have been allocated to cultural and natural resources of water flowing in streams. It was decided not to reactivate many of the smaller intakes, although some water continued to enter the ditch from these sources, especially during rain.

The ditch remained operational for over a decade, despite perennial issues with the inefficiency of ground leakage, trail access to intakes and the condition of flumes and distribution lines. A plan to utilize USGS observation wells similar to the current program was explored in 2009-10. The largest income producers for the Kohala Ditch became kayak float tours that used the ditch to transport visitors through the district on private flume adventures. There was also a small hydroelectric power plant near the end of the ditch, which produced intermittent electrical power to the public utility company for several decades.

In April of 2021 the dramatic geology of the intake areas once again intervened. A large landslide in the upper reaches of the ditch caused severe damage to one of the tunnels and heavily damaged a flume, cutting off the supply of water from the Honokane intake (see map of ditch system and photo of landslide damage in Figure 6). Upon inspection of the damages, the Kohala Ditch Company deemed the repairs infeasible and soon abandoned the Kohala Ditch.

Since that time, there has been no permanent flow in the ditch and it cannot be used for irrigation, dealing a heavy blow to the region's farmers, ranchers and agricultural production. Hawai'i Island is almost double the size of all the other islands put together, but because so much is recent volcanic rock and/or extremely dry or cold, it hosts only 30% of the State's total crop area, at 61,000 acres. Two thirds are planted in macadamia nuts or commercial forestry. In addition, there are roughly 560,000 acres in pastureland, or 73% of the State's total.

Figure 6. Kohala Ditch Map and April 2021 Landslide at Flume No. 1



North Kohala has long been one an agricultural center. For centuries, wetland taro was produced in the windward valleys, and an extensive dryland field system focused on sweet potatoes stretched for miles along the mid-level slopes of Kohala's leeward coast. By the 1860s, sugar began to replace subsistence farming as the primary agricultural activity. In the early 1900s, nearly 20,000 acres were planted in sugar, partially fed by a surface irrigation system anchored by the Kohala Ditch that served six sugar mills and irrigated most leeward plantation fields.

After plantation sugar ceased in 1975, new agricultural activity sporadically emerged over the next few decades. The foliage industry, led by Kohala Nursery, was the first successful post-plantation agricultural venture to develop from a series of efforts envisioned by the State's Kohala Task Force in 1970s. For a time, Kohala Nursery was the biggest foliage plant exporter in the State. Rising competition and economic cycles, both locally and nationally, have seen the foliage industry grow and then recede. As of 2015, there were about 85 acres of land in North Kohala dedicated to foliage production, most of it in Honomaka'u and Kapa'au. Products include palms, potted plants, and landscape trees and shrubs. Macadamia orchards were part of plantation diversification experiments in the 1960s but really took hold in the 1980s. The agricultural footprint of North Kohala changed little between 2015 and 2020 and remained dominated by pastureland for cattle production (Figure 7). A notable addition was 14 acres of irrigated sugar cane in Hāwī as part of a distillery operation, marking the first return of commercial sugar cane plantings on Hawai'i Island since the plantation closures of the 1980s.

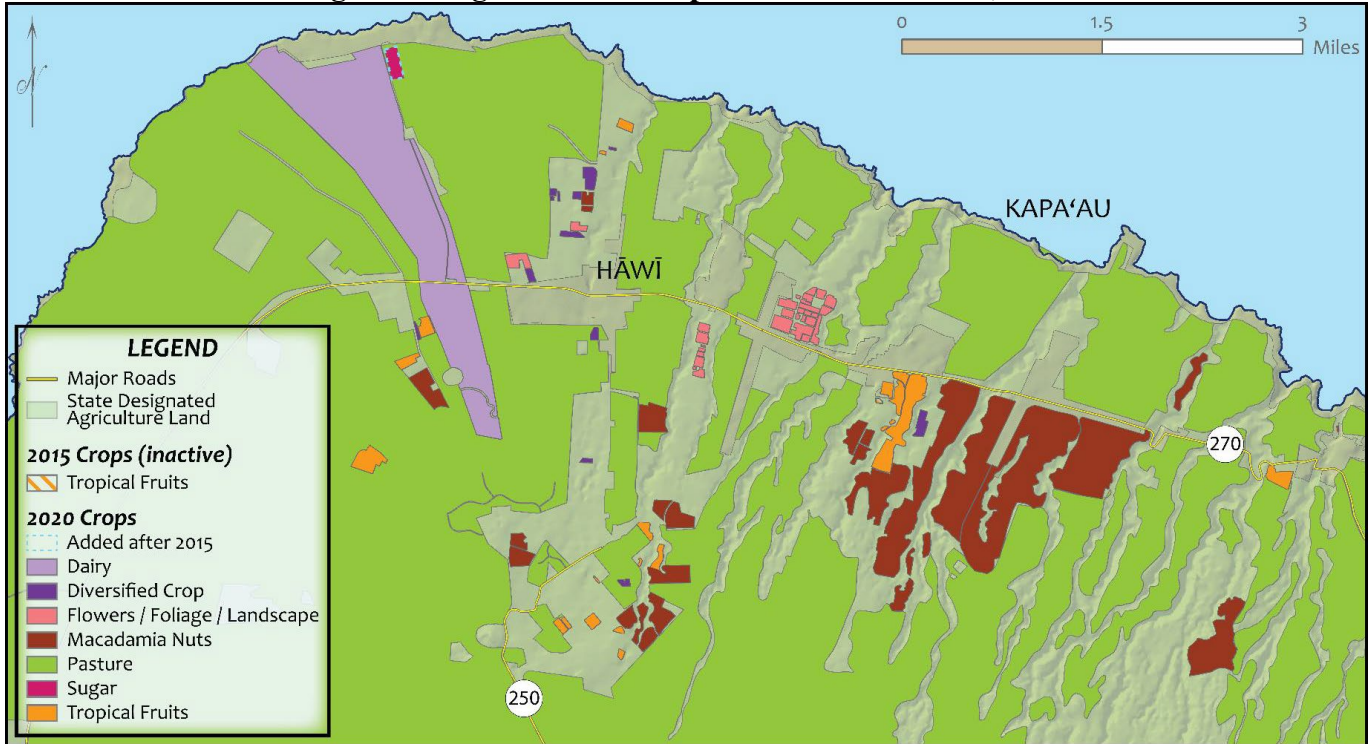
Over 1,080 unirrigated acres were in production by 2015. Kohala is also home to Clover Leaf Dairy, which moved into a State-owned feedlot near 'Upolu Point in 1985. It operates on 840 acres and has had up to 600 milking cows. The dairy formerly used Kohala Ditch water to irrigate pastureland to produce green chop, which helped reduce the grain imports. Clover Leaf is one of only two commercial dairy operations in the State. Milk is sold to Meadow Gold Dairies and processed at its facility in Hilo.

There is a relatively small amount of diversified crop production in North Kohala but a significant interest within the Kohala community to strive for community food self-sufficiency. A Food Forum held in North Kohala in 2009 identified a relatively short list of five to six commercial farmers in the region, most of whom were organic vegetable growers who marketed their crops to local residents, restaurants, and to retail outlets around the Island.

Akinaka and Associates Ltd., was contracted by the State of Hawai'i to prepare a feasibility study for constructing the well and associated storage and transmission facilities on the property(see Appendix 2). The property is located in a transition zone between the dry and wet parts of North Kohala in which irrigation is required by farmers and ranchers. The 'Upolu Point-Ka'auhuhu County zoning map (see App. 2 of App. 2) shows that a majority of land in the area is zoned for agricultural uses. Aside from strictly engineering considerations, important goals of the study were to determine interested parties within the area that might look to be serviced by the new irrigation water system now that the Kohala Ditch is inoperable, and to weigh the cost of operation and maintenance of the system against the community demand.

The feasibility study accounted for the costs of delivering water to the edge of the subject property. The cost for construction was not considered in this analysis due to the fact that legislative funding has already

Figure 7. Agricultural Footprint in North Kohala, 2020



Source: Perroy and Collier 2020, *2020 Update to the Hawai‘i Statewide Agricultural Land Use Baseline*

been appropriated to cover any work related to the design and construction of this project, and was essentially a subsidy. Furthermore, the private distribution line portion of the system is not covered, as this would be borne by the end users. Factoring in the energy costs of pumping water established a water rate of \$1.645 per thousand gallons just to support the energy operations of the system. The transmission lines would be gravity fed, with no booster pumps needed, and thus there would be no transmission costs. When including a 25% contingency for maintenance costs, a rate of \$2.00 per thousand gallons was estimated for the ‘Upolu well water system.

The feasibility survey identified surrounding farming and ranching parcels near the well site that may have a possible need for irrigation water. The potential users were surveyed on their current and expected future water usage and their interest in utilizing the system. A market outreach survey was conducted on February 16, 2022. Out of the 40 members of the community who were surveyed, 10 responded. The farmers provided some general background information such as location, land area, water usage, interest in leasing or using water system. Overall interest in the water system including the potential to lease the system was moderately high from the community. The range of price stated as an affordable rate of water was from \$0.25-\$1.00 per thousand gallons, with an average of \$0.68 per thousand gallons. Although the proposed rate is higher than the desired rate, it may offer the only feasible option for acquiring irrigation water.

1.3 Purpose and Need

Based on the need to replace a long-standing source of irrigation water that is no longer operational, the purpose of the project is to provide critical water supply support for farms, dairies and ranches in North Kohala to help preserve agriculture of the region and serve as a model for water supply.

1.4 Alternatives

As part of project conception, the State of Hawai'i analyzed different strategies that could provide critical water supply for agriculture in North Kohala, which has relied for over a century on agricultural water from the privately owned and operated Kohala Ditch.

Repair Kohala Ditch

Inspection of the damage to the flumes, tunnels and support structures by the Kohala Ditch Company and Waimea Water Services indicates that repair would be extremely difficult and excessively costly. Even if repairs at the Honokane intake could occur, other elements of the aging infrastructure of the Ditch are still vulnerable to damage and leaks, and the system would still be at risk from future seismic damage. With the current projected use, the high costs of repair and continual maintenance would not be justified.

Kehena Ditch

A lesser known water system located at the top of Kohala Mountain is the Kehena Ditch (see lower left of Figure 1 for former location), which was also a privately owned and operated system. A major difference and benefit with respect to the Kohala Ditch was that water was collected at a much higher elevation. This allowed for irrigation of lands located above the Kohala Ditch. Unfortunately, the transmission system was flawed and lost up to 80% of the water through infiltration. Due to the cost of the system and the low productivity, it was abandoned, and easements to cross private lands for transmission were surrendered. The Kehena Ditch is no longer functional and would be very difficult to revive for reasons of land control, water permitting, and state of repair (pers. comm. John Richards).

Springs

There are over thirty mapped springs in Kohala ranging in capacity from a few gallons to several hundred gallons per minute. Very few have been maintained for water production since the 1970s, and much of the supporting infrastructure is defunct and unsafe. However, with changes in technology and the availability of new and better equipment, they offer a potential water resource for certain limited uses. Many of the shallow springs could be excavated and stabilized to provide long-term agricultural water. Springs vary in their ability to provide adequate, suitable quality water when needed. Most of the most reliable and productive springs occur in the wetter regions of Kohala, somewhat limiting their direct usefulness to leeward areas that require extensive irrigation. Most are higher in elevation than the Kohala Ditch, allowing irrigation of higher elevation land and also facilitating efficient lateral movement of water to the drier regions. The privately owned Bond and Watt Tunnels in I'ole are two important resources, together producing approximately 1.5 MGD, that are currently being fully utilized as agricultural water at that location. Very few other sources have this capacity. Because of the distance from sufficiently productive

and reliable springs to the proposed users near ‘Upolu, the high cost of transmission facilities, and the relatively small quantity of water that would be available given the high cost of investment, springs do not appear to present a cost-effective option to satisfy the purpose and need.

Hawai‘i County Department of Water Supply

The Hawai‘i County Department of Water Supply (HDWS) provides agricultural water rates for those who qualify. These rates and associated costs (such as energy CIP charges) are spelled out in an HDWS brochure (see App. D of App. 2). It can be difficult to provide a comparison with other agricultural water rates because of differential rates applied to varying levels of use that have been imposed to disincentivize excessive consumption. The most relevant comparison for the scale of use for many potential users in North Kohala is the charge for a 25,000 gpd use rate, which according to the feasibility study would cost the user roughly double the estimated rate from the proposed DoA ‘Upolu Irrigation Well system. This does not even factor in the time and expense for HDWS to approve and install service laterals/boxes for new users. Perhaps most importantly, agricultural water can only be supplied if and when HDWS determines that there is capacity to accommodate extra services, which may not always be the case.

Alternate Sites

The site was selected because it was State land with an existing convertible observation well, sufficient size, appropriate terrain, adequate electrical and road infrastructure, and an acceptable elevation relative to potential users. A search of nearby State properties has not revealed any well sites with all or even most of these critical characteristics.

No Action Alternative

Under the No Action Alternative, the State of Hawai‘i would not adapt and improve the well and built storage and distribution system to facilitate an agricultural water system. Farms, dairies and ranches that formerly depended on the Kohala Ditch for water and are seeking sources to replace this would not have the option of using the ‘Upolu facility. They would instead need to rely on other more expensive sources of water, such as HDWS or private wells, if available. Alternatively, they may need to switch to crops or livestock with lower water needs, or abandon agriculture altogether. No ground disturbance or expenditure of public funds would occur. The No Action Alternative provides a basis for comparing the impacts of the proposed program.

Selection of Alternatives to Advance and Rationale

Strategies to utilize surface water through springs or by repairing former ditches are not feasible for economic and other reasons. Although HDWS water is a potentially feasible option for certain properties and crops, especially if additional sources of groundwater could be economically developed, this water is currently too expensive and scarce to offer a realistic alternative for all but very low consumption and/or high value agricultural uses. The current site has the advantage of an existing well, the potential to utilize State property, the proven presence of good quality water, proximity to former users of the Kohala Ditch, excess land that could readily be used for the Agricultural Park if water were available, and proximity to other State parcels onto which the Agricultural Park could expand if demand and water availability justify

it. No other properties have been identified that are similarly suitable. After careful consideration of options and all their implications, only the proposed program of converting the USGS 'Upolu Observation Well J-B to an agricultural production well and building associated storage and transmission infrastructure has been advanced in this Environmental Assessment. Because the No Action alternative provides a useful baseline, it will also be analyzed.

1.5 Cost and Schedule

Shortly after the EA is complete and necessary permits are obtained, the State will prepare to construct the water system improvements. Construction is expected to take about nine months to complete. The cost of the improvements to the well, tank and waterlines is estimated at \$4.0 million. Costs and schedules for future phases are not yet determined.

PART 2: EA PROCESS & PUBLIC INVOLVEMENT AND AGENCY COORDINATION

2.1 Environmental Assessment Process

This Environmental Assessment (EA) is being conducted in accordance with Chapter 343 of the Hawai'i Revised Statutes, and Title 11, Chapter 200.1, of the Hawai'i Administrative Rules. This law and its implementing regulations are the basis for the environmental impact process in the State of Hawai'i. According to Chapter 343, an EA is prepared to determine impacts associated with an action, to develop mitigation measures for adverse impacts, and to determine whether any of the impacts are significant according to thirteen specific criteria. Part 4 of this document states the anticipated finding that no significant impacts are expected to occur; Part 5 lists each criterion and presents the findings for each made by the Hawai'i State Department of Land and Natural Resources, the proposing and approving agency. If, after considering comments to the Draft EA, the approving agency concludes that no significant impacts would be expected to occur, then the agency will issue a Finding of No Significant Impact (FONSI), and the action will be permitted to proceed to other appropriate approval and permit processes. If the agency concludes that significant impacts are expected to occur as a result of the proposed program, then an Environmental Impact Statement (EIS) will be prepared.

2.2 Public Involvement and Agency Coordination

The following agencies, organizations and individuals were consulted by letter during development of the Environmental Assessment.

State:

Department of Health
Department of Land and Natural Resources
Department of Transportation, Director and Hawai'i District Engineer
Office of Hawaiian Affairs

County:

Civil Defense Agency
County Council, Tim Richards

Department of Environmental Management
Department of Public Works
Department of Water Supply
Fire Department
Planning Department
Police Department

Private:

Sierra Club

Neighboring Property Owners: Hoff, Villena, Ramos, Boteilho Hawaii Enterprises, 'Upolu Point Properties LLC, Hualua Farms LLC, B.P. Bishop Estate Trustees

Responses received are contained in Appendix 1a. A public meeting will be held on September 29, 2022, to provide information about the program, take input from the public and encourage review and comment on the Draft EA. The Final EA will report on this meeting.

PART 3: ENVIRONMENTAL SETTING, IMPACTS AND MITIGATION MEASURES

Introduction

The locations for the proposed program include the 44.5-acre TMK (3) 5-5-006:002 on which the well and accessory facilities would be located, as well as the potential first increment of a future Agricultural Park (see Figures 1-3 for maps). This property will be referred to throughout this EA as the *project site*. Potential locations for expansion of the Agricultural Park concept, in particular the 404-acre TMK (3) 5-5-006:003, are referred to as the *potential future Agricultural Park sites*. The property locations of existing farms and ranches that may choose to use the water have not been conclusively identified as of yet and are not individually mapped. They are broadly indicated in Figure 2.

The resource by resource discussion below focuses first on the *direct impacts* that would occur onsite related to converting the former observation well to production, storage and transmission facilities in order to replace a long-standing agricultural water source. Also included as direct impacts are effects from potential future water use onsite, if an Agricultural Park is developed on the subject property. *Secondary impacts* of the action are primarily related to the perpetuation of irrigation-dependent agriculture on existing farms and ranches, and potentially, other State properties that formerly supported sugar cane agriculture, but are now fallow or support only extensive grazing, and which could be part of future Agricultural Parks. The impact discussions will therefore first analyze direct, on-site impacts and then discuss the secondary effects at varying levels of specificity as appropriate and discernible. Cumulative effects are dealt with in a standalone discussion in Section 3.4.

3.1 Physical Environment

3.1.1 Climate, Geology, Soils and Geologic Hazards

Environmental Setting

At an elevation of 320 to 600 feet above sea level, the project site is warm in the daytime and usually mild at night. Average annual rainfall is about 44 to 52 inches, increasing in the *mauka* direction (Giambelluca et al. 2013). Winds are generally northeasterly trade winds day and night, with short periods of winds that are southerly or from other directions. Long-term data from the 'Upolu Airport Final EA (Hawai'i State DOT-A 1999) noted that winds were trades 98 percent of the time, averaging 12.4 miles per hour. The tradewinds of North Kohala contribute to excellent air quality by generally dispersing human-derived pollutants as well as volcano-induced vog, which are volcanic emissions of sulfur dioxide that convert into particulate sulfate and produce a haze. Mean wind speeds at an altitude of 50 meters above the ground surface are 20 to 21 MPH, making the area among the windiest spots in the State, which has been exploited by the nearby Hawi Renewable Energy Wind Farm (<https://www.hawaiianelectric.com/clean-energy-hawaii/our-clean-energy-portfolio/renewable-energy-sources/wind/wind-maps>). Potential future Agricultural Park sites would share the same basic climate.

Geologically, the project site is located on old lava flows of the Pololu Basalt Series from Kohala Volcano erupted roughly 250,000 years ago, with flow surfaces mantled in places by unmapped aeolian and tephra-fall deposits (Wolfe and Morris 1996).

The project site is covered by soil types classified by the U.S. Natural Resources Conservation Service (formerly Soil Conservation Service) as Kohala Silty Clay, generally on slopes of 3 to 12 percent. The soils in this group are well-drained, with runoff slow to medium and a slight to moderate erosion hazard. They are slightly acid in the surface layer, slightly acid and neutral in the subsoil, and neutral in the substratum. They typically consist of up to 14 inches of silty clay covering a layer of silty clay loam up to 25 inches deep overlying what is usually 'a'a lava bedrock, and were typically used for irrigated sugar cane and pasture (U.S. Soil Conservation Service 1973). This soil along with Hawi Silty Clay covers most of the potential future Agricultural Park sites. The Hawi Series soils are also well-drained, with medium permeability and runoff and a moderate erosion hazard. The surface layer, which is typically up to 15 inches thick, is slightly acid with a neutral subsoil. Like the Kohala Series, these soils were typically used for irrigated sugar cane and pasture.

The entire Big Island is subject to geologic hazards, especially lava flows and earthquakes. Volcanic hazard as assessed by the U.S. Geological Survey in this area of North Kohala is zone 9 on a scale of ascending risk from 9 to 1 (Heliker 1990:23). The low hazard risk is based on the fact that Kohala Volcano, the oldest volcano on the island, has not erupted for 60,000 years and is possibly extinct. As such, there is negligible risk of lava inundation over relatively short time scales in the project area.

The Island of Hawai'i experiences high seismic activity and is at risk from major earthquake damage (USGS 2000), especially to structures that are poorly designed or built. On Sunday, October 15, 2006, two damaging earthquakes of magnitude 6.7 and 6.0 struck the west side of Hawai'i Island. These earthquakes caused extensive damage to some historic buildings and road cuts in the area, but there was

no known damage to the project site or nearby areas. The project site does not appear to be subject to subsidence, landslides or other forms of mass wasting. The perpetuation and re-establishment of agriculture afforded by continuation of agricultural water does not entail geological hazard impacts.

There is a scientific consensus that the earth is warming due to manmade increases in greenhouse gases in the atmosphere, according to the United Nations' Intergovernmental Panel on Climate Change (UH Manoa Sea Grant 2014). Global mean air temperatures are projected to increase by at least 2.7°F by the end of the century. This will be accompanied by the warming of ocean waters, expected to be highest in tropical and subtropical seas of the Northern Hemisphere. For Hawai'i, where warming air temperatures are already quite apparent, not only is the equable climate at risk but also agriculture, ecosystems, the visitor industry and public health. Guidance to federal agencies for addressing climate change issues in environmental reviews was released in August 2016 by the Council on Environmental Quality (US CEQ 2016). The guidance urged that when addressing climate change, agencies should consider: 1) the potential effects of a project on climate change as indicated by assessing greenhouse gas emissions in a qualitative, or if reasonable, quantitative way; and 2) the effects of climate change on a project and its environmental impacts. It recommends that agencies consider the short- and long-term effects and benefits in the alternatives and mitigation analysis in terms of climate change effects and resiliency to the effects of a changing climate. The State of Hawai'i in Hawai'i Revised Statutes §226-109 encourages a similar analysis, and both Act 17 of the 2018 Hawai'i Legislature and Title 11, Chapter 200.1 now require analysis of sea-level rise and greenhouse gases in environmental impact statements.

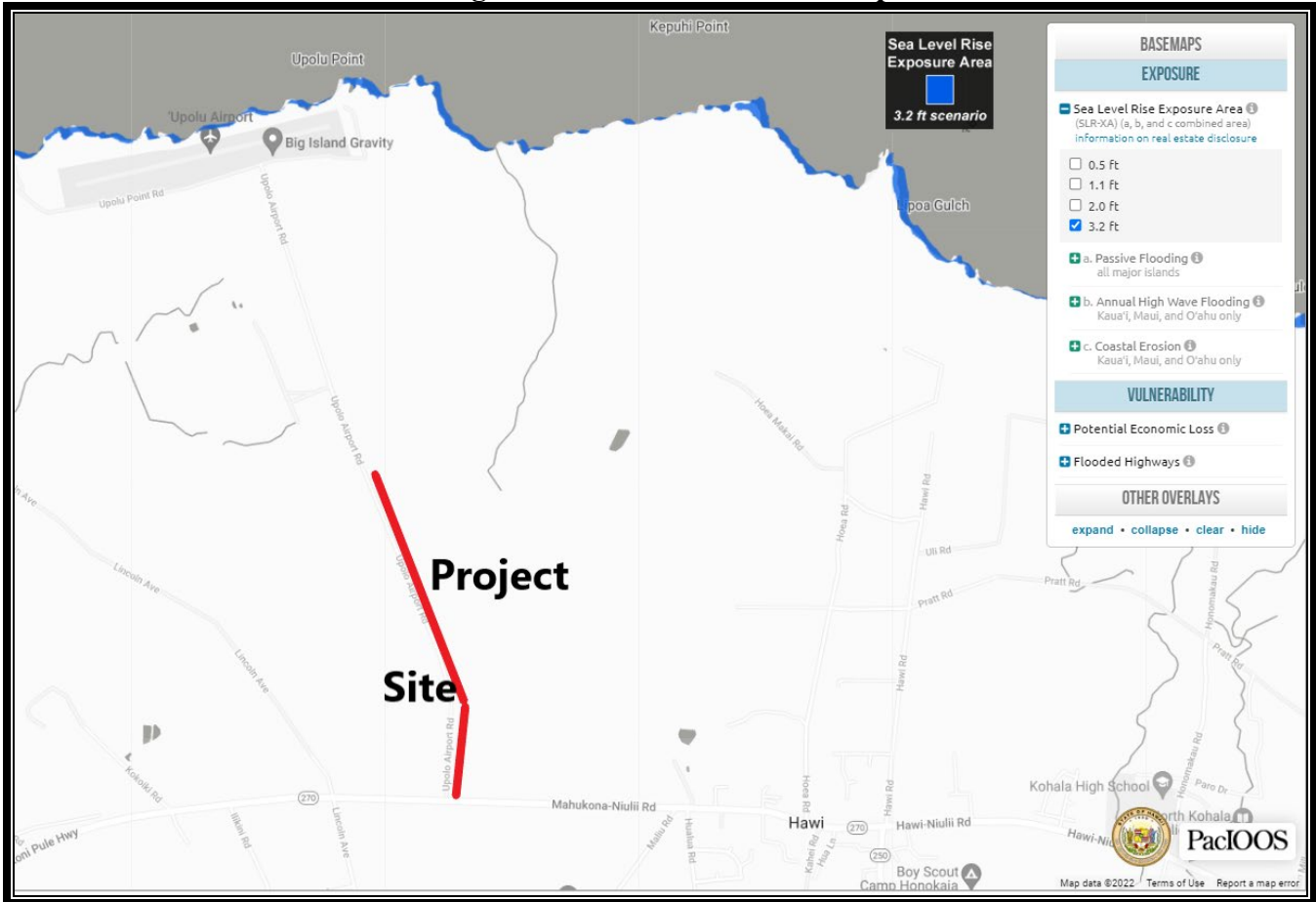
In terms of precipitation, wet and dry season contrasts may increase, and wet tropical areas in particular are likely to experience more frequent and extreme precipitation. In general, rainfall in Hawai'i has been variable in the recent past with some years much drier and some much wetter than average. The El Niño Southern Oscillation (i.e., periodic variation in winds and sea surface temperatures in the Pacific, the warming phase of sea temperature known as El Niño and the cooling phase as La Niña) will likely continue to dominate precipitation patterns from year to year in the tropical Pacific. Climate change-related increases in air temperatures will lead to more evaporation and more moisture in the air. As a result, the variability in El Niño-related precipitation will probably increase, making rainfall predictions difficult. However, it is very likely that warmer temperatures and larger and more frequent tropical storms and hurricanes will affect the Hawaiian Islands in the future.

Land uses in Hawai'i – and not only coastal properties vulnerable to sea level rise – will be subject to increasing stress as a result of climate change. In addition to greater overland flooding, stronger and more frequent tropical storms may bring higher winds.

Direct Impacts and Mitigation Measures

Lava flow, seismic hazards and mass wasting conditions impose no constraints on the proposed program, and the water system improvements are not imprudent to undertake in terms of geological hazards. Given the need for the facilities, the State of Hawai'i has determined that it is sensible to construct them in this location. Engineers have determined that the substrate of the site selected for the reservoir appears to be suitable for bearing the weight of a tank reservoir, with proper engineering. All associated facilities will be designed in accordance with the HDWS Water System Standards and the County of Hawai'i Standard Specifications for Public Works Construction. In addition, any accessory structures needed for this

Figure 8 Sea Level Rise Map



Source: Pacific Island Ocean Observing System: <https://www.pacioos.hawaii.edu/shoreline/slr-hawaii/>

project, including pads and enclosures for control and electrical equipment, will be designed in accordance with applicable codes and standards to accommodate the island’s seismic activity. New construction for the project will be designed with adequate wind load to account for potentially greater storm winds that could arise in the coming decades. As discussed below in Section 3.1.2, project design will direct surface runoff into facilities of sufficient disposal capacity to accommodate reasonably expected increases in runoff. A sea level rise viewer from the Pacific Island Ocean Observing System (<https://www.pacioos.hawaii.edu/shoreline/slr-hawaii/>) provides graphic representation of how locations will be affected by sea level rise. Due to the elevation of the property at 320 to 600 feet above sea level, there is no risk to the proposed facilities from sea level rise (Figure 8). Improvements to the source, storage and transmission facilities and onsite farming would involve unavoidable minor carbon emissions, but would not be expected to contribute significantly to global climate change. The State is exploring use of renewable resources and particularly locally available wind energy to power well pumping.

Indirect Impacts and Mitigation Measures Associated with Offsite Agricultural Water Use

Continued agricultural activities on existing farms and new agriculture in potential offsite Agricultural Parks would entail activities generally unconstrained by geological conditions, as the long history of

farming over the entire project region has shown. Farming and ranching activities may be affected by droughts and deluges that could be part of the uncertain effects of climate change in Hawai‘i, but the region is highly suited and necessary for the perpetuation of agriculture. Irrigation water would provide resiliency for potential drought conditions. Continuing farming would entail greenhouse gas emissions that would be essentially the same regardless of the location of agricultural activities, likely leading to no net increase. Additional agriculture would increase greenhouse gas emissions for a particular property. However, any net increase is unlikely, because locally produced food crops will tend to reduce greenhouse gas emissions from a system perspective, through the substitution of local agricultural produce for that shipped in from other U.S. states or foreign countries. No mitigation is required.

3.1.2 Flood Hazard

Existing Environment

Floodplain status for many areas of the island of Hawai‘i has been determined by the Federal Emergency Management Agency (FEMA), which produces the Flood Insurance Rate Maps (FIRM). The entire area is depicted on the FIRM within Zone X: areas determined to be outside the 0.2% annual chance floodplain (Figure 8). Maps printed by the Pacific Tsunami Warning Center/Hawai‘i County Civil Defense Agency locate the project site outside the area that should be evacuated during a tsunami warning (<https://tsunami.coast.noaa.gov/#/>). The project site currently has no drainage facilities.

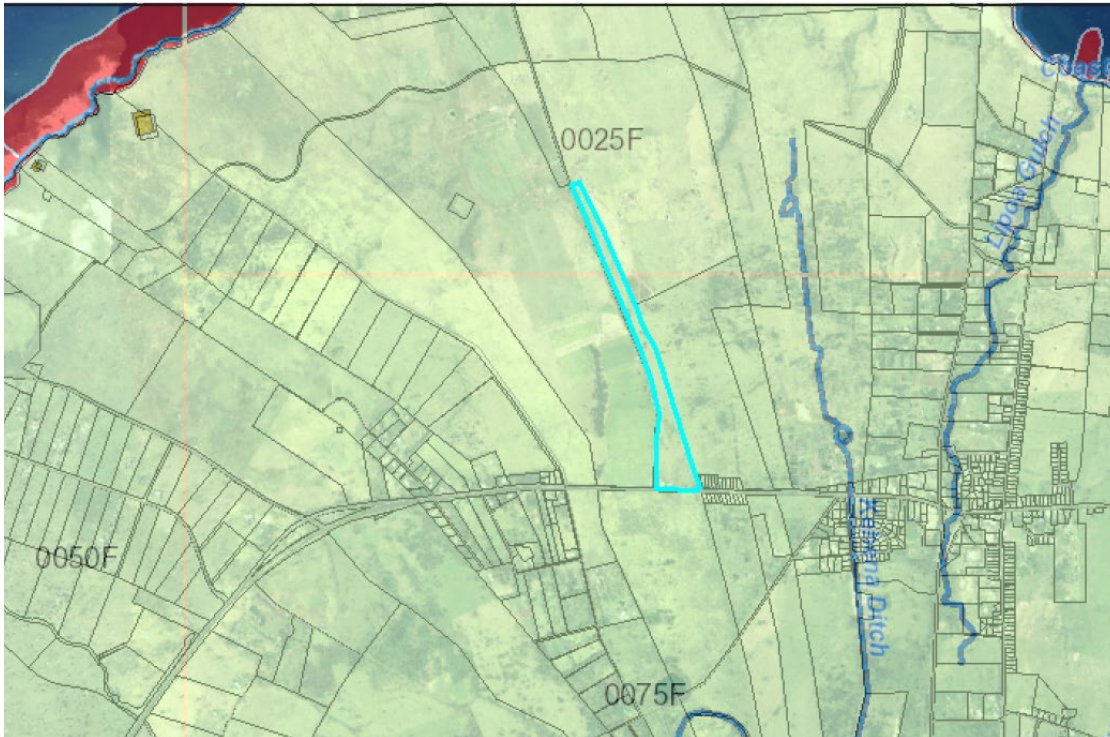
Direct Impacts and Mitigation Measures


There will be no impact to floodplains in the area. The State of Hawai‘i will ensure that its contractor performs all earthwork and grading in conformance applicable standards and regulations of Chapter 27, “Flood Control,” of the Hawai‘i County Code and the Storm Drainage Standards,” County of Hawai‘i, October, 1970 (as revised). Chapter 27 and the Storm Drainage Standards require that all increases in runoff due to a project’s development must be captured and disposed of. During final design, the project engineers will utilize the Storm Drainage Standards to calculate rainfall runoff, accounting for all new development. Based on the minimal area of impervious surface and the ready drainage of the existing pasture, it is expected that any runoff increase would be negligible and that no drainage structures will be required to capture and retain the small increase in rainfall runoff.

Indirect Impacts and Mitigation Measures Associated with Offsite Agricultural Water Use

Continued agricultural activities on existing farms and ranches would not induce any new runoff or drainage concerns. New agricultural ventures within potential new Agricultural Parks would be conducted in areas with a long history of agriculture. In order to minimize the potential for drainage issues, the State of Hawai‘i will encourage lessees to become cooperators with the U.S. Natural Resources Conservation Service. This will assist farmers and ranchers to develop and manage their lands in ways that reflect land and water suitability through identification of best practices and cost-sharing implementation.

Figure 8. Flood Hazard Map





Flood Hazard Assessment Report
www.hawaiiinfip.org

Property Information

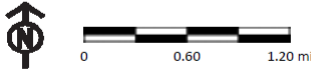
COUNTY: HAWAII
 TMK NO: (3) 5-5-006:002
 WATERSHED: HUALUA; KEALAHWEHA
 PARCEL ADDRESS: ADDRESS NOT DETERMINED
 HAWI, HI 96719

Flood Hazard Information

FIRM INDEX DATE: SEPTEMBER 29, 2017
 LETTER OF MAP CHANGE(S): NONE
 FEMA FIRM PANEL - EFFECTIVE DATE: 1551660025F - SEPTEMBER 29, 2017
 1551660075F - SEPTEMBER 29, 2017

THIS PROPERTY IS WITHIN A TSUNAMI EVACUATION ZONE: NO
 FOR MORE INFO, VISIT: <http://www.scd.hawaii.gov/>

THIS PROPERTY IS WITHIN A DAM EVACUATION ZONE: YES ()
 FOR MORE INFO, VISIT: <http://dlnr.hawaii.gov/dam/>



Disclaimer: The Hawaii Department of Land and Natural Resources (DLNR) assumes no responsibility arising from the use, accuracy, completeness, and timeliness of any information contained in this report. Viewers/Users are responsible for verifying the accuracy of the information and agree to indemnify the DLNR, its officers, and employees from any liability which may arise from its use of its data or information.

If this map has been identified as 'PRELIMINARY', please note that it is being provided for informational purposes and is not to be used for flood insurance rating. Contact your county floodplain manager for flood zone determinations to be used for compliance with local floodplain management regulations.

FLOOD HAZARD ASSESSMENT TOOL LAYER LEGEND
(Note: legend does not correspond with NFHL)

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD - The 1% annual chance flood (100-year), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. SFHAs include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

	Zone A: No BFE determined.
	Zone AE: BFE determined.
	Zone AH: Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
	Zone AO: Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
	Zone V: Coastal flood zone with velocity hazard (wave action); no BFE determined.
	Zone VE: Coastal flood zone with velocity hazard (wave action); BFE determined.
	Zone AEF: Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

NON-SPECIAL FLOOD HAZARD AREA - An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

	Zone XS (X shaded): Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
	Zone X: Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

	Zone D: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase apply, but coverage is available in participating communities.
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Source: Hawai'i State DLNR <http://gis.hawaiiinfip.org/FHAT/>

3.1.3 Groundwater

Existing Environment

Precipitation that is not lost through evapotranspiration or runoff into the ocean percolates into the ground to collect in underground aquifers, which are rock layers in which the pore spaces are filled with water, before slowly making its way to the sea. As streams in Hawai‘i are generally flashy or even ephemeral, underground water is the most reliable source of water supply, because there is less daily or seasonal change in water tables.

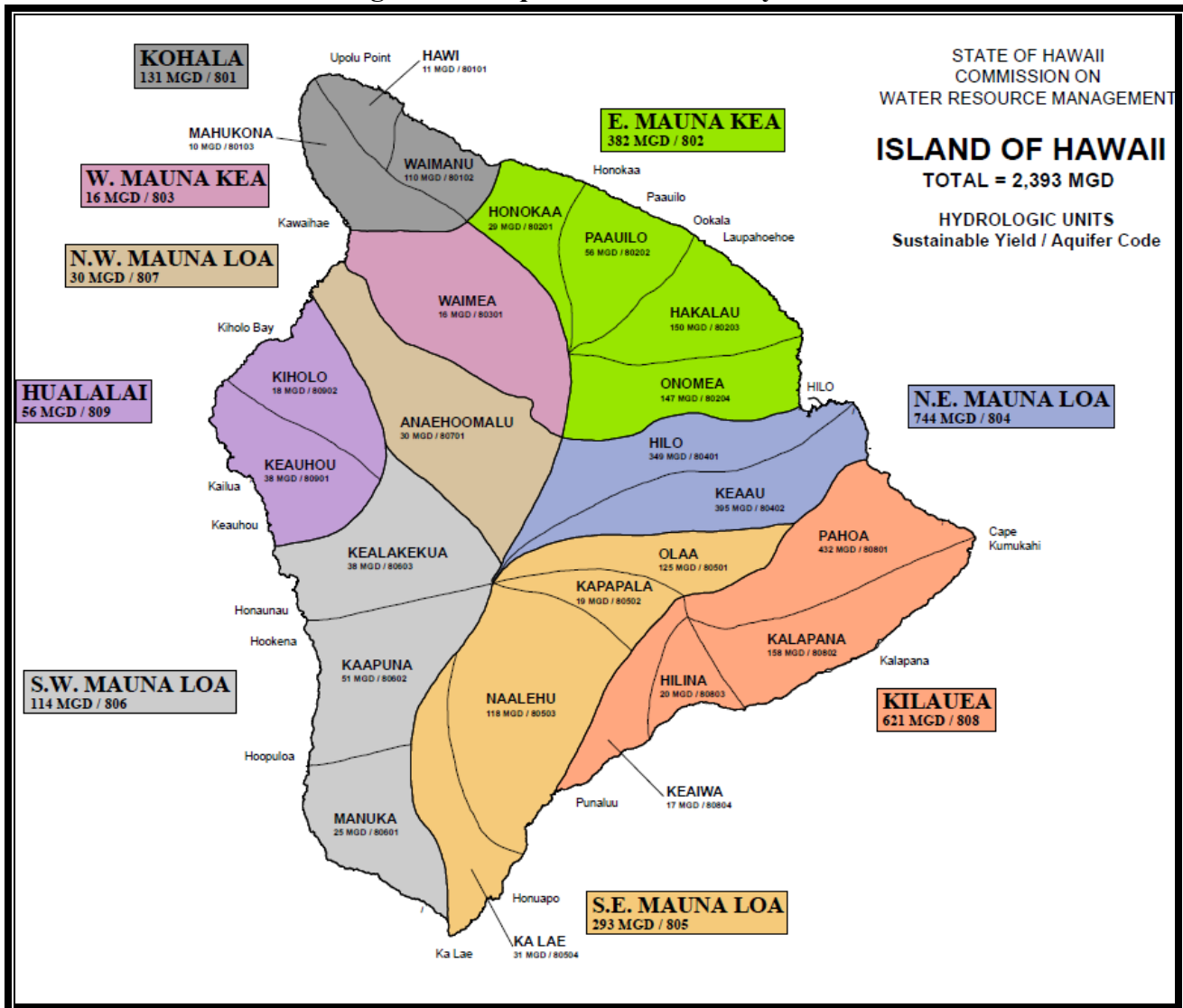
The State Commission on Water Resource Management (CWRM) classification this part of Kohala as the Hawi Aquifer System Area (80101), a subunit of the Kohala Aquifer Sector Area (ASEA). The Hawi ASA has a sustainable yield of 11 million gallons per day (MGD) according to the latest CWRM records, and the Kohala ASEA has a sustainable yield of 131 MGD. The management boundaries of these aquifers are shown in Figure 10. The recharge area for the Hawi Aquifer System is assumed to be roughly congruent with the surface area contained within the boundaries of the ASA. The Hawi ASA extends from Pu‘u Pili, along the crest of the Kohala Mountains, northwest to the northern extremity of the island between Puakea Point and ‘Upolu Point, with the eastern boundary being Pololū Valley. Thus the Hawi ASA underlies areas that are densely vegetated forest, as well as agricultural areas close to the communities of Hawi and Kapa‘au. This area is on the transition from leeward to windward and includes coastal plains and mountain summits, and thus has a range of annual average rainfall of almost 200 inches on the summit of the Kohala Mountains to 20 inches on its leeward coastal edge. Mink and Lau (1993) noted that where rainfall is substantial and the Hawi Volcanics overlie the Pololu Basalt, perched water occurs. Also, high-level dike water also occurs inland in the rift zone. Over a distance of 2 to 3 miles inland the Pololu Basalt contains a basal lens. The Hawi ASA thus contains a several distinct basal and upper-level aquifers. The DoA ‘Upolu Irrigation Well would develop groundwater within the basal lens in unconfined layers of basalt rock. The height of the water table as measured in a drawdown test in June 2022 was 4.4 feet above sea level, indicating a basal lens in the area approximately 176 feet thick.

Existing Wells and Current Estimated Water Use

CWRM maintains a database of wells that provides information on, among other aspects, aquifer identity, user identity, installed capacity, chloride content and function. According to a review of the CWRM database in the 2010 *Hawai‘i County Water Use and Development Plan Update* (HCWUPD), there are 63 production wells in the sector area, including 18 municipal, 1 domestic, 3 industrial, 33 irrigation and 8 categorized as “other”; however, only 5 wells reported pumpage. The majority of these wells are tunnels or shafts. There are also 30 wells drilled and categorized as “unused.” Aside from a companion USGS observation well, several wells are located in the ‘Upolu area, approximately one mile away.

Due to installation of a number of wells over the past century that are now inactive, the current total installed pump capacity in the Hawi ASA is 31.890 MGD (see Appendix 2 for Hawi ASA Well Report). Most of this capacity represents abandoned wells and wells with pump capacity far greater than intended average daily use, e.g., to provide fire flow. The actual 12-month moving average of pumping for the past year is less than 1 MGD, or less than 10% of the sustainable yield of 11 MGD (see Appendix 2).

Figure 10. Aquifer Sectors and Systems



Source: Hawaii State Commission on Water Resources Management
<http://hawaii.gov/dlnr/cwrm/mapsillustrations/gwhawaii.pdf>

Other Planned Uses in Aquifers and Issues of Concern

The HCWUPD modeled future development based on zoning and General Plan designations throughout the island’s aquifer systems to arrive at future “worst-case” water demand. This included potential private development as well as State water projects from agencies such as the Department of Agriculture and the Department of Hawaiian Home Lands. This process enabled assessment of the potential for future development to stress water resources, which should inform planning decisions. The plan noted that groundwater and surface water are plentiful in the Kohala ASEA, and that these could continue as the primary sources of water. Specifically, high-level groundwater could be developed for potable water sources, and the island’s four major ditch systems could be restored to satisfy non-potable needs, an

assessment that has proven problematic. In the Hawi ASA in particular, the highest projected 15-year growth rate would double non-agricultural demand from 2.5 to 5.0 MGD, in an aquifer system with a sustainable yield of 27 MGD. If worst-case agricultural demands (which is a highly unlikely and speculative scenario in which every acre of agriculturally zoned land is not only fully developed but also and irrigated), full development would not be sustainable within the Hawi ASA. However, the HCWUPD noted that there were at the time no specific State, County or DHHL water development projects identified within the Hawi ASA. Indeed, in the 12 years since publication of the HCWUPD, water use has not actually increased here, and concerns about a five to twenty-fold increase in water consumption based on the cumulative impact of urban and agricultural demand have not proven to be realistic.

Direct Impacts/Indirect Impacts and Mitigation Measures Associated with Offsite Agricultural Water Use

Hydrologic Impacts: Expected Water Resources and Effects on Sustainable Yield

The expected average daily pumpage of 0.456 MGD would have only minor effects in terms of the aquifer's sustainable yield, which is 11 MGD, with current average pumping from other wells only totaling 1 MGD. Even considering the HCWUPD's worst-case water use projects, which would double demand from 2.5 to 5.0 MGD, there is virtually no risk of approaching the sustainable yield within the foreseeable future.

Hydrologic Impacts: Effects on Streams and Springs

The Hawai'i Stream Assessment (Hawai'i CWRM 1990) lists 376 perennial streams throughout the State. Of these, 132 perennial streams are on the island of Hawai'i. Most are in windward areas with high rainfall on the slopes of Kohala Mountain and Mauna Kea. In other areas of the island, streams are intermittent or nonexistent.

There are 40 streams in the Kohala ASEA classified as perennial, of which 34 are considered continuous and 6 are considered intermittent. Seven of the 12 active gages on the island operated by the USGS are located in the sector area. The gages are mostly located in the Waimanu ASA; the Hawi ASA has only one gage, on Hapahapai Gulch in Kapa'au. No permanent streams that currently flow to the sea are present within almost two miles of the proposed 'Upolu Well. The nearest stream considered permanent is Kumakua Stream (see Figure 1, east of Hawi), located approximately two miles to the east. According to the Hawai'i DLNR Division of Aquatic Resources (DAR), two highly intermittent drainages flank 'Upolu Road: 'Upolu and Hualua Streams. Although only partially traceable on USGS maps, they are somewhat visible on aerial images as subtly greener corridors in the pastures (see Figures 1 and 2). No known springs are present in the area.

The DoA 'Upolu Irrigation Well would have a basal water source, meaning that the only streams or springs that could be affected would have to be in reasonable proximity to the well with beds carved down to sea level. No such water bodies are present and none would be affected by the well drawdown. As with all wells, the withdrawal of 384,000 gpd of water by the DoA 'Upolu Irrigation Well would very slightly reduce the leakage of groundwater along the Hawi area coastline, which is probably on the order of 14,000,000 gpd. Although no major groundwater dependent ecosystems (GDE) such as anchialine ponds are known to be present, effects to any subsurface GDE would be insignificant. Mitigation during the

drilling process prevents rock cuttings or drilling water from entering the surrounding streams by overland means and thereby degrading stream water quality.

Hydrologic Impacts: Effects on Nearby Wells

Three closely spaced USGS observation wells were drilled as part of the monitoring study (State Well IDs 8-7351-01, 02 and a third unnumbered well). The unnumbered well was most likely an unfinished first attempt at drilling 7351-02. It was never completed and was sealed by the USGS. Inspection determined that 7351-01 is obstructed and non-functional. This abandoned well will be sealed as part of the project, which helps protect the aquifer by preventing contamination. The only working wells within one mile are a pair of wells located approximately 0.8 miles to the south, State Well IDs 8-7350-01 and 02. These wells drilled in 2006 have not provided the required reports to CWRM since at least 2015. Given the results of the pump tests for the DoA 'Upolu Irrigation Well, which showed insignificant drawdown, very low chlorides, and the very substantial distance to these wells, no measurable impact to them from use of the proposed well at the projected pumping rate is likely.

Water Quality

Prior tests of the water from the 'Upolu Well in April 2010 measured total chlorides at 40 mg/L and total dissolved solids of 118 mg/L. These levels indicate very fresh water that could be utilized as potable water, and they are highly acceptable for agricultural uses, which requires chlorides of less than 1,000 mg/L. As for contaminants, although there is a history of sugar cane agriculture in the early 20th century, and individual wastewater systems are present at homes on the upgradient side of the well, the lack of industrial, commercial or dense residential land use upgradient, as well as the underlying geology and the depth to the aquifer, reduces the likelihood of substantial aquifer contamination. There is no information concerning existing aquifer contaminants in the area, but based on the project site's setting, the State has determined that there are unlikely to be concerns for the proposed use as agricultural water.

Improper drilling and use of wells can sometimes introduce contaminants that may be present in surface or subsurface layers down into the tapped aquifer. Since the well will be fully grouted to a significant depth, no surface or near-surface contamination of the groundwater aquifer is expected to occur beyond that of pre-development conditions. The well will be periodically tested to verify lack of contaminants and ensure that future contamination does not occur, or if detected, is mitigated through appropriate measures.

No designated Principal or Sole-Source Aquifers are located nearby or would be affected (Source: Designated Sole Source Aquifers in EPA Region IX, <https://www.epa.gov/dwssa/map-sole-source-aquifer-locations>. U.S. Environmental Protection Agency web page, checked July 2022). There are no State Wellhead Protection Plans in force in or near the well site.

3.1.4 Surface Water

Existing Environment

No permanent streams, wetlands or ponds are present in or near the project site. Sensitive receiving waters at the project site are limited to the Pacific Ocean itself, which is a minimum of 1.7 miles downslope from

the well and reservoir locations. The waters of Kohala are classified as “AA,” with the highest level of water quality goals. Hawai‘i Administrative Rules (HAR) Chapter 11-54 03(c)(1) states that class AA waters are “high quality waters ... in which water quality is expected to exceed that necessary to support oceanographic research, propagation of aquatic communities and wildlife, compatible recreation and aesthetic enjoyment. It is the objective of class AA waters that these waters remain in their natural pristine state as nearly as possible with an absolute minimum of pollution or alteration of water quality from any human caused source or actions. To the extent practicable, the wilderness character of these areas shall be protected.” These coastal waters are important for fishing, recreation, scenery and traditional practices.

As discussed in Section 3.1.3, no permanent streams currently flow to the sea within almost two miles of the project site. The nearest permanent stream is Kumakua Stream (see Figure 1, E. of Hawi), about two miles to the east. Two highly intermittent drainages flank ‘Upolu Road: ‘Upolu and Hualua Streams. The general project area where the water would be utilized has several small intermittent streams in shallow gulches between farmland fields and pastures, including Lipoa, Kumakua, Kapua and Hanaula Gulches.

Direct Impacts and Mitigation Measures

Development of the well and reservoir facilities and onsite farming would have temporary and minimal effects on water quality that are completely mitigable through adherence to best management practices. Minimal landclearing is expected as part of the improvements, and all grading would occur in an area of less than one acre and thus will not require a National Pollutant Discharge Elimination System (NPDES) permit. Plans submitted as part of the application for a County grading permit will ensure that offsite erosion and sedimentation impacts will be minimized, if not completely avoided. The State will ensure that its contractors perform all earthwork and grading in conformance with Chapter 10, “Erosion and Sedimentation Control,” of the Hawai‘i County Code.

The plans will specify Best Management Practices (BMPs) to minimize the potential for sedimentation, erosion and pollution of coastal waters. BMPs that will be specified in final design for the proposed program will likely include, but may not be limited to:

- The total amount of land disturbance will be minimized. The construction contractor will be limited to the delineated construction work areas within the project site.
- The contractor will not allow any sediment to leave the site.
- Construction activities with the potential to produce polluted runoff will not be allowed during unusually heavy rains or storm conditions that might generate storm water runoff.
- Cleared areas will be replanted or otherwise stabilized as soon as possible.
- Structures for sediment control will include grated inlets in the parking area, silt fences, and a stabilized construction entrance.
- All erosion and sediment control measures shall be inspected daily prior to and after each day’s construction.
- All waste materials shall be collected and stored in a securely lidded, leak proof metal dumpster, which shall be emptied a minimum of once per week.
- The contractor will be required to follow good housekeeping practices for materials to prevent spills or leaks, including storing only enough products and material required to perform the job,

keeping products in their original containers, having secondary containment for appropriate products, and following manufacturers' directions for proper use and disposal.

- All hazardous waste materials shall be disposed of in the manner specified by local or State or federal regulations.
- All sanitary waste shall be collected from the portable restroom facilities a minimum of once per week, and more often, as necessary.
- Hazardous products shall be kept in their original containers with the original manufacturer's labeling, with material safety data sheets (MSDS) retained and available for review by users, with all hazardous waste material disposed of in a manner permitted by local, State or federal regulations.
- All on-site vehicles shall be monitored for leaks and shall be subject to regular preventive maintenance to reduce the chance of leaks occurring, with leaks that cannot be repaired immediately contained in spill pans or other appropriate containers.
- Concrete trucks shall discharge drum wash water only at designated sites.

Indirect Impacts and Mitigation Measures Associated with Offsite Agricultural Water Use

Continued agricultural activities on existing farms and new agriculture in potential Agricultural Parks would involve to some degree the typical erosion and sedimentation impacts associated with even careful farming and ranching. A minimum level is an inevitable price for the practice of agriculture, but levels that produce impacts to sensitive water resources can and should be prevented through appropriate farming practices. As stated with relation to drainage impacts in Section 3.1.1, the State of Hawai'i will encourage lessees to become cooperators with the U.S. Natural Resources Conservation Service. This will assist farmers and ranchers to develop and manage State lands in ways that reflect land and water suitability through identification of best practices and cost-sharing implementation.

3.1.5 Flora, Fauna and Ecosystems

Existing Environment

The natural vegetation of this part of North Kohala was most likely lowland mesic and dry forest with a particularly rich range of species (Gagne and Cuddihy 1990). These original communities were affected by traditional Hawaiian cultivation and then heavily degraded by sugar cane plantations, cattle grazing, and clearing for small farms and residences. The vegetation in and around the project site (as well as all other potentially involved properties) is now either managed vegetation (i.e., crops, pasture or landscaped grounds) or adventive "communities" of various alien weeds (see Figures 4 for photos).

The project site property in particular is fully utilized as pasture and contains typical grass and forage crops, including Guinea grass (*Megathyrsus maximus*), green panic grass (*M. maximus* var. *trichoglume*), kikuyu grass (*Cenchrus clandestinus*), crabgrass (*Digitaria* spp.), Bermuda grass (*Cynodon dactylon*), goosegrass (*Eleusine indica*), smutgrass (*Sporobolus* spp.), tinaroo (*Neonotonia wightii*) and *Desmodium* spp. Interspersed are several groves, hedgerows, and individual shrubs or trees such as koa haole (*Leucaena leucocephala*), ironwood (*Casuarina equisetifolia*), Formosan koa (*Acacia confusa*), Christmas berry (*Schinus terebinthifolius*) and java plum (*Syzygium cumini*). Over a dozen weedy herbs, shrubs, vines and grasses including the pasture pest fireweed (*Senecio madagascariensis*), Sodom apple

(*Solanum linnaeanum*) and heliotrope (*Heliotropium amplexicaule*) dot the pastures. Native plants are almost absent; the only natives observed were a few individuals of the common roadside herb 'uhaloa (*Waltheria indica*). The full list of plant species detected is contained in Table 1.

A large variety of alien birds makes up the avifauna of this area. Common mynas (*Acridotheres tristis*), black francolins (*Francolinus francolinus*), house finches (*Carpodacus mexicanus*), Japanese white-eyes (*Zosterops japonicus*), cattle egrets (*Bubulcus ibis*) and spotted doves (*Spilopelia chinensis*) were observed during reconnaissance. Observations for longer periods and at different seasons and times of the day would undoubtedly uncover a larger variety of species, but nearly all would be non-native.

No native birds were noted during project site reconnaissance, but long term studies might observe several species. Surveys of birds near the coast by P. Bruner on six days during the months of April, July and October in 1997 for the 'Upolu Airport Final Environmental Assessment (HDOT-A 1999) noted four native birds. Two are very likely to be present on the project site and in the general project region: Pacific golden-plover or kolea (*Pluvialis fulva* – not observed in the early August survey because most kolea are in Alaska during this time) and short-eared owl or pueo (*Asio flammeus sandwichensis*), which is fairly common in grasslands of the leeward side of the Big Island. As reported in Geometrician (2011), previous consultation by the U.S. Natural Resources Conservation Service (USNRCS) with the U.S. Fish and Wildlife Service (USFWS) during preparation of soil conservation plans for the adjacent dairy noted that the endangered Hawaiian coots or 'alae ke'oke'o (*Fulica alae*) and Hawaiian duck or koloa maoli (*Anas wyvilliana*) may utilize reservoirs in the area at times. The former open reservoir on the project site was drained pre-1976 and no longer holds water. There are no nearby sightings of either of these species in the eBird geographic database, which records birder observations.

The formerly federally-endangered Hawaiian hawk – which remains listed by the State of Hawai'i – occurs throughout the island of Hawai'i from sea level to 8,530 feet in elevation. Although no hawks were observed during site reconnaissance, they are frequently seen in a variety of habitats in upper elevations of Kohala. They generally prefer 'ōhi'a forest habitat but are known from both native and non-native forests and even range into farmland and towns to forage. Hawks nest in tall trees within their large territories from early March through the end of September. Most nesting occurs in native 'ōhi'a trees but non-native trees, including eucalyptus, ironwood, mango, coconut palm and macadamia, may also be used. The agricultural land uses on and around the project site do not offer optimal nest sites for Hawaiian hawks. Maps by Gorresen et al (2008) place the project site along with potential user properties and Agricultural Park sites well outside agency hawk observations and mapped breeding ranges. However, eBird databases record several sightings of hawks in the general area, which were likely foraging. There is thus a small but not negligible possibility that hawks somewhere in the project region. If nests were present on or very near the property, any major grading or tree removal might disturb nesting. Although potentially suitable nesting trees exist at the project site, they are well *makai* of the known nesting range for Hawaiian hawks.

Table 1. Plant Species Detected at Project Site

Scientific Name	Family	Common Name	Life Form	Status
<i>Abutilon grandifolium</i>	Malvaceae	Hairy abutilon	Herb	A
<i>Acacia confusa</i>	Fabaceae	Formosan koa	Tree	A
<i>Amaranthus spinosus</i>	Amaranthaceae	Spiny amaranth	Herb	A
<i>Artocarpus heterophyllus</i>	Moraceae	Jackfruit	Tree	A
<i>Asclepias physocarpa</i>	Apocynaceae	Balloon plant	Herb	A
<i>Asystasia gangetica</i>	Acanthaceae	Chinese violet	Herb	A
<i>Casuarina equisetifolia</i>	Casuarinaceae	Ironwood	Tree	A
<i>Cenchrus clandestinus</i>	Poaceae	Kikuyu grass	Grass	A
<i>Cirsium vulgare</i>	Asteraceae	Bull thistle	Herb	A
<i>Chloris barbata</i>	Poaceae	Swollen fingergrass	Grass	A
<i>Commelina diffusa</i>	Commelinaceae	Honohono	Herb	A
<i>Conyza bonariensis</i>	Asteraceae	Hairy horseweed	Herb	A
<i>Crotalaria spp.</i>	Fabaceae	Rattlebox	Herb	A
<i>Cucumis dipsaceus</i>	Cucurbitaceae	Hedgehog gourd	Vine	A
<i>Cynodon dactylon</i>	Poaceae	Bermuda grass	Grass	A
<i>Desmodium incanum</i>	Fabaceae	Desmodium	Vine	A
<i>Digitaria insularis</i>	Poaceae	Sourgrass	Grass	A
<i>Digitaria spp.</i>	Poaceae	Crabgrass	Grass	A
<i>Eleusine indica</i>	Poaceae	Goosegrass	Grass	A
<i>Eragrostis pectinacea</i>	Poaceae	Carolina lovegrass	Grass	A
<i>Heliotropium amplexicaule</i>	Boraginaceae	Heliotrope	Herb	A
<i>Indigofera suffruticosa</i>	Fabaceae	Indigo	Shrub	A
<i>Lantana camara</i>	Verbenaceae	Lantana	Shrub	A
<i>Lepidium bonariense</i>	Brassicaceae	Pepperwort	Herb	A
<i>Leucaena leucocephala</i>	Fabaceae	Haole koa	Tree	A
<i>Malvastrum coromandelianum</i>	Malvaceae	False mallow	Herb	A
<i>Megathyrsus maximus</i>	Poaceae	Guinea grass	Grass	A
<i>Murraya paniculata</i>	Rutaceae	Mock orange	Shrub	A
<i>Neonotonia wightii</i>	Fabaceae	Glycine	Herb	A
<i>Pluchea carolinensis</i>	Asteraceae	Sourbush	Shrub	A
<i>Ricinus communis</i>	Euphorbiaceae	Castor bean	Shrub	A
<i>Sacciolepis indica</i>	Poaceae	Glenwood grass	Grass	A
<i>Schinus terebinthifolius</i>	Anacardiaceae	Christmas berry	Shrub	A
<i>Senecio madagascariensis</i>	Asteraceae	Fireweed	Vine	A
<i>Solanum linnaeanum</i>	Solanaceae	Sodom apple	Shrub	A
<i>Sphagneticola trilobata</i>	Asteraceae	Wedelia	Shrub	A
<i>Sporobolus spp.</i>	Poaceae	Smutgrass	Grass	A

Table 1, continued				
Scientific Name	Family	Common Name	Life Form	Status
<i>Stylosanthes viscosa</i>	Fabaceae	Stylosanthes	Herb	A
<i>Waltheria indica</i>	Malvaceae	‘Uhaloa	Herb	I

* A = alien; I = indigenous; E= endemic; PI = Polynesian introduction

Note: one tree and several pasture grasses not identified

As with all of the island of Hawai‘i, several threatened or endangered seabirds may fly over the general project area, including the endangered Hawaiian petrel (*Pterodroma sandwichensis*), the endangered band-rumped storm petrel (*Oceanodroma castro*), and the threatened Newell’s shearwater (*Puffinus auricularis newelli*). Although they may overfly the project site on their way to and from mountain nesting areas and the open ocean, no suitable nesting habitat for any of these seabird species is present in the project area. The primary cause of mortality in these species in Hawai‘i is thought to be predation by alien mammals at the nesting colonies. Collision with man-made structures is another significant cause. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. Disoriented seabirds may collide with manmade structures and, if not killed outright, may become easy targets of predatory mammals.

Endangered Hawaiian hoary bats (*Lasiurus cinereus semotus*), the only native Hawaiian land mammals, have been found throughout the island of Hawai‘i. Bats may forage for flying insects on the property on a seasonal basis and may also roost in trees and large shrubs. Bats are often visible while they are feeding on flying insects near dusk and dawn. Their presence can also be verified by ultrasound detectors or radar. If a bat is detected during a night’s study, this merely indicates that they were present in the area. Conversely, the absence of bat detections does not indicate an absence of bats, which may have been absent for only a night, a week, or a season, or may have been present but undetected. Determination of bat populations or usage patterns requires much more sophisticated, long term studies. No bats were observed in our site reconnaissance, which took place in full daylight and did not use any detection equipment. For the purposes of this assessment, it is assumed that Hawaiian hoary bats are present at least some of the time, as they have been frequently seen or detected by ultrasound and radar in rural Kohala. Hawaiian hoary bats are vulnerable to disturbance during the summer pupping season and require special mitigation measures.

As the project site is a pasture, the most common mammal is the domestic cow (*Bos taurus*). We did not observe any other non-native mammals on the property. It is likely that feral pigs (*Sus scrofa*), feral cats (*Felis catus*), Indian mongooses (*Herpestes a. auro punctatus*), mice (*Mus* spp.), rats (*Rattus* spp.), and domestic dogs (*Canis f. familiaris*) are sometimes present. None of these alien mammals have conservation value and all are deleterious to native flora and fauna.

Hawai‘i has no native terrestrial reptiles or amphibians. No reptiles were seen, but various species of skink (Family: Scincidae) and gecko (Gekkonidae) are likely present. There was no evidence of amphibians; in particular, the pest coqui frog (*Eleutherodactylus coqui*) was not heard at the site.

No invertebrate survey was undertaken, but rare, threatened or endangered invertebrates in Hawai‘i tend to be associated with either higher-elevation, older substrate rainforests (e.g., various *Drosophila*); coastal dry shrubland (e.g., various *Hylaeus*); the summit of Mauna Kea (*Nysius wekiuicola*); extremely dry,

disturbed ‘a‘a flows (*Manduca blackburnii*); or aquatic settings (various *Megalagrion*). The project site does not contain suitable habitat for any threatened or endangered invertebrates.

Direct Impacts and Mitigation Measures

Because of the lack of native ecosystems or threatened or endangered species on the project site, the proposed water system improvements and onsite farming are unlikely to have adverse impacts to biological resources. In order to avoid and minimize impacts to such species that could occasionally utilize or overfly the area, the following mitigation measures will be implemented:

- There will be no removal or major trimming of woody vegetation taller than 15 feet during the bat pupping season, which runs from June 1 through September 15 each year.
- To avoid potential seabird downing through interaction with outdoor lighting, no construction or unshielded equipment lighting will be used after dark between the months of April and October. No permanent lighting will be involved in the water system improvements.

Indirect Impacts and Mitigation Measures Associated with Offsite Agricultural Water Use

Continued agricultural activities on existing farms and new agriculture in potential Agricultural Parks would not pose any significant risk of harm to native ecosystems or threatened or endangered species.

3.1.6 Air Quality, Noise, and Scenic Resources

The tradewinds of North Kohala contribute to excellent air quality by generally dispersing human-derived pollutants as well as volcano-induced vog, which are volcanic emissions of sulfur dioxide that convert into particulate sulfate and produce a haze. No major sources of air pollutants are present in the region.

Noise levels at the project site vary from low to moderate, depending primarily on the proximity to the wind farm at the *makai* end of the property and current wind conditions. There is minor noise from agricultural activities and vehicle traffic on Highway 270 and ‘Upolu Road. Aircraft landings occur only infrequently at ‘Upolu Airport and aircraft noise is not a factor. Currently, the only noise-sensitive receptors within 2,000 feet of the project site are several onsite residences of the leased property and a subdivision of several dozen homes, both immediately bordering Highway 270 (see Figure 2). No schools, parks or hospitals are nearby.

The project site has impressive upslope views of Kohala Volcano and downslope views of the ocean (see photos in Figure 4). The Hawai‘i County General Plan contains Goals, Policies and Standards intended to preserve areas of natural beauty and scenic vistas from encroachment. The plan lists ‘Upolu Point (TMK 5-5-007:007), along with the coastal viewplane from the Akoni Pule Highway (various TMKs), as significant for their scenic character. The Hawi Renewable Development electricity-generating wind farm is located adjacent to the *makai* portion of the project site lands, on the eastern side of the ‘Upolu Point road. The wind farm consists of 16 wind generators that measure roughly 200 feet tall. These represent the primary manmade element in the viewplane from Akoni Pule Highway in this area. From all adjacent viewpoints, the project site and the adjacent dairy present a pleasing scene of grazing cows in pastures and green forage areas.

Direct Impacts and Mitigation Measures

Due to the minor scale of the proposed water system improvements and future onsite farming, they would not measurably affect air quality, except temporarily and minimally during construction; dust will be strictly controlled through required BMPs.

Construction may generate loud noise exceeding 95 decibels at times, impacting nearby areas. In cases where construction noise is expected to exceed the Department of Health's (DOH) "maximum permissible" property-line noise levels, contractors are required to consult with DOH and determine whether they should obtain a permit per Title 11, Chapter 46, HAR (Community Noise Control) prior to construction. DOH will review the proposed activity, location, equipment, project purpose, and timetable in order to decide upon conditions and mitigation measures, such as restriction of equipment type, maintenance requirements, restricted hours, and portable noise barriers. Such measures, when needed, are effective in reducing noise to minimal levels.

On an ongoing basis, the proposed vertical line shaft pump with an above ground motor will generate noise at the surface near the well. Although the nearest off-property homes are more than 800 feet away, which will greatly reduce any pump noise, the design includes sound attenuating housing installed around the above ground line shaft motor. This will reduce noise to far below acceptable property boundary levels. The reservoir and pipes will not generate any noticeable noise.

The Hawai'i County General Plan calls for preserving the visual quality of areas endowed with natural beauty and protecting scenic vistas and view planes from becoming obstructed. The only highly visible structure on the project site will be the 660,000-gallon reservoir, which will be a 20-foot high cylinder 75 feet in diameter (see Figure 4). Due to its proposed location behind three existing structures, situated at a ground elevation approximately 30 feet lower than Akoni Pule Highway, no impacts to the view plane from Akoni Pule Highway or to any other scenic sites, vistas or view planes would occur. All permanent lighting is being kept to minimum necessary levels. Lighting planned for the site will consist of blue-deficient LED, shielded so as to lower the ambient glare, in conformance with the Hawai'i County Outdoor Lighting Ordinance (Hawai'i County Code Chapter 9, Article 14). This will both preserve dark skies and protect threatened or endangered seabirds.

Indirect Impacts and Mitigation Measures Associated with Offsite Agricultural Water Use

The typical minor and temporary air quality, noise and visual impacts associated with farming and ranching would continue to occur, mitigated to various degrees by farming practices decided on by the individual farmer. No additional mitigation measures are proposed. Similar impacts would occur in proposed Agricultural Parks. As all such properties would be situated on land that has historically been farmed and is adjacent to other farmland and pastures, no impacts that would be considered significantly adverse would occur.

3.1.7 Hazardous Substances, Toxic Waste and Hazardous Conditions

Environmental Setting

No Phase I Environmental Site Assessment was conducted for the project site. It has long history of agricultural use and State officials are not aware of any hazardous substances, toxic waste or hazardous conditions. State databases did not indicate any Underground Storage Tanks (USTs), Leaking Underground Storage Tanks (LUSTs), or records of incidents or releases on the site or in adjacent properties (<https://eha-cloud.doh.hawaii.gov/iheer/#!/viewer> Accessed September 2022)

Direct Impacts and Mitigation Measures

There are no known hazardous materials on site, and the water system improvements do not involve reportable hazardous materials. Although it is unlikely that any heretofore unknown hazardous materials or toxic or radioactive waste would be found on the project site during construction, construction best management practices will include contingencies for appropriate response and remediation should such conditions be encountered.

Indirect Impacts and Mitigation Measures Associated with Offsite Agricultural Water Use

Continued agricultural activities on existing farms and new agriculture in potential Agricultural Parks would involve the types and levels of fertilizer, fuels, herbicides and pesticides typical of farming activities. In order to avoid or minimize impacts, farmers and ranchers must follow label instruction and in some cases obtain training or licenses for use. A certain level of risk is associated with any agricultural operation, and no additional mitigation is proposed.

3.2 Socioeconomic and Cultural

3.2.1 Socioeconomic Characteristics

Existing Environment

The North Kohala District is an ethnically and economically diverse community. Data from the 2020 U.S. Census of Population has not yet been released, but survey results from Census Bureau's periodic American Community Survey (which come with a margin of error of up to 10% because of the small sample size) estimate a population of 5,906 and a median age of 48.6 years. About 32% of the population is White, with 20% Asian and 8% Native Hawaiian or Pacific Islander. Per capita income is \$38,945, median household income is \$82,483, the median value for owner-occupied housing units of \$502,800, and the poverty rate is about 11.5%. Compared to the island and State as a whole, North Kohala has a higher proportion of White residents and is older and wealthier. In 2005, the Hawai'i County General Plan noted that North Kohala had seen significant growth over the preceding 25 years from an influx of retirees and continuing development of resort complexes in the neighboring South Kohala District. It predicted continuing growth of up to 8,000 residents by 2010, which did not occur, because very little new housing was actually built. Many residents commute to visitor industry jobs in South. Local tourism is also an

important source of income and employment in the district, including health and wellness and eco-tourism enterprises. As discussed in Section 1.2, agriculture is also an important part of the economy.

Direct Impacts and Mitigation Measures

The proposed water system improvements and onsite farming would have no adverse socioeconomic effects.

Indirect Impacts and Mitigation Measures Associated with Offsite Agricultural Water Use

As discussed in detail below in Section 3.6.4, land use designations, as well as the policies, strategies and objectives of land use plans, call for the perpetuation and expansion of agriculture in North Kohala. The preservation and potential expansion of farming and ranching is highly consistent with these plans and represents a beneficial socioeconomic impact. According to the Hawai'i County Planning Department (see letter in Appendix 1a), the area appears to be within the North Kohala Enterprise Zone. The Enterprise Zones (EZ) Partnership Program gives State and County benefits to companies in an effort to stimulate business activity, job preservation, and job creation in areas where they are most appropriate or most needed. Additional agricultural production may have spinoff economic benefits that can be leveraged within an EZ.

3.2.2 Cultural Resources

ASM Affiliates conducted a complete Archaeological Inventory Survey (AIS) of the entire 44.5-acre project site (Appendix 3), as well as an archaeological literature review of a portion of the adjacent TMK (3) 5-5-006:003 to determine the general potential for archaeological resources on properties that might be considered in the future for Agricultural Parks (Appendix 4). ASM also researched potential traditional cultural resources and practices in the area and initiated consultation. Information from these research efforts is summarized below and supplemented with other material.

Cultural and Historical Background

The first inhabitants of Hawai'i were believed to be settlers who had undertaken difficult voyages across the open ocean from Kahiki, the ancestral homelands of the Hawaiian gods and people. Recent work suggests this occurred around A.D. 1000 (Kirch 2011). The first voyagers are believed to have come from the southern Marquesas Islands and settled initially on the windward side, eventually expanding to leeward areas. Early Hawaiian farmers developed new strategies and tools for their new environment (Kirch 2011; Pogue 1978). Societal order was maintained by their traditional philosophies and by the conical clan principle of genealogical seniority (Kirch 2011). Universal Polynesian customs brought from their homeland included the observance of major gods Kane, Ku, and Lono; the *kapu* system of law and order; cities of refuge, and the concepts of *mana* and the *'aumakua* (Fornander 1969).

The Development Period, from about A.D. 1100 to 1350, brought an evolution of traditional tools such as a variation of the *ko'i* (adze), as well as new Hawaiian inventions such as the two-piece fishhook and the octopus-lure breadloaf sinker. That was followed by the Expansion Period (A.D. 1350 to 1650) which saw greater social stratification, intensive land modification, and population growth. This period was also

the setting for the second major migration to Hawai‘i, this time from Tahiti. Also established during this period was the *ahupua‘a*, a land-use concept that incorporated all of the eco-zones from the mountains to the shore and beyond. The usually wedge-shaped *ahupua‘a* provided a diverse subsistence resource base (Hommon 1986) and added another component to what was already becoming a well-stratified society (Kirch 2011). The project site for the well and reservoir is located in the *moku* or district of Kohala, in the *ahupua‘a* of ‘Opihipau. Surrounding properties that may receive the agricultural water are scattered across the nearby *ahupua‘a* of Hukia‘a, Pu‘uepa, Kokoiki, Kealahewa, Hualua, and Kahei (see Figure 1).

Handy et al. (1972:528) relate that “North Kohala...was intensively cultivated in dry and forest taro, sweet potatoes, bananas, and cane” as well as wet taro. Dry taro was planted fairly continuously over all of the grassy *kula* lands of the district between Pololū and Hāwī. To prepare the ground, Hawaiian planters would burn off the grass, pull out the stubble, and allow it to rot before planting their starts. Upland forest plantations were also developed in the clearings of the North Kohala forest. Sugarcane was often planted near taro and sweet potato patches. Handy and Handy explain:

In dry-taro and sweet-potato fields on the sloping *kula* or in the lower forest zone, cane was planted as hedges along the lines of stone and rubbish thrown up between the fields. Thus it helped the planter to utilize to the maximum his soil and water, and acted as a windbreak against the gusty breezes which blow in most valley bottoms, along the coasts, and on the uplands where taro is grown (1972:186).

Sugar cane has an extensive history in North Kohala. Pukui (1983), who notes that Hawaiian proverbs often carry multiple meanings, recounted proverbs about the relationship between sugar cane and the land:

He pa‘a kō kea no Kohala, e koleaika waha ke ‘ai.

A resistant white sugar cane of Kohala that injures the mouth when eaten.

Pukui’s interpretation was thus:

A person that one does not tamper with. This was the retort of Pupukea, a Hawai‘i chief, when the Maui chief Makakuikalani made fun of his small stature. It was later used in praise of the warriors of Kohala, who were known for valor (1983).

The second proverb:

I ‘ike ‘ia no o Kohala i ka pae kō, a o ka pae kō ia kole ai ka waha.

One can recognize Kohala by her rows of sugar cane which can make the mouth raw when chewed.

Pukui’s explanation:

When one wanted to fight a Kohala warrior, he would have to be a very good warrior to succeed. Kohala men were vigorous, brave, and strong (1983).

As population grew during the following centuries, so too did the reach of inland cultivation and consequent political and social stress. During the Proto-Historic Period (A.D. 1650-1795), wars reflective of a complex and competitive social environment are evidenced by *heiau* building. By the seventeenth century, large areas of Hawai'i Island (*moku 'aina* – districts) were controlled by a few powerful *ali'i 'ai moku*. There is island-wide evidence to suggest that growing conflicts between independent chiefdoms were resolved through warfare, culminating in a unified political structure at the district level. The legend of Kapunohu (set about A.D. 1600), relates that in North Kohala, the chiefs of Kukuipahu ruled the leeward *ahupua'a* of the district, while the chiefs of Niuli'i ruled the windward *ahupua'a* of the district. Wainaia Gulch was the boundary between the two domains (Erkelens and Athens 1994). In about A.D. 1600, the armies of the two polities met on the battlefield of Hinakahua (east of the present day town of Kapa'au), and the forces of Kukuipahu were defeated, putting control of the district under the chiefs of Niuli'i (Fornander 1916:215-220).

During this period, sometime during the reign of Kalaniopu'u (A.D. 1736-1758), Kamehameha I was born in North Kohala. In fact, North Kohala is probably best known as his birthplace, in the *ahupua'a* of Kokoiki (Kamakau 1992). It has been said that when he was born, an army was assembling on the leeward Kohala coast, preparing for an attack on Maui, and his birth occurred on a night filled with rain, thunder and lightning (Kamakau 1964, Tomonari-Tuggle 1988). Kohala is also known for Mo'okini Heiau, located near the shoreline west of the airport. Mo'okini is the *luakini* type of *heiau*, where human sacrifices were believed to have occurred. According to Stokes (1919), the *heiau* was said to have been built from stones brought from Pololū Valley. It was believed that the stones were passed hand-to-hand by men standing in a line spanning the 15-mile distance from the valley.

Hawai'i's history took a sharp turn on January 18, 1778 with the arrival of British Capt. James Cook in the islands. On a return trip to Hawai'i 10 months later, Kamehameha visited Cook aboard his ship the *Resolution* off the east coast of Maui and helped Cook navigate his way to Hawai'i Island (Kamakau 1992). Cook exchanged gifts with Kalaniopu'u at Kealakekua Bay the following January, and Cook left Hawai'i in February. However, Cook's ship then sustained damage to a mast in a severe storm off Kohala and returned to Kealakekua, setting the stage for his death on the shores of the bay (Kuykendall and Day 1976). In 1779, Captain Cook explored the North Kohala area and reported:

As far as the eye could reach, seemed fruitful and well inhabited ... [three and four miles inland, plantations of taro and potatoes and wauke] neatly set out in rows. The walls that separate them are made of the loose burnt stone, which are got in clearing the ground; and being entirely concealed by sugar-canes planted close on each side, make the most beautiful fences that can be conceived ... [The exploring party stopped six or seven miles from the sea] To the left a continuous range of villages, interspersed with groves of coconut trees spreading along the sea-shore; a thick wood behind this; and to the right, an extent of ground laid out in regular and well-cultivated plantations ... as they passed, they did not observe a single foot of ground, that was capable of improvement, left unplanted (Handy and Handy 1972).

Another early account of the northern tip of Kohala was made in 1793 by Archibald Menzies (1920:52), who wrote:

From the north-west point of the island [‘Upolu Point], the country stretches back for a considerable distance with a very gradual ascent, and is destitute of trees or bushes of any kind. But it bears every appearance of industrious cultivation by the number of small fields into which it is laid out, and if we might judge by the vast number of houses we saw along the shore, it is by far the most populous part we had yet seen of the island.

During the Proto-Historic Period there was a continuation of the trend toward intensification of agriculture, *ali ‘i*-controlled aquaculture, settling of upland areas and development of traditional oral history. The *luakini heiau* and the *kapu* system were at their peaks, but the influence of the western world was being felt in the introduction of trade for profit and a market-system economy. By 1810, the sandalwood trade established by Europeans and Americans twenty years earlier was flourishing. That contributed to the breakdown of the traditional subsistence system, as farmers and fishermen were required to toil at logging, which resulted in food shortages and a decline in population (Kuykendall and Day 1976, Kent 1983). Following the death of Kamehameha I in 1819, the customary relaxing of *kapu* after the death of a ruler took place. But with the introduction of Christianity shortly thereafter, his successor Kamehameha II renounced the traditional religion and ordered that *heiau* structures either be destroyed or left to deteriorate (Kamakau 1992). The family worship of ‘*aumakua* images was allowed to continue. Mo‘okini Heiau was deserted in 1832, after which *wauke* (paper mulberry) was cultivated in the interior and *kukui* trees grown in the enclosure which was also overgrown with grass (Napoka n.d).

The Protestant missionaries who arrived from Boston in 1820 were soon rewarded with land and government positions, as many of the *ali ‘i* were eager to assimilate western-style dress and culture. Missionary William Ellis traveled along North Kohala from Pololū Valley by way of Hawala (“Halau”), Kapa‘au (“Kapaau”), Awalua (“Owawarua”), and Hihui to Kawaihae (“Towaihae”):

The soil was fertile, the vegetation abundant. The coast, as they approached the N.W. point of the island, was frequently broken by snug little bays, or inlets, which are invaluable to the inhabitants, on account of the facilities they afford for fishing. The tract they passed over to-day, seemed more populous than that through which they had travelled yesterday; but they found most of the villages destitute of inhabitants, except a few women, who had charge of some of the houses. On inquiry they learned, that, a short time ago, the people of Kohala had received orders from the king [Kamehameha] to provide a certain quantity of sandalwood, and that they were all absent in the mountains, cutting it. At noon they stopped at Kapaau, an inland village...passed the north point of the island shortly afterwards, and at 3 P.M. reached Owawarua, a considerable village on the north-west coast, inhabited mostly by fishermen (Ellis (1825:215).

The rampant sandalwood trade resulted in the first Hawaiian national debt, as promissory notes and levies granted by American traders were enforced by American warships (Oliver 1961). The assimilation of Western ways continued with the short-lived whaling industry and then commercial production of sugarcane, which was more lucrative but carried a heavy environmental price.

Profound religious, socioeconomic and demographic changes in the early 1800s resulted in the establishment of a Euro-American style of land tenure. The *Māhele ‘Āina* of 1848 was the vehicle used to divide the land between the crown, government, *konohiki* and native tenants. Prior to this land “reform”, all the land and natural resources of Hawai‘i were held in trust by the *ali‘i* who, in concert with *konohiki* land agents, meted out use rights to the native tenants at will. The *Māhele* of 1848 would forever change the land tenure and the landscape of the Hawaiian Islands. During the *Māhele* all lands were placed in one of three categories: Crown Lands (for the occupant of the throne), Government Lands, and Konohiki Lands; all three types of land were subject to the rights of the native tenants therein.

The *ali‘i* and *konohiki* were required to present their claims to the Land Commission to receive a Land Commission Award (LCAw.) for lands provided to them by Kamehameha III. They were also required to provide commutations to the government in order to receive royal patents on their awards. The lands were identified by name only, with the understanding that the customary known boundaries would prevail until the land could be surveyed. This process expedited the work of the Land Commission and subsequent land transfers (Chinen 1958). In 1862, the Commission of Boundaries (Boundary Commission) was established to legally set the boundaries of all the *ahupua‘a* that had been awarded as a part of the *Māhele*. However, boundary descriptions were not collected for all *ahupua‘a*. During this process, the ‘Opihipau Ahupua‘a ultimately became Government land, being returned by Victoria Kamamalu in 1850 (Soehren 2005).

Conditions of the *Māhele ‘Āina* also afforded native tenants the right to claim, and acquire title to, parcels that they actively lived on or cultivated for a living. These *kuleana* claims were essentially transfers of ownership from the *ali‘i nui* (high chief) or *konohiki* (lesser chief/overseer), who had been awarded ownership of the *ahupua‘a* by Kamehameha III, to the commoners. The Board of Commissioners oversaw the program and administered the *kuleana* as Land Commission Awards (LCAw.). No *kuleana* were claimed or awarded within ‘Opihipau Ahupua‘a (AVA-Konohiki 2015; Office of Hawaiian Affairs 2018; Waihona 2018 – see Appendix 3).

In conjunction with the *Kuleana* Act, the King authorized the issuance of Land Grants to applicants for tracts of Government land that were allocated during the *Māhele*. These Land Grants were generally larger than those awarded by the Land Commission. The Act resolved that portions of the Government Lands should be set aside and sold as grants ranging in size from one to fifty acres at a cost of fifty cents per acre. The stated goal of this program was to enable native tenants, many of whom were insufficiently awarded or not awarded land through the *Kuleana* Act, to purchase lands of their own. Despite the goal, this provided the mechanism that allowed many foreigners to acquire large tracts of the Government Lands. While the specific land use practiced during the mid-1800s on many grant parcels is not known, it is likely that many of the grantees in the vicinity of the project area used their newly acquired lands for homesteading, agricultural, or even ranching purposes. In ‘Opihipau, no land grants were sold. Two grants were sold during the twentieth century in the adjacent *ahupua‘a* of Hukia‘a for parcels associated with John Hind and the Hawi Mill and Plantation Company.

The first documented production of sugar by foreigners in Hawai‘i was by Chinese on Lana‘i in 1802. Commercial sugar production would not occur until 1835 when it began replacing the waning sandalwood industry (Oliver 1961, Kuykendall and Day 1976). Sugar became part of Kohala’s economy with the arrival of American missionary Elias Bond (KTF 1975). In 1860, the Rev. Bond enlisted the help of

Samuel N. Castle in founding the Kohala Sugar Company on lands owned by Bond and his neighbor, Dr. James Wight. The first crop was harvested in January 1865 (KTF 1975). As Tomonari-Tuggle notes:

The arrival in 1841 of Elias Bond, of the Protestant American Board of Commissioners for Foreign Missions, to Kohala marked the beginning of a 22-year period of transition in the district's history. In those years a new religion, a new land tenure system, and a changing economy altered the lifestyles and world view of the indigenous population of the district. The Kohala community was in flux, attempting to find a firm footing in a changing world, in a much larger network of social, political, and economic interactions than had previously existed.

When Elias Bond directed his efforts to initiating sugar as a major agricultural industry in Kohala, he could not have foreseen the incredible success of his modest venture. His primary concern was to develop a means for the Hawaiian people of the district to compete successfully in the market economy that had evolved in Hawaii. What resulted was a vigorous, stable, and competitive industry which survived over a century of changing economic situations. For the Hawaiian people, however, the impact was not what Bond anticipated. (Tomonari-Tuggle 1988)

The history of Kohala from the 1870s on was largely the history of sugar cane. The sugar industry flourished in Kohala, as elsewhere in Hawai'i. Tens of thousands of laborers were brought in from Asia, Europe, the Americas, Oceania, and Africa to work on the many plantations and mills that were being established on all major islands (Oliver 1961). The result was a radical change of the culture and drastic alteration of agriculture land and the destruction of traditional archaeological sites.

In 1873 the English-born Robert Robson Hind moved to Kohala from Maui to invest in the booming sugar industry. He purchased land in the flat plains of Pūehuehu west of Kohala Sugar Company, and although rainfall was less than ideal, he established the Union Mill. Months prior to formal opening in 1874, a fire broke out and destroyed the mill. It was rebuilt just in time to harvest and process its first crops. Another fire occurred in 1878, destroying the rebuilt mill. Shortly thereafter, Hind sold the mill to independent growers who organized themselves as the Pūehuehu Plantation Company. In 1905, Henry Renton took over management of the mill. Most of the mill's 280 employees were of Japanese descent. During this time the mill was harvesting 1,260 acres of cultivated sugar. In 1932, the Union Mill was joined with the Niuli'i Mill and Plantation, under Robert Lindsey. At its peak the mill cultivated three thousand acres, only one-fifth of which was leased (Schweitzer 2003). The Union Mill was purchased by the Kohala Mill in 1937, and the cane harvested from the former Union Mill planting fields was then transferred to Hala'ula for processing.

During the late 19th century sugar planters constructed a railroad to transport sugar to market. By 1883 the railroad stretched almost 20 miles from Niuli'i in the far east of Kohala to Mahukona, the sugar port on the dry leeward coast. The railroad hauled cane for more than six decades, finally ceasing operations in 1941.

The drier portions of Kohala from Hāwī westward had become largely government land after the Mahele. The Kohala Ditch and the economies of scale of sugar cane production allowed these lands to be used by both large and small farmers for sugar cane. The project site appears to have had a history of sugar cane cultivation. Ho'ea Mill, erected in 1909 about a mile east and part of the Hawi Mill and Plantation

Company, was the sugar mill closest to the project site. A photograph of Ho‘ea Mill from 1929 shows sugar cane fields extending from the mill far to the west *mauka* of ‘Upolu Point (Schweitzer 1973).

The drier leeward portions of Kohala where irrigation was not possible were not suited for sugar cane cultivation but became vast pasturelands for grazing cattle. Large landholdings such Kahuā Ranch, Kohala Ranch, Pu‘uhue Ranch and others flourished for periods and struggled in others. The most famous ranch on the island, Parker Ranch, gradually acquired land in North Kohala.

Following World War II, the plantation remained marginally profitable as long as the weather was cooperative (Dorrance and Morgan 2000). By the late 1960s, Castle & Cooke reported diminishing returns and even financial losses from the Kohala sugar plantations. In 1971, Castle & Cooke announced that its Kohala plantations would close at the end of the 1973 grinding season, for economic reasons. At the same time, a growing concern about environmental pollution at the state, local, and national levels led to more stringent regulations on water and air quality, ultimately resulting in the passage of the National Environmental Policy Act of 1970. In June of 1971, the United States Environmental Protection Agency published a study on pollution in the sugar cane industry that had immense effects on North Kohala (US EPA 1971). The study found that sugar industry’s long standard practice of discharging materials into the ocean was violating state water quality standards. The study recommended that discharges of trash and bagasse to coastal waters be discontinued, that all discharges be treated or controlled in compliance with state water quality standards, and that the plantations make improvements to their irrigation facilities and management to minimize and control discharges. For a time, plantations were granted pollution waivers, ultimately were required to meet the new standards. Anticipating the closure of the Kohala Sugar Company, in 1971 the Governor appointed a Task Force to explore the potential agricultural future of North Kohala, which led to recommendations that established some of the agricultural ventures that thrive today in Kohala (KTF 1975). In 1975 the last crop was ground and the Kohala Sugar Company closed its doors for good, ending its 112 years of operation (Dorrance and Morgan 2000).

Summary of Identification of and Direct and Indirect Impacts to Valued Natural, Cultural and Historical Resources

The project site is a fully utilized cattle pasture that was formerly cultivated in sugar cane. As discussed in Section 3.2.3, some remnants of plantation infrastructure are present, but no Hawaiian archeological sites are present. No caves, springs, pu‘u, native forest groves, gathering resources or other natural features are present on or near the project site. No natural vegetation exists that would be important for native gathering. As part of the EA process, an effort was made to obtain information about any potential cultural properties and associated practices that might be present, or have taken place on the property. The Office of Hawaiian Affairs was contacted but did not supply any information relative to the existence of cultural properties or current use of the project site for traditional and customary practices. Consultations are ongoing to determine if any resources or practices are present on the project site property or adjacent land on which future Agricultural Parks might be located.

The extraction of water is a culturally sensitive issue, but the use of water for farming is a culturally appropriate use with long historical precedent. Sustaining agriculture and local farming opportunities for youth can be said to help sustain both the culture and the people who might otherwise emigrate and without whom culture becomes just a memory. The proposed withdrawal of water is very minor in terms

of sustainable yield, and it will not affect springs, streams or nearshore ecology. As no resources or practices of a potential traditional cultural nature (i.e., landform, vegetation, etc.) appear to be present on or near the project site, and there is no evidence of any traditional gathering uses or other cultural practices, the proposed water system improvements and water use at existing farms, ranches and dairies – as well as use at a potential future Agricultural Park on the subject property itself – would not appear to impact any culturally valued resources or cultural practices. Cultural properties and practices at other potential sites for Agricultural Parks will require examination in future compliance documents.

The Office of Hawaiian Affairs and the State Historic Preservation Division were supplied a link to the Draft EA, which may also be reviewed by other agencies and the general public, in order to help finalize the mitigation measures.

3.2.3 Archaeology and Historic Properties

ASM affiliates conducted an Archaeological Inventory Survey (AIS) of the entire 44.5-acre project site. The AIS is contained in whole in Appendix 3 and summarized below. In order to guide fieldwork, the AIS first examined archaeological surveys from other properties and theoretical models to help predict what types of sites might be found in the area. Tomonari-Tuggle (1988) developed a model of settlement and cultivation in northern Kohala that, like many other parts of Hawai‘i Island, involved coastal settlements oriented around fishing with agricultural lands, primarily non-irrigated, developed inland according to rainfall, temperature, and the availability of sunlight. In this model, the ‘Opihipau area was likely to have had coastal settlement, along with non-irrigated fields extending *mauka* from the coast to the forest, including the project site. While it is clear from *kuleana* claim testimony and other early historic accounts of the project area vicinity that the inland fields in this portion of North Kohala were once part of a vast traditional agricultural area, the advent of commercial sugarcane cultivation in the late nineteenth century radically altered the landscape. Conversion of the traditional agricultural system to commercial sugarcane resulted in plowing over any material evidence of the older system. At the outset of the field survey, it appeared unlikely that archaeological features or deposits associated with these fields would have survived nearly a century of increasingly mechanized and intensive sugarcane cultivation.

In contrast, historic maps and aerial photography indicate that archaeological evidence of the historic-era commercial sugarcane fields and associated infrastructure have not been erased and are still present on the land. This evidence includes elements of the previously documented State Inventory of Historic Place (SIHP) 50-10-02-31284 (Hō‘ea Mill Infrastructure) associated with the operation of the Hāwī Mill and Plantation Company’s Hō‘ea Mill and surrounding sugarcane fields and pasture between ca. 1904 and 1975 (the reader is referred to Appendix 3 for map). These features include the Hawi Plantation’s Reservoir No. 4, ditches that feed water to and from this reservoir, and also ditches that transported water from other reservoirs. Aerial photographs also suggested the possibility that intra-field roads.

Fieldwork was conducted on August 18, 2022, by Benjamin Barna, Ph.D. (Principal Investigator); Johnny Dudoit, B.A.; and Candace Gonzales, B.A. Unmanned aerial photography was conducted by Manuel Lopez, B.A. A previous archaeological survey (Barna and Kepaa 2022) in the ‘Upolu Road area had recorded Site 50-10-02-31284 (Hō‘ea Mill Infrastructure). The site, as previously recorded, was thought to comprise 33 features, all of them remnant elements of plantation infrastructure associated with the Hawi Mill and Plantation Company and its successor, the Kohala Sugar Company.

In addition to those features of Site 31284 previously recorded, archaeologists for the current survey identified six new features (Figure 11). These include one reservoir (Feature AI), four ditch segments (Features AJ, AK, AL, AM, and AN), and one berm (Feature AN). All of these features were constructed during the twentieth century by the Hawi Mill and Plantation Company. The archaeologists assessed Site 31284 as significant under Criterion d of Hawai‘i Administrative Rules (HAR) §13-275-6 for the information it has yielded relative to sugar industry practices. They concluded that Site 31284 has been adequately documented by the current study and recommended no further historic preservation work. In order to advance compliance with the Chapter 6e, Hawai‘i Revised Statutes (HRS) process, DLNR-Engineering has submitted the AIS to the State Historic Preservation Division (SHPD) for its evaluation and consideration of concurrence with its findings and recommendations.

Direct Impacts and Mitigation Measures

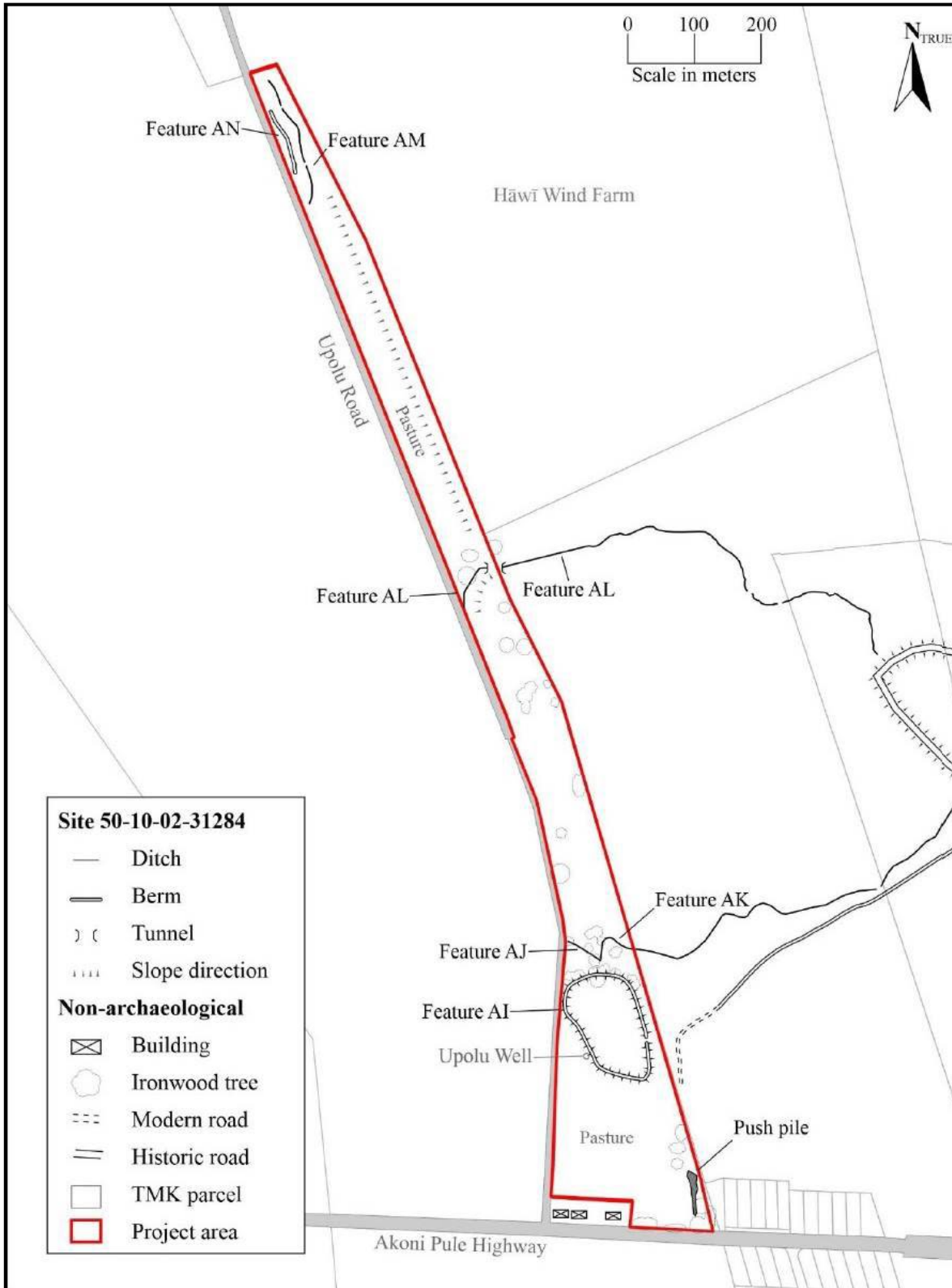
The water infrastructure and a potential future Agricultural Park on the property could utilize and disturb areas occupied by various features of Site 31284. These features are considered significant only for the information yielded during the current study. Because they have been adequately documented, and no further historic preservation work is recommended, the recommended determination of effect for the proposed project is “no historic properties affected.”

As a further precaution, in the unlikely event that additional archaeological resources are encountered during grading or construction, contract conditions will require that work in the immediate area of the discovery will be halted and the SHPD will be contacted as outlined in HAR §13-275-12.

Indirect Impacts and Mitigation Measures Associated with Offsite Agricultural Water Use

Continued agricultural activities on existing farms would likely have no effects on historic properties that would require compliance with Chapter 6e, HRS. New agriculture in potential offsite Agricultural Parks could have effects if renewed agricultural activities within these Parks, which were formerly used for sugar cane and in some cases pastoral purposes, contained historic properties that would be affected by dairying, farming or ranching activities. Archaeological research for the program also included background literature review to determine the likelihood and nature of historic properties within potential offsite Agricultural Parks, along with potential compliance issues. Although it is not clear if there will be sufficient surplus water or demand for lots in future Agricultural Parks, this program EA outlines potential future steps if there is. The focus was within the most likely candidate for a potential offsite Agricultural Park, a 150-acre portion of property directly across ‘Upolu Road identified by TMK (3) 5-5-006:003 (see Figure 2). The review (see Appendix 4) indicated that this area was under commercial sugarcane cultivation beginning in the late 19th century. It has been heavily impacted by land altering activities undertaken by the Hawi Mill and Plantation Company, its successor the Kohala Sugar Company, and subsequent lessees, who converted the sugarcane fields to other agriculture and pasture uses. These types of activities included earth-moving, road building and maintenance, plowing, and the installation and removal of water irrigation infrastructure such as flumes, pipes, and ditches.

Figure 11. Archaeological Sites



These activities, especially those associated with sugarcane cultivation, have likely destroyed evidence of Precontact land use and human occupation pre-dating to the establishment of the sugar plantation. One exception to this could be on the summit of the small pu‘u named Mauna Kea that is located in the northwest corner of this property, which may have traditional archaeological sites and perhaps cultural significance.

Archaeological features that are likely to exist in the project area include remnants of plantation infrastructure associated with three previously identified historic properties. These properties include SIHP 50-10-02-30913, the original alignment of ‘Upolu Point Road; SIHP 50-10-02-30914, a system of intra-field roads documented as erosion control ditches by Haun and Henry (2020); and features of SIHP 50-10-02-31284, the “Hoea Mill infrastructure” site that includes plantation water and transportation features in the Hawi Mill and Plantation Company’s fields previously identified. These features could include inter- and intra-field roads, irrigation systems such as flumes, pipes, and ditches, and clearance piles created before, during, and after commercial sugarcane cultivation.

Given the results of the current literature review, an archaeological inventory survey may be required as part of HRS Chapter 6e compliance if the State or future lessees propose activities within this property. State officials would consult SHPD, and future HRS 343 documents associated with the program would analyze the potential for impacts to historic properties, if and when new offsite Agricultural Parks were proposed.

3.3 Infrastructure

3.3.1 Utilities, Public Services and Transportation

Existing Facilities and Services

Electrical power to the site is supplied by Hawaiian Electric, a privately owned utility company, via its island-wide distribution network, with poles and lines on ‘Upolu Road. No sanitary sewer system or other wastewater treatment is available on or near the project site. No HDWS water lines are present in ‘Upolu Road, but it is likely that several individual customer lines are present, based on HDWS records of meters and serviced lots.

Fire, police and emergency medical services are available from the North Kohala Fire Station and Police Station, which are located about three miles to the east on Akoni-Pule Highway in Kapa‘au.

As shown in Figure 4, access to the site would be from two driveways on ‘Upolu Road, one leading to the well, and one to the reservoir. The west water line would also cross ‘Upolu Road. This road is maintained by the State of Hawai‘i as State Highway 271 (see Appendix 3, Figure 3). Approval from State Department of Transportation, Highways Division, and a Use Occupancy Agreement would be required. Traffic is very light on this road, which provides access to State leased agricultural land, a few private properties, the infrequently used ‘Upolu Airport, and coastal and cultural sites to the west of the airport. ‘Upolu Point Road connects to Akoni Pule Highway, a two-lane secondary highway also known as State Route 270.

Direct Impacts and Mitigation Measures

The proposed program will require upgrades to electrical service to accommodate additional load from the well pump but does not involve any other utilities. It will not have impacts on any public utilities or services. No effect on Hawaiian Electric's ability to service the area will occur, and no mitigation measures are necessary. The project would not impose any burden on public services. Construction will work to avoid impact to any HDWS customer water lines near any project site disturbance areas.

Normal operation of the well and reservoir would involve very little use of the driveways, aside from occasional maintenance, and will not affect traffic congestion. During movement of heavy equipment on or off the site, and at any times when there is a potential for project construction to impede traffic, professional traffic control will be utilized. Such activities will not occur during peak hour traffic for Highway 270 unless it is unavoidable. Future onsite potential farming activities on the small property would be unlikely to stress local utilities, transportation facilities or services.

Indirect Impacts and Mitigation Measures Associated with Offsite Agricultural Water Use

Continued agricultural activities on existing farms and new agriculture in potential Agricultural Parks would not involve any new impacts to utilities or public services or utilities. New dairying, farming or ranching within Agricultural Parks or other agricultural operations receiving agricultural water could involve new utility connections. In general, the individual operators of these ventures would be responsible for determining utility availability and requirements. There are no indications that any public services or utilities necessary to future farming operations would be a limiting factor, or that such operations would impose impacts on the system or its existing users.

3.4 Cumulative Impacts

Review of HRS 343, National Environmental Policy Act and Special Management Area Permit documents in the editions during the previous year of *The Environmental Notice* indicates no known major planned or ongoing projects in the Hāwī to 'Upolu area in the 2022 to 2024 timeframe that could interact with the proposed program. Most development involves construction or renovation of individual homes and commercial structures, and no major infrastructure or development projects were noted. There does not appear to be any need for additional mitigation for cumulative construction-phase impacts, based on distance, scale and nature of other projects.

3.5 Required Permits and Approvals

The following permits and approvals would be required:

- Grading, Grubbing and Driveway Permits (County Department of Public Works DPW)
- Building Permits and Plan Approval (County DPW and County Planning Department)
- Use and Occupancy Approval and Agreement (State Department of Transportation)
- Pump Installation Permit (State Commission on Water Resources Management CWRM)
- Well Abandonment Permit (CWRM)
- National Pollutant Discharge Elimination System Permit (State Department of Health)
- Chapter 6e, HRS, Historic Property Effects Determination (State Historic Preservation Division)

3.6 Consistency with Government Plans and Policies

3.6.1 Hawai‘i State Plan

Adopted in 1978 and last revised in 1991 (Hawai‘i Revised Statutes, Chapter 226, as amended), the Plan establishes a set of themes, goals, objectives and policies that are meant to guide the State’s long-run growth and development activities. The three themes that express the basic purpose of the *Hawai‘i State Plan* are individual and family self-sufficiency, social and economic mobility, and community or social well-being. The proposed program would promote these goals by producing economic and social benefits from preserving and expanding local farming, dairying and ranching, with no adverse environmental or social impacts, thereby enhancing quality-of-life and community and social well-being.

3.6.2 Hawai‘i State Land Use Law

Hawai‘i State Land Use District. All land in the State of Hawai‘i is classified into one of four land use categories – Urban, Rural, Agricultural, or Conservation – by the State Land Use Commission, pursuant to Chapter 205, HRS. The property is in the State Land Use Agricultural District. The proposed program promotes agriculture and is consistent with intended uses for this Land Use District. The project is partly sponsored and supported by the Department of Agriculture.

3.6.3 Hawai‘i County Zoning

The County Zoning of the project site property is A-20a (agriculture, minimum lot size 20 acres), which provides for agricultural and very low density agriculturally based residential use. Public uses and structures necessary for agricultural practices may be permitted ‘by right’ in County Zoning A. Furthermore, “Public uses, structures and buildings and community buildings are permitted uses in any district, provided that the director has issued plan approval for such use”. Additionally, “buildings and uses accessory” (to permitted uses) are permissible in the A district. The water system improvements and the agricultural uses they support are consistent with County zoning.

3.6.4 Hawai‘i County General Plan and North Kohala CDP

The *General Plan* for the County of Hawai‘i is a policy document expressing the broad goals and policies for the long-range development of the Island of Hawai‘i. The plan was adopted by ordinance in 1989 and revised in 2005 (Hawai‘i County Planning Department). The *General Plan* itself is organized into thirteen elements, with policies, objectives, standards, and principles for each. There are also discussions of the specific applicability of each element to the nine judicial districts comprising the County of Hawai‘i. Most relevant to the proposed program are the following Goal and Policies, and Courses of Action of particular chapters of the General Plan. Most relevant are sections related to land use and agriculture:

Land Use Element – In General:

Goals:

- Designate and allocate land uses in appropriate proportions and mix and in keeping with the social, cultural, and physical environments of the County.

- Protect and encourage the intensive and extensive utilization of the County’s important agricultural lands.

Land Use – Agriculture

Goals:

- Identify, protect and maintain important agriculture lands on the island of Hawaii.
- Preserve the agricultural character of the island.
- Preserve and enhance opportunities for the expansion of Hawaii’s Agricultural Industry.

Policies:

- Implement new approaches to preserve important agricultural land.
- Coordinate and encourage efforts to solve the problems of the agricultural industry in the County of Hawaii.
- Designate, protect and maintain important agricultural lands from urban encroachment.
- Ensure that development of important agricultural land be primarily for agricultural use.
- Assist in the development of agriculture.

Land Use – Agriculture - Courses of Action for North Kohala:

- Encourage the maintenance and more intensive utilization of the Kohala Ditch irrigation system for agricultural production.
- Support the development of private and State agricultural parks as a means of making agricultural land available for commercial agricultural activities.
- In reviewing Special Permit applications, rezonings, and other land use changes in the Agricultural District, great care should be given to preserve existing view planes to and along the coastline.

Discussion: The proposed program will help promote desirable diversified agriculture on the island, preserving the agricultural character of the island and district and helping to protect agricultural lands from other uses. Although it does not appear feasible or sensible at this time to invest in a massive project to repair the privately owned and operated Kohala Ditch, the project represents a new approach to obtaining needed agricultural water and promotes the potential development of Agricultural Parks. No effects to viewplanes to or along the coastline would occur.

Other relevant sections include:

Economic Element

Goals:

- Provide residents with opportunities to improve their quality of life through economic development that enhances the County’s natural and social environments.
- Economic development and improvement shall be in balance with the physical, social, and cultural environments of the island of Hawaii.
- Strive for diversity and stability in the economic system.

- Provide an economic environment that allows new, expanded, or improved economic opportunities that are compatible with the County's cultural, natural and social environment.
- Strive for an economic climate that provides its residents an opportunity for choice of occupation.
- Strive for diversification of the economy by strengthening existing industries and attracting new endeavors.
- Strive for full employment.

Policies:

- Assist in the expansion of the agricultural industry through the protection of important agricultural lands, development of marketing plans and programs, capital improvements and continued cooperation with appropriate State and Federal agencies.
- The land, water, air, sea, and people shall be considered as essential resources for present and future generations and should be protected and enhanced through the use of economic incentives.
- Identify and encourage primary industries that are consistent with the social, physical, and economic goals of the residents of the County.
- Assist the further development of agriculture through the protection of important agricultural lands.
- Assist in the promotion of the agriculture industry whose products are recognized as being produced on the island of Hawaii.

Economic Element: North Kohala District

Courses of Action:

- Aid in the expansion of agriculture through the protection of important agricultural lands.
- Support efforts to promote small business development that is consistent with the rural, agricultural, and historic character of the area.
- Assist the communities and residents in diversifying the economic base in ways that are consistent with the rural, agricultural, and historic character of North Kohala.

Discussion: The proposed program will allow existing ranches, dairies and farms with diverse products to continue their operations and for these and other businesses to expand and grow, thereby furthering the Economic goals of the General Plan. The operation provides jobs and helps to diversify Hawai'i Island's economy.

Natural Beauty Element

Goals:

- Protect, preserve and enhance the quality of areas endowed with natural beauty, including the quality of coastal scenic resources.
- Protect scenic vistas and view planes from becoming obstructed.
- Maximize opportunities for present and future generations to appreciate and enjoy natural and scenic beauty.

Policies:

- Consider structural setback from major thoroughfares and highways and establish development and design guidelines to protect important viewplanes.
- Protect the views of areas endowed with natural beauty by carefully considering the effects of proposed construction during all land use reviews.
- Do not allow incompatible construction in areas of natural beauty.

Discussion: The proposed program will not affect scenic vistas. Continued agricultural operations will preserve existing open space, and future Agricultural Parks will preserve rural character.

Historic Sites Element**Goals:**

- Protect, restore, and enhance the sites, buildings, and objects of significant historical and cultural importance to Hawai'i.
- Appropriate access to significant historic sites, buildings, and objects of public interest should be made available.

Discussion: In order to advance compliance with the Chapter 6e, HRS process, DLNR-Engineering has submitted information concerning the proposed program to the State Historic Preservation Division for their consideration of concurrence. Therefore the proposed program is not inconsistent with the relevant goals, policies, and courses of action for historic sites in Hawai'i County.

Natural Resources Element**Goals:**

- Protect and conserve the natural resources from undue exploitation, encroachment and damage.
- Provide opportunities for recreational, economic, and educational needs without despoiling or endangering natural resources.
- Protect and promote the prudent use of Hawaii's unique, fragile, and significant environmental and natural resources.
- Protect and effectively manage Hawaii's open space, watersheds, shoreline, and natural areas.

Policies:

- Encourage a program of collection and dissemination of basic data concerning natural resources.
- Encourage public and private agencies to manage the natural resources in a manner that avoids or minimizes adverse effects on the environment and depletion of energy and natural resources to the fullest extent.
- Encourage an overall conservation ethic in the use of Hawaii's resources by protecting, preserving, and conserving the critical and significant natural resources of the County of Hawaii.

- Ensure that activities authorized or funded by the County do not damage important natural resources.

Discussion: The proposed program involves a property that has been inventoried for natural resources and does not involve destruction of natural resources. The development of sustainable groundwater for agriculture is an appropriate use of natural resources. The program is consistent with the goals, standards and policies of the Natural Resources chapter of the Hawai‘i County General Plan.

The *Hawai‘i County General Plan Land Use Pattern Allocation Guide (LUPAG)*. The LUPAG map component of the *General Plan* is a graphic representation of the Plan’s goals, policies, and standards as well as of the physical relationship between land uses. It establishes the basic urban and non-urban form for the County and identifies critical planned public and cultural facilities, public utilities and safety features, and transportation corridors. The Land Use Pattern Allocation Guide (LUPAG) Map from the 2005 General Plan designation is Important Agricultural Land. The proposed program is consistent with this designation. Such lands are those with better potential for sustained high agriculture yields because of soil type, climate, topography, or other factors. According to the Hawai‘i County Planning Department (see letter in Appendix 1b): “In the face of competition from urban uses, the protection of important agricultural lands has long been a policy of the County”.

North Kohala Community Development Plan. The North Kohala Community Development Plan encompasses the judicial district of North Kohala, and was developed under the framework of the February 2005 County of Hawai‘i General Plan. Community Development Plans are intended to translate broad General Plan Goals, Policies, and Standards into implementation actions as they apply to specific geographical regions around the County. CDPs are also intended to serve as a forum for community input into land-use, delivery of government services and any other matters relating to the planning area. The General Plan now requires that a Community Development Plan shall be adopted by the County Council as an “ordinance,” giving the CDP the force of law. This is in contrast to plans created over past years that were adopted by “resolution” and therefore served only as guidelines or reference documents to decision-makers. In November 2008, the North Kohala CDP was adopted by the County Council. The version referenced in this Environmental Assessment is at: <http://hawaii-county.gov/north-kohala-cdp>.

The purposes of the North Kohala CDP are to:

- Articulate North Kohala’s residents’ Vision and Values for their Community
- Identify North Kohala’s residents’ Priority Issues to be addressed by the CDP
- Develop Strategies and Action Programs to address those Priority Issues

The CDP states that its goal is:

To manage the future growth of the district in a manner that is consistent with the Kohala lifestyle and ideals of being a rural community with a strong cultural heritage, an agricultural base, and a small town feel.

The CDP, with a theme of “Keep Kohala, Kohala,” describes the district as a “Cultural and Historical Preservation Community” and emphasizes that all development decisions “shall be required to assess and

disclose their potential impact on cultural sites and resources within the district, and shall be in keeping with the heritage and culture of North Kohala.”

The plan notes on Page 13 and in other sections that agriculture has a long tradition in North Kohala and should be continued to be supported and promoted.

The proposed program is compatible with the plan’s following Key Policies, as found beginning on Page 22:

1. **Cultural and Historical Preservation Community** – All future land use decisions for North Kohala shall be in keeping with the heritage and cultural significance of Kohala.
2. **Rural Character** – Recognize North Kohala as a Rural Community that should not experience significant urban/suburban development that impacts population growth.

It is also in keeping with the goal of directing growth toward existing town centers to preserve the District’s open space and to promote agriculture. More specifically, it is in keeping with Strategy 1.4 which calls for the promotion and support a community of diversified agriculture. The plan notes:

Many residents see diversified agriculture as one of the best options for creating jobs and local businesses, since it utilizes Kohala’s natural resources (fertile soils, availability of water), helps increase the community’s self-sufficiency, and protects its rural character (Page 34).

The continuation of agricultural operations can facilitate outcomes envisioned in Strategies 1.5 and 1.6 as well, which call for establishing agricultural education programs and community cultural programs, respectively.

The proposed program is also in keeping with Strategy 1.8:

Participate in the identification of Important Agricultural Lands as established by Chapter 205-47, Hawaii Revised Statutes to ensure that appropriate lands are identified and protected.

The project site has already been designated as Important Agricultural Land and the proposed program will maintain its use in agriculture.

The proposed program will also help further Strategy 1.9 which calls for the protection of view planes, particularly those along Kohala Mountain Road and Akoni-Pule Highway. The proposed water system improvements, continued agricultural operations and potential expansion of Agricultural Parks will preserve viewplanes and rural scenery.

PART 4: DETERMINATION

Based on the information to this point, the Hawai'i State Department of Land and Natural Resources expects to determine that the proposed program will not significantly alter the environment. It is therefore anticipated that an Environmental Impact Statement is not warranted and that the Department will issue a Finding of No Significant Impact (FONSI). A final determination will be made by the Department after consideration of comments on the Draft EA.

PART 5: FINDINGS AND REASONS

Chapter 11-200.1-13, Hawai'i Administrative Rules, outlines those factors agencies must consider when determining whether an Action has significant effects:

- (a) In considering the significance of potential environmental effects, agencies shall consider and evaluate the sum of effects of the proposed program on the quality of the environment.
- (b) In determining whether an action may have a significant effect on the environment, the agency shall consider every phase of a proposed program, the expected impacts, and the proposed mitigation measures. In most instances, an action shall be determined to have a significant effect on the environment if it may:

- (1) Irrevocably commit a natural, cultural, or historic resource;

No valuable natural or cultural resources would be committed or lost by the proposed program, which would not adversely affect significant historic sites or native species or habitat. No cultural resource or practices on the project site will be affected, and mitigation measures will reduce impacts to adjacent natural and cultural resources to minimal levels.

- (2) Curtail the range of beneficial uses of the environment;

The proposed program expands agricultural opportunities on current and former farm lands and in no way curtails beneficial uses of the environment.

- (3) Conflict with the State's environmental policies or long-term environmental goals established by law;

The State's long-term environmental policies are set forth in Chapter 344, HRS. The broad goals of this policy are to conserve natural resources and enhance the quality of life. The proposed program is minor, environmentally beneficial, and fulfills aspects of these policies calling for an improved social environment by enhancing agricultural activities in a sustainable manner without causing environmental harm. It is thus consistent with all elements of the State's long-term environmental policies.

- (4) Have a substantial adverse effect on the economic welfare, social welfare, or cultural practices of the community and State;

The proposed program will benefit the social and economic welfare of the community and State by supporting farming, dairying and ranching in a traditionally agricultural community.

(5) Have a substantial adverse effect on public health;

The proposed program will not have any adverse effect on public health.

(6) Involve adverse secondary impacts, such as population changes or effects on public facilities;

Secondary effects include a potential expansion of agricultural uses on current and former farmland, in keeping with State and County plans for the area. Minimal in-migration that could unduly burden local services is expected.

(7) Involve a substantial degradation of environmental quality;

The proposed program is minor and environmentally benign and would thus not contribute to environmental degradation with adherence to Best Management Practices.

(8) Be individually limited but cumulatively have substantial adverse effect upon the environment or involves a commitment for larger actions;

The proposed program is not related to activities in the region in such a way as to produce adverse cumulative effects or involve a commitment for larger actions.

(9) Have a substantial adverse effect on a rare, threatened, or endangered species, or its habitat;

The project site and all potentially affected properties have been utilized for over a century for various forms of agriculture. No rare, threatened or endangered plant species are present at the project site. Direct or indirect impacts to rare, threatened or endangered species of fauna will not occur in association with the water system improvements, with planned restrictions of the timing of woody vegetation removal.

(10) Have a substantial adverse effect on air or water quality or ambient noise levels;

Slight increases in noise and effects to air quality will occur during construction, but they will be temporary and mitigated to non-significant levels. Sedimentation will be controlled through project BMPs developed as part of grading and engineering plans.

(11) Have a substantial adverse effect on or be likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, sea level rise exposure area, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters;

Although the proposed program is located in an area with slight volcanic and substantial seismic risk, the entire Island of Hawai'i shares this risk. The proposed program is not imprudent to undertake and will employ design and construction standards for the water system improvements that are appropriate to the seismic zone. The property is not located in a flood zone or any other hazardous area, and it would not

affect any such area. Due to the elevation of the project site at over 300 feet above sea level, there is no risk to the water system from sea level rise. The proposed expanded farming component of the program is resilient to most hazards.

(12) Have a substantial adverse effect on scenic vistas and viewplanes, during day or night, identified in county or state plans or studies;

The proposed program would not adversely impact any scenic sites or viewplanes.

(13) Require substantial energy consumption or emit substantial greenhouse gases.

Water system improvements would involve unavoidable minor carbon emissions to construct, and operation of the well would involve substantial energy use. The State is exploring use of renewable resources and particularly locally available wind energy to power well pumping. The proposed program would not be expected to contribute significantly to global climate change.

For the reasons above, the proposed program would not have any significant effect in the context of Chapter 343, Hawai‘i Revised Statutes and section 11-200-12 of the State Administrative Rules.

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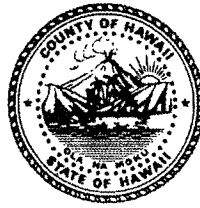
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**‘Upolu Well and Agricultural Water
Distribution System/Agricultural Park
Environmental Assessment**

**APPENDIX 1a
Comments in Response to Early Consultation**

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Mitchell D. Roth
Mayor



Stephen M. Pause, P.E.
Acting Director

Lee E. Lord
Managing Director

County of Hawai'i
DEPARTMENT OF PUBLIC WORKS
Aupuni Center

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(808) 961-8321 · Fax (808) 961-8630
public_works@hawaiiicounty.gov

JULY 1, 2022

ATTN: RON TERRY
GEOMETRICIAN ASSOCIATES, LLC.
P.O. BOX 396
HILO, HAWAII 96721
(via email to rterry@hawaii.rr.com)

SUBJECT: EARLY CONSULTATION FOR PROGRAM ENVIRONMENTAL ASSESSMENT
FOR UPOLU WELL AND AGRICULTURAL WATER DISTRIBUTION
SYSTEM/AGRICULTURE PARK
NORTH KOHALA DISTRICT, ISLAND OF HAWAII
TMK: (3) 5-5-006:002, 5-5-006:003

We received the subject dated June 15, 2022 and have the following comments:

The subject parcels are in an area designated as Zone X on the Flood Insurance Rate Map (FIRM) by the Federal Emergency Management Agency (FEMA). Zone X is an area determined to be outside the 500-year floodplain.

All development-generated runoff shall be disposed of on site and not directed toward any adjacent properties. A drainage study shall be prepared and the recommended drainage system shall be constructed meeting the approval of the Department of Public Works.

All activities shall comply with the requirements of Hawaii County Code (HCC), Chapter 10, Erosion and Sedimentary Control.

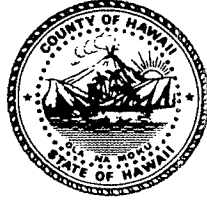
Construction within Upolu Road, a County right-of-way, shall comply with HCC, Chapter 22, County Streets.

Should there be any questions concerning this matter, please contact Ms. Robyn Matsumoto in our Engineering Division at (808) 961-8924.


ALAN K. THOMPSON, Division Chief
Engineering Division

RM

Mitchell D. Roth
Mayor



Paul K. Ferreira
Police Chief

Kenneth Bugado Jr.
Deputy Police Chief

County of Hawai`i

POLICE DEPARTMENT

349 Kapi`olani Street • Hilo, Hawai`i 96720-3998
(808) 935-3311 • Fax (808) 961-2389

June 28, 2022

Mr. Ron Terry, Ph.D.
Geometrician Associates, LLC
10 Hina Street
Hilo, Hawai`i 96720

Dear Mr. Terry:

SUBJECT: EARLY CONSULTATION FOR PROGRAM ENVIRONMENTAL ASSESSMENT FOR UPOLU WELL AND AGRICULTURAL WATER DISTRIBUTION SYSTEM/AGRICULTURE PARK, ISLAND OF HAWAII`I

This is in response to your correspondence dated June 15, 2022, with regard to the above-referenced subject.

Thank you for allowing the Hawai`i Police Department to offer comments regarding this request. At this time, the Hawai`i Police Department has no objections or comments.

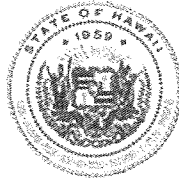
Please direct any questions or concerns to Captain Scott Kurashige, Commander of our North Kohala District, via email at Scott.Kurashige@hawaiicounty.gov or at the North Kohala Police Station at (808) 889-6540.

Sincerely,

PAUL K. FERREIRA
POLICE CHIEF

SJK
22HQ0724

DAVID Y. IGE
GOVERNOR



STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

JADE T. BUTAY
DIRECTOR

Deputy Directors
ROSS M. HIGASHI
EDUARDO P. MANGLALLAN
EDWIN H. SNIFFEN

IN REPLY REFER TO:
DIR 0601
STP 8.3428

July 8, 2022

VIA EMAIL: rterry@hawaii.rr.com

Mr. Ron Terry, Ph.D.
Geometrician Associates, LLC
10 Hina Street
Hilo, Hawaii 96720

Dear Mr. Terry:

Subject: Early Consultation for Program Environmental Assessment
Upolu Well and Agricultural Water Distribution System/Agriculture Park
North Kohala, Hawaii
Tax Map Key: (3) 5-5-006:002

Thank you for your letter dated June 15, 2022, requesting the Hawaii Department of Transportation's (HDOT) review and comment on the subject early consultation. HDOT understands the Department of Land and Natural Resources in coordination with the Department of Agriculture is proposing to develop the existing U.S. Geological Survey Upolu Observation Well J-B and convert it for use as an agricultural well supplying non-potable water to the area. Other supporting facilities and infrastructure will be included in the project. The proposed site is located off of Upolu Road which intersects with Akoni Pule Highway (State Route 270) to the south.

Our Highways Division provided comments in a separate letter HWY-H 22-2.0062 dated July 6, 2022. We now provide the following comments from our Airports Division.

1. The project site is approximately 0.73 miles from the property boundary of Upolu Airport (UPP). All projects within 5 miles from Hawaii State airports are advised to read the Technical Assistance Memorandum (TAM) for guidance with development and activities that may require further review and permits. The TAM can be viewed at this link: http://files.hawaii.gov/dbedt/op/docs/TAM-FAA-DOT-Airports_08-01-2016.pdf.
2. Federal Aviation Administration (FAA) regulation requires the submittal of FAA Form 7460-1 Notice of Proposed Construction or Alteration pursuant to the Code of Federal Regulations, Title 14, Part 77.9, if the construction or alteration is within 20,000 feet of a public use or military airport which exceeds a 100:1 surface from any point on the runway of each airport with its longest runway more than 3,200 feet. Construction

Mr. Ron Terry
July 8, 2022
Page 2

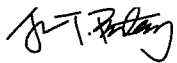
STP 8.3428

equipment and staging area heights, including heights of temporary construction cranes, shall be included in the submittal. The form and criteria for submittal can be found at the following website: <https://oeaaa.faa.gov/oeaaa/external/portal.jsp>.

3. The proposed Agriculture Park shall not provide vegetation that will create a wildlife attractant, which can potentially become a hazard to aircraft operations. Please review the FAA Advisory Circular 150/5200-33C, Hazardous Wildlife Attractants On Or Near Airports for guidance. If the Park's vegetation creates a wildlife attractant, the farmer shall immediately mitigate the hazard upon notification by the HDOT-A and/or FAA.
4. Due to the project's proximity to UPP, the users of the Agriculture Park should be aware of potential single event noise from aircraft operations. There is also a potential for fumes, smoke, vibrations, odors, etc., resulting from occasional aircraft flight operations over or near the project. These incidences may increase or decrease over time and are dependent on airport operations.

If there are any questions, please contact Mr. Blayne Nikaido of the HDOT Statewide Transportation Planning Office at (808) 831-7979 via email at blayne.h.nikaido@hawaii.gov.

Sincerely,



JADE T. BUTAY
Director of Transportation

DAVID Y. IGE
GOVERNOR



**STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION**

HAWAII DISTRICT
50 MAKAALA STREET
HILO, HAWAII 96720
TELEPHONE: (808) 933-8866 • FAX: (808) 933-8869

JADE T. BUTAY
DIRECTOR

Deputy Directors
ROSS M. HIGASHI
EDUARDO P. MANGLALLAN
EDWIN H. SNIFFEN

IN REPLY REFER TO:
HWY-H 22-2.0062

July 6, 2022

Mr. Ron Terry
Geometrician Associates, LLC
Principal
10 Hina Street
Hilo, Hawaii 96720

Dear Mr. Terry:

Subject: Early Consultation for Program Environmental Assessment
Upolu Well and Agricultural Water Distribution System
Upolu Airport Road
Route 270 – Akoni Pule Highway Mile Post 18.704
Kealahena 3rd and Opihipau, North Kohala, Hawaii
Tax Map Key: 3rd Div. 5-5-006:002

Thank you for your letter requesting our comments on the subject project.

The proposed project is not anticipated to have an impact on our State Highways facilities.

We appreciate your providing this advance notice and for the opportunity to provide comments.

If you have any questions, please contact me at (808) 933-8866 or via email at harry.h.takiue@hawaii.gov.

Sincerely,

A handwritten signature in black ink, appearing to read "Harry H. Takiue".

HARRY H. TAKIUE
Hawaii District Engineer



DEPARTMENT OF WATER SUPPLY • COUNTY OF HAWAI'I

345 KEKŪANAŌ'A STREET, SUITE 20 • HILO, HAWAI'I 96720
TELEPHONE (808) 961-8050 • FAX (808) 961-8657

July 28, 2022

Ron Terry, Ph.D.
Geometrician Associates, LLC
10 Hina Street
Hilo, HI 96721

Dear Dr. Terry:

**Subject: Pre-Environmental Assessment Consultation for Upolu Well and Agricultural Water Distribution System / Agricultural Park, Island of Hawai'i
Tax Map Key 5-5-006:002**

This is in response to your Pre-Environmental Assessment Consultation request dated June 15, 2022.

We have no objection to the proposed project with the condition that the applicant will be responsible for the cost of relocating or modifying any of our water system facilities within the project area, should it be necessary. The construction plans for the project will need to be submitted to the Department for review and approval so that all of the water system facilities can be identified and any relocation or adjustment of our existing facilities can be properly shown.

Should there be any questions, please contact Mr. Ryan Quitarano of our Water Resources and Planning Branch at (808) 961-8070, extension 256.

Sincerely yours,

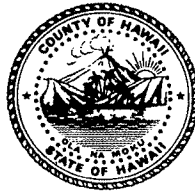
Keith K. Okamoto, P.E.
Manager-Chief Engineer

RQ:dfg

Mitchell D. Roth
Mayor

Lee E. Lord
Managing Director

West Hawai'i Office
74-5044 Ane Keohokālole Hwy
Kailua-Kona, Hawai'i 96740
Phone (808) 323-4770
Fax (808) 327-3563



County of Hawai'i

PLANNING DEPARTMENT

Zendo Kern
Director

Jeffrey W. Darrow
Deputy Director

East Hawai'i Office
101 Pauahi Street, Suite 3
Hilo, Hawai'i 96720
Phone (808) 961-8288
Fax (808) 961-8742

August 12, 2022

Ron Terry
Geometrician Associates, LLC
10 Hina Street
Hilo, HI 96720

Dear Mr. Terry:

**SUBJECT: Early Consultation for Program Environmental Assessment
(PL-INT-2022-002652)**
Landowner: State of Hawai'i
**Project: Upolu Well and Agricultural Water Distribution System/Agriculture
Park**
Location: (3) 5-5-006:002 North Kohala, Island of Hawai'i

Thank you for including us in early consultation for this draft environmental assessment.

The State Land Use designation of the subject property is Agriculture. Hawai'i Revised Statutes (H.R.S.), Section 205-4.5 allows for "public institutions and buildings that are necessary for agricultural practices" to be permitted uses in Agriculture State Land Use districts¹. The Land Use Pattern Allocation Guide (LUPAG) Map from the 2005 General Plan designation is Important Agricultural Land². In the face of competition from urban uses, "the protection of important agricultural lands has long been a policy of the County"³. The County Zoning of the property is also agriculture and noted as A-20a, which provides for agricultural and very low density agriculturally based residential use, encompassing rural areas of good to marginal agricultural and grazing land, forest land, game habitats, and areas where urbanization is not found to be appropriate⁴. In furtherance of H.R.S. Chapter 205, "Public uses and structures which are necessary for agricultural practices" may be permitted 'by right'⁵ in County Zoning A. Further, "Public uses, structures and buildings and community buildings are permitted uses in any district, provided that the director has issued plan approval for such use"⁶. Additionally, "buildings and uses accessory" (to permitted uses), are permissible in the A district⁷.

¹ H.R.S. §205-4.5(a)(5)

² "Important Agricultural Land: Important agricultural lands are those with better potential for sustained high agricultural yields because of soil type, climate, topography, or other factors".

³ 2005 General Plan 2.1 (Agriculture)

⁴ HCC Sec. 25-5-70. Purpose and Applicability

⁵ HCC 25-5-72(a)(18)

⁶ HCC Section 25-4-11. Power lines, utility substations, public buildings.

⁷ HCC Sec. 25-5-72(e)

The affected area appears to be within the North Kohala Enterprise Zone. The Enterprise Zones (EZ) Partnership Program gives State & County benefits to companies in an effort to stimulate business activity, job preservation, and job creation in areas where they are most appropriate or most needed. More information may be found at: <https://invest.hawaii.gov/business/ez/>

According to the 2005 General Plan, the North Kohala District obtains water primarily from two wells and a spring. The Hāwī Wells No. 1 and 2 serve the following areas: Ka‘auhuhu, Hāwī-Kokoiki, Kynnersley-Kapa‘au, and Hala‘ula. The Makapala-Kēōkea water system source is from the Murphy Tunnel owned by Chalon International of Hawai‘i⁸.

In addition to General Plan Goals (14.2.2) and Policies for Agriculture (14.2.3), the following General Plan Courses of Action⁹ apply to the proposed action:

- (a) Encourage the maintenance and more intensive utilization of the Kohala Ditch irrigation system for agricultural production.
- (b) Support the development of private and State agricultural parks as a means of making agricultural land available for commercial agricultural activities.
- (c) In reviewing Special Permit applications, rezonings, and other land use changes in the Agricultural District, great care should be given to preserve existing view planes to and along the coastline.

The proposed action may also further the following policies in the 2005 General Plan¹⁰:

- (a) Aid in the expansion of agriculture through the protection of important agricultural lands.
- (c) Encourage the establishment of an open farmer’s market in North Kohala¹¹.
- (g) Assist the communities and residents in diversifying the economic base in ways that are consistent with the rural, agricultural, and historic character of North Kohala.

Additionally, the 2008 North Kohala Community Development Plan (NKCDP) states the majority of the land in Kohala is zoned for agriculture, is suitable for such use, and should be utilized as such and limit upzoning unless it substantially conforms to the goals and policies of the North Kohala CDP. Kohala’s physical setting and history stems from its agricultural tradition, and the CDP conveys that agriculture should be preserved, practiced and promoted in various forms. The community has confirmed the desire for these lands to be utilized for agriculture, with one of their biggest concerns being the misuse for luxury subdivisions and/or “gentlemen estates.” The CDP further states that Important Agricultural Lands shall not be rezoned to parcels too small to support economically viable farming units. Thus, any proposed Agricultural Subdivision in North Kohala shall submit an agricultural use/production plan with their preliminary subdivision application that clearly demonstrates that the land will be primarily used for active agriculture, and that any proposed dwellings will be farm dwellings.

⁸ 2005 General Plan 11.2.4.5.1 North Kohala Profile

⁹ 2005 General Plan 14.2.4.4.2 North Kohala

¹⁰ 2.4.5.2 Courses of Action (Economic)

¹¹ The ... North Kohala districts have a disproportionately large number of County park acreage in relationship to their small populations.

- NKCDP Strategy 1. 4: Promote and Support a Community of Diversified Agriculture
 - Intended Outcome — Agriculture will be promoted and supported within Kohala, and farmers — both current and potential — will have various forms of support and programming made available to them. The Kohala community will eventually produce 50% of the food it consumes.
- NKCDP Strategy 1. 5: Establish Agricultural Education Programs
 - Intended Outcome — Larger pool of people with expertise to farm the land. Increased understanding regarding various agricultural issues specific to North Kohala, which will support the long-term viability of agriculture.
- NKCDP Strategy 1. 6: Establish Community Cultural Programs
 - Intended Outcome — Community-wide events could celebrate Kohala's rich cultural heritage and help "newcomers" to become familiar with the local lifestyle and traditions, thereby integrating them into the community and its values.

Finally, upon review of the Early Consultation information, we offer the following inquiries for consideration and inclusion in the Draft Environmental Assessment.

1. Please provide a comparison of water supply and demand provided by the Kohala Ditch vs. the proposed/initial (basal water) well system and any estimates of supply/demand if the Program is successfully scaled out (Ag Park). We note that the Hawai'i County Water Use and Development Plan (2010) indicates a significant amount of agricultural water use demand for the Kohala Aquifer Sector.
2. Please include a discussion of the functional impact of the damage to the Ditch system: Is it completely useless or without repair? Is there some percent capacity/functionality for water supply remaining? Will abandonment and/or subsequent disrepair(s) serve to return historic (meteoric) water and drainage patterns to certain areas, such as adjacent forests, rivers or valleys?
3. Please spatially locate the properties the well system is intended to support, immediately and as reasonably modelled via the Program (feasibility) including but not limited to additional lands within the adjacent 404-acre TMK (3) 5-5-006:003.
4. Please provide the well's pump testing results.
5. Please provide the noted feasibility study, including market study components.
6. Please include water quantity in your areas of investigation in the Environmental Assessment, to show any modelled drawdown of the aquifer, cone(s) of depression and potentiometric surface, and/or water table information.
7. Please include the location of any recharge areas that would act to offset the new pumped water amounts; provide analysis as necessary.
8. Please discuss any impact to cultural or community resources, such as coastal or valley trails impacted directly or indirectly by this change in water sourcing

Mr. Ron Terry
Geometrician Associates, LLC
August 12, 2022
Page 4

We recommend that the project be presented to the North Kohala Advisory Group to garner community input. You can contact them at NKAdvisoryGroup@gmail.com. We look forward to reviewing the Draft Environmental Assessment when available. If you have any questions regarding this correspondence, please contact Kevin Sullivan of this office at (808) 961-8135 or via email at kevin.sullivan@hawaiiicounty.gov.

Sincerely,

Zendo Kern

Zendo Kern (Aug 16, 2022 07:46 HST)

ZENDO KERN
Planning Director

KS:cc

\\coh01\planning\public\wpwin60\CH343\2022\08.12.2022_PL-INT-2022-002652_AgWells55-102 UPOLU RD HI_DEA_precons.docx

From: Baybayan, Clinton <Clinton.Baybayan@hawaiicounty.gov>
Sent: Monday, June 20, 2022 3:16 PM
To: rterry@hawaii.rr.com
Subject: HFD response, Upolu Well and Agriculture Water Distribution System/Agriculture Park

Good Afternoon Ron,
We do not have any hazardous materials incidents or fire code violations for the requested site and the adjacent 404 acre TMK. Please let me know if you have any questions.

Thanks,

Clinton K. Baybayan
Fire Captain
Hawaii Fire Department
Fire Prevention Branch
(W) 808-323-4761

From: grhoff@aol.com <grhoff@aol.com>

Sent: Saturday, June 18, 2022 5:09 PM

To: rterry@hawaii.rr.com

Subject: North Kohala well project

Aloha Dr Terry;

Mahalo for your letter of June 15; it was greatly appreciated. However, there are still a few questions we still have about the project.

First, what is the timeline for the Environmental Assessment, and for completion of the entire project?

Second, what permanent structures will be built on the site? Will the reservoir mentioned in the letter, be built above ground? How big?

Third, since we live nearby on Old Camp 17 Road, how much noise will the pump make operating 16 hours a day?

Fourth, will there be a public meeting to discuss the project? Is one required?

Fifth, can you provide a better map that shows more detail, including specific location of the well, and includes existing homes and buildings for context?

We understand the importance of this well for our agricultural neighbors, and appreciate your responses.

Sincerely yours,

Gary Hoff

**‘Upolu Well and Agricultural Water
Distribution System/Agricultural Park
Environmental Assessment**

APPENDIX 2

‘Upolu Well Development Feasibility Study and Well Information

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UPOLU WELL DEVELOPMENT
FEASIBILITY STUDY

KOHALA, HAWAII ISLAND, HAWAII

Prepared for:

STATE OF HAWAII
DEPARTMENT OF AGRICULTURE

Prepared By:

Akinaka & Associates, Ltd.

May 2022

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A. INTRODUCTION

Akinaka and Associates Ltd., herein referred to as the “Consultant” was contracted by the State of Hawaii Department of Land and Natural Resources (DLNR) to complete a feasibility study (FS) for the Proposed Action to develop State Well No. 7451-02, which is currently an observation well owned by the United States Geological Survey (USGS), into a production well for irrigation water. The Proposed Action also includes developing an accompanying irrigation water system, to be owned and operated by the Department of Agriculture (DOA). The FS will be presented to the State of Hawaii Department of Agriculture (DOA) for their information and use.

1. Purpose & Need

In April 2021, a large landslide destroyed a flume connecting the Kohala Ditch to one of its main water sources and caused severe damage to one of the tunnels within the system. Upon examination of the damages, Kohala Ditch Company deemed the repairs unfeasible and have since abandoned the Kohala Ditch.

According to the Upolu Point-Kaauhuhu zoning map (**see Appendix A – Upolu Points-Kaauhuhu Homesteads Zone Map Section 25-8-8**), a majority of land in the area is zoned for agricultural uses. With the Kohala Ditch becoming inoperable, a need arose for economically feasible alternative water sources to help support current and future agricultural endeavors in the area.

2. Objective

The goals of this study are:

- Give background on the proposed plan to develop an existing observation well (State Well No. 7451-02) into a production well for irrigation purposes.
- Provide details on the necessary utility improvements to get a viable irrigation water system running (electrical, drainage, etc.).
- Determine interested parties within the area that may look to be serviced by the new irrigation water system.
- By weighing the cost of operation and maintenance of the system against the community input, provide insight on the feasibility of developing the well site and irrigation water system.

The feasibility study is intended to be a planning level assessment for the feasibility of the Proposed Action which would involve developing Well No. 7451-02 into a

production well with an accompanying irrigation water system (storage and transmission) within the proposed area of North Kohala.

B. SITE BACKGROUND¹

1. Site Selection and Location

The well being looked at for development is State Well No. 7451-02 located on TMK parcel (3) 5-5-006:002. The land is currently owned by the State but leased to Bothelho Hawaii Enterprises, Inc. for agricultural purposes. The parcel has a gross area of 44.50 acres and a net area of 39.28 acres when considering the 5.22 acres of exclusions (reservoir and exclusion “F”). The ground elevation for the well is 567ft. above msl with a depth of 632 ft.

2. Water Resources

2.1. Groundwater

State Well No. 7451-02 is located within the Hawi Aquifer System Area (80101). The Hawi Aquifer System Area has a sustainable yield of 11 million gallons per day (MGD) and is within the greater Kohala Aquifer Sector Area, which has a sustainable yield of 131 MGD (**see Appendix B – CWRM Groundwater Hydrologic Unit Map**). Current total installed pump capacity in the Hawi ASA is 31.890 MGD (**see Appendix C – Hawi Aquifer System Well Report**). Although the installed pump capacity is over the sustainable yield, the actual 12-month moving average for the past year (2021-Current) is <1 MGD, which is well under the sustainable yield of 11 MGD (**see Exhibit 1 – 12 Month Moving Average for Pumping**).

C. Development and Improvement Analysis

3. Proposed Improvements

To convert the observation well into a production well, an adequately sized pump will need to be installed. Based on the preliminary pump tests, the proposed pump to be installed will have a pumping rate of 475 gallons per minute (gpm). This allows the well to provide approximately 456,000 gallons per day (gpd) of water. Storage and transmission lines will also need to be installed to provide adequate service to the area. The proposed storage facility is a 660,000 gallon tank that will be located adjacent to the ‘Akoni Pule Highway within the same parcel as the well (**see Exhibit 2 – Proposed Site Plan**). The tank is sized to accommodate the water produced from the well after 16 hours of pumping. The influent line will run parallel to the Upolu Airport Road. The effluent line will run separately from the influent line

¹ Additional background information on the project and project site will be presented in the related Environmental Assessment Report, to be completed in the future.

and split into two proposed transmission lines that will be constructed: An East line and a West line. Each line will follow their respective East or West bearing and run parallel to 'Akoni Pule Highway. The East transmission line would stub out at the property line while the West transmission line will stub out at the adjoining State-Owned Parcel's (TMK 5-5-006:003) western property line. This proposed plan would involve constructing about 400 linear feet (LF) of High Density Polyethylene (HDPE) from the well to the tank, 2000 LF of HDPE West transmission line, and 500 LF of HDPE East transmission line, for a total of approximately 2900 LF.

3.1. Irrigation Water System Operation

A preliminary operation plan was formed based on the proposed irrigation water system improvements. The idea for the system is that end users will be accountable for tracking their individual uses and compensate the owner/operator of the water system accordingly. At each stub out there will be a meter to measure usage. Users of the water system will provide their own lateral service connection at the stub out. Water usage will be based on the readings from the meters.

4. Operation and Maintenance Costs

It should be noted that the cost for construction was not considered in this analysis due to the fact that legislative funding has already been appropriated to cover any work related to the design and construction of this project.

The different costs to operate and maintain the various portions of the irrigation water system are listed below. Operational costs consist mainly of electrical power costs. Labor costs were not considered in this analysis.

4.1. Source (Well)

The preliminary design for the well will be a 150 Horsepower (HP) pump that will have design capacity of 475 gpm. It is assumed that the pump will run for approximately 16 hours daily and turn off when the storage tank is full. Assumed cost to run the pump for the full 16 hours is \$750 per day. Upon video analysis, the well casing has an assumed 30–50 year lifespan remaining. Typical pump lifespans are around the 10-15 year range.

4.2. Transmission

The transmission lines will be gravity fed and no booster pumps will be installed. Operational costs are assumed to be \$0 due to no power requirements. Maintenance costs will be replacing the HDPE line, as necessary, in the event of breaks. HDPE pipe has a typical design life of 50 years.

4.3. Storage

There will be minimal operational costs at the storage tank since minimal electrical improvements are proposed at the tank site.

4.4. Distribution

Current proposed design of the water system does not include a distribution portion. The water system will stub out at the end of the transmission lines allowing for users to connect their own service laterals.

4.5. Proposed Water Rate

Based on electrical costs, water rates would need to be \$1.645 per thousand gallons to support the operations of the system. When including a 25% contingency for maintenance costs, a rate of \$2.00 per thousand gallons can be assumed for the Upolu well water system.

5. Hawaii Department of Water Supply (HDWS)

5.1. Ag Water Rates

HDWS provides agricultural water rates for those who qualify. The Ag water rates as well as standby, power cost, and energy CIP charges can be found in the HDWS water brochure (**see Appendix D – HDWS Water Brochure**). Based on the water brochure, and assuming a 1-½” water meter, and usage of 3,000 gallons per day, the assumed breakdown of costs are as follows:

Standby (per day)	\$3.01
Water Rate (per 1,000 gal.) Block 3	\$1.44
Power Cost (per 1,000 gal.)	\$2.34
CIP Charge (per 1,000 gal.)	\$0.05
Total (assuming 25,000 gpd)	\$98.75

6. Department of Agriculture (DOA) State Irrigation Water System

6.1. DOA Irrigation Water Rates

Water rates for the DOA State Irrigation Water Systems are currently \$.50 per thousand gallons. Through correspondence with DOA, this irrigation water rate may increase to \$1.10 per thousand gallons over the years.

D. MARKET ASSESSMENT & PUBLIC OUTREACH

1. Current and Future Water Demands

Through coordination with Waimea Water Services Inc. (WWS), surrounding parcels within the proximity of the proposed water system that have a possible need for irrigation water were identified. The community members were surveyed on their current and proposed water usages. The results of this public outreach will be presented in the following sections.

2. Public Outreach

To gauge community interest on the proposed irrigation water system improvements, a market outreach survey was conducted on February 16, 2022. Out of the 40 members of the community that were surveyed, 10 responses were received (**see Exhibit 3 – Market Survey Respondents**). The farmers provided some general background information such as location, land area, water usage, interest in using water system, interest in leasing the water system, and if applicable, the interest that their hui/co-op would have in leasing the system. Responses were recorded and the results can be found in **Exhibit 4 – Market Survey Results**.

2.1. Summary of Results

Overall interest in the water system seems to be moderate-high from the community. Overall interest in leasing the water system is also moderate-high. There was only a moderate interest by Hui/Co-op's in leasing the water system. The range of price for the affordable rate of water was from \$0.25-\$1.00 per thousand gallons with the average being \$0.68 per thousand gallons.

E. ALTERNATIVE ACTIONS

1. Water Lease

It is plausible for the water system to be owned by DOA, however, be leased to a private entity to purvey water to a region. Due to the economic burden of owning and operating an irrigation water system, DOA prefers to lease smaller water systems. The initial public outreach showed positive feedback from the community with regards to their interest in leasing the system.

2. No Action

The No Action alternative would be to not develop the well into a production well and not construct the accompanying water system. Without surface water sources, the only other source of water to the area would be through the County system. A comparison was done between the HDWS Ag rate with the water rate

for the Upolu Well water system. Because of how the HDWS Ag rate is structured in the block system, both rates were computed out for 25,000 GPD usage. The resulting total was \$98.75 for HDWS Ag rate and \$50 for the Upolu Well water system. The price of water from the Proposed Action is nearly half the price as the County rate. Moreover, the County needs to approve and install service laterals/boxes for any new users, which could prove to be a difficult and timely process. This is also dependent on whether the County has the capacity to accommodate extra services.

F. CONCLUSIONS & RECOMMENDATIONS

To determine feasibility, the cost to operate and maintain the Proposed Action was analyzed. The assumed water rate that would need to be charged to properly operate and maintain the system would be \$2.00 per thousand gallons. This figure is well above the current DOA Ag water rate of \$0.50 and still above the proposed DOA Ag water rate of \$1.10 per thousand gallons. The initial conclusion drawn would be that the Proposed Action is unfeasible. However, as previously mentioned, if the Proposed Action were to be not pursued, farmers in the area would need to rely on County water. This is presented as the No Action alternative, which shows that County rates are nearly twice as much as the Proposed Action rates. Moreover, the No Action alternative would be dependent on the County capacity and infrastructure.

Although the Proposed Action may initially seem unfeasible, it is a more feasible option than having the farmers rely on County water. Furthermore, the community has shown strong interest in the Proposed Action and becoming possible users of the system. There was also some interest shown from the community with regards to leasing the system. As previously mentioned in the Alternative's, DOA has the option to lease the system to a private entity to provide water to the area. Leasing the system would be a feasible alternative to the Proposed Action.

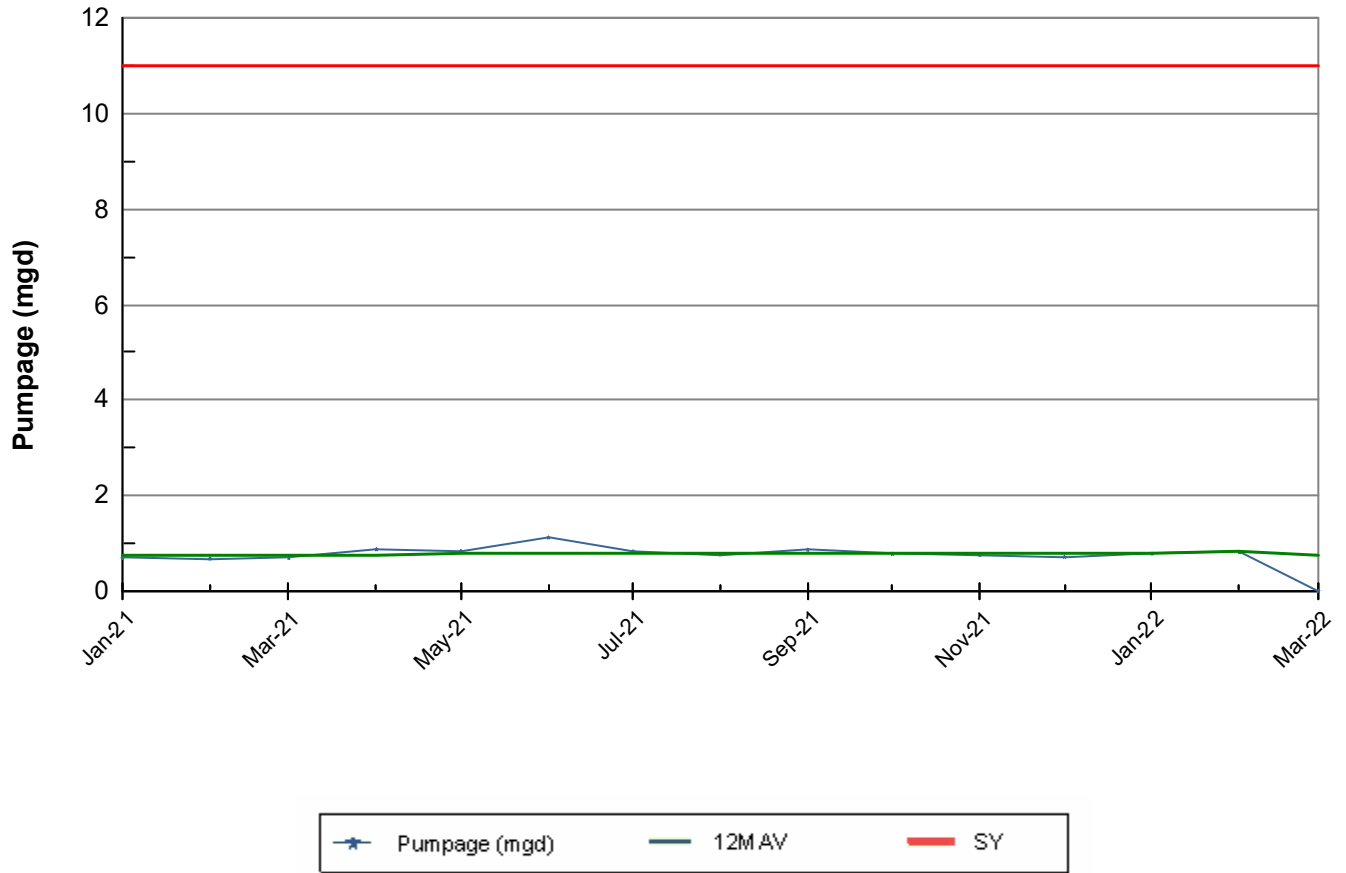
With the Kohala Ditch being rendered inoperable, an immediate need for alternative sources of water for irrigation/agricultural uses in the North Kohala area arose. The development of Upolu Well into a production well for irrigation uses would be a positive first step in remedying this need.

EXHIBIT 1

12 Month Moving Average of Pumping



Monthly Pumpage Chart 12 Month Moving Average



Report Parameters	
Date:	01/01/2021 - 03/31/2022
Island:	Hawaii
Well Owner:	All
Well Reporter:	All
Well # Prefix:	All
Aquifer Sector:	All
Aquifer:	80101 Hawi
Water Quality:	Fresh (0-250 ppm), Brackish (251-16,999 ppm), Not Specified
Potable/Non-Potable:	All
TMK:	All
PWS:	All
Aquifer Type:	Alluvial, Basal, Caprock, Dike, Perched, Not Specified
Pump Capacity:	All
Well Use:	All

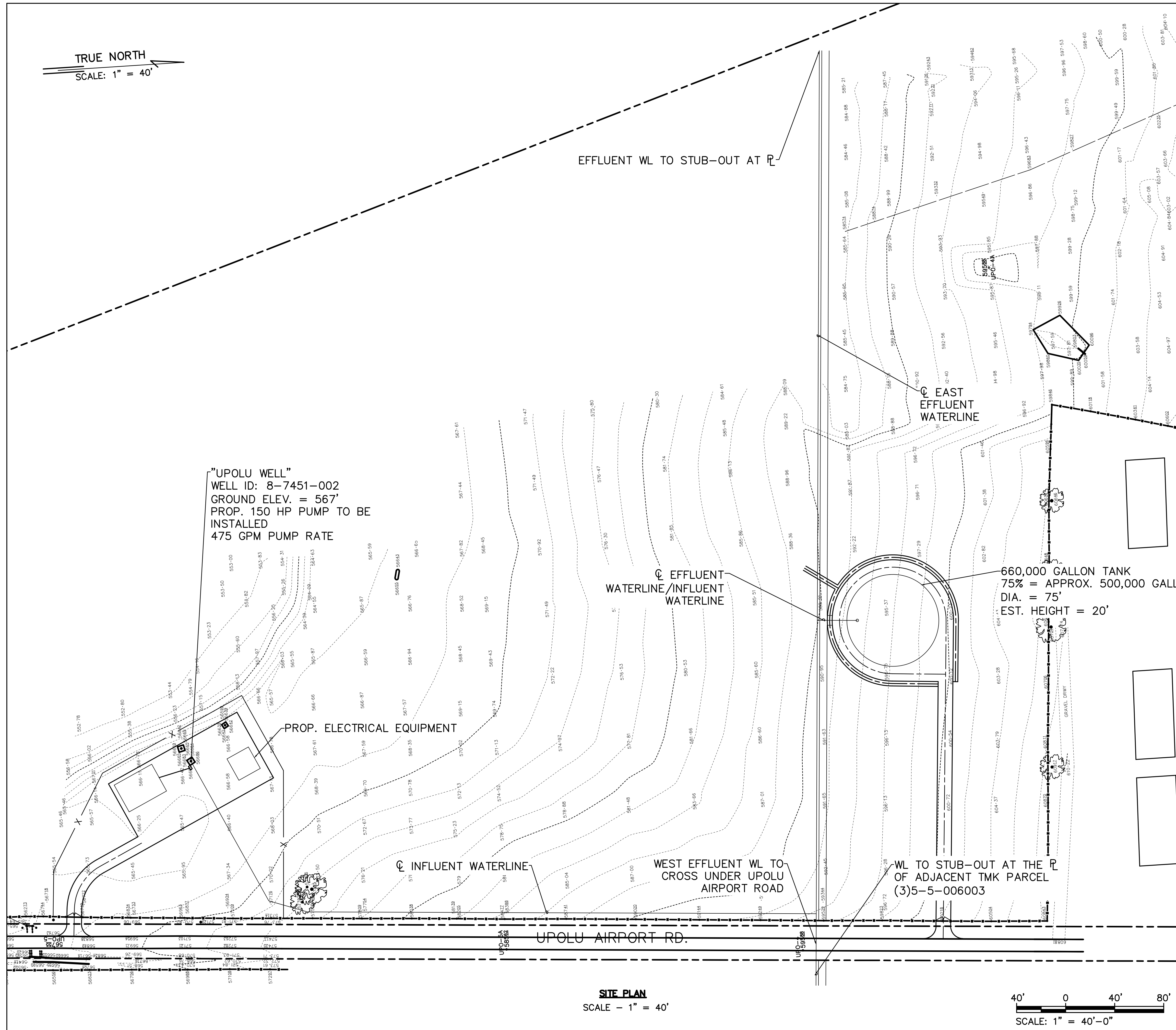
Month Year	Pumpage (Mgd)	12MAV (Mgd)	SY (Mgd)
January 2021	0.691	0.773	11.000
February 2021	0.682	0.767	11.000
March 2021	0.698	0.762	11.000
April 2021	0.877	0.770	11.000
May 2021	0.841	0.775	11.000
June 2021	1.124	0.803	11.000
July 2021	0.834	0.805	11.000
August 2021	0.773	0.804	11.000
September 2021	0.869	0.806	11.000
October 2021	0.783	0.801	11.000
November 2021	0.762	0.801	11.000
December 2021	0.723	0.805	11.000
January 2022	0.788	0.813	11.000
February 2022	0.817	0.824	11.000
March 2022	0.007	0.767	11.000

EXHIBIT 2

Proposed Site Plan

Last Save by: ACHEN
 Last Saved: 5/26/2022
 Plotted on: 5/26/2022

G:\DLNR2101 North Kohala Well\300
 Design\310 Plans\DLNR2101 - SITE
 PLAN.dwg



TRUE NORTH
 SCALE: 1" = 40'

EFFLUENT WL TO STUB-OUT AT R

"UPOLU WELL"
 WELL ID: 8-7451-002
 GROUND ELEV. = 567'
 PROP. 150 HP PUMP TO BE
 INSTALLED
 475 GPM PUMP RATE

PROP. ELECTRICAL EQUIPMENT

EFFLUENT
 WATERLINE/INFLUENT
 WATERLINE

EAST
 EFFLUENT
 WATERLINE

660,000 GALLON TANK
 75% = APPROX. 500,000 GALLONS
 DIA. = 75'
 EST. HEIGHT = 20'

INFLUENT WATERLINE

WEST EFFLUENT WL TO
 CROSS UNDER UPOLU
 AIRPORT ROAD

WL TO STUB-OUT AT THE R
 OF ADJACENT TMK PARCEL
 (3)5-5-006003

UPOLU AIRPORT RD.

AKONI PULE HWY.

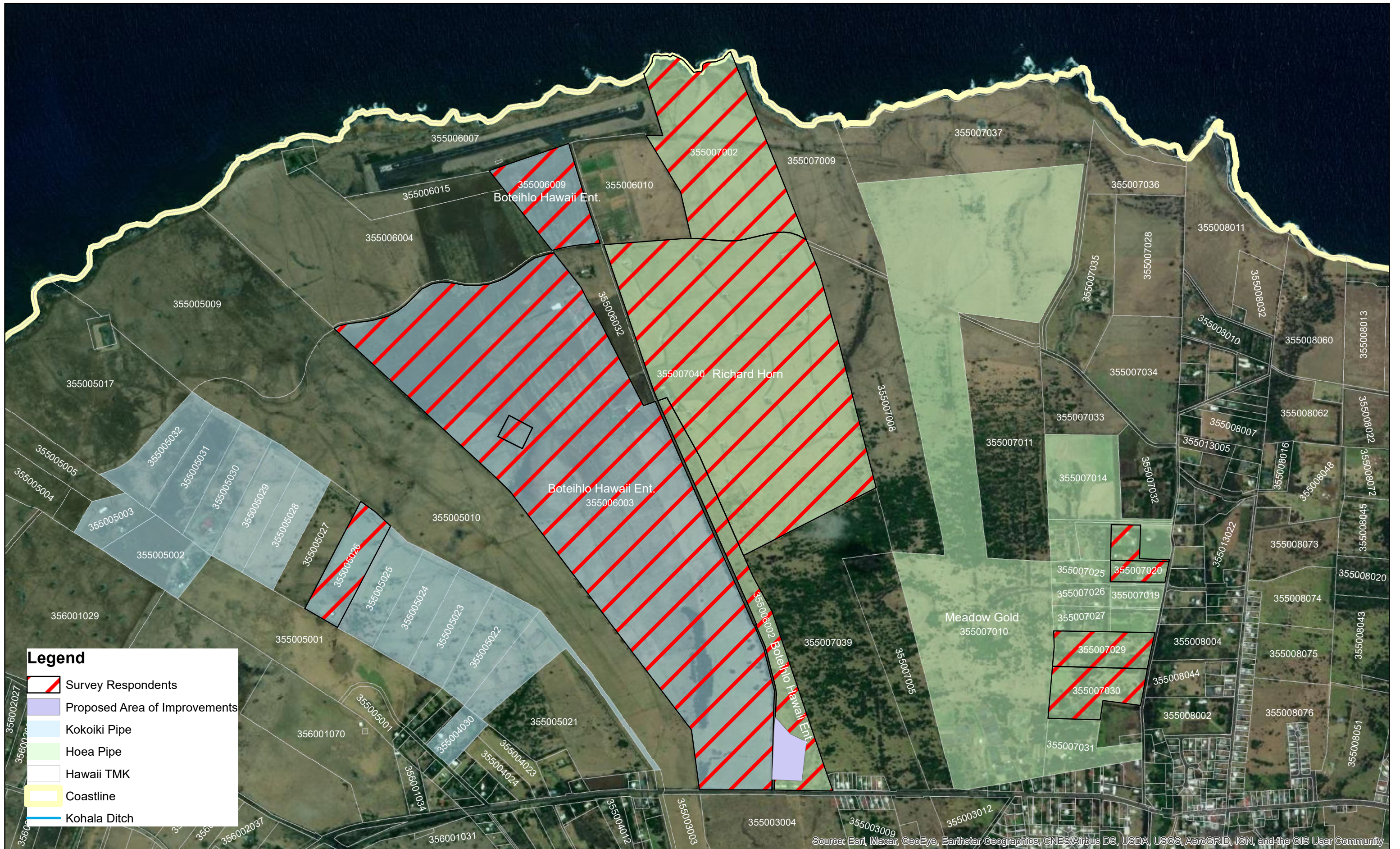
SITE PLAN
 SCALE - 1" = 40'

40' 0 40' 80'
 SCALE: 1" = 40'-0"








REVISION NO.	SYM.	DESCRIPTION	SHT./OF	DATE	APPROVED
STATE OF HAWAII DEPARTMENT OF LAND AND NATURAL RESOURCES ENGINEERING DIVISION					
UPOLU WELL IMPROVEMENTS HAWAII, HAWAII					
SITE PLAN					
DESIGNED:			SUBMITTED:		
DRAWN: AKI			DATE: MARCH 2022		
CHECKED: SAK			SCALE: AS NOTED		
APPROVED:			DRAWING NO.		
CHIEF ENGINEER			DATE		

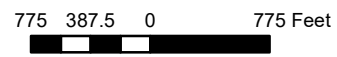
EXHIBIT 3

Market Survey Respondents



Legend

-  Survey Respondents
-  Proposed Area of Improvements
-  Kokoiki Pipe
-  Hoea Pipe
-  Hawaii TMK
-  Coastline
-  Kohala Ditch



Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Market Survey Respondents

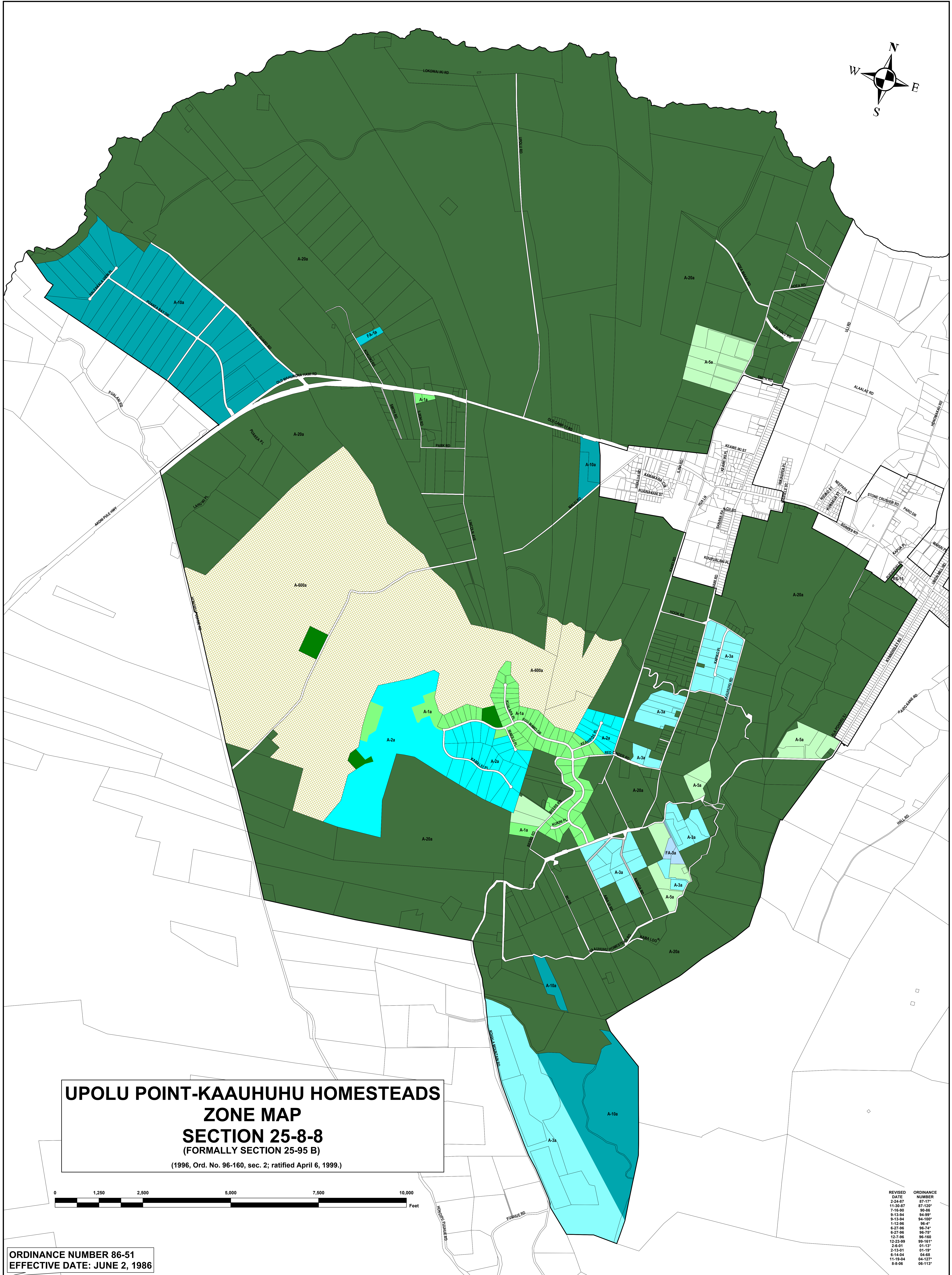
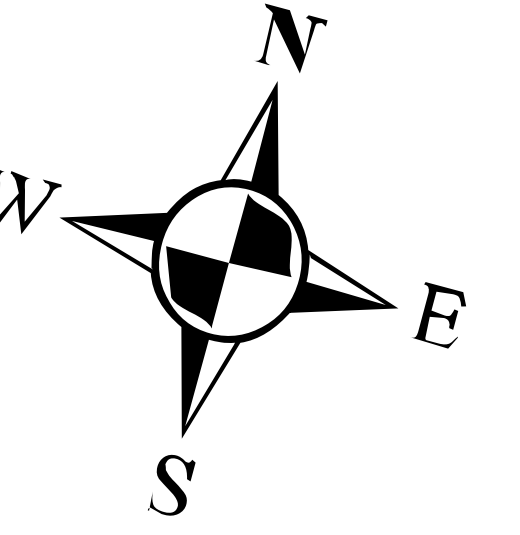
EXHIBIT 4

Market Survey Results

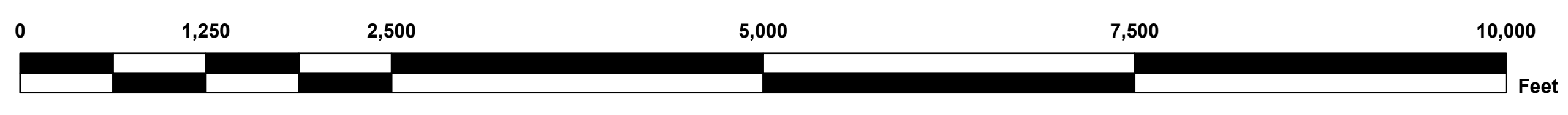
Chris and Satrim English	Christ@ponoholo.com	994-5100	Ponoholo Ranch	not surveyed
Ralph Blancato	ralphblancato@gmail.com	896-9771	Pou Hoi Hu	not surveyed
Randee Golden	Rgolden808@gmail.com	889-0011	n/a	not surveyed
David Barclay	bigislandproject@gmail.com	896-290-1961	Aquatic Culture and Design The Dorrance Family	not surveyed
Carrie Ostroski		480-290-1961	Section	not surveyed
Kite Hazelwood	Kyehaze@gmail.com	987-1239	Ditch Co-Op	not surveyed
Karin Cooke	Karin@kokolulu.com	895-4506	Kokolulu Farm	not surveyed
Lew Whitney	Lew@kokolulu.com	889-9893	Kokolulu Farm	not surveyed
Crystal West	Crystalinx@yahoo.com	--	n/a	not surveyed
C.A. Baber		989-1836	Island Herbs AFUU	not surveyed
Dudley D. Carvalho	dudleydcarvalho@gmail.com	443-8626	BIM	not surveyed
Tim Richards	Tim.Richards@hawaiicounty.gov	887-2069	n/a	not surveyed
Gail Byrne Baber	--		Koh Farmers Union	not surveyed
Yvonne Weiser			n/a	not surveyed
Jill Peters	jillpeters@aol.com		Kohala Ditch Association	not surveyed
Jim	Alomapex@gmail.com		Ditch Com.	not surveyed
Bill Showell	skyool@hawaii.rr.com		n/a	not surveyed
John Winter	winters@whitman.edu		NKCDP	not surveyed
Michael Bassalberg	Michael@desertwindfarms.com		Botelho Dairy	not surveyed
Noe Kalipi	noe@kohalainstitute.org	808-365-3479	Kohala Institute	not surveyed
Hanna Bree	hbree@kohalacenter.org		Kohala Center	not surveyed
Cody Dwight	cdwight@kohalacenter.org		Kohala Center	not surveyed
Patte Cook	cookshi@aol.com		n/a	not surveyed
Jane Sherwood	jamesher@hawaii.edu		n/a	not surveyed
Kama Hopkins	Jeremyh@oha.org		OHA	not surveyed
Perry Kealoha			KSBE	not surveyed
Delphina Dorrance	Leighdelphina@gmail.com	987-1891	KVHUB	not surveyed
Sarah Pule-Fujii	allreif@aol.com		n/a	not surveyed
Bob Martin	bobmartin@hawaii.rr.com	896-0101	Kohele Radio	not surveyed
Peter Rishey	PeterRishey47@gmail.com		n/a	not surveyed
Sue Caranvalho	Suec222@gmail.com		Resident	not surveyed
Cheri Gallo		889-5001	KDF	not surveyed
Bo Kahui	bokahui@laiopua.org		Laiopua	not surveyed
RIVER MTN RCH			5-5-003	not surveyed
HAWI AG ENERGY			5-5-003-016	not surveyed
STATE DLNR			5-5-003-019	not surveyed
STATE DLNR			5-5-006-002	not surveyed
STATE DLNR			5-5-006-004	not surveyed
STATE DLNR			5-5-006-005	not surveyed
CHALON INT			5-5-006-006	not surveyed
STATE DLNR			5-5-007-005	not surveyed
STATE DLNR			5-5-007-007	not surveyed
STATE DLNR			5-5-007-009	not surveyed
STATE DLNR			5-5-007-013	not surveyed
CHALON INT			5-5-008-013	not surveyed
CHALON INT			5-5-008-045	not surveyed
STATE DLNR			5-5-011-047	not surveyed

APPENDIX A

Upolu Points - Kaauhuhu Homesteads Zone Map Section 25-8-8



**UPOLU POINT-KAAUHUHU HOMESTEADS
ZONE MAP
SECTION 25-8-8
(FORMALLY SECTION 25-95 B)**
(1996, Ord. No. 96-160, sec. 2; ratified April 6, 1999.)



**ORDINANCE NUMBER 86-51
EFFECTIVE DATE: JUNE 2, 1986**

REVISED DATE	ORDINANCE NUMBER
2-24-87	87-17*
11-30-87	87-120*
7-16-90	90-56
9-13-94	94-99*
9-13-94	94-100*
1-12-96	96-4*
6-27-96	96-74*
6-27-96	96-75*
12-7-96	96-160
12-23-99	99-161*
2-6-01	01-13*
2-13-01	01-19*
6-14-04	04-68
11-19-04	04-127*
6-6-06	06-113*

APPENDIX B

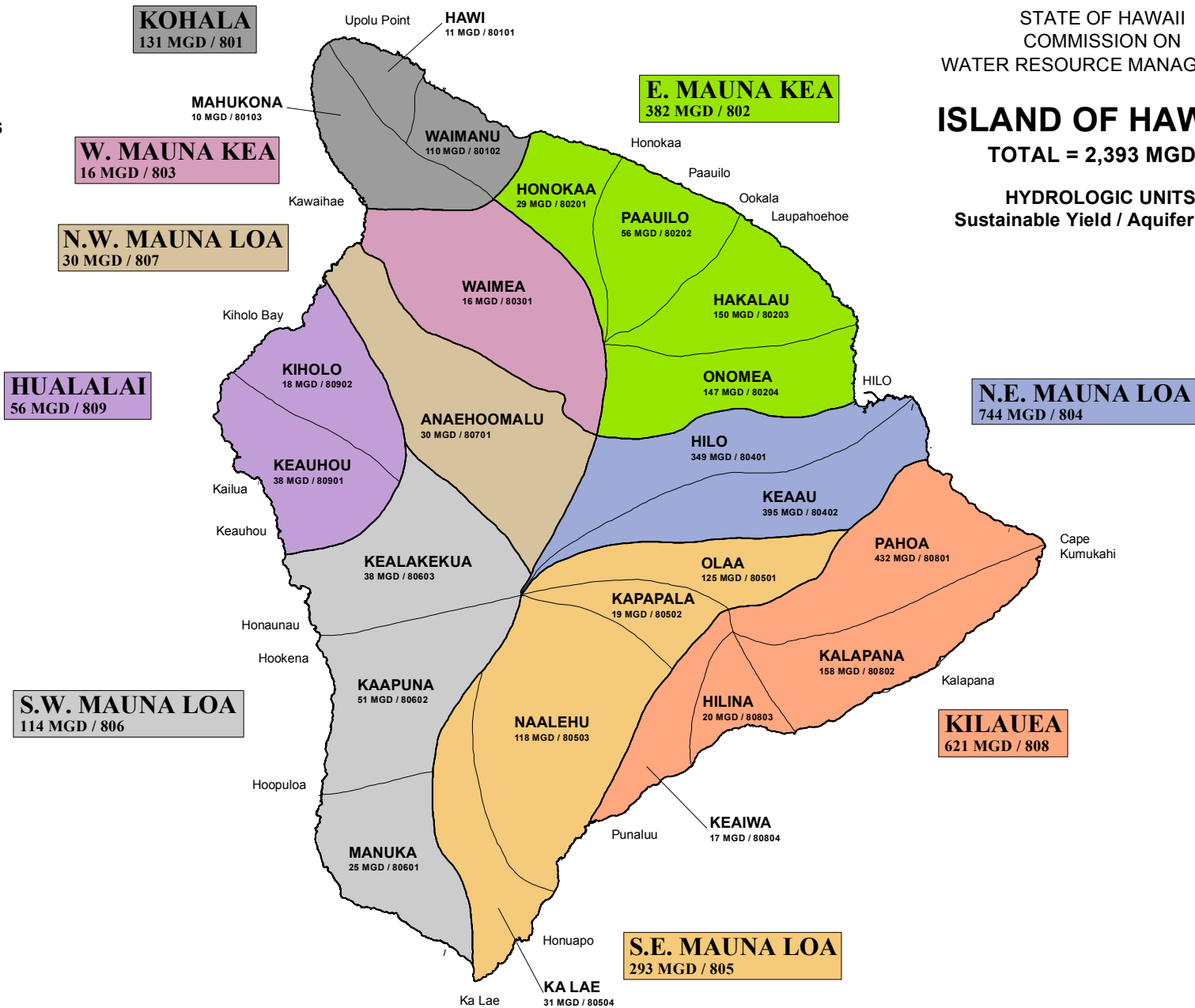
CWRM Groundwater Hydrologic Unit Map

ISLAND OF HAWAII

TOTAL = 2,393 MGD

HYDROLOGIC UNITS
 Sustainable Yield / Aquifer Code

1" = 15 MILES



APPENDIX C

Hawi Aquifer System Well Report



Wells Reviewed in Report

Island: Hawaii
 Well Owner: All
 Well Reporter: All
 Land Owner: All
 Contractor: All
 Aquifer Sector: All
 Aquifer: 80101 Hawi
 Aquifer Type: Alluvial, Basal, Caprock, Dike, Perched, Not Specified
 TMK: All
 PWS: All
 Water Quality: Fresh;Brackish;Salt;other
 Well Type: Tunnel, Dug, Percussion, Rotary, Shaft, Not Specified
 Well Use: All

Well No	Well Name	Aquifer	Well Owner/Operator	Year Drilled	Coordinates(NAD83)		Type	Physical Data		Elevations in feet (msl)			Initial			Pump Test Result			
					Latitude DD	Longitude DD		Casing Dia in.	Total Depth ft.	Ground	Bottom Solid Casing	Bottom Perf Casing	Bottom of Hole	Static Head	Cl	Temp	Spec Cap	T ft ² /d	Installed Capacity mgd
Island: Hawaii																			
80101 Hawi																			
8-7047-001	Lindsey Tunnel	80101	Ho'okipa Ranch LLC	1933	20.170278	-155.785278	TUN			2,150			2,150.00						AGRCP
8-7145-001	Waikani Tunnel	80101	Ho'okipa Ranch LLC		20.185556	-155.759444	TUN			1,500			1,500.00						AGRCP
8-7145-002	Murphy Tunnel	80101	Ho'okipa Ranch LLC		20.190278	-155.756167	TUN			1,250							0.250		AGRCP
8-7145-003	Puu Mini Tunnel	80101	HALAWA EAST LLC	1937	20.196111	-155.760833	TUN			1,200			1,200.00						MUNPR
8-7145-004	Paa Tunnel	80101	HALAWA EAST LLC	1939	20.196389	-155.763056	TUN			1,200			1,200.00						AGRCP
8-7145-005	Amau Tunnel	80101	HALAWA EAST LLC	1939	20.196111	-155.754444	TUN			1,000			1,000.00						AGRCP
8-7145-006	Murphy Tunnel Spring	80101	Ho'okipa Ranch LLC		20.190250	-155.756306	TUN			1,280									AGRCP
8-7146-001	Waipunalau Tunnel	80101	Ho'okipa Ranch LLC	1934	20.184722	-155.768889	TUN			1,600			1,600.00						AGRCP
8-7147-001	Kay Tunnel	80101	Halawa SW LLC		20.193333	-155.790000	TUN			1,700			1,700.00						IRR
8-7147-002	Mcgill 1 Tunnel	80101	PR Kohala LLC		20.181944	-155.793889	TUN			2,000									ABNSLD
8-7147-003	Mcgill 3 Tunnel	80101	PR Kohala LLC	1932	20.181389	-155.795000	TUN			2,040			2,040.00						AGRCP
8-7147-004	Mcgill 2 Tunnel	80101	PR Kohala LLC	1932	20.180556	-155.795278	TUN			2,060			2,060.00						AGRCP
8-7147-005	J D Bond Tunnel	80101	Kohala Institute at "Iole	1935	20.194722	-155.793611	TUN			1,500			1,500.00						UNU
8-7147-006	Watt 2 Tunnel	80101	Kohala Institute at "Iole	1936	20.191944	-155.795556	TUN			1,700			1,700.00						ABN
8-7147-007	Koelling Tunnel	80101	Halawa SW LLC	1937	20.193333	-155.792222	TUN			1,600			1,600.00						MUN
8-7148-001	Cowpen 1 Tunnel	80101	Kohala Institute at "Iole		20.195833	-155.808611	TUN			1,700			1,700.00						UNU
8-7148-002	Cowpen 2 Tunnel	80101	Kohala Institute at "Iole		20.195000	-155.808611	TUN			1,740			1,740.00						UNU
8-7148-003	Cowpen 3 Tunnel	80101	Kohala Institute at "Iole		20.195833	-155.807222	TUN			1,740			1,740.00						UNU
8-7148-004	Watt Tunnel	80101	Kohala Institute at "Iole		20.193750	-155.806722	TUN			1,750			1,750.00						UNU
8-7148-005	Olding Tunnel	80101	Kohala Institute at "Iole		20.195278	-155.798333	TUN			1,600			1,600.00						ABN

Well No	Well Name	Aquifer	Well Owner/Operator	Coordinates(NAD83)			Physical Data			Elevations in feet (msl)				Initial			Pump Test Result			
				Year Drilled	Latitude DD	Longitude DD	Type	Casing Dia in.	Total Depth ft.	Ground	Bottom Solid Casing	Bottom Perf Casing	Bottom of Hole	Static Head	Cl	Temp	Spec Cap	T ft ² /d	Installed	
																			Capacity mgd	Use
8-7244-003	Avaseva	80101	One Village Project LLC	2016	20.211481	-155.745819	ROT	4	480	450	-2	-30	-30	19.75	68.0		0.023	AGR		
8-7245-001	Maulua Tunnel	80101	Ho'okipa Ranch LLC	1939	20.199722	-155.756389	TUN			750				750.00				AGRCP		
8-7246-001	Halawa Tunnel	80101	Ho'okipa Ranch LLC	1938	20.199167	-155.770278	TUN			1,000				1,000.00				AGRCP		
8-7247-001	Bond Tunnel	80101	Kohala Institute at "Iole	1937	20.210278	-155.795833	TUN			978				978.00				AGR		
8-7247-002	Bond 2 Tunnel	80101	Kohala Institute at "Iole	1934	20.199722	-155.796667	TUN			1,450				1,450.00				UNU		
8-7247-003	Halaula Deepwell	80101	Department of Water Supply Hawaii - Hilo, HDWS	2011	20.214083	-155.788383	ROT	18	850	773	-7	-57	-77	1.93	25	71.4	241,000	UNU		
8-7248-001	Dr Bond Tunnel	80101	Kohala Institute at "Iole		20.209167	-155.799167	TUN			968				968.00				UNU		
8-7248-002	Kaala Tunnel	80101	Nunulu LLC	1934	20.212222	-155.809444	TUN			1,025				1,025.00				AGRCP		
8-7248-003	Hapahapai Tunnel	80101	Kohala Institute at "Iole	1935	20.203056	-155.805000	TUN			1,350				1,350.00				ABN		
8-7248-004	Pahei Tunnel	80101	Kohala Institute at "Iole	1939	20.209444	-155.799444	TUN			1,000				1,000.00				ABN		
8-7344-001	Starseed	80101	Starseed Ranch LLC		20.216389	-155.748167												DOM		
8-7344-003	Hua Nui	80101	Nathaniel Hayward & Katherine Lahey	2017	20.219310	-155.746388	ROT	4	310	280	-12	-33	-30	8.00	30	68.0		0.031	IRRLA	
8-7345-001	Aamakoia Gu TH 2	80101	Halawa North LLC	1964	20.218889	-155.755833	ROT	3	255	171	133		-84	6.80	25			UNU		
8-7345-002	Waikani Gu TH 3	80101	South Pacific Christian Camps Inc.	1964	20.219444	-155.749167	ROT	3	265	161	146		-104		25			UNU		
8-7345-003	Makapala Obs A	80101	Pacific Islands Water Science Center, USGS, U.S. Geological Survey	1989	20.214722	-155.753333	ROT	12	495	396	-44	-99	-99	10.30		62		OBS		
8-7345-004	Makapala Obs A	80101	Vincent B & Marsha A DeCaria	1989	20.215278	-155.753056	ROT	8	440	396	175		-45	10.20				UNU		
8-7345-005	Makapala Well	80101	Department of Water Supply Hawaii - Hilo, HDWS	2002	20.214961	-155.753136	PER	10	547	400	-50		-147	8.73	40		66,999	0.093	MUNCO	
8-7345-006	Vipassana Hawaii	80101	DPAC Outdoors, LLC	2009	20.226944	-155.766111	ROT	4	291						45			0.038	AGRCP	
8-7345-007	Moray	80101	Lynn Moray		20.220371	-155.750498													IRRLA	
8-7345-008	Flying Dog	80101	Dan Brophy (Flying Dog, Trust)	2019	20.227700	-155.761010	ROT	6	236	236	11	1	1	27.00	80	70.1		0.050	AGRLI	
8-7346-001	Halawa Gu TH 1	80101	South Pacific Christian Camps Inc.	1964	20.226111	-155.764167	ROT	3	267	170	143		-97	7.40	54				UNU	
8-7346-002	Bamboo 1	80101	Quindembo Bamboo Nursery															0.122	IRR	
8-7347-001	Iole-Bond Tunnel	80101	Kohala Institute at "Iole		20.215278	-155.793889	TUN			650				650.00					UNU	
8-7347-002	Halaula	80101	EWM Investments LLC	1948	20.228056	-155.781944	PER	16	505	342	-10		-163	7.80	26	86	262,080	1.710	DOM	

Well No	Well Name	Aquifer	Well Owner/Operator	Coordinates(NAD83)			Physical Data			Elevations in feet (msl)				Initial			Pump Test Result			
				Year Drilled	Latitude DD	Longitude DD	Type	Casing Dia in.	Total Depth ft.	Ground	Bottom Solid Casing	Bottom Perf Casing	Bottom of Hole	Static Head	Cl	Temp	Spec Cap	T ft ² /d	Installed Capacity mgd	Use
8-7347-003	Halaula Makai E	80101	Pacific Islands Water Science Center, USGS, U.S. Geological Survey	1989	20.229181	-155.780836	ROT	8	405	341	261		-64	9.80	21				OBS	
8-7347-004	Halaula Mauka B	80101	Pacific Islands Water Science Center, USGS, U.S. Geological Survey	1989	20.218639	-155.787083	ROT	8	730	630	530		-100	11.40					OBS	
8-7347-005	Halaula B	80101	Pacific Islands Water Science Center, USGS, U.S. Geological Survey	1989	20.218722	-155.787222	ROT	10	730	628	0	-27	-102	11.40	19	120	396,950		OBS	
8-7348-001	Kohala Sugar	80101	Nunulu LLC		20.215278	-155.809444	TUN			900									IRR	
8-7349-001	Hawi #2 Deepwell	80101	Department of Water Supply Hawaii - Hilo, HDWS	1993	20.227683	-155.827141	ROT	18	847	791	6	-56	-56	7.16	20	65.0	169	224,350	1.008	MUNCO
8-7350-001	Kealahewa 1	80101	Wendell Brooks Jr.	2006	20.230556	-155.844167	ROT	12	860	800	-12	-52	-60	6.01	10		303	320,000		UNU
8-7350-002	Kealahewa 2	80101	Wendell Brooks Jr.	2006	20.229722	-155.844167	ROT	12	889	801	11	-29	-88	7.36	10		611	460,000	0.352	MUNPR
8-7445-001	Hapuu Bay D	80101	Pacific Islands Water Science Center, USGS, U.S. Geological Survey	1989	20.232222	-155.760000	ROT	8	460	109	-73		-351	7.20						OBS
8-7446-001	Kohala Shaft	80101	Kohala Institute at "Iole	1900	20.238000	-155.777667	SHF		135	123			-12						9.910	ABN
8-7446-004	Ulrych 2	80101	Hale Ipu Kukui LLC	2009	20.238333	-155.769167	ROT	6	88						78				0.007	DOM
8-7446-007	Ulrych 1	80101	Hale Ipu Kukui LLC	2009	20.236944	-155.771944	ROT	6	132	110	1	-22	-22		45				0.007	DOM
8-7447-001	Ahu Pohaku Farms	80101	Robert Watkins	2009	20.244722	-155.798889	ROT	6	157						32				0.039	AGRCP
8-7448-001	Union Mill	80101	Wendell Mattos	1898	20.239167	-155.809167	ROT	4	425	420			-5							ABNSLD
8-7448-003	Gusman Gu TH 5	80101	Christopher J Helmuth	1964	20.237500	-155.802222	ROT	3	402	306	30		-96	6.20	12					UNU
8-7448-004	Union Mill 1	80101	McIntyre Living Trust	1965	20.237778	-155.803333	PER	16	412	311	-1	-37	-101	7.00	47		222		2.640	IND
8-7448-005	Union Mill 2	80101	Wendell Mattos	1969	20.238611	-155.808611	PER	16	522	420	0	-40	-102						2.640	IND
8-7448-006	Kohala Obs F	80101	Pacific Islands Water Science Center, USGS, U.S. Geological Survey	1989	20.237286	-155.798389	ROT	8	440	412	289		-28	8.21						OBS
8-7448-007	Honopueo	80101	Kathie Pomeroy	1989	20.237061	-155.798406	ROT	10	429	415	8	-14	-14	8.00	36		67		0.029	AGRCP
8-7448-008	La'aumana	80101	Kohala Makani Wai, LLC	2012	20.240472	-155.804528	ROT	8	410	388	0	363	-22	4.54	41	68.0	48	12,500	0.547	IRR
8-7449-001	Hawi	80101	State of Hawaii	1898	20.239722	-155.820556	ROT		200	500			300							UNU
8-7449-002	Hawi #1 Deepwell	80101	Department of Water Supply Hawaii - Hilo, HDWS	1975	20.237987	-155.825279	PER	12	591	542	-39		-49		18		261		1.008	MUNCO
8-7449-003	Hawi Obs H	80101	Pacific Islands Water Science Center, USGS, U.S. Geological Survey	1989	20.237778	-155.825278	ROT	8	585	541	451		-44	7.00	21					OBS

Well No	Well Name	Aquifer	Well Owner/Operator	Coordinates(NAD83)			Physical Data			Elevations in feet (msl)				Initial			Pump Test Result			
				Year Drilled	Latitude DD	Longitude DD	Type	Casing Dia in.	Total Depth ft.	Ground	Bottom Solid Casing	Bottom Perf Casing	Bottom of Hole	Static Head	Cl	Temp	Spec Cap	T ft ² /d	Installed Capacity mgd	Use
8-7449-004	Nahm	80101	Hub Well Gardens, LLC	2010	20.236761	-155.832208	ROT	6	640	632	32	-8	-8	36.30	40			0.058	DOM	
8-7449-005	Hawi Nani 1	80101	Hawi Nani LLC	2015	20.239794	-155.829792	ROT	6	444	390	-44	-54	-54	46.40	40	68.0		0.058	IRRLLA	
8-7449-006	Wolin	80101	Joseph E & Ann M Wolin	2016	20.247739	-155.819619	ROT	6	406	360	7	-46	-46	8.00	187	66.0	200	172,228	0.115	AGR
8-7451-001	Upolu Obs J-A	80101	Pacific Islands Water Science Center, USGS, U.S. Geological Survey	1989	20.241361	-155.848778	ROT	8	632	567	467		-65	4.20						OBS
8-7451-002	Upolu Obs J-B	80101	Pacific Islands Water Science Center, USGS, U.S. Geological Survey	1989	20.241444	-155.848861	ROT	10	632	567	4	-21	-65	4.20			517			OBS
8-7548-001	Pa Ka Makani	80101	Pa Ka Makani Farm, LLC	2014	20.250106	-155.813094									90				0.036	DOM
8-7548-002	Hoakua Wai	80101	First Raeco, LLC	2017	20.252680	-155.816330	ROT	6	282	265	256	-7	-17	20.00	150	69.9			0.023	AGRLLI
8-7549-001	Alaala Shaft	80101	EWM Enterprises, LP	1900	20.257778	-155.825833	SHF			75										ABN
8-7549-002	Alaala Gu TH 7	80101	ZOPA LLC	1965	20.248056	-155.823889	ROT	3	84	362	298		278	5.20	25					UNU
8-7549-003	Hawi Makai I	80101	Pacific Islands Water Science Center, USGS, U.S. Geological Survey	1989	20.248611	-155.823611	ROT	10	436	299	169		-137	2.20						OBS
8-7549-006	Kohala Wishing	80101	Kohala Wishing Well, LLC	2013	20.255350	-155.829550	ROT	6	266	260	14	-6	-6	20.70	120	78.0			0.023	DOM
8-7549-007	Johns	80101	Nola Grannis	2012	20.250842	-155.827667	ROT	5	344	335	5	-9	-9	5.00	82	69.0			0.035	AGRCP
8-7549-008	Uli Ranch	80101	Patrick & Alida Adamek	2014	20.252667	-155.826375	ROT	5	304	290	6	-14	-14	5.50	82	69.0			0.036	DOM
8-7549-009	Bemaxem	80101	John Wilson (Wilson Kim Trust)	2019	20.254583	-155.820719	ROT	6	205	198	3	-7	-7	8.50	90	75.2			0.016	DOM
8-7550-001	Blessed Waters	80101	Zibasara LLC	2012	20.265139	-155.839556	ROT	5	105	94	4	-11	-11	4.00	350	68.0			0.040	DOM
8-7550-002	Algood	80101	Eila & Holly Algood		20.258078	-155.836044														AGRON
8-7551-001	Kuleana	80101	Kuleana Spirits Inc.	2020	20.261274	-155.852921	ROT	10	230	229	9	-1	-1	24.00	140	75.4			0.036	DOM
8-7552-001	Upolu TH 6	80101	Kohala Sugar	1964	20.249722	-155.865556	ROT	3	360	293	260		-67	2.80	349					UNU
8-7650-001	Hoea Shaft	80101	Zibasara LLC	1900	20.264444	-155.836667	SHF		61	52			-9	2.00					7.940	UNU
8-7652-001	Waikane Shaft	80101	Ludwig O & Rebekah L Simmet	1920	20.264444	-155.868611	SHF		42	33			-9						2.970	AGRCP

Total Installed Pump Capacity in Aquifer in mgd: 31.890

Total Number of wells in Aquifer: 86

APPENDIX D

HDWS Water Brochure

Our Mission:

Providing **Safe & Dependable** Drinking Water at a **Reasonable** Cost

How is your money spent?

Water Quality

Providing safe drinking water is the foremost goal of the Department. We intend to meet the stringent requirements of the federal Safe Drinking Water Act. This includes testing of the water on a regular basis, developing better sources, and furnishing more treatment facilities.

Dependable Systems

Making sure that you have water involves drilling more wells (since well water is more dependable and less susceptible to droughts than surface sources); repairing and replacing outdated systems; and installing new modern equipment to monitor our systems.

You Can Contact Us at the Following Numbers:

Administration/Finance/General(808) 961-8050
Billing/Customer Service(808) 961-8060
Engineering(808) 961-8070
Emergencies & Field Operations(808) 961-8790
Water Quality.....(808) 961-8670
Website Address www.hawaiiidws.org

EXPLANATION OF CHARGES:

Your water bill consists of four components:

1. **Standby Charge:** This is a minimum monthly service charge based on meter size.
2. **Consumption Charge:** This is a service charge based on water use.
3. **Power Cost Charge:** This is a charge to offset power costs incurred by the Department.
4. **Energy CIP (Capital Improvement Project) Charge:** This is a charge to fund projects that improve energy efficiency.

HOW TO PAY YOUR BILL:

1. Mail in your payment.
2. In person at our office at 345 Kekūanaō‘a St., Suite 20, in Hilo, or at our district offices in Waimea and Kona.
3. By Automatic Bill Payment from your checking account.
4. On-line at www.hawaiiidws.org. Follow the “Water Bill” link.
5. Call toll free (844) 216-1994.

Please allow sufficient time for your payment to reach us by the DUE DATE. We are not responsible for any payment which may be in transit on the due date. A late payment penalty of one-percent (1%) per month will be assessed on unpaid account balances outstanding for more than 30 days.

If payment is not received by the due date, a shut-off notice with a scheduled shut-off date will be mailed to the account holder. Contact us immediately if you are unable to pay amounts due by the due date. A disconnected service will not be restored until all amounts due are paid.

We assess a \$30 fee for all dishonored payments.

All water charges will continue to be your responsibility until you notify us to close your account.

ESTIMATED READINGS:

We try to read your meter each billing period. However, if it is not possible to do so, we will estimate your consumption based on your recent average water usage. Please help us by keeping your meter accessible and clear of cars, fences, walls, debris, foliage, and animals.



The Department of Water Supply is an equal opportunity provider and employer.

*... Water, Our Most Precious Resource...
The Department of Water Supply is an equal opportunity provider and employer.*

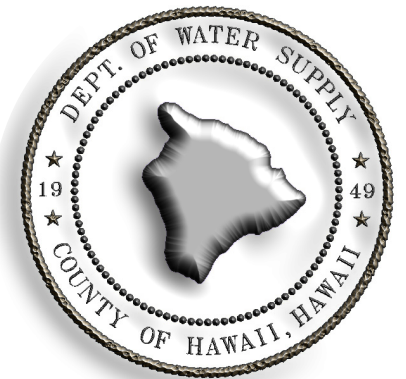
Department of Water Supply
345 Kekūanaō‘a Street, Suite #20
Hilo, Hawai‘i 96720

Water Rates

Department of Water Supply

County of Hawai‘i

345 Kekūanaō‘a Street, Suite #20
Hilo, Hawai‘i 96720



Effective May 1, 2022

A. MONTHLY STANDBY CHARGES*

All meter connections shall be subject to a monthly standby charge as follows:

Meter Size (inches)	Effective July 1, 2019	Effective January 1, 2021
5/8"	\$ 20.20	\$ 22.83
1"	43.00	48.59
1-1/2"	80.00	90.40
2"	125.00	141.25
3"	229.00	258.77
4"	377.00	426.01
6"	747.00	844.11
8"	1,192.00	1,346.96
10"	1,720.00	1,943.60
12"	3,000.00	3,390.00

*Standby charge is a minimum monthly charge.

B. GENERAL USE RATES (per 1,000 gallons)

In addition to standby, power cost, and energy CIP charges, a consumption charge will be applied to all general use customers as follows:

	Effective July 1, 2019	Effective January 1, 2021
1 st Block	\$ 0.92	\$ 1.04
2 nd Block	2.01	2.27
3 rd Block	3.53	3.99
4 th Block	4.69	5.30

BLOCK THRESHOLDS (gallons per month)

The threshold for the rate blocks vary with the size of the water meter as follows:

Meter Size (inches)	1st Block	2nd Block	3rd Block	4th Block
5/8"	5,000	5,001 - 15,000	15,001 - 40,000	> 40,000
1"	5,000	5,001 - 100,000	100,001 - 300,000	> 300,000
1-1/2"	5,000	5,001 - 400,000	400,001 - 1,000,000	> 1,000,000
2"	5,000	5,001 - 900,000	900,001 - 2,000,000	> 2,000,000
3"	5,000	5,001 - 2,000,000	2,000,001 - 5,000,000	> 5,000,000
4"	5,000	5,001 - 4,700,000	4,700,001 - 10,000,000	> 10,000,000
6"	5,000	5,001 - 10,000,000	10,000,001 - 25,000,000	> 25,000,000
8"	5,000	5,001 - 20,000,000	20,000,001 - 50,000,000	> 50,000,000
10"	5,000	5,001 - 40,000,000	40,000,001 - 100,000,000	>100,000,000
12"	5,000	5,001 - 60,000,000	60,000,001 - 150,000,000	>150,000,000

C. AGRICULTURAL USE RATES (per 1,000 gallons)

In addition to standby, power cost, and energy CIP charges, a consumption charge will be applied to all agricultural use customers as follows:

	Effective July 1, 2019	Effective January 1, 2021
1st Block	\$0.92	\$1.04
2nd Block	2.01	2.27
3rd Block	1.27	1.44

AGRICULTURAL BLOCK THRESHOLDS (gallons per month)

Meter Size	1st Block	2nd Block	3rd Block
All Sizes	5,000	5,001 - 15,000	>15,000

In order to qualify for agricultural rates, applicants shall file annually with the Department, a written application and furnish upon request, satisfactory proof (as determined by the Department), of engagement in agriculture, stock raising or dairy farming on a commercial basis, and that water used in addition to the above is limited to one dwelling. The Department reserves the right to limit or restrict water flow to agricultural users in the event of water shortage or in the event water service to domestic users is disrupted or lowered because of agricultural water use. Applicants shall install backflow preventers which shall be inspected and approved by the Department before water service is granted. Agricultural rates are not applicable to canneries, mills or markets or other establishments engaged in the conversion or treatment or packaging of agricultural products.

D. FIRE PROTECTION - MONTHLY STANDBY CHARGES*

For each connection of automatic fire sprinklers or other private fire protection, there shall be a standby charge per month, in addition to consumption, power cost, and energy CIP charges, based on the size of the connection as follows:

Size of Service (inches)	Effective July 1, 2019	Effective January 1, 2021
2"	\$ 18.00	\$ 20.34
3"	35.00	39.55
4"	48.00	54.24
6"	119.00	134.47
8"	181.00	204.53

E. FIRE LINE OR FIRE SERVICE METERS - MONTHLY STANDBY CHARGES*

For each connection of combined fire & domestic services, there shall be a standby charge per month, in addition to consumption, power cost, and energy CIP charges, based on the larger size of the connection as follows:

Size of Service (inches)	Effective July 1, 2019	Effective January 1, 2021
3"	\$ 207.00	\$ 233.91
4"	340.00	384.20
6"	675.00	762.75
8"	1,078.00	1,218.14
10"	1,551.00	1,752.63

F. SERVICE LATERAL INSTALLATION CHARGES

Installation charge for service lateral connection with a 5/8-inch meter:

County	Effective July 1, 2010		Effective January 1, 2021	
	Same Side	Cross Road	Same Side	Cross Road
Right-of-Way	\$ 3,000.00	\$ 4,000.00	\$ 3,000.00	\$ 6,000.00
State				
Right-of-Way	12,000.00	17,000.00	17,000.00	21,000.00

CONDITIONS:

- For special conditions such as concrete sidewalks, compaction tests, large cut or fill areas where additional work is required, additional charges, as determined by the Department, shall be added to the installation charges listed above.
- Deduct \$40 if no meter is required.

G. FACILITIES CHARGES

A facilities charge will be applicable to all new service connections based on the maximum size of the meter and type of service the service lateral can support or by the number of lots, dwelling units or equivalent units in the development, whichever cost is larger. The unit cost in determination of the facilities charges shall be \$6,095.00 for each additional lot, dwelling unit, or equivalent unit. The facilities charge is in addition to the service lateral installation charge. The schedule of facilities charges is as follows:

Meter Size (inches)	Effective July 1, 2010	Effective January 1, 2021
5/8" First Connection	\$ 1,190.00	\$ 1,319.00
Additional Connection	5,500.00	6,095.00
1" Each Connection	13,750.00	15,237.00
1-1/2" Each Connection	27,500.00	30,474.00
2" Each Connection	44,000.00	48,759.00
3" Each Connection	82,500.00	97,518.00
4" Each Connection	137,500.00	152,372.00
6" Each Connection	275,000.00	304,744.00
8" Each Connection	495,000.00	487,591.00
10" Each Connection	797,500.00	1,279,927.00
12" Each Connection	1,182,500.00	1,615,146.00

H. TEMPORARY SERVICE ON HYDRANT CHARGES

Each applicant for a temporary connection of a meter to a fire hydrant shall be charged an initial payment, to be set periodically by the Department, in addition to consumption, standby, power cost, and energy CIP charges. Service shall be limited to a period not longer than 180 calendar days. The Department reserves the right to deny any application or remove any temporary connection at any time.

I. STANDPIPE CHARGES

New customers obtaining water service from Department of Water Supply standpipe facilities shall be charged an initial payment and a proportional cost of the standpipe facility on a monthly basis. These charges are as follows and are in addition to consumption, standby, power cost, and energy CIP charges:

	Effective July 1, 2019	Effective January 1, 2021
Initial Payment		
Meter Size		
5/8"	\$ 183.00	\$ 206.79
1"	369.00	416.97
1-1/2"	460.00	519.80
2"	551.00	622.63
Amortized Installation Cost - Monthly		
Meter Size		
5/8"	\$ 10.00	\$ 11.30
1"	20.00	22.60
1-1/2"	25.00	28.25
2"	29.00	32.77

J. POWER COST CHARGES (per 1,000 gallons)

All water use shall be subject to the imposition of a Power Cost Charge in addition to consumption, standby, and energy CIP charges. The Department shall calculate the rate based on actual power costs and consumption every two months or for the period since the last revision to the power cost charge. Current and historic power cost charges are as follows:

Effective Date	Power Cost Charges
May 1, 2022	\$2.34
March 1, 2022	\$2.02
November 1, 2021	\$2.15
June 1, 2021	\$1.85

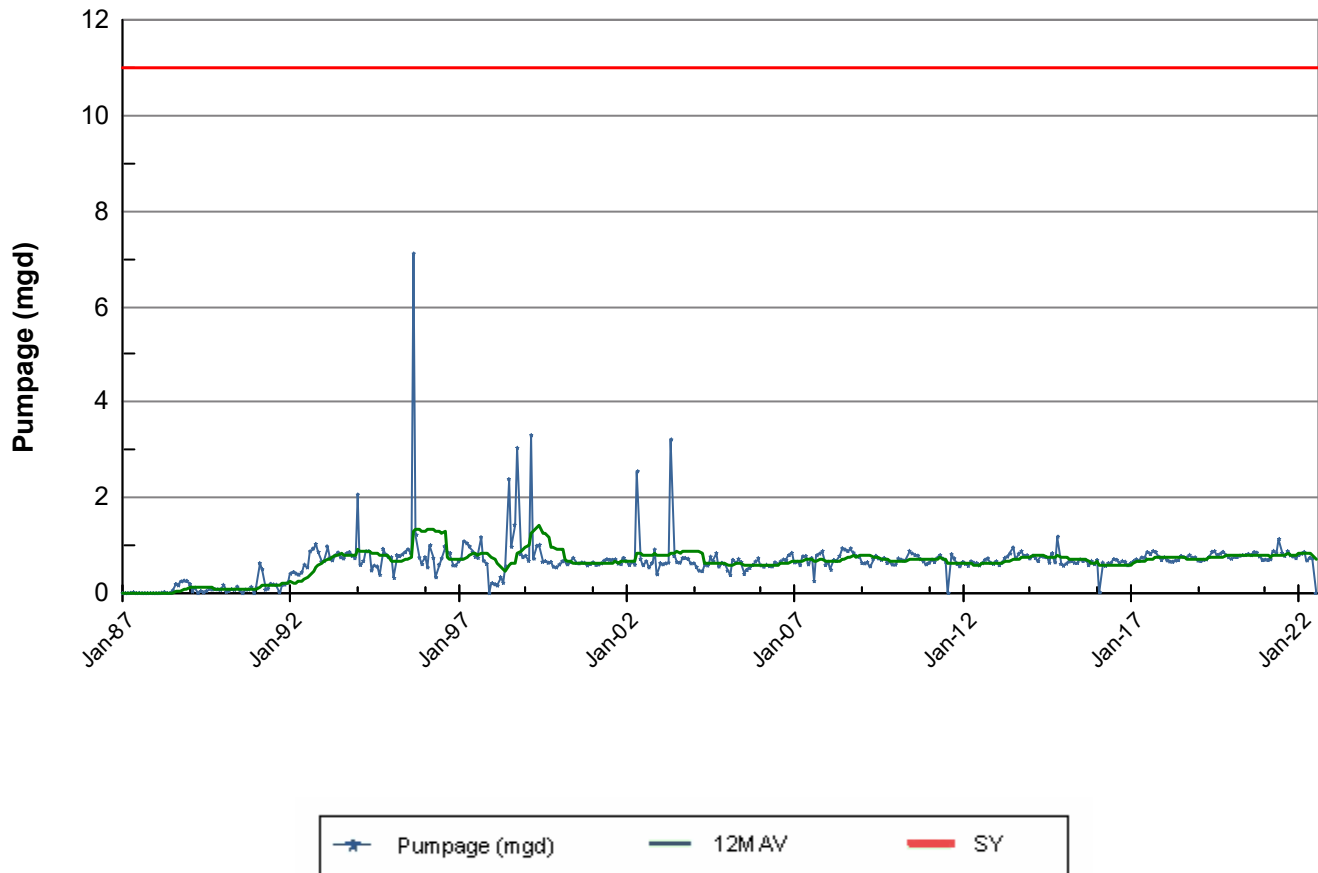
K. ENERGY CIP CHARGES (per 1,000 gallons)

All water use shall be subject to the imposition of an Energy CIP Charge in addition to consumption, standby, and power cost charges. The rate shall be adjusted annually in order to fund projects designed to improve the Department's energy efficiency. The current energy CIP charge is as follows:

Effective Date	Energy CIP Charge
July 1, 2016	\$0.05



Monthly Pumpage Chart 12 Month Moving Average



Report Parameters

Date:	01/01/1987 - 08/01/2022
Island:	Hawaii
Well Owner:	All
Well Reporter:	All
Well # Prefix:	All
Aquifer Sector:	All
Aquifer:	80101 Hawi
Water Quality:	Fresh (0-250 ppm), Brackish (251-16,999 ppm), Salt (greater than 17,000 ppm), Not Specified
Potable/Non-Potable:	17,000 ppm), Not Specified
TMK:	All
PWS:	All
Aquifer Type:	All
Pump Capacity:	Alluvial, Basal, Caprock, Dike, Perched, Not Specified
Well Use:	All

Month Year	Pumpage (Mgd)	12MAV (Mgd)	SY (Mgd)
July 2019	0.882	0.755	11.000
August 2019	0.795	0.758	11.000
September 2019	0.826	0.765	11.000
October 2019	0.865	0.770	11.000
November 2019	0.792	0.775	11.000
December 2019	0.755	0.775	11.000
January 2020	0.723	0.778	11.000
February 2020	0.760	0.786	11.000
March 2020	0.759	0.791	11.000
April 2020	0.785	0.797	11.000
May 2020	0.795	0.800	11.000
June 2020	0.798	0.795	11.000
July 2020	0.820	0.789	11.000
August 2020	0.795	0.789	11.000
September 2020	0.857	0.792	11.000
October 2020	0.849	0.791	11.000
November 2020	0.767	0.789	11.000
December 2020	0.693	0.783	11.000
January 2021	0.701	0.782	11.000
February 2021	0.693	0.776	11.000
March 2021	0.708	0.772	11.000
April 2021	0.887	0.780	11.000
May 2021	0.851	0.785	11.000
June 2021	1.134	0.813	11.000
July 2021	0.844	0.815	11.000
August 2021	0.783	0.814	11.000
September 2021	0.879	0.816	11.000
October 2021	0.793	0.811	11.000
November 2021	0.772	0.812	11.000
December 2021	0.733	0.815	11.000
January 2022	0.798	0.823	11.000
February 2022	0.828	0.834	11.000
March 2022	0.863	0.847	11.000
April 2022	0.686	0.830	11.000
May 2022	0.742	0.821	11.000
June 2022	0.731	0.788	11.000
July 2022	0.004	0.718	11.000
August 2022			11.000

WRIMS

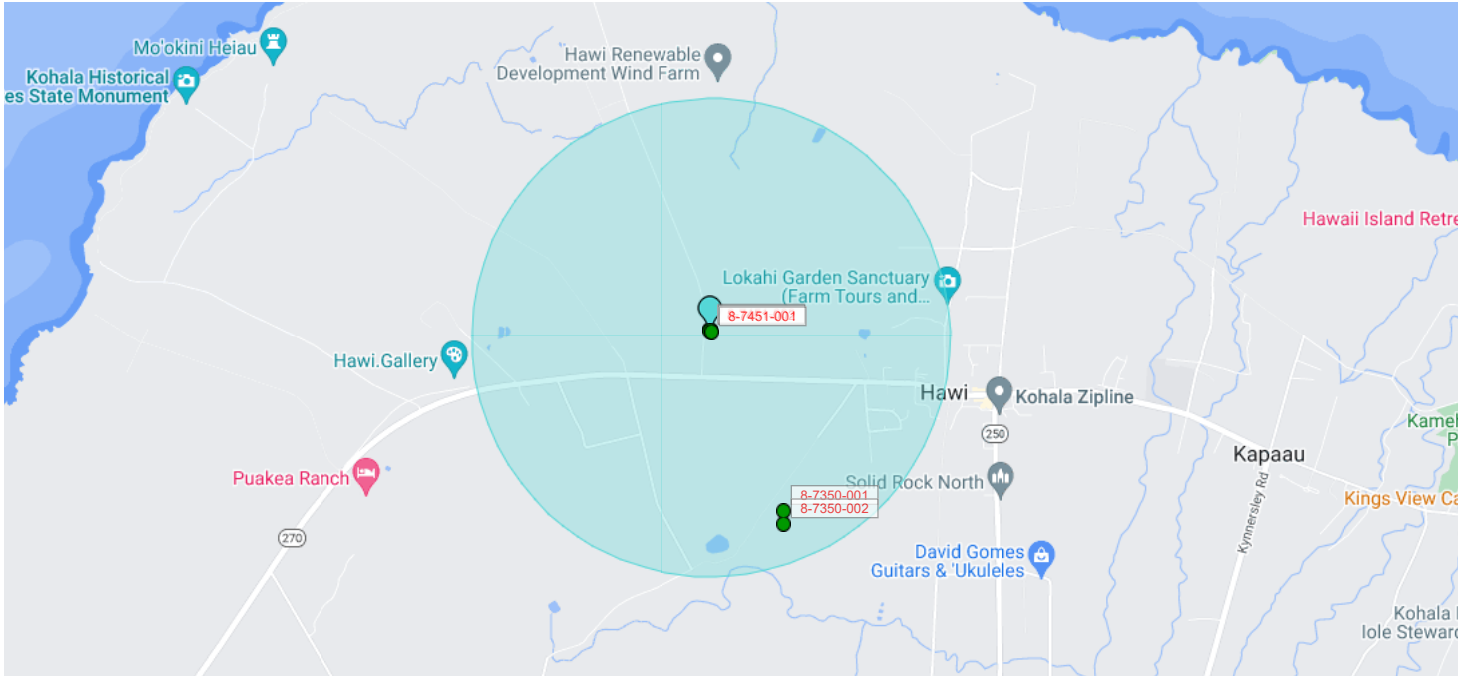
Water Resource Information Management System
 Commission on Water Resource Management, State of Hawaii

1-Mile Radius Tool

1. Move the blue pin or right click on the map to select a center position.
2. Click on "Go" button to find a well within the specified radius from the center position.

Latitude: Longitude: Radius: mile Include 12-MAV

5 wells found. [Download KML](#) | [Download Excel](#)



Map data ©2022 Google

5 matching results found.

Sort By:

Well Number	Aquifer System	Well Name	Well Owner/Operator	Water Use Reporter	Land Owner	TMK	Use	Year Drilled	Latest 12-MAV	Last Reported Date
8-7350-001	80101 Hawi	Kealahewa 1	Morrison Grove Capital Advisors		Yap Ranch Inc.	(3) 5-5-003:008	UNU	2006	0.000	8/31/202
8-7350-002	80101 Hawi	Kealahewa 2	Wendell Brooks Jr.	Bill Shontell (Surety Kohala Corporation)	Yap Ranch Inc.	(3) 5-5-003:008	MUNPR	2006	0.000	7/31/202
8-7451-001	80101 Hawi	Upolu Obs J-A	Pacific Islands Water Science Center, USGS, U.S. Geological Survey	Todd Presley (Pacific Islands Water Science Center, USGS, U.S. Geological Survey)	State of Hawaii	(3) 5-5-006:002	OBS	1989		
8-7451-002	80101 Hawi	Upolu Obs J-B	Pacific Islands Water Science Center, USGS, U.S. Geological Survey	Todd Presley (Pacific Islands Water Science Center, USGS, U.S. Geological Survey)	State of Hawaii	(3) 5-5-006:003	OBS	1989		
8-7451-003	80101 Hawi	Upolu Obs J-C	Pacific Islands Water Science Center, USGS, U.S. Geological Survey		State of Hawaii	(3) 5-5-006:002	ABNSLD	1989		

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**‘Upolu Well and Agricultural Water
Distribution System/Agricultural Park
Environmental Assessment**

APPENDIX 3

Archaeological Inventory Survey of TMK: (3) 5-5-006:002

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Archaeological Inventory Survey for the Development of the USGS Observation 'Upolu Well J-B (7451-02)

TMK: (3) 5-5-006:002 (por.)

'Opihipau Ahupua'a
North Kohala District
Island of Hawai'i

DRAFT VERSION



Prepared By:

Benjamin Barna, Ph.D.
and
Candace Gonzales, B.A.

Prepared For:

Akinaka & Associates, LTD.
1100 Alakea Street, Suite 1800
Honolulu, Hawai'i 96813

September 2022



Archaeology • History • Anthropology • Architectural History

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Honolulu Office: (808) 439-8089 Fax: (808) 439-8087
820 Mililani Street, Suite 700, Honolulu, HI 96813

ASM Project Number 40960.00

**An Archaeological Inventory Survey
for the Development of the USGS Observation
'Upolu Well J-B (7451-02)**

TMK: (3) 5-5-006:002 (por.)

'Opihipau Ahupua'a
North Kohala District
Island of Hawai'i



EXECUTIVE SUMMARY

At the request of Akinaka and Associates, LTD., on behalf of the Engineering Division of the Department of Land and Natural Resources (DLNR), ASM Affiliates conducted an archaeological inventory survey (AIS) of a 43.25-acre portion of Tax Map Key (TMK): (3) 5-5-006:002 (the “project area”) within ‘Opihipau Ahupua‘a, North Kohala District, Island of Hawai‘i. The AIS was conducted in support of the development of the U.S. Geological Survey (USGS) Observation ‘Upolu Well J-B (State Well ID 7451-02). The Engineering Division of the DLNR is cooperating with the Department of Agriculture (DoA) and other State agencies to develop the existing USGS Upolu Observation Well J-B and a 660,000-gallon above-ground reservoir to provide water for agricultural use. The proposed project necessitates review by the Department of Land and Natural Resources-State Historic Preservation Division (DLNR-SHPD) under Hawai‘i Revised Statutes (HRS) Chapter 6E-8. The current study was undertaken in accordance with Hawai‘i Administrative Rules (HAR) §13-275 and the *Rules Governing Standards for Archaeological Inventory Surveys and Reports* as contained in HAR §13-276.

Background research indicates that the project area was incorporated into the Hāwī Mill and Plantation Company’s sugarcane fields during the late nineteenth and early twentieth century. This information was used to inform the current fieldwork. Fieldwork for the current study was conducted on August 18, 2022, by Benjamin Barna, Ph.D. (Principal Investigator); Johnny Dudoit, B.A.; and Candace Gonzales, B.A. Unmanned aerial photography was conducted by Manuel Lopez, B.A.

As a result of the current study, features of one previously identified historic property, SIHP 50-10-02-31284 (Hō‘ea Mill Infrastructure), was identified in the current project area. The site, as previously recorded, consists of 33 features remnant elements of plantation infrastructure associated with the Hāwī Mill and Plantation Company and its successor, the Kohala Sugar Company. Within the current project area, six additional features of Site 31284 were identified. These include one reservoir (Feature AI), four ditch segments (Features AJ, AK, AL, AM, and AN), and one berm (Feature AN). All of these features were constructed during the twentieth century by the Hāwī Mill and Plantation Company.

Site 31284 was previously assessed to be significant under Criteria a and d as a result of the Barna and Kepa‘a (2022) AIS. The features identified during the current fieldwork retain sufficient integrity of all categories. Site 31284 remains assessed to be significant under Criterion a for its association with the development of the sugar industry in North Kohala and under Criterion d for the information yielded during the current study relative to sugar industry practices. Site 31284 has been adequately documented by the current study and no further historic preservation work is recommended.

The proposed project would develop the existing ‘USGS Observation ‘Upolu Well J-B (7451-02) and install a new above ground water tank near the southeast corner of the project area. There are no historic properties located at the proposed water tank site. While the existing ‘USGS Observation ‘Upolu Well J-B (7451-02) is located near the berm of Site 31284 Feature AI (the Hāwī Mill and Plantation Company’s Reservoir No. 4), the minor improvements and operation of the well pump will not cause adverse impacts to that feature. The potential future phases of the project, which could involve development of agricultural lots within the current project area, may result in impacts to the features of Site 31284 identified during the current study. These features, however, are considered significant only for the information yielded during the current study. Because they have been adequately documented, and no further historic preservation work is recommended, the recommended determination of effect for the proposed project is “no historic properties affected.”

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1. INTRODUCTION

At the request of Akinaka and Associates, LTD., on behalf of the Engineering Division of the Department of Land and Natural Resources (DLNR), ASM Affiliates conducted an archaeological inventory survey (AIS) of a 43.25-acre portion of Tax Map Key (TMK): (3) 5-5-006:002 (the “project area”) within ‘Opihipau Ahupua‘a, North Kohala District, Island of Hawai‘i (Figures 1, 2, and 3). The AIS was conducted in support of the development of the U.S. Geological Survey (USGS) Observation ‘Upolu Well J-B (State Well ID 7451-02). The Engineering Division of the DLNR is cooperating with the Department of Agriculture (DoA) and other State agencies to develop the existing USGS Upolu Observation Well J-B and a 660,000-gallon above-ground reservoir to provide water for agricultural use. The proposed project necessitates review by the Department of Land and Natural Resources-State Historic Preservation Division (DLNR-SHPD) under Hawai‘i Revised Statutes (HRS) Chapter 6E-8. The current study was undertaken in accordance with Hawai‘i Administrative Rules (HAR) §13-275 and the *Rules Governing Standards for Archaeological Inventory Surveys and Reports* as contained in HAR §13-276. This report contains information describing the proposed project and current project area, a background section that presents a culture-historical context and previous archaeological work in the vicinity of the current project area, and current survey expectations based on that research. This is followed by an explanation of the current study’s methods, a detailed description of the findings of the archaeological field survey, interpretation and significance evaluations of identified historic properties, treatment recommendations, and a recommended determination of effect for the proposed project.

THE PROPOSED PROJECT

The DLNR, in cooperation with the DoA and other State agencies, proposes to develop the existing USGS Upolu Observation Well J-B (State Well ID 7451-02) and convert it for use as an agricultural well supplying non-potable water for farming, dairying, and ranching uses. The well is located on State-owned land on a 44.5-acre parcel (TMK (3) 5-5-006:002) on Upolu Road, north of Akoni Pule Highway, in the North Kohala District of the Island of Hawai‘i. Based on the results of a recent pump testing, the plan is to run the pump 16 hours per day and supply 456,000 gallons per day. A 20-foot tall, 660,000-gallon above-ground reservoir would be built at the *mauka* end of the project area as shown in Figure 3. Transmission⁴. Water transmission lines would run from the new reservoir to the east and west boundaries of the property. The DoA or another State agency may choose to operate the system itself, or more likely, it may lease the water system to a private operator. Individual farmers or cooperatives would privately design and fund simple distribution facilities from the subject property to convey the water to areas of agricultural water demand. The full action under consideration by the DoA is currently envisioned as a program that involves in its first phase development of the well, storage and transmission facilities within the subject property and making this water available to existing farms in the area. The program also envisions potential future phases. If there is sufficient additional water after existing agricultural uses, and there is also demand for more land with available agricultural water, a part or all of the project area may be developed into an Agricultural Park, with lots for lease. To facilitate planning for this potential future action, the 43.25-acre portion of the 44.5-acre subject parcel that could be made available for these agricultural leases was also included in the current project area.

1. Introduction

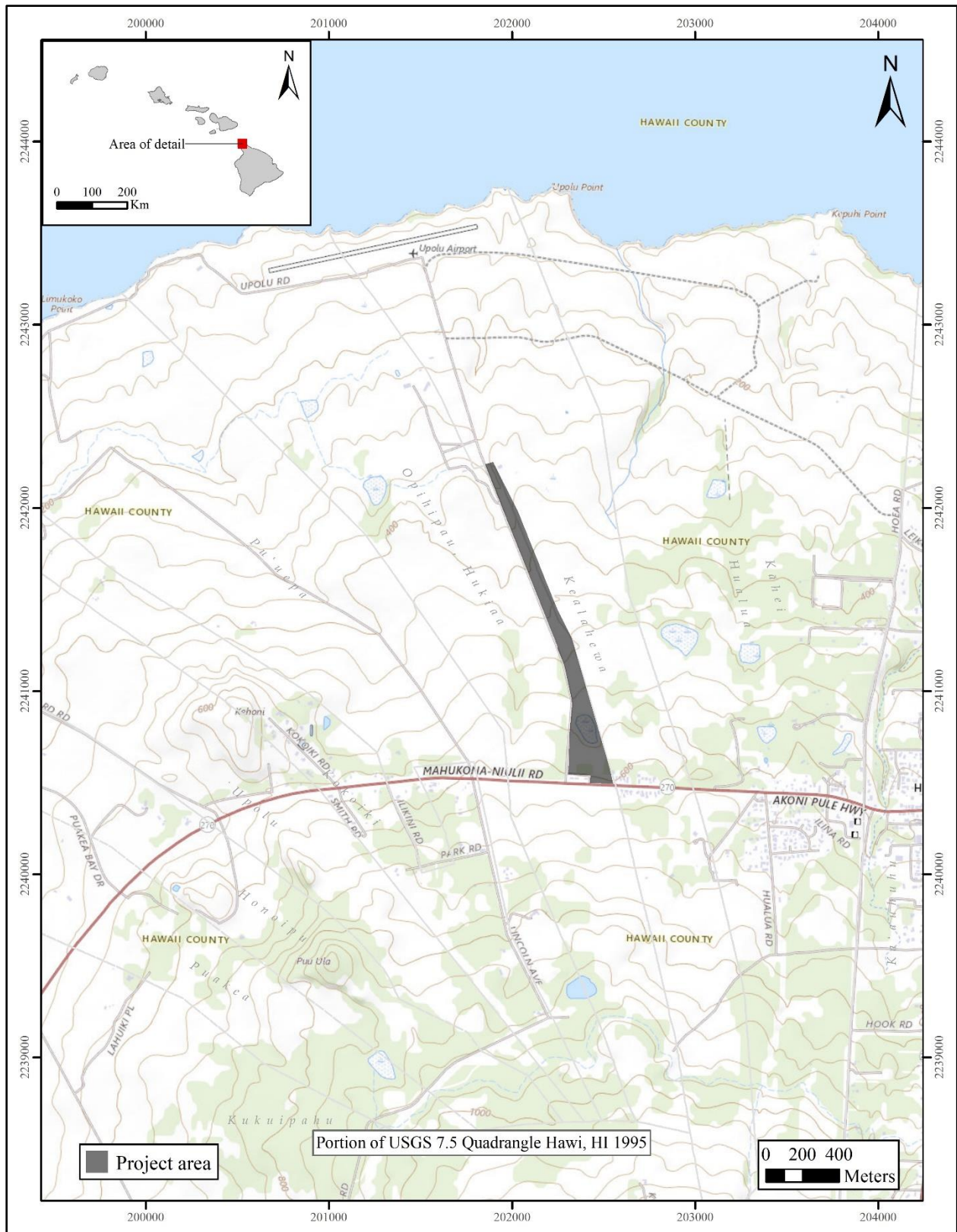


Figure 1. Project area location.

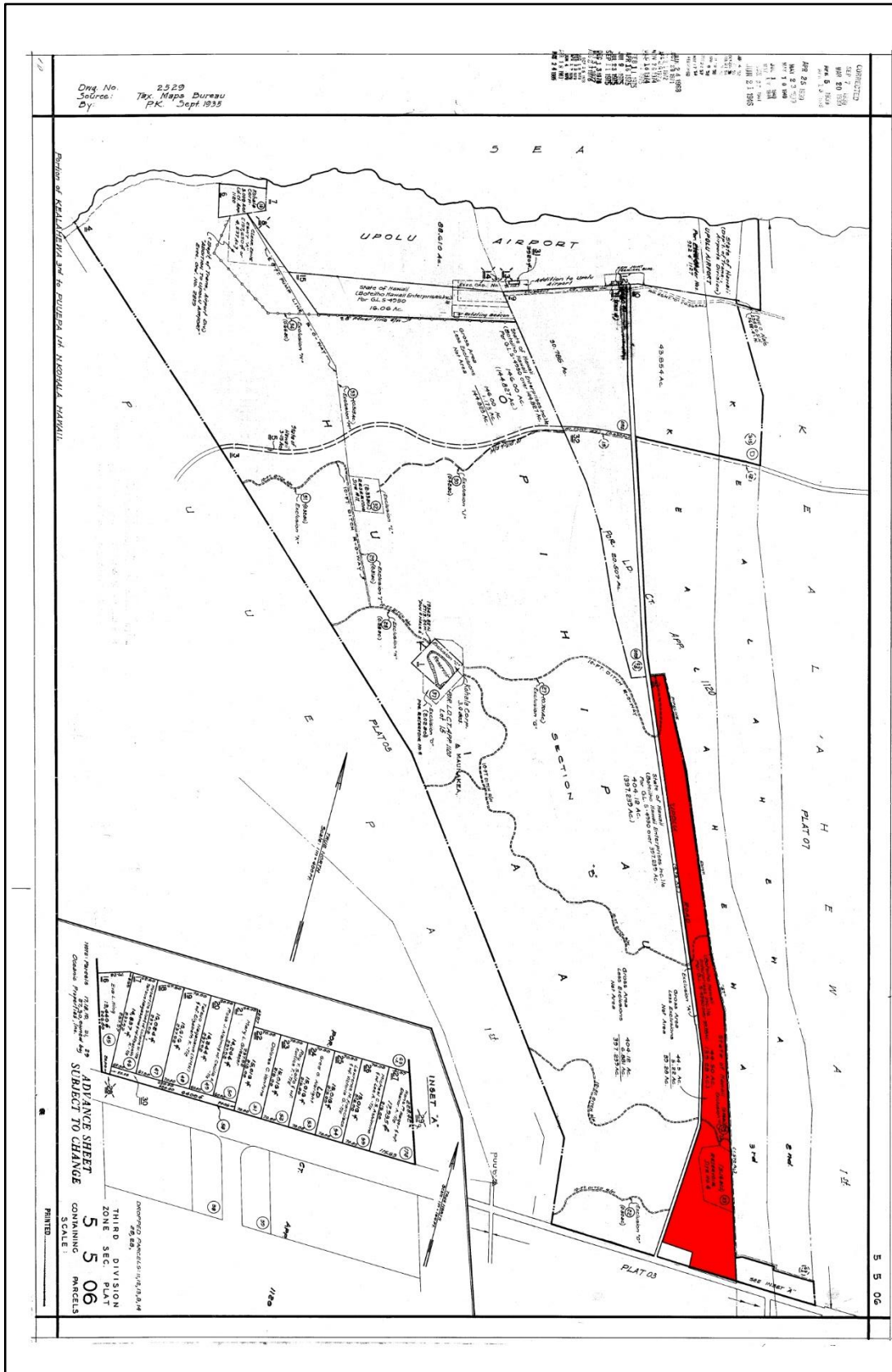


Figure 2. Tax Map Key plat (3) 5-5-006 with the project area (portion of parcel 002) indicated in red.

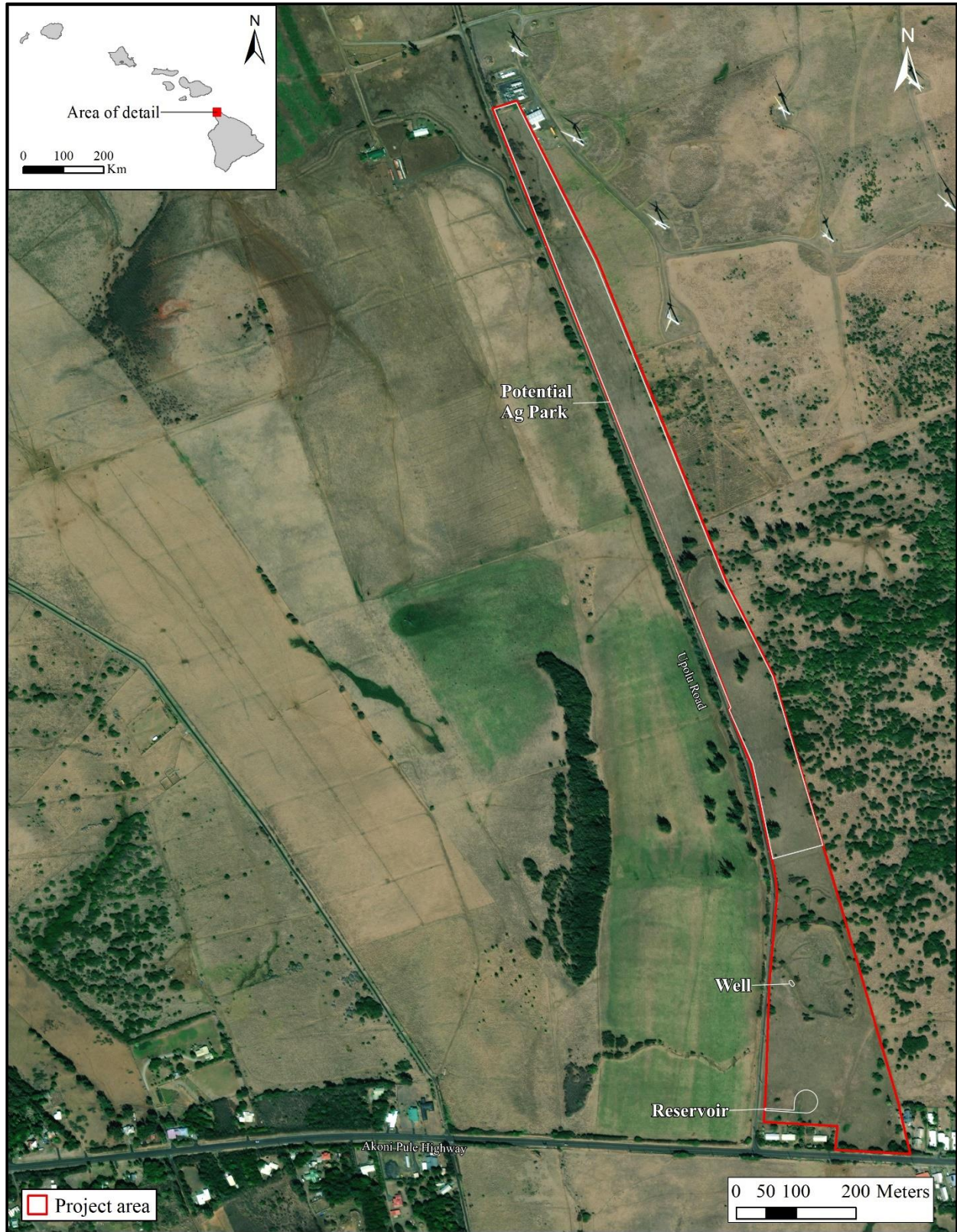


Figure 3. Recent aerial photograph showing the current project area and proposed development areas (Maxar-DigitalGlobe 2020).

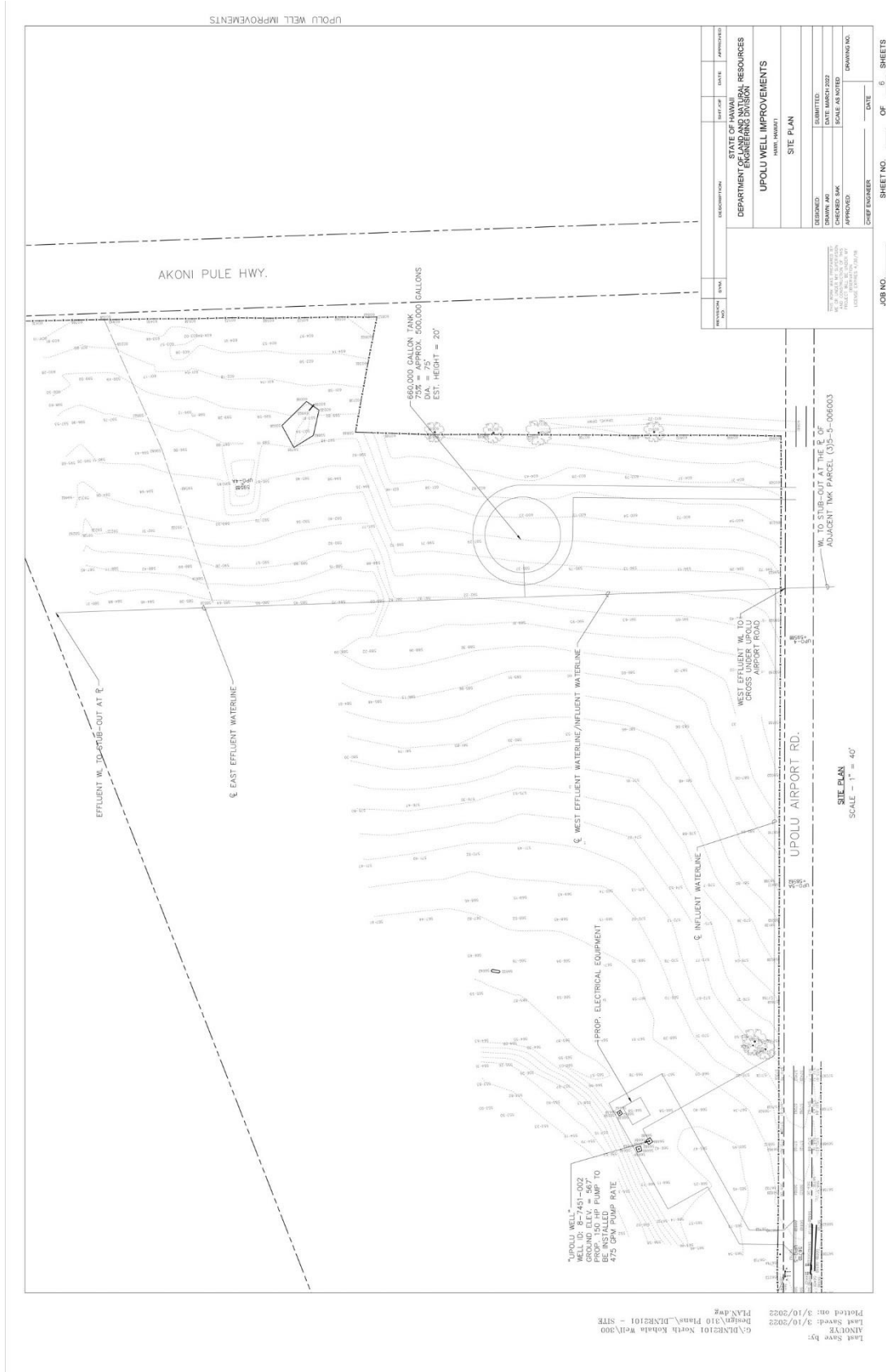


Figure 4. Well and above ground reservoir plans.

PROJECT AREA DESCRIPTION

The current project area (Figures 5 and 6) consists of the majority of a 44.5-acre agriculturally zoned parcel located on former sugarcane plantation land. It is located between 97 and 184 meters (320 and 605 feet) above mean sea level and 1.4 to 3.3 kilometers from the coast at ‘Upolu Point. The project area is bounded on the south by Akoni Pule Highway and on the west by ‘Upolu Road. The Hāwī Wind Farm facility borders the project area on its north and east sides. Also on the eastern boundary of the project area is former sugarcane land currently used for pasture. The project area excludes the developed residential lots located on Akoni Pule Highway at the southwest corner of the parcel.

The geology in this portion of the North Kohala District is generally blanketed in a combination of alkalic and tholeiitic basalt pāhoehoe lava flows mapped as Pololu Volcanics that originated from Kohala Volcano between 260,000 and 500,000 years ago during the Pleistocene epoch (labeled Qpl in Figure 7) (Lanphere and Frey 1987; Sherrod et al. 2021; Wolfe and Morris 1996). Soils are mapped as Kohala silty clay, primarily 3-12 percent slopes (labeled 416 in Figure 8), with small areas of the same soils on 0-3 percent slopes (labeled 435 in Figure 8) the southwest corner of the project area and on 12-20 percent slopes (labeled 436 in Figure 8) on an east-west trending knoll near the center of the project area. Kohala silty clays are deep, well drained soils that formed in material weathered from basic volcanic ash and residuum from basaltic lava. Topography in the project area is characterized by a gentle to moderate slope toward the north (*makai*) and west. The *mauka* end of the project area is relatively level, with the westerly slope becoming more pronounced as the parcel extends northward. Near the center of the parcel there is an east-west trending knoll that crosses the project area from the east.

There are no perennial or intermittent streams present within the project area. During the twentieth century, a basal aquifer beneath the project area was tapped by wells for both sugar plantation and domestic uses. The climate at this elevation in North Kohala is moderately cool, with a mean annual temperature of between 70° to 75° Fahrenheit throughout the year (Giambelluca et al. 2013). The lands in the vicinity of the project area receive a mean annual rainfall of approximately 1,234 millimeters (48 inches), with the highest rainfall occurring during the spring month of March, and the least amount of rainfall occurring during the autumn month of September. Strong trade winds often blow from east to west across this region, except when *kona* winds are blowing (typically during the summer months), and the wind pattern is reversed. The project area is primarily vegetated with grasses, reflecting their long-time use for low-intensity grazing. Occasional ironwood (*Casuarina equisetifolia*) trees grow on the knoll located near the center of the project area.

Past ground disturbance associated with sugarcane cultivation and post-sugar plantation activities is evident in project area. Near the new reservoir location, this includes mechanical ground clearance at the *mauka* end of the project area (Figure 9), which has flattened the ground surface and created a push pile (Figure 10) containing rubble from one or more buildings that once stood on the parcel. Immediately south of this is a dry reservoir (Figure 11) dating to the sugar plantation era. The USGS Upolu Observation Well J-B (Figure 12) is located southeast of the edge of the reservoir berm. The *makai* end of the project area includes a 2.7-acre paddock (Figure 13). In this paddock are a ditch and a berm extending roughly parallel to ‘Upolu Road.



Figure 5. Project area, view to the north.



Figure 6. Project area, view to the south.

I. Introduction

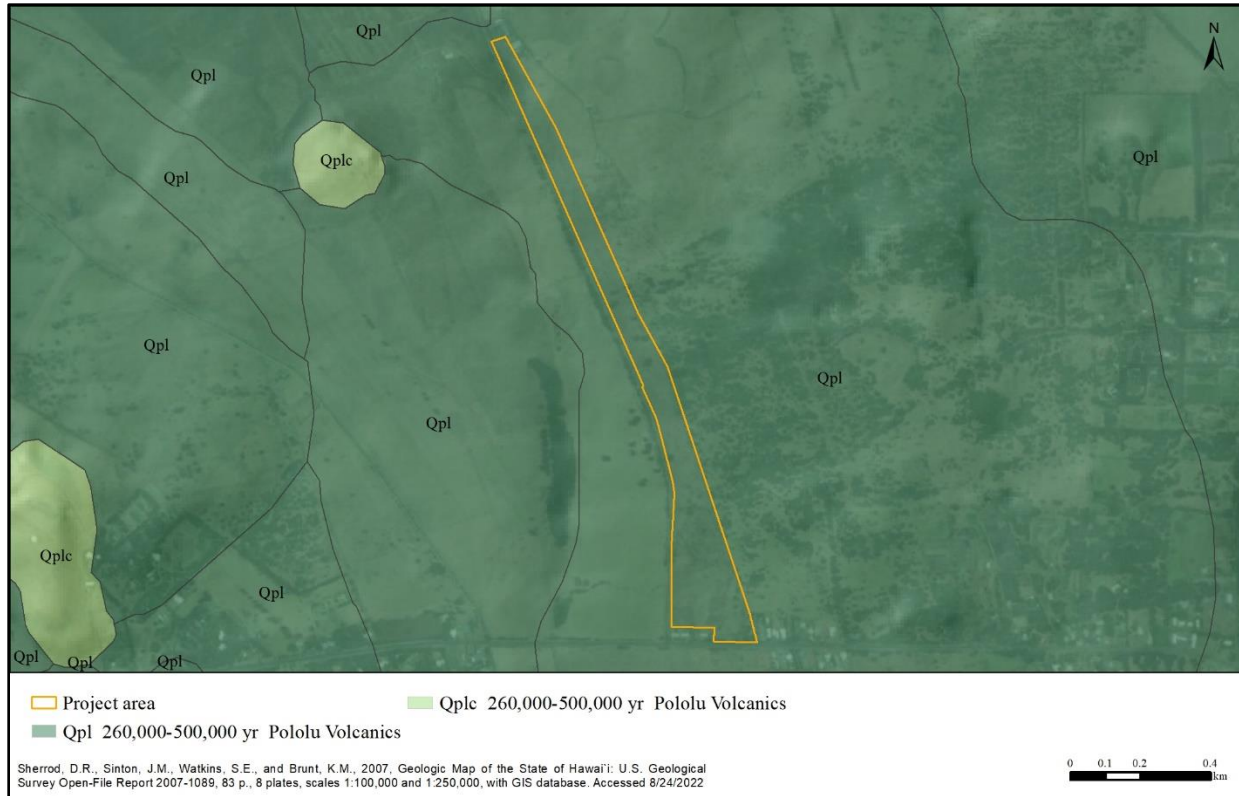


Figure 7. Geology underlying the current project area (Sherrod et al.).

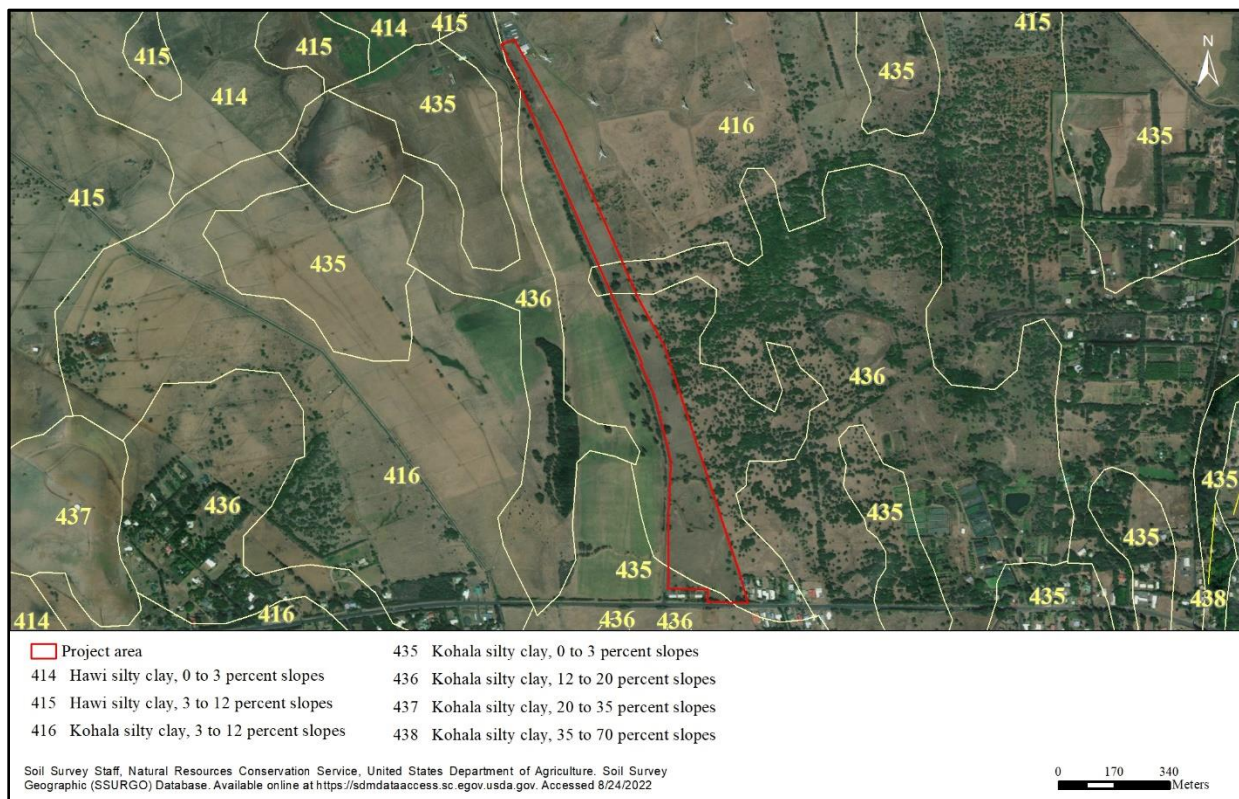


Figure 8. Soils mapped in the current project area vicinity (Soil Survey Staff).



Figure 9. Mechanically cleared ground at the *mauka* end of the project area, view to the southeast.



Figure 10. Push pile in southeast corner of project area, view to the east.



Figure 11. *Mauka* end of project area, view to the south.



Figure 12. USGS Upolu Observation Well J-B (State Well ID 7451-02), view to the east.



Figure 13. Paddock at *makai* end of project area, view to the northeast.

2. BACKGROUND

To generate a set of expectations regarding the nature of archaeological resources that might be encountered within the current project area, and to establish an environment within which to assess the significance of any such resources, a general culture-historical context for the North Kohala region that includes specific information regarding the known history of ‘Opihipau Ahupua‘a and the project area is presented. This is followed by a discussion of relevant prior archaeological studies conducted in the vicinity of the project area.

The culture-historical context and summary of previously conducted archaeological and cultural research presented below are based on research conducted by ASM Affiliates at various physical and digital repositories. Primary English language and Hawaiian language resources were found at multiple state agencies, including the State Historic Preservation Division, Hawai‘i State Archives, and the Department of Accounting and General Services Land Survey Division. Digital collections provided through the Office of Hawaiian Affairs Papakilo and Kīpuka databases, Waihona ‘Āina, the Ulukau Hawaiian Electronic Library, the Hawai‘i Genealogical Indexes, and Newspapers.com provided further historical context and information. Lastly, secondary resources stored at ASM Affiliates’ Hilo office offer general information regarding the history of land use, politics, and culture change in Hawai‘i, enhancing the broad sampling of primary source materials cited throughout this cultural impact assessment.

CULTURE-HISTORICAL CONTEXT

The chronological summary presented below begins with the peopling of the Hawaiian Islands and includes a presentation of a generalized model of Hawaiian Prehistory containing legendary references to and a discussion of the general settlement patterns for North Kohala. The discussion of prehistory is followed by a summary of historical events in the district that begins with the arrival of foreigners in the islands and then continues with the history of land use in Kohala in the vicinity of ‘Opihipau during the nineteenth and twentieth centuries. The summary includes a discussion of the changing lifeways and population decline during the early Historic Period, a review of land tenure in the study *ahupua‘a* during the *Māhele ‘Āina* of 1848, the use of the project area vicinity for commercial sugarcane cultivation, and the transition away from sugar during the last half of the twentieth century.

A Generalized Model of Hawaiian Prehistory

While the question of the timing of the first settlement of Hawai‘i by Polynesians remains unanswered, the current archaeological consensus derives from various sources of information (i.e., archaeological, genealogical, mythological, oral-historical, radiometric). With data from advances in palynology and radiocarbon dating techniques, Kirch (2011) and others (Athens et al. 2014; Wilmshurst et al. 2011) have argued that Polynesians arrived in the Hawaiian Islands, sometime between A.D. 1000 and A.D. 1200 and expanded rapidly thereafter. Other versions of the peopling of the islands, including various native Hawaiian traditions, place the event earlier in time—and as early as the creation of the world (e.g., Beckwith 1951; Liliuokalani 1978; Malo 1951). What is more widely accepted is the answer to the question of where Hawaiian populations came from and the transformations, they went through on their way to establishing a uniquely Hawaiian culture. The initial migration to Hawai‘i is believed to have occurred from Kahiki (the ancestral homelands of Hawaiian gods and people) with long-distance voyages occurring fairly regularly through at least the thirteenth century. It has been generally reported that the sources of the early Hawaiian populations originated from the southern Marquesas Islands (Emory in Tatar 1982). In these early times, Hawai‘i’s inhabitants were primarily engaged in subsistence-level agriculture and fishing (Handy et al. 1991). This was a period of widespread environmental modification when early Hawaiian farmers developed new subsistence strategies by adapting their familiar patterns and traditional tools to their new environment (Kirch 1985; Pogue 1978). According to Fornander (1969), the Hawaiians brought from their homeland certain Polynesian customs and belief: the major gods Kāne, Kū, Lono, and Kanaloa; the *kapu* system of law and order; and the concepts of *pu‘uhonua* (places of refuge), *‘aumakua* (ancestral deity), and *mana* (divine power).

As currently understood, the settlement of the islands involved a gradual shift in residential patterns from seasonal, temporary habitation to the permanent dispersed habitation of both coastal and upland areas. Following the initial settlement period, areas with the richest natural resources became populated and perhaps crowded, and the population began expanding to the Kona (leeward side) and more remote areas of the island (Cordy 2000). As the population grew, so did social stratification, which was accompanied by major socioeconomic changes and intensive land modification. Most of the ecologically favorable zones of the windward and coastal regions of all major islands were eventually settled, and the more marginal leeward areas were being developed. During this expansion period, additional migrations to Hawai‘i occurred from Tahiti in the Society Islands. Rosendahl (1972) has proposed that settlement at this time was related to the seasonal, recurrent occupation in which coastal sites were occupied in the summer to exploit marine resources, and upland sites focused on agriculture were occupied during the winter months. An increasing reliance on agricultural products may have caused a shift in social networks as well, which increasingly supported the exchange of upland agricultural products for marine resources. Hommon (1976) argues that kinship links among coastal settlements became less important than those with the *mauka-makai* (upland-coastal) settlements. This shift is believed to have resulted in the establishment of the *ahupua‘a* system sometime during the A.D. 1400s (Kirch 1985), which added another component to an already well-stratified society.

Handy et al. (1991:528) relate that “North Kohala, in old Hawaiian times, was the wet taro area, but was intensively cultivated in dry and forest taro, sweet potatoes, bananas, and cane, as well.” Dry taro was planted fairly continuously over all of the grassy *kula* lands of the district between Pololū and Hāwī. To prepare the ground, Hawaiian planters would first burn off the grass, then pull out the stubble, and allow it to rot before planting their starts. Upland forest plantations were also developed in the clearings of the North Kohala forest. Sugarcane was often planted near taro and sweet potato patches. Handy and Handy explain:

In dry-taro and sweet-potato fields on the sloping *kula* or in the lower forest zone, cane was planted as hedges along the lines of stone and rubbish thrown up between the fields. Thus it helped the planter to utilize to the maximum his soil and water, and acted as a windbreak against the gusty breezes which blow in most valley bottoms, along the coasts, and on the uplands where taro is grown (1991:186).

By the seventeenth century, large areas of Hawai‘i Island (*moku ‘aina* – districts) were controlled by a few powerful *ali‘i ‘ai moku*. There is island-wide evidence to suggest that growing conflicts between independent chiefdoms were resolved through warfare, culminating in a unified political structure at the district level. The legend of Kapunohu (set about A.D. 1600), relates that in North Kohala, the chiefs of Kukuipahu ruled the leeward *ahupua‘a* of the district, and the chiefs of Niuli‘i ruled the windward *ahupua‘a* of the district, and that Wainaiā Gulch was the boundary between the two domains (Erkelens and Athens 1994). In about A.D. 1600, the armies of the two polities met on the battlefield of Hinakahua at Kapa‘au (east of the present day town of Kapa‘au), and the forces of Kukuipahu were defeated, thus control of the district was united under the chiefs of Niuli‘i (Fornander 1916:215-220).

The late seventeenth to late eighteenth century was marked by both political intensification and stress. Wars occurred regularly between intra-island and inter-island polities, and this period was one of continual conquest by the reigning *ali'i*. The chiefs of Kona and Hilo competed for control of the island, but also waged war against the rulers of Maui and O'ahu (Kamakau 1992). It was sometime between A.D. 1736 and 1758 during this time of warfare, that Kamehameha was born. According to tradition related by Mo'okini Heiau guardian Oliver Lum, he was born on a canoe on its way from Maui and taken from the landing at Kapakai in the *ahupua'a* of Kokoiki (west of the current project area) to Mo'okini Heiau receive his birth rituals (Wizinowich 2019). Throughout the last decades before the arrival of Europeans to Hawai'i, it appears that the current project area and surrounding agricultural lands remained in agricultural use, as evidenced by the early historical accounts of the area.

Early Historical Accounts of Kohala (1823-1847)

One of the earliest written accounts of the northern tip of Kohala was made in 1793 by Archibald Menzies (1920:52), who wrote:

From north-west point of the island [‘Upolu Point], the country stretches back for a considerable distance with a very gradual ascent, and is destitute of trees or bushes of any kind. But it bears every appearance of industrious cultivation by the number of small fields into which it is laid out, and if we might judge by the vast number of houses we saw along the shore, it is by far the most populous part we had yet seen of the island.

This assessment was echoed by William Ellis (1825:215), who traveled along North Kohala from Pololū Valley by way of Hawala (“Halaua”), Kapa‘au (“Kapaau”), Awalua (“Owawara”), and Hihui to Kawaihae (“Towaihae”):

The soil was fertile, the vegetation abundant. The coast, as they approached the N.W. point of the island, was frequently broken by snug little bays, or inlets, which are invaluable to the inhabitants, on account of the facilities they afford for fishing. The tract they passed over to-day, seemed more populous than that through which they had travelled yesterday; but they found most of the villages destitute of inhabitants, except a few women, who had charge of some of the houses. On inquiry they learned, that, a short time ago, the people of Kohala had received orders from the king [Kamehameha] to provide a certain quantity of sandalwood, and that they were all absent in the mountains, cutting it. At noon they stopped at Kapaau, an inland village...passed the north point of the island shortly afterwards, and at 3 P.M. reached Owawarua, a considerable village on the north-west coast, inhabited mostly by fishermen.

From these and other early accounts, Tomonari-Tuggle (1988) developed a model of settlement and cultivation in northern Kohala that, like many other parts of Hawai'i Island, involved coastal settlements oriented around fishing with agricultural lands, primarily non-irrigated, developed inland according to rainfall, temperature, and the availability of sunlight (Figure 14). In this model, a coastal settlement near the ‘Upolu Airport in ‘Opihipau would be expected, with non-irrigated fields extending *mauka* from the coast to the forest. The current project area is located in the modeled area containing non-irrigated fields.

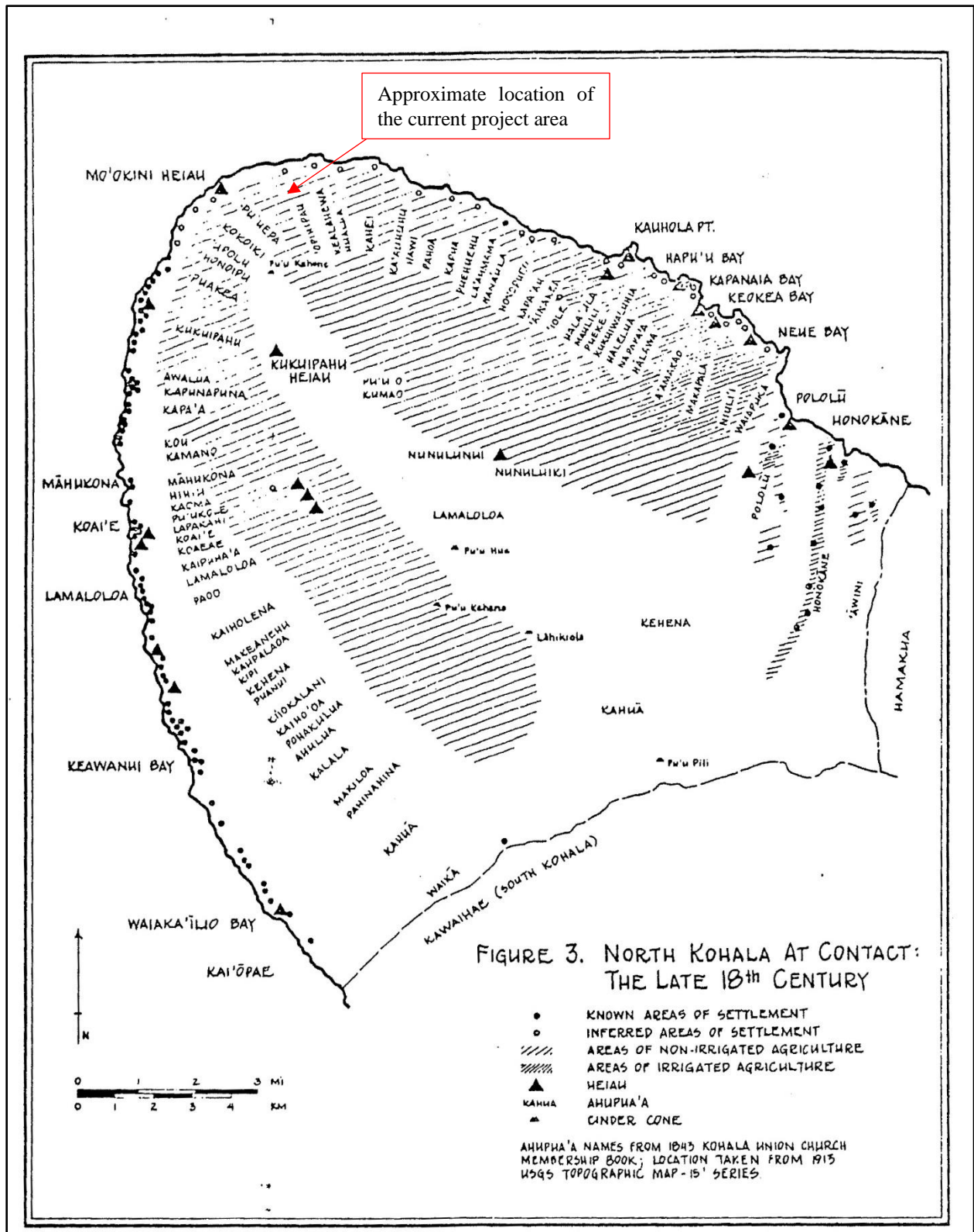


Figure 14. Settlement patterns in North Kohala in the late 18th century (Tomonari-Tuggle 1988:18).

The Legacy of the *Māhele* ‘*Āina* of 1848

By the mid-nineteenth century, the Hawaiian Kingdom was an established center of commerce and trade in the Pacific, recognized internationally by the United States and other nations in the Pacific and Europe (Sai 2011). As Hawaiian political elites sought ways to modernize the burgeoning Kingdom, and as more Westerners settled in the Hawaiian Islands, major socioeconomic and political changes took place, including the formal adoption of a Hawaiian constitution by 1840, the change in governance from an absolute monarchy to a constitutional monarchy, and the shift towards a Euro-American model of private land ownership. This change in land governance was partially informed by ex-missionaries and Euro-American businessmen in the islands who were generally hesitant to enter business deals on leasehold lands that could be revoked from them at any time. *Mōʻī* (Ruler) Kamehameha III, through intense deliberations with his high-ranking chiefs and political advisors, separated and defined the ownership of all lands in the Kingdom (King n.d.). They decided that three classes of people each had one-third vested rights to the lands of Hawai‘i: the *Mōʻī*, the *aliʻi* and *konohiki*, and the native tenants (*hoaʻāina*). In 1846, King Kamehameha III formed the Board of Commissioners to Quiet Land Titles (more commonly known as the Land Commission) to adopt guiding principles and procedures for dividing the lands, grant land titles, and act as a court of record to investigate and ultimately award or reject all claims brought before them (Bailey in Commissioner of Public Lands 1929). All land claims, whether by chiefs for an entire *ahupuaʻa* or *ʻili kūpono* (nearly independent *ʻili* land division within an *ahupuaʻa*, that paid tribute to the ruling chief and not to the chief of the *ahupuaʻa*), or by *hoaʻāina* for their house lots and gardens, had to be filed with the Land Commission within two years of the effective date of the Act (February 14, 1846) to be considered. This deadline was extended several times for chiefs and *konohiki*, but not for native tenants (Soehren 2005).

The King and some 245 chiefs spent nearly two years trying unsuccessfully to divide all the lands of Hawai‘i amongst themselves before the whole matter was referred to the Privy Council on December 18, 1847 (King n.d.; Kuykendall 1938). Once Kamehameha III and his chiefs accepted the principles of the Privy Council, the *Māhele* ‘*Āina* (Land Division) was completed in just forty days (on March 7, 1848). The names of nearly all of the *ahupuaʻa* and *ʻili kūpono* of the Hawaiian Islands, as well as the names of the chiefs who claimed them, were recorded in the *Buke Māhele* (*Māhele* Book) (Buke Māhele 1848; Soehren 2005). As this process unfolded, King Kamehameha III, who received roughly one-third of the lands of Hawai‘i, realized the importance of setting aside public lands that could be sold to raise money for the government and also purchased for fee simple title by his subjects. Accordingly, the day after the division when the name of the last chief was recorded in the *Buke Māhele*, the King commuted about two-thirds of the lands awarded to him to the government (King n.d.). Unlike Kamehameha III, the chiefs and *konohiki* were required to present their claims to the Land Commission to receive their Land Commission Awards (LCAw.). The chiefs who participated in the *Māhele* were also required to provide to the government commutations of a portion of their lands in order to receive a Royal Patent giving them title to their remaining lands. The lands surrendered to the government by the King and chiefs became known as “Government Land.” The lands personally retained by the King became known as “Crown Land.” Lastly, the lands received by the chiefs became known as “Konohiki Land” (Chinen 1958:vii; 1961:13). To expedite the work of the Land Commission, all lands awarded during the *Māhele* were identified by name only, with the understanding that the ancient boundaries would prevail until the lands could be formally surveyed. During this process, the *ʻOpihipau ahupuaʻa* ultimately became Government land, being returned by Victoria Kāmāmalu in 1850 (Soehren 2005).

As the *Mōʻī* and *aliʻi* made claims to large tracts of land during the *Māhele*, questions arose regarding the protection of rights for the native tenants. To address this matter, on August 6, 1850, the *Kuleana* Act or Enabling Act was passed, allowing native tenants to claim a fee simple title to any portion of lands which they physically occupied, actively cultivated, or had improved (Garovoy 2005). Additionally, the *Kuleana* Act clarified rights to gather natural resources, as well as access rights to *kuleana* parcels, which were typically landlocked. Lands awarded through the *Kuleana* Act were and still are, referred to as *kuleana* awards or *kuleana* lands. The Land Commission oversaw the program and administered the *kuleana* as Land Commission Awards (Chinen 1958). Native tenants wishing to claim land were required to register their claim in writing (either in the Hawaiian or English language) by submitting a register to the Land Commission who assigned the claimant a number, and that number was used to track the claimant through the entire claims process. Subsequently, the claimant had to get supporting testimony from two individuals (typically neighbors) to confirm their claim to the land. The document generated as part of this process was known as a Native or Foreign Testimony depending upon the language used by the claimant. Upon successful submittal of the required documents, the Land Commission rendered their decision, and if successful, the tenant was issued the LCAw. A total of 13,514 *kuleana* were claimed by native tenants throughout the islands, of which 9,337 were awarded (Maly 2000). No *kuleana* were claimed or awarded within *ʻOpihipau Ahupuaʻa* (AVA-Konohiki 2015; Office of Hawaiian Affairs 2018; Waihona 2018).

Royal Patent Land Grants

In conjunction with the *Māhele*, the King also authorized the issuance of Royal Patent Grants to applicants for tracts of land, larger than those generally available through the Land Commission. The process for applications was clarified by the “Enabling Act,” which was ratified on August 6, 1850. The Act resolved that portions of the Government Lands established during the *Māhele* of 1848 should be set aside and sold as grants ranging in size from one to fifty acres at a cost of fifty cents per acre. Despite the stated goal of the land grant program, this provided the mechanism that allowed many foreigners to acquire large tracts of the Government Lands. Unlike in the *kuleana* claims, where claimants stated their use of the land, the grant records are silent regarding the grantees’ intended use. The Royal Patent deeds and survey notes do contain some limited information about geographical features of the grant lands, and describe boundary markers, such as rock piles and vegetation, but they generally do not say anything about improvements to the land or land use. While the specific land use practiced during the mid-1800s on many grant parcels is not known, it is likely that many of the grantees in the vicinity of the project area used their newly acquired lands for homesteading, agricultural, or even ranching purposes. In ‘Opihipau, no land grants were not sold. Two grants were sold during the twentieth century in the adjacent *ahupua‘a* of Hukia‘a for parcels associated with John Hind and the Hāwī Mill and Plantation Company (see Table 1) (Kohala Sugar Company 1935).

Table 1. Grant parcels purchased within the vicinity of the ‘Opihipau *ahupua‘a*.

<i>Grant No.</i>	<i>Grantee</i>	<i>Ahupua‘a</i>	<i>Year</i>	<i>Acreage</i>
7693	John Hind	Hukia‘a	1920	3.09
6268	Hāwī Mill and Plantation Co.	Hukia‘a	1932	3.0

Boundary Commission Testimony (1862-1876) In 1862, the Commission of Boundaries (Boundary Commission) was established in the Hawaiian Kingdom to legally set the boundaries of all the *ahupua‘a* that had been awarded as a part of the *Māhele*. Subsequently, in 1874, the Commissioners of Boundaries were authorized to certify the boundaries for lands brought before them. The primary informants for the boundary descriptions were old native residents of the lands, many of which had also been claimants for *kuleana* during the *Māhele*. This information was collected primarily between 1873 and 1885 and was usually given in Hawaiian and transcribed in English. Although hearings for most *ahupua‘a* boundaries were brought before the Boundary Commission and later surveyed by Government employed surveyors, in some instances, the boundaries were established through a combination of other methods. In some cases, *ahupua‘a* boundaries were established by conducting surveys on adjacent *ahupua‘a*. In cases where the entire *ahupua‘a* was divided and awarded as Land Claim Awards and or Government issued Land Grants (both which required formal surveys), the Boundary Commission relied on those surveys to establish the boundaries for that *ahupua‘a*. Although these surveys aided in establishing the boundaries, they lack the detailed knowledge of the land that is found in the Boundary Commission hearings. As Government lands, no Boundary Commission testimony was taken for ‘Opihipau *Ahupua‘a*, however the boundaries of the neighboring *ahupua‘a* of Kealahewa 3rd were recorded (Boundary Commission 1874). The testimony provided by Kanehalau mentions *lauhala* trees and piles of stones marking the boundary between Kealahewa 3rd and ‘Opihipau, but the location of these features relative to the current project area cannot be discerned.

Sugar Plantation History (1873 to 1975)

The current project area was integrated into Hawai‘i’s sugar industry as part of the Hāwī Mill and Plantation Company started by the English born Robert Hind in 1881. Details about the early decades of the sugar industry in Kohala and Hind’s involvement in it are known from a short manuscript (Hind n.d.) written by Robert Hind’s son, John Hind, in about 1900. As it is told by his son, in 1872 and 1873, Robert Hind decided to invest in the booming sugar industry and move his family from Maui to North Kohala after visiting his friend George C. Williams. William was the manager of the Kohala Sugar Company, which had had been formed by the Reverend Elias Bond in 1862 as a means of creating employment for Kohala residents (see also Damon 1927). Hind had recently completed a milling contract with Alexander and Baldwin on Maui and was interested in finding a promising new location to start his own company. At that time only two sugar mills were operating in the district, the Kohala Sugar Company’s mill at Hala‘ula, and a much cruder operation at Hālawa. In 1873 the sugar industry was still in its infancy in North Kohala, and most of the infrastructure that it would come to rely on had not yet been built.

Travel through the district during the early 1870s was mostly by foot, supplemented to a limited extent by horseback riding. Kohala at this time, with the exception of a few short stretches around the Kohala Sugar Company,

“had no roads worthy of a name,” and what roads Kohala possessed “were narrow uneven and rough” (Hind n.d.:20-21). Gulches were crossed by the most direct route, descending and ascending the steeply sloped sides, which were in some places so steep that, when riding horseback, one would have “to dismount and lead the horse, rather than risk the chances of a mis-step” (Hind n.d.:21). During his first days in Kohala, Hind toured the district on horseback looking for a suitable location to build a plantation, and had a vast area from which to choose:

The Kohala Sugar co.’s area extended from the sea on the north to the forest line (an elevation of about 1600 ft.) on the south, and from Halawa gulch on the east to Kapauu on the west.

With the exception of a few patches of cane on upper Halawa, it was all open grass land from the Kohala Sugar Co.’s east boundary to Pololu gulch, and west from the company’s west boundary at Kapa’au was also entirely open country, grass lands for a matter of five to six miles. (Hind n.d.:12)

Robert Hind eventually “secured [leased] a large tract of land at and near Puehuehu” (Hind n.d.:39) to the west of Kohala Sugar Company’s lands, on which he began his plantation. By the end of 1873, Hind “entered into agreements for the planting cane with Mr. Dan Vida of Waikapu, Maui, Judge C. F. Hart of Kona, Hawaii, Mr. George F. Holmes, of Kahuā, and Mr. James Woods of Puuhue”, and, “shortly after, these gentlemen were on the ground, land was being plowed, and in due time cane was planted and plans laid for the erection of the sugar factory” (Hind n.d.:39-40). The plowing in those days was done by a team of six pair of oxen dragging a plow slowly back and forth across a field, with the drivers frantically racing up and down the line trying to keep the team moving. While this initial field preparation was difficult, “the real problem was furrowing for planting,” for “this operation special men were selected; otherwise the furrows would be inclined to assume the lines of a dog’s hind leg” (Hind n.d.:37).

The building materials for Hinds’ mill arrived by inter-island schooner and were landed by raft at Honoipu Harbor. The materials were then floated ashore, hoisted up the 100-foot-high cliff, and dragged by oxen 6½ miles to the mill site. Some of the machinery, such as the boilers, required twelve yoke of oxen to navigate the heavy loads up and down the steep grades (Hind n.d.). The mill, which Hind called the Union Mill, was erected near the boundary between Laaumama and Puehuehu Ahupua’a, *makai* of the Government Road and to the east of the current project area. The Union Mill, however, “had its share of misfortunes” (Hind n.d.:72). When it was nearly completed, just months prior to the harvest of the first crop of cane in 1874, a fire broke out that completely destroyed the entire factory. Fortunately for the Hind’s, the insurance was in order and more materials were quickly ordered, and a new mill (Figure 30) was built just in time to process the first sugar crop. The capacity of the mill was six tons per day of twelve hours, an amount that was frequently exceeded by adding night work (Hind n.d.). The following year, the sugar crop came in better than expected, but before it was milled, the Union Mill factory was once again destroyed by fire. Shortly thereafter, Robert Hind, who by this time had entered into agreements to build a mill at Hāwī, sold the Union mill to James Renton and a group that included Daniel Vida, Theo H. Davies & Co., and the brothers Clement (Cecil) and Ralph Sneyd Kynnersley (Schweitzer 2003). Renton quickly rebuilt the mill, and “fortunately the weather had been favorable, and the loss by delay [from the fire] was not as serious as it otherwise would have been” (Hind n.d.:74).

After the sale of the Union Mill and Plantation Company, Robert Hind focused on building his new Hāwī Mill to the west of his former plantation lands. This mill, which was built to minimize fire damage, had corrugated galvanized iron for its roof and sides and was ready for operation by the time the 1876-1877 crop matured (Hind n.d.). By this time, six sugar mills were operating in North Kohala: Kohala Mill, Union Mill, Hāwī Mill, Star Mill, Hālawa Mill, and Niuli’i Mill. Hind’s plantation had 32 employees in 1880. By 1889 the plantation was taken over by W. G. Irwin & Co. to cover its debts (Dorrance and Morgan 2000). At this time Robert Hind, who wished to purchase certain lands in Hāwī from W. G. Irwin & Co. at the expiration of his lease, made a deal to also purchase the Star Mill Company lands, which were then jointly managed by the Hāwī and Union Mill companies (Hind n.d.).

Prior to the 1880s, the sugar companies hauled their product by oxcart to landings at Hāpu’u, Kauhola Point, and Honoipu (Tomonari-Tuggle 1988). In July of 1880, however, Samuel G. Wilder, the Minister of the Interior in the King’s cabinet, was granted a charter of incorporation for the Hawaiian Railway Company, and he commenced building a railroad to connect the various mills with the best harbor in the district at Māhukona. By 1883, the railroad had reached its full twenty-mile length, ultimately crossing seventeen trestles and extending from Māhukona to Niuli’i (Tomonari-Tuggle 1988). The railway line was built to avoid costs of cuts, fills, and bridges – following the contours of the land. It therefore contained many curves, as it was necessary to follow the numerous gulch edges to a point where it could cross by means of a low trestle, and was consequently much longer than the road to Māhukona (Hind n.d.). All but one of the Kohala sugar companies began shipping their processed sugar to the newly improved Māhukona Harbor facility; the lone exception was Hind’s Hāwī Mill and Plantation Company and its two sugar growing subsidiaries, Puakea and Homestead Plantations. The Hāwī plantation, for economic reasons, continued shipping its sugar from Honoipu Landing until ca. 1912 (Tomonari-Tuggle 1988).

2. Background

In 1901, the Hāwī Mill and Plantation Company decided to construct a new mill at Hō‘ea to replace the Hāwī Mill, which could not handle the plantation’s increased production (Hannah 1938). Construction of the mill began in 1903, and the first cane was ground in July of 1904 (Honolulu Evening Bulletin 1905). A camp was also established at the mill. A map prepared in 1905 (Figure 15) depicts details of Hō‘ea Mill and the associated camp during this early period. However these structures are located north of the current project area, none of which fall within the current project area; including the several other related buildings surrounding the mill that are known to have included storage buildings, a sugar warehouse, cooling tanks, and a pump house. The majority of the current project area appears to be in undeveloped pasture with the only feature on the map depicted being the “Main Gov’t Road” along the southern border. Additionally, water sources were developed by drilling wells at Hō‘ea, Waikāne (immediately west of what is now the ‘Upolu Airport), and at the Kohala Mill to the east in Hala‘ula (Bowles et al. 1974).

The mill and camp evolved with the plantation operations over the next two decades, adding or upgrading crystallizers, machinery sheds, carpenter and machine shops, a social hall, company store, and dwellings (Sanborn Map Company 1919:18). A hydroelectric power plant was added to the plantation in 1910, which fed power to Hō‘ea Mill (The Hawaiian Star 1910). In an aerial photograph taken in 1925 (Figure 16), a reservoir is visible in the *mauka* portion of the project area. This is the plantation’s Reservoir No. 4 (Bowles et al. 1974). The cultivated sugarcane fields within and surrounding the project area can be seen, along with the ‘Upolu Point Road.

In 1930, the Hāwī Mill and Plantation Company was acquired by Castle & Cooke, which formed the Hāwī Sugar Company to continue operating the plantation and mill as a subsidiary (Case 1930a). Then, in December of that same year, the Hāwī Sugar Company merged with Kohala Sugar Company (Case 1930b). The Kohala Sugar Company was the oldest sugar plantation in Kohala, having been founded by the Reverend Elias Bond in 1863. Land Court Application 1,120 was made by Kohala Sugar Company when it consolidated its land holdings, and a map (Figure 17) made to accompany the land court application depicts some features of the plantation as they existed in 1935. This map, focused on parcel boundaries, shows the Main Government Road and ‘Upolu Point Road. The plantation’s Camp 17 can be seen just to the east of the project area along the government road.

‘Upolu Airport, located north of the project area, was originally part of the ‘Upolu Point Military Reservation, also referred to as ‘Upolu Landing Field or ‘Upolu Airplane Landing field flights (Rechtman and Orr 1998). It was utilized as a landing field by the United States Air Service beginning in 1927 on lands that were appropriated from the Territory of Hawai‘i. In 1930, the War Department allowed for the Territory of Hawai‘i to also use the Army landing field for a term of five years; several months later majority of these lands were restored to the Territory of Hawai‘i with 95-acres being reserved for the ‘Upolu Airport which would be under jurisdiction of the Territory of Hawai‘i. Between 1944 and 1947, the Territory of Hawai‘i had granted the United States military exclusive use of the airport. The United States government continued to occupy the reserve until 1952 at which point all lands were returned to the Territory of Hawai‘i. Currently, the airport is rarely used for training exercises by the United States Hawaii Air National Guard and no longer used for commercial.



Figure 16. Detail of a 1925 aerial photograph of Hō'ea Mill (USAAF 1925).

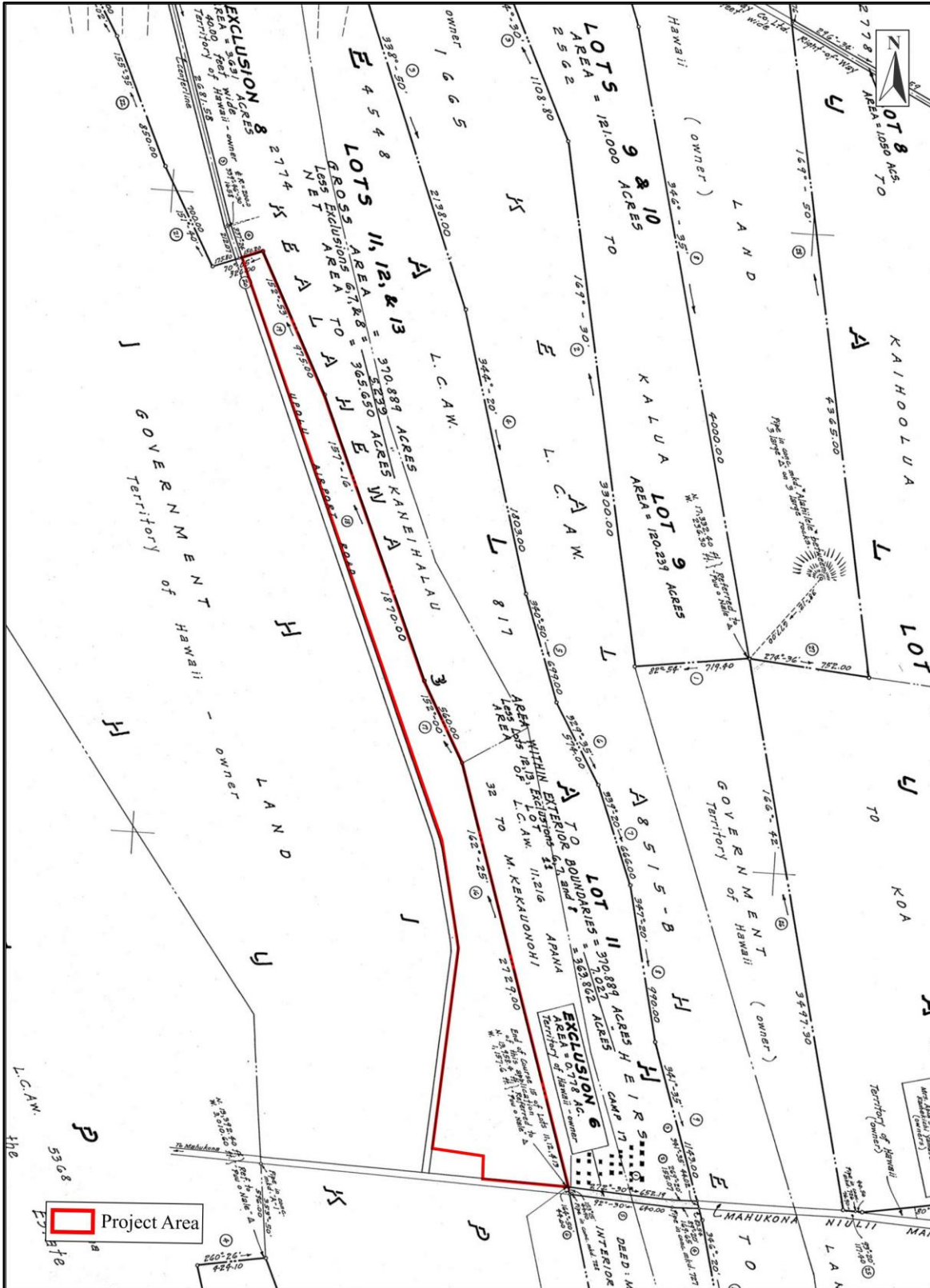


Figure 17. Portion of Land Court Application 1120 Map 1 showing the lack of Kohala Sugar Company facilities in the current project area (Kohala Sugar Company 1935).

One result of the acquisition and merger was the renovation of the overhead irrigation system at the former Hāwī Mill and Plantation fields, including those in the current project area. Castle & Cooke was also the parent company of several plantations that included the Waialua Plantation on the North Shore of O‘ahu (Dorrance and Morgan 2000; Wilcox 1996). Among the innovations developed at the Waialua Plantation was an irrigation system built using portable modular concrete flumes known as Waialua Flumes (Wilcox 1996), which were developed by the Waialua Sugar Company in 1936 (The Honolulu Advertiser 1940). The construction and operation of Waialua flume system at the Waialua plantation was described in detail in a newspaper article published in 1940:

30-Inch Sections

The water goes into the fields in concrete box-flumes, with bottoms pyramidal in cross section. The sections, about 30 inches long, are laid down the slope of the field, butt to butt and joined with asphalt putty. Little side openings, spaced so that each is opposite a furrow, are opened or closed with a “gate” of galvanized iron which slides up and down in a slot cast in the concrete. The gates are bent at the top to form a flange so that it can be used to direct the flow of water into the furrow.

The flumes are widest and deepest at the top of the field, being designed to take up to 6,000,000 gallons of water from the main supply ditch, tapering gradually to the lower end. One of the plantation surveyor’s jobs is to specify sizes of the flume boxes based on the volume and velocity of the water so that the 6,000,000 gallons entering the flume intake will be shrunk to “one man’s water” at the lower end.

All Start At Once

The irrigators all start work at the same time, each opening 200 to 300 gates on his side of the flume, depending on the slope and lay of the field. The water trickles slowly along the furrows, with 1 ½ to two hours allowed to reach the far end. In other words, the ground is thoroughly soaked on each side of the flume, the irrigations amounting to a slow and steady rain. The cane furrows are laid out on a 1.5 grade. I saw one field of 98 acres where one man was in charge and he was just standing around watching his furrows.

Waialua organized a subsidiary Concrete Productions Company which operates a quarry and crusher, supplies sand, buys the cement and fabricates flume boxes, shapes, pipes and slabs, or whatever concrete work is required on the plantation. They were pouring flume boxes in steel moulds with hinged sides. A measured charge is dumped in each and then an electric vibrator is attached to the rim, which sakes down the concrete, eliminating air spaces and bubbles.

System Not So New

H. R. Shaw, irrigation superintendent, said that the staff thought they had something entirely new, four years ago [i.e., 1936] when they went over to this new irrigation system. The, somebody unearthed a U.S. department of agriculture bulletin that was published about 60 years ago, with description and drawings of practically the same thing, the difference being that the boxes were to be made of sheet iron...(The Honolulu Advertiser 1940)

The consolidation of sugar plantations in Kohala during the early 1930s also included the merger of the Union Mill and Plantation Company with the Niuli‘i Mill and Plantation Company in 1932 (Dorrance and Morgan 2000), which was followed in 1937 by the purchase of the Union Mill by the Kohala Sugar Company. With this merger, Kohala Sugar Company became the only sugar producer in North Kohala. A few months after the merger, Kohala Sugar Company began efforts to reduce operation costs by consolidating its milling operations. This included the closure of the Union Mill in 1937 and both the Niuli‘i Mill and Hō‘ea Mill in 1938 (Hannah 1938).

During the 1940s the global effects of World War II were felt in North Kohala. In 1941 Māhukona Harbor was closed for national security reasons (Tomonari-Tuggle 1988). Following the closure of this port the products of the Kohala Sugar Company were trucked fifty miles to the railhead of the Hawaiian Consolidated Railway at Pa‘auilo for transport to the open port at Hilo (Dorrance and Morgan 2000). The Kohala railroad continued to operate during the early years of the war, hauling unprocessed cane from the fields to the mills, but that too shut down in October of 1945 due to the lack of freight (Schweitzer 2003). In 1943 the Kohala Sugar Company produced 41,501 tons of sugar, the most sugar produced during any of the war years (Dorrance and Morgan 2000). The current project area, as depicted on a 1942 map of the Kohala Sugar Company’s plantations (Figure 18), shows a few changes to the plantation infrastructure. ‘Upolu Point Road, has been straightened, and with the construction of Reservoir No. 8 to the west of the project area, a ditch in the northern end of the to carry water *makai* of Pu‘u Maunakea into that reservoir. The map indicates that the project area occupies portions of sugar cane fields “Upolu 11” and “Upolu 12.”

Following the war, business at the Kohala Sugar Company returned to normal, and the plantation remained a marginally profitable operation when the weather was cooperative (Dorrance and Morgan 2000). In 1951, the Hawai‘i County supervisors voted to abandon the Hō‘ea Road in Kāhei, making the route property of the plantation (Hilo Tribune-Herald 1951). A 1954 aerial photograph (Figure 19) shows the configuration of plantation infrastructure in the project area, which appears to have remained similar to that depicted on the 1942 Kohala Sugar Company map (see Figure 18). One exception is a new road crossing the southern end of the project area *mauka* of Reservoir No. 4. This road connects this portion of the plantation to Pratt Road *makai* of Hāwī Village.

During the late 1960s, Castle & Cooke reported diminishing returns, and even financial losses from the Kohala sugar plantations (The Honolulu Advertiser 1971a). The increased use of trucks and advances in irrigation and planting mechanization led to the creation of a grid of intra-field roads on some of the flatter portions of the sugarcane fields. This grid of roads can be seen in a 1964 aerial photograph of the area (Figure 21). Which also clearly shows three large ditches crossing the project area from east-to-west.

In 1971, Castle & Cooke announced that its Kohala plantations would close at the end of the 1973 grinding season, for “economic reasons”(The Honolulu Advertiser 1971b). At the same time, a growing concern about environmental pollution at the state, local, and national levels led to more stringent regulations on water and air quality, ultimately resulting in the passage of the National Environmental Policy Act of 1970. In February of 1971, the State Health Department ruled that plantations would need cease burning sugar cane fields within three years (Kakesako 1971). On the heels of this decision, in June of 1971, the United States Environmental Protection Agency published a study on pollution in the sugar cane industry that had immense effects on North Kohala (US EPA 1971). The study found that sugar industry was discharging materials into the ocean that resulted in violations of state water quality standards. The study recommended that discharges of trash and bagasse to coastal waters be discontinued, that all discharges be treated or controlled in compliance with state water quality standards, and that the plantations make improvements to their irrigation facilities and management to minimize and control discharges. For a time, plantations were granted pollution waivers, ultimately were required to meet the new standards. With the anticipated closure of the Kohala Sugar Company, in 1971 the Governor appointed a Task Force to explore the potential agricultural future of North Kohala which resulted in a report titled “Kohala Water Resources Management and Development Plan” (Bowles et al. 1974) which included a map of all the water resources around the current project area. Other than the previously mentioned reservoir, no other water resources are shown to be within the current project area.

Profitable sugar crops and pollution waivers allowed Castle & Cooke to delay closure for two additional years (Soares, Yangson, and Carvalho in Barna and Kepa‘a 2022), but in 1975 the last crop was ground and the Kohala Sugar Company closed its doors for good, ending its 112 years of operation (Dorrance and Morgan 2000). Any camp buildings not purchased were dismantled, and the remains of Hō‘ea Camp were bulldozed to make room for agricultural fields (Soares, Yangson, and Carvalho, personal communication, October 28, 2021). Once the sugarcane fields were abandoned, various diversified agricultural projects were attempted in North Kohala, but most of the fields were allowed to go to grass, and the primary land use within the current project area has been cattle grazing. During the late 1980s, former Kohala Sugar Plantation lands were purchased by Chalon International of Hawai‘i, Inc., which later changed its name to the Surety Kohala Corporation; Currently the project area is owned by the State of Hawai‘i Department of Land and Natural Resources. County of Hawai‘i tax records indicate that parcel comprising the current project area was created in 2004 and is currently being leased to Boteilho Hawaii Enterprises, Inc (County of Hawaii 2021).

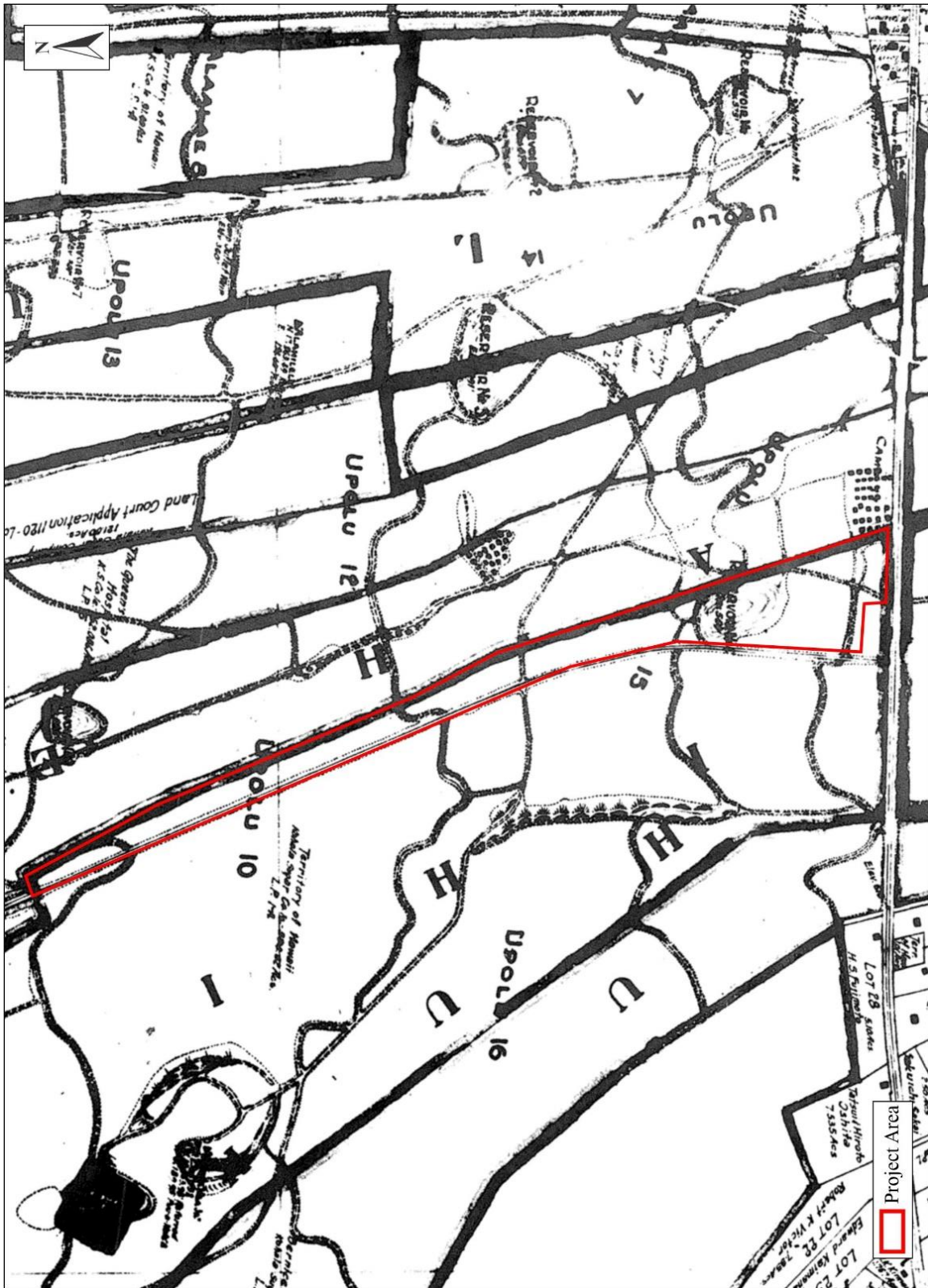


Figure 18. Detail of a 1942 Kohala Sugar Company field map.



Figure 19. Detail of a 1954 aerial photograph showing the current project area (USGS 1954).



Figure 20. Detail of a 1963 Kohala Sugar Company Field Map.



Figure 21. Detail of a 1964 USDA aerial photograph (USDA 1964).

PREVIOUS ARCHAEOLOGICAL STUDIES

A review of available records at the DLNR-SHPD Kapolei Library and on HICRIS indicates that very few archaeological studies have been conducted on the coastal and former sugarcane lands in the vicinity of the current project area (Figure 22) and in ‘Opihipau *ahupua‘a* in particular. One major reason for this has been continued agricultural use of the lands since the ending of plantation-run commercial sugarcane cultivation in the 1970s. Prior to that, J.F.G. Stokes documented Mo‘okini Heiau, located just over a mile (3.0 kilometers) to the west of the current project area (Stokes and Dye 1991). After the transition away from commercial sugarcane cultivation, a large-scale review of historic resources in North Kohala was conducted by International Archaeological Research Institute, Inc. (IARII) (Tomonari-Tuggle 1988). That study established a Historic District (SIHP 50-10-02-7105) that included multiple properties associated with sugar plantations in North Kohala (none of which are in the current project area). The few compliance-driven studies in the vicinity of the current project area (Table 2, see Figure 22) have generally found a limited number of archaeological resources, and those that have been found tend to be remnants of commercial sugarcane fields and associated infrastructure, with a few exceptions immediately inland of the shoreline.

In 1988, International Archaeological Research Institute, Inc. conducted a large-scale cultural resource study of North Kohala Tomonari-Tuggle (1988). The study, which included archival and oral history research and targeted field surveys, identified 266 historic sites across the district. The Hō‘ea Mill and Camp were noted among the Historic Period sites. Tomonari-Tuggle (1988) also noted the existence of a “Kohala Sugar District” Historic property (SIHP 50-10-02-7105) in DLNR-SHPD files. This property apparently includes the mill sites, the plantation houses, and the offices of the companies that participated in the sugar industry in Kohala (Tomonari-Tuggle 1988). Records associated with Site 7105 were not available for review during the current study. Reconnaissance fieldwork did not include the current project area, but did include a coastal area between ‘Upolu Airport (about 1,200 meters north of the current project area) and the former United States Coast Guard LORAN Station. Tomonari-Tuggle (1988:70) noted that this area contained five sites (K-2 through K-6), which she described as “fragmentary at best and may be of little significance. However, their proximity to the important sites of Mo‘okini heiau and the Kamehameha birth-site, now under State control, warrants some further investigation.” These sites (SIHP numbers could not be found for them) included a small concrete foundation (K-2), a deposit containing charcoal, shell, fire-cracked rock, and a possible fire pit exposed in the beach face (K-3), a remnant stone structure (K-4), two basalt flakes in a secondary depositional context (K-5), and stone facing on a low hill overlooking the ocean on the LORAN station property (K-6).

Table 2. Previous archaeological studies conducted in the vicinity of the current project area.

<i>Year</i>	<i>Author(s)</i>	<i>Type of Study</i>	<i>Results</i>
1988	Tomonari-Tuggle	Archival review and reconnaissance	Kohala Sugar District (SIHP 50-10-02-7105); Five sites (K-2 through K-6) west of ‘Upolu Point.
1992	Streck	Reconnaissance	No archaeological resources.
1998	Rechtman and Orr	AIS	Irrigation flumes and ditch (SIHP 50-10-02-21740); Concrete foundation (SIHP 50-10-02-21741).
2012	DLNR-SHPD	Permit review	No AIS required due to disturbance.
2014	DLNR-SHPD	Permit review	Irrigation features (SIHP 50-10-02-30049).
2020	Haun & Associates	AIS	Road (SIHP 50-10-02-30191); Concrete posts (SIHP 50-10-02-31092) Road (SIHP 50-10-02-30193); Ditch complex (SIHP 50-10-02-30914)
2022	Barna and Kepa‘a	AIS	Coastal Settlement (SIHP 50-10-02-3283) Hō‘ea Mill Infrastructure (SIHP 50-10-02-31284) Hō‘ea Camp (SIHP 50-10-02-31285)

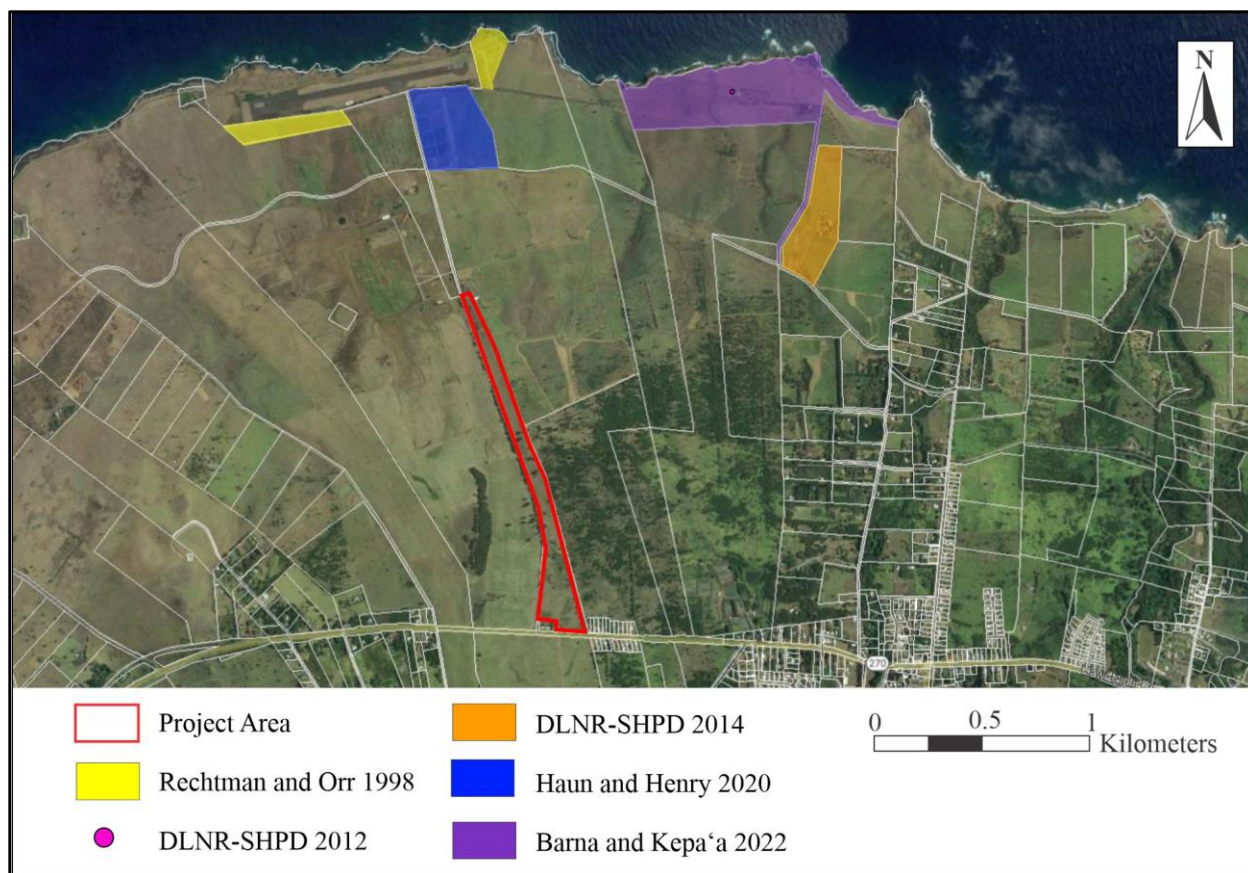


Figure 22. Location of previous archaeological studies.

In 1998, Paul H. Rosendahl, Ph.D., Inc., conducted an archaeological inventory survey (Rechtman and Orr 1998) with subsurface testing on roughly 28 acres located adjacent to ‘Upolu Airport (see Figure 22). No Native Hawaiian Precontact cultural remains were observed during the fieldwork; however, two sets of Historic Period features were recorded. In the area west of the airport, rows of concrete irrigation flumes and an irrigation ditch (SIHP 50-10-02-21740) were observed. These appear to have been associated with early twentieth century sugar cane production and were not considered significant. In the area inland from the existing airport property, the demolished remains of foundations and a standing concrete structure were recorded (SIHP 50-10-02-21741). This site was also not considered significant. Oral interviews with four long-time North Kohala residents identified no traditional cultural properties within their survey area, but noted that renewed active use of the airport, especially for commercial aviation purposes, was desirable as long as the use did not limit access to, or otherwise impact, local fishing.

In 2012, DLNR-SHPD reviewed a well permit application (Log No. 2010.0363, Doc. No. 1203MV15) to construct a potable water well near the current location of the main residence, 1.5 kilometers northeast current project area (see Figure 22). Because the proposed well location was within an area that was previously utilized for large scale agriculture and likely impacted by mechanical grading, no AIS was required.

In 2014, during the implementation of a Natural Resource Conservation Service conservation plan on TMK: (3) 5-5-0070:035 (located approximately 1.5 kilometers east of the current project area), four irrigation features associated with the Kohala Sugar Company sugarcane plantation (SIHP 50-10-02-30049) were inadvertently discovered (Log No. 2014.1774; Doc. No. 1405MV03). A report, titled *Inadvertent Discovery of SIHP 50-10-02-30049 Kahei 2nd Ahupua‘a, North Kohala District, Island of Hawaii*, appears to have been prepared, but could not be obtained from DLNR-SHPD at the time of the current study. The site was determined eligible for the National Register of Historic Places under Criteria A, C, and D. Because a 20-foot buffer around the features was incorporated into the conservation plan, the Section 106 consultation for the plan resulted in a no adverse effect determination and no additional mitigation measures (e.g., preservation plan) were required.

In 2018, Haun & Associates conducted an archaeological inventory survey (Haun and Henry 2020) of a 44-acre parcel located *mauka* of ‘Upolu Airport approximately 800 meters north of the current project area. The AIS report was not publicly available at the time of the current study. The survey identified five historic properties, including the two historic roads (SIHP 50-10-02-30911 and 50-10-02-30913) and historic railroad alignment identified by the National Park Service, as well as gate posts (SIHP 50-10-02-30912) and a ditch complex for flood control (SIHP 50-10-02-30914). This latter site, upon comparison with historic aerial photographs of the sugarcane fields, appear to have been the intrafield roads established ca. the early 1960s (see Figures 19 and 20). The five sites were all assessed as significant under Criterion d for their information content related to historic agriculture within the area. Two sites (Sites 12350 and 30911) were also assessed as significant for their association with the broad pattern of sugar industry development in Hawai‘i. The documentation of the five sites in the project area adequately recorded them and no further work or preservation was recommended; however, the landowner agreed to preserve Site 30911 (Hō‘ea Road) as this road provided access to the coastal area to the east of the project area. An Archaeological Preservation Plan was chosen to be the instrument through which coastal access would be established, with a vehicular and pedestrian easement over the preserved site to be created within the plan.

In 2022, ASM Affiliates conducted an archaeological inventory survey (Barna and Kepa‘a 2022) of a 105.647-acre parcel located 1,400 meters northeast of the current project area. The survey identified a portion of one previously identified historic property, Hō‘ea road (SIHP 50-10-03-30911), and portions of three previously unidentified historic properties (SIHP 50-10-02-31283, the Hō‘ea Coastal Settlement; SIHP 50-10-02-31284, Hō‘ea Mill Infrastructure; and SIHP 50-10-02-31285, Hō‘ea Camp. As recorded during that survey, Site 50-10-02-31284 (Hō‘ea Mill Infrastructure) consists of 33 remnant elements of the infrastructure associated with the operation of the Hāwī Mill and Plantation Company’s Hō‘ea Mill and surrounding sugarcane fields and pasture between ca. 1904 and 1975. The recorded features include earthworks (e.g., berms, push piles, and a mechanically altered swale), portable concrete flumes, and midden/surface artifact deposits (e.g., rubbish dumps), along with foundation remnants of the plantation’s water pumphouse, wooden and concrete fence posts, a culvert, and metal stakes embedded in the sea cliff. Sites 30911 and 31283 were assessed as significant under Criterion a for their association with the broad pattern of sugar industry development in Hawai‘i and of land use and settlement patterns in Kohala during the Precontact Period into the nineteenth century. All four sites were assessed as significant under Criterion d for their information content related to historic agriculture in Hawai‘i, precontact habitation in coastal Kohala during the Precontact Period, sugar industry practices, and the history of Hō‘ea Camp. All of the sites were deemed to have been adequately documented with no further work being needed except for Site 31283, which was recommended for preservation and a preservation plan in accordance with HAR §13-277 to be prepared and reviewed by DLNR-SHPD.

3. PROJECT AREA EXPECTATIONS

While it is clear from *kuleana* claim testimony and other early historic accounts of the project area vicinity that the *kula* in this portion of North Kohala was once part of a vast traditional agricultural area, the advent of commercial sugarcane cultivation in the late nineteenth century radically altered the landscape. It is very likely that conversion of the traditional agricultural system to commercial sugarcane resulted in plowing over any material evidence of the older system. It is unlikely that archaeological features or deposits associated with these fields survived nearly a century of increasingly mechanized and intensive sugarcane cultivation.

Historic maps and aerial photography indicate, however, that archaeological evidence of the commercial sugarcane fields and associated infrastructure are still present on the land. This evidence includes elements of the previously documented SIHP 50-10-02-31284 (Hō‘ea Mill Infrastructure) that is associated with the operation of the Hāwī Mill and Plantation Company’s Hō‘ea Mill and surrounding sugarcane fields and pasture between ca. 1904 and 1975 exist within the current project area. These features include the Hāwī Plantation’s Reservoir No. 4, ditches that feed water to and from this reservoir, and also ditches that transported water from Reservoirs 5, 8, and 9 (Figure 23). Aerial photographs also suggest the possibility that intra-field roads, which Haun and Henry (2020) documented as ditches (features of SIHP 50-10-02-30914) may also be present. Additionally it is possible that remnants of the original alignment of ‘Upolu Point Road (SIHP 50-10-02-20913) may be present.

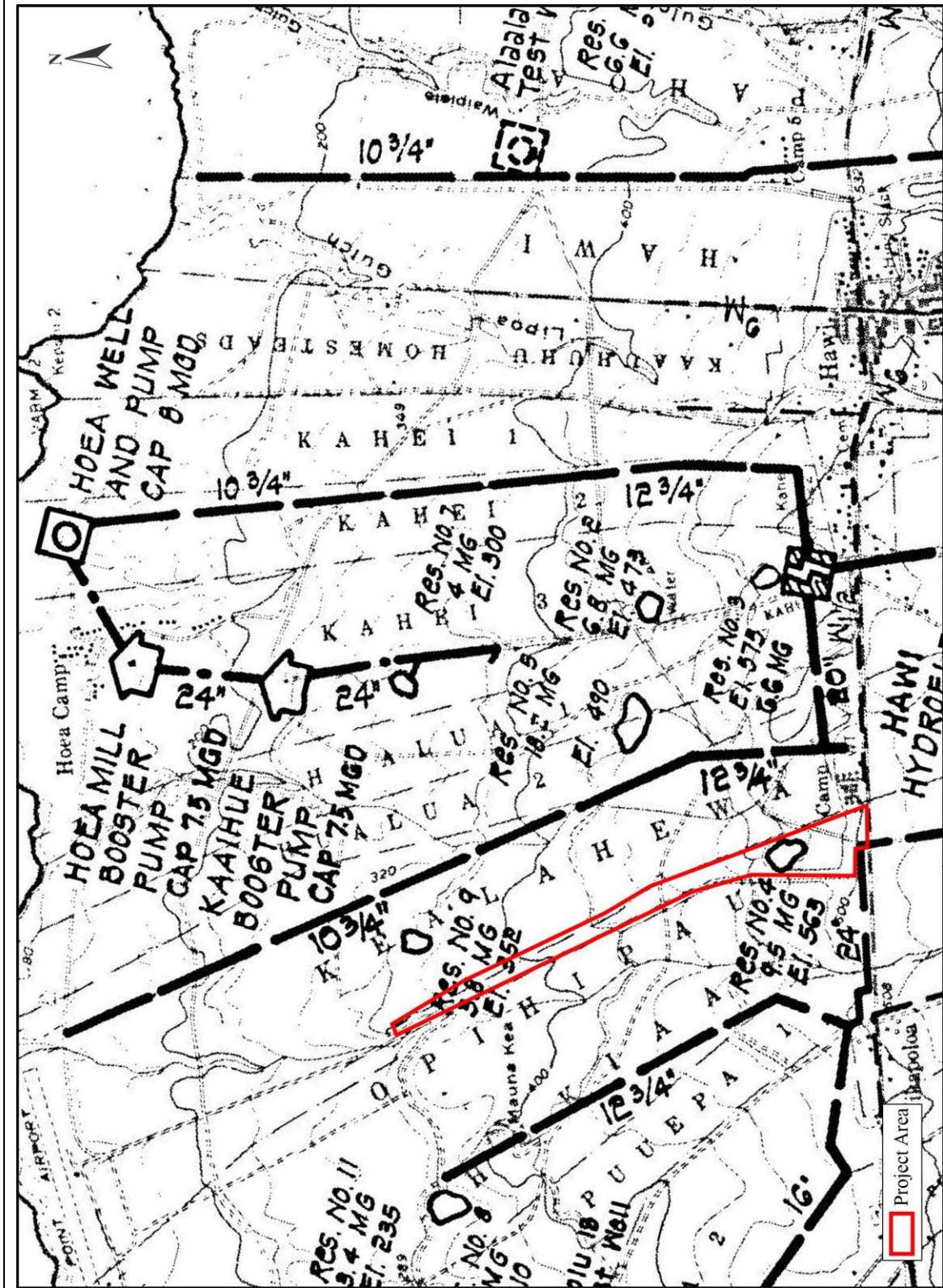


Figure 23. Detail of a 1974 USGS Water Resources (Bowles et al. 1974).

4. FIELDWORK

Fieldwork for the current study was conducted on August 16, 2022, by Benjamin Barna, Ph.D. (Principal Investigator), with Johnny Dudoit, B.A., and Candace Gonzales, B.A. Unmanned aerial photography was conducted by Manuel Lopez, B.S. A total of 28 person-hours were expended during the current fieldwork.

FIELD METHODS

During the archaeological field survey, the entire (100%) ground surface of project area was visually inspected by field technicians walking transects oriented north-south, spaced at no more than 5 meters apart. The entire project area was accessible at the time of the survey, and the boundaries of the project area were clearly identifiable in the field. While the vegetation cover (primarily low grass) was moderately thick in some areas, ground visibility was more than adequate across the entire survey area to identify any potential historic properties. Identified features deemed to be historic properties were then cleared of vegetation, photographed (both with and without a meter stick for scale), depicted on a scaled drafted plan map, and described using standardized record forms. Each feature was assigned a temporary site number sequentially as it was recorded (T-1, T-2, T-3, etc.), and the locations of the recorded features were collected using a handheld tablet computer running ESRI's Collector application connected to an EOS Arrow 100 GNSS receiver with sub-meter accuracy (set to the NAD 83 Zone 5 North). Site boundaries were defined based upon the spatial arrangement of the recorded features and the inferred associations between them. No subsurface testing was conducted due to the extensive prior ground disturbance caused by commercial sugarcane cultivation. No cultural material was collected during the survey.

FINDINGS

As a result of the fieldwork for the current study, six additional features of one previously identified historic property (Table 3) were identified. The locations of these sites relative to the current project area are presented in Figure 24. The identified features are described in detail below.

Table 3. Archaeological sites recorded during the current study.

<i>SIHP Site Number</i>	<i>Feature</i>	<i>Type</i>	<i>Function</i>	<i>Age</i>
50-10-02-31284	AN	Berm	Water infrastructure	Historic

Site 50-10-01-31284

Site 50-10-02-31284 (Hō'ea Mill Infrastructure) was previously identified on TMK: (3) 5-5-007:037, located in the coastal portion of the former Hāwī Mill and Plantation Company's sugarcane fields and pasture lands (Barna and Kepa'a 2022). The site, as previously recorded, includes the former location of the Hō'ea Mill—which was also previously assigned SIHP site number 50-10-02-7105 (Tomonari-Tuggle 1988)—and 33 features that comprise remnant elements of plantation infrastructure associated with the Hāwī Mill and Plantation Company and its successor, the Kohala Sugar Company.

Within the current project area, six additional features (Table 4) of Site 31284 were identified. These include one reservoir (Feature AI), four ditch segments (Features AJ, AK, AL, AM, and AN), and one berm (Feature AN). These features are described in detail below.

Table 4. Features of Site 31284 identified during the current study.

<i>Feature</i>	<i>Type</i>	<i>Function</i>	<i>Age</i>
AI	Reservoir	Water infrastructure	Historic
AJ	Ditch	Water infrastructure	Historic
AK	Ditch	Water infrastructure	Historic
AL	Ditch	Water infrastructure	Historic
AM	Ditch	Water infrastructure	Historic
AN	Berm	Water infrastructure	Historic

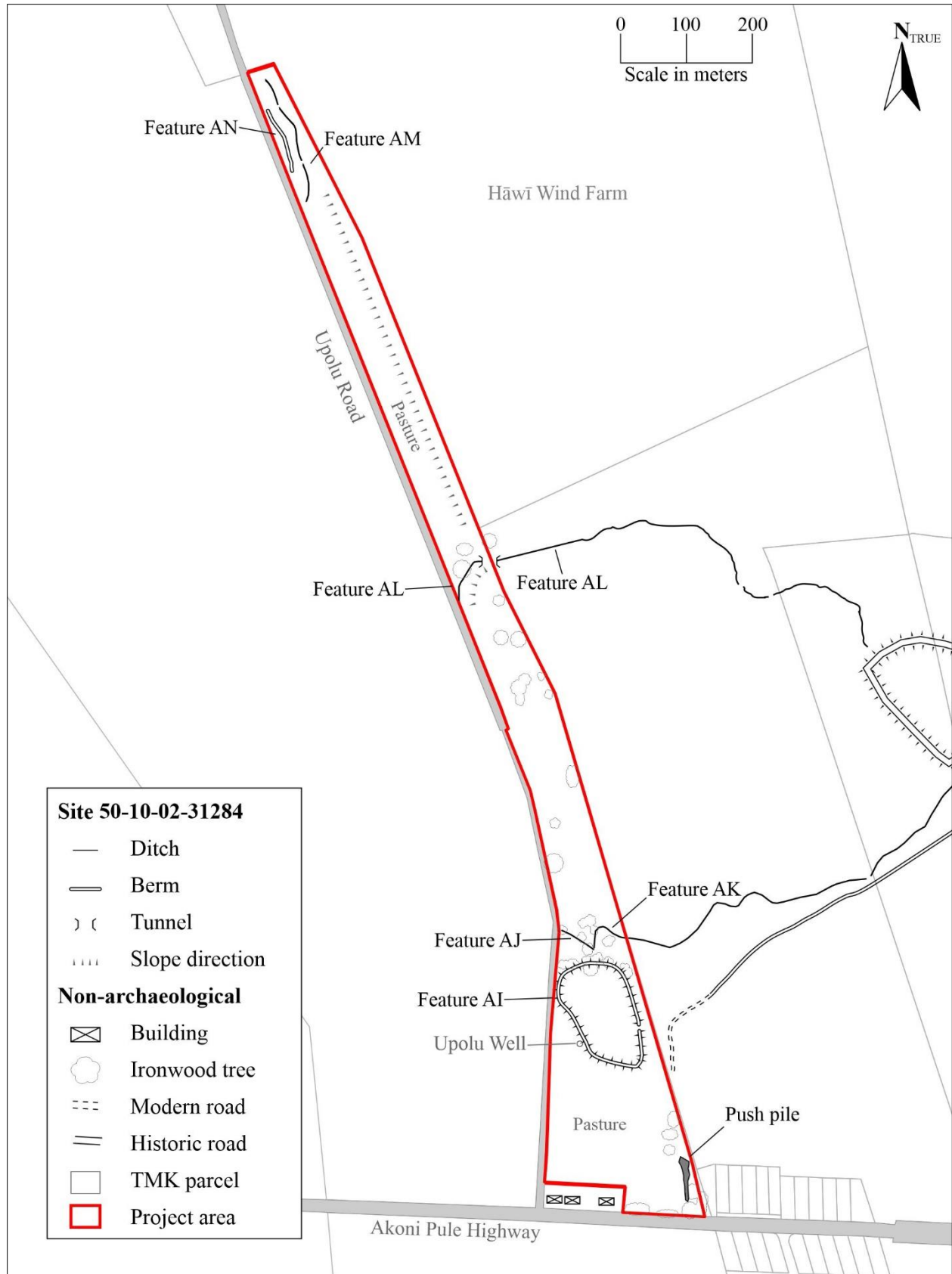


Figure 24. Site location map.

Feature AI

Feature AI (Figure 25) is an earthen reservoir identified as Reservoir No. 4 of the water system used by the Hāwī Mill and Plantation Company (later Kohala Sugar Company). It is located in the southern portion of the current project area (see Figure 24), and the USGS Observation ‘Upolu Well J-B (7451-02) is situated above its western embankment. The reservoir measures 156 meters by 100 meter with berm heights exceeding 4 meters above the floor of the reservoir. The ‘Upolu Well J-B (7451-02) is located on a roughly graded area measuring 74 meters by 24 meters along the southwest edge of the reservoir. The reservoir has been constructed by excavating its interior and building up earthen berms around its perimeter. It has an inlet/outlet on its northern side that connects it to an inlet ditch (Feature AK) and an outlet ditch (Feature AJ). It is in relatively poor condition, with breaches in the berms. The inlet and outlet of the reservoir are obscured by thick vegetation.

Feature AJ

Feature AJ (see Figure 25) is an earthen ditch extending from the east into the project area and connecting to Reservoir No. 4 on its northern end (see Figure 24). The ditch measures 107 meters long within the current project area, 5.4 meters wide across the top of its banks, and 1.7 meters across the ditch bottom. It is in fair condition, exhibiting signs of erosion along its banks. Its eastern end has been filled in by the creation of a fence line road on the eastern parcel boundary. No culvert was observed crossing beneath the fence line road.

Feature AK

Feature AK (Figure 26) is a concrete ditch extending from Feature AJ just north of Reservoir No. 4 (Feature AI) toward the northwest (see Figure 24). It is constructed of cast concrete that stand between 54 and 62 centimeters tall on the interior of the ditch. The ditch (Figure 27) is 1.2 meters wide on its interior. There is a sluice gate opening to the north located 16 meters west of Feature AJ. Overall the feature is in good to fair condition. In several places the concrete walls of the ditch are broken, and the last 11.5 meters of the ditch on the ‘Upolu Airport Road side of Feature AJ has been filled in.

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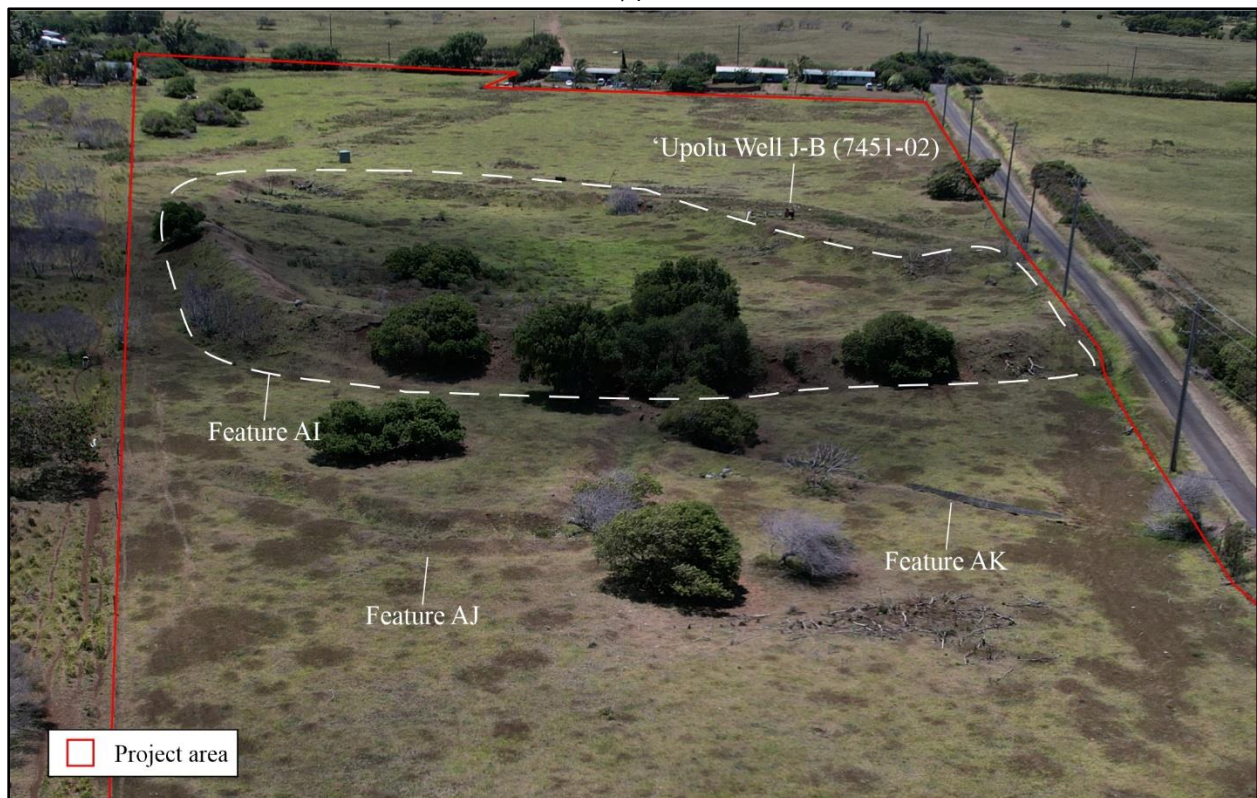


Figure 25. Aerial view of Site 31284 Feature AI, Hāwī Mill and Plantation Company Reservoir No. 5, view to the south.



Figure 26. Aerial view of Site 31284 Feature AK, concrete ditch.

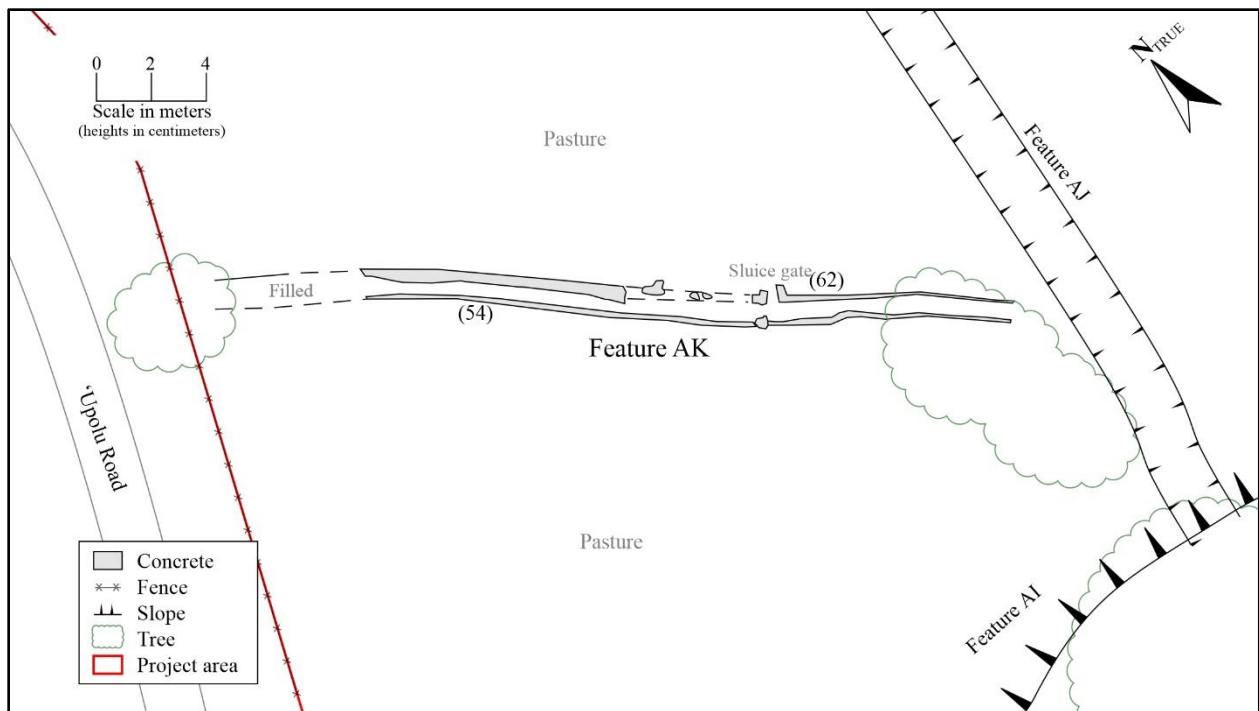


Figure 27. Site 31284 Feature AK plan view.

Feature AL

Feature AL (Figure 28) is a concrete-lined ditch that crosses the current project area approximately 980 meters north of the government road (see Figure 24). The ditch enters the project area from the east through a hand-dug earthen tunnel, follows along the contour of a knoll toward the southwest, and exits the project area at the parcel boundary fence along ‘Upolu Airport Road. The ditch (Figure 29) is approximately 100 meters long in the current project area, and 1.0 to 1.3 meters wide, where it is intact. The headwall of the tunnel is constructed of concrete slabs that appear to be recycled Waialua flume fragments, although it is possible that they were purposely cast for construction of this feature. It measures 210 centimeters long by 28 centimeters wide (the exposed portion), and stands 71 centimeters tall on the outflow side. It has an intact wingwall on the southern side that is similarly constructed and measures 268 centimeters long by 16 centimeters wide by 31 centimeters tall. Like the headwall, it is partially buried. The northern wingwall has collapsed. Behind the headwall, the tunnel has collapsed, leaving a hole that measures 60 centimeters by 40 centimeter and 76 centimeters deep. The ditch is eroded immediately downstream of the headwall, and approximately 10 meters further downstream there is a pile of concrete rubble that appears to have been the walls and floor of the ditch lining. The remainder of the ditch is intermittently visible in the accumulated sediments that have been transported down the knoll. At the toe of the knoll immediately east of the project area boundary, the ditch appears to be disturbed by the fence line road. The ditch may pass beneath the road through a culvert, and if so, the culvert is buried and was not visible during the current field work. The feature is in fair condition within the project area, but the tunnel is in good condition on the parcel located immediately to the east.

Features AM

Feature AM (Figure 30) is an earthen ditch located in the northern end of the project area (see Figure 24). It begins in the project area 5 meters south of the northern project area boundary; between this point and the fence on the parcel boundary the ditch has been filled in. It extends toward the southwest, descending toward ‘Upolu Airport Road. The ditch measures 200 meters long by 6 meters wide at the top of its bank and 2 meters wide at the bottom of the ditch. There are two culverts located 40 meters and 132 meters, respectively, from the northern project area boundary. These are 48-inch diameter, 12-foot-long corrugated metal pipe culverts. The locations of these culverts appear to match well with intrafield roads visible in Figure 21, and the technology of the culverts is appropriate to the mid-twentieth century. There is a concrete sluice gate (Figures 31 and 32) located 18 meters from the northern project area boundary. The sluice gate opens to the west. Comparison with aerial photography indicates that this ditch continued toward the west to connect to Reservoir No. 8. To the north and east, the construction of the Hāwī Wind Farm facility has destroyed a portion of this ditch.

Feature AN

Feature AN is an earthen berm that roughly parallels Feature AM for 90 meters (see Figure 24). The berm is located about 15 to 18 meters below the ditch on the moderately sloping ground. The berm measures 1.2 meters across its top and 3.6 meters wide from toe to toe. This ditch appears to have been constructed to control water runoff toward ‘Upolu Road. It is not readily visible in historic aerial photographs, and may post-date the abandonment of the Feature AM ditch.



Figure 28. Site 32184 Feature AL ditch and tunnel headwall, view to the east.

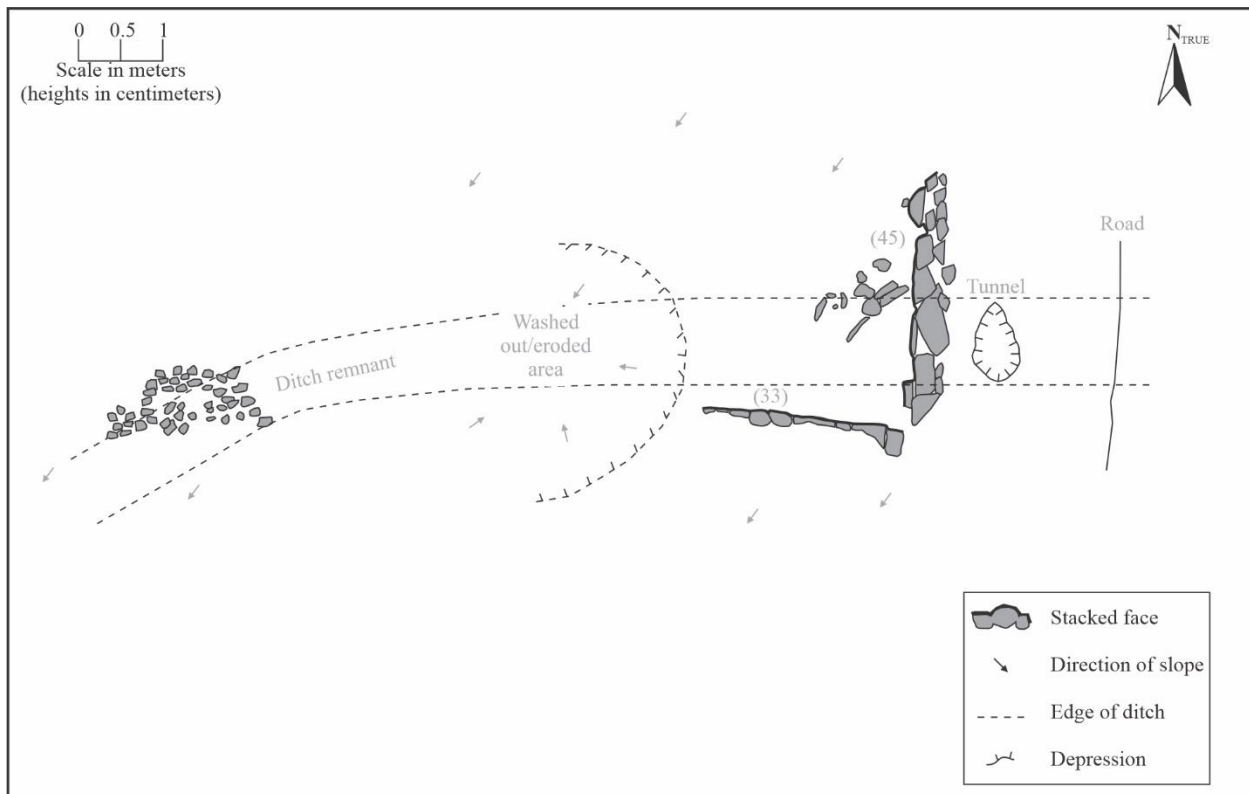


Figure 29. Site 32184 Feature AL plan view.



Figure 30. Site 31284 Feature AM ditch, view to the south.

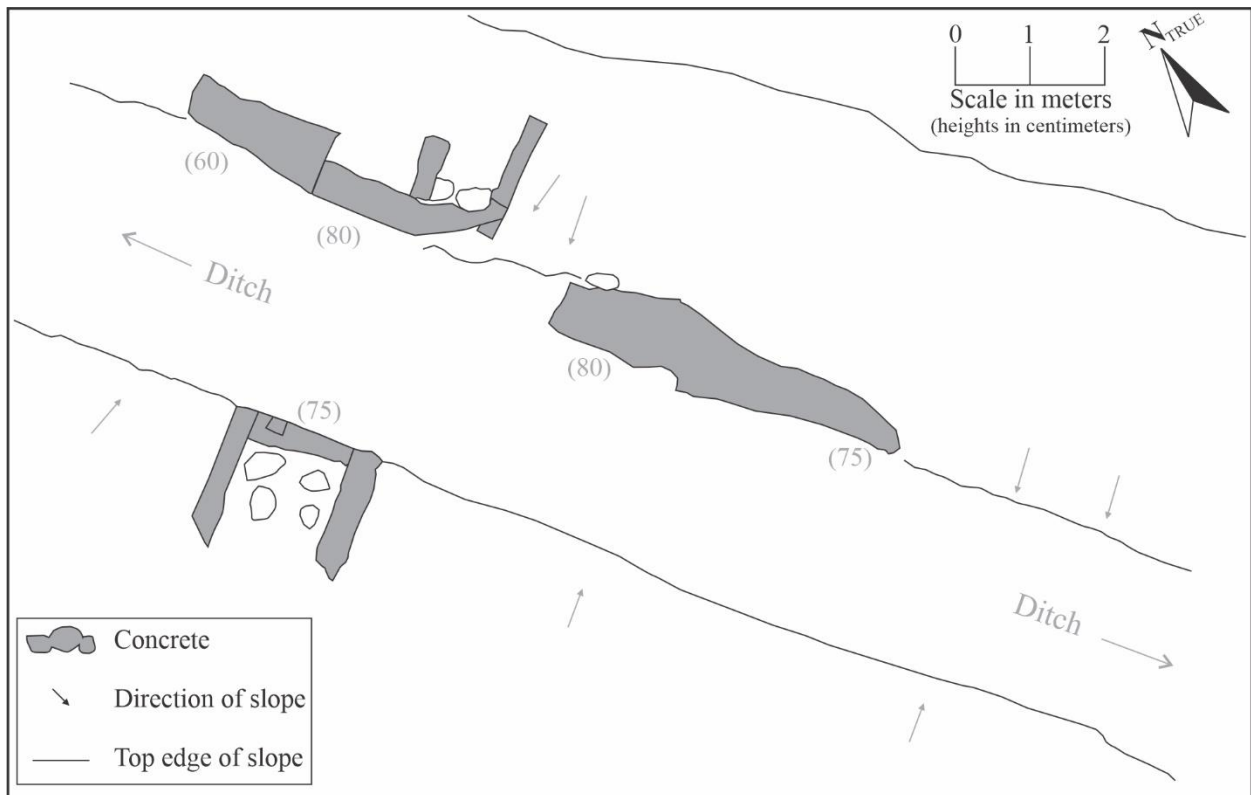


Figure 31. Site 31284 Feature AM ditch and concrete sluice gate plan view.



Figure 32. Site 31284 Feature AN earthen berm, view to the north.

SUMMARY AND DISCUSSION

As a result of the current fieldwork, no new archaeological historic properties were identified. The overall dimensions of the site, as recorded archaeologically, include the 100-acre parcel located *makai* of Hō‘ea Camp (see Barna and Kepa‘a 2022) and the 43.5 acres within the current project area. The six features of Site 31284 that were identified represent additional elements of the extensive water infrastructure system created by the Hāwī Mill and Plantation Company to irrigate their sugarcane fields. As illustrated by maps and aerial photographs of the project area vicinity, as well as in the schematic representation of the water system presented by (Bowles et al. 1974) (see Figures 16, 18,19,20,21, and23), this water system tapped the basal aquifer at several locations in North Kohala, and fed an intricate system of pipelines, ditches, flumes, and reservoirs. The features documented in this report represent a small fraction of that system, as well as fractions of individual ditches. The system of intrafield roads documented by Haun and Henry (2020) as Site 30914 were not observed however, the two culverts through which Feature AM passes are likely remnants of those roads. No archaeological traces of the original alignment of ‘Upolu Point Road (Site 30913) were observed in the current project area. This is likely due to the creation of Feature AM and AN, which appear to be located in roughly the same location within the project area. Overall, the results of the current fieldwork indicate that post-sugar industry changes to in land use have impacted these elements of the water infrastructure, and, as was observed near the Hō‘ea plantation camp by Barna and Kepa‘a (2022), these elements are generally in fair to remnant condition, and appear to have limited interpretive and information potential. Site 31284 was previously assessed to be significant under Criteria a and d for its historical association with the sugar industry and for the information yielded regarding the plantation infrastructure system. The site continues to be considered significant under these criteria.

5. SIGNIFICANCE EVALUATIONS AND TREATMENT RECOMMENDATIONS

The recorded archaeological site is assessed for its significance based on criteria established and promoted by the DLNR-SHPD and contained in the Hawai‘i Administrative Rules 13§13-275-6. For a resource to be considered significant it must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet one or more of the following criteria:

- a Be associated with events that have made an important contribution to the broad patterns of our history;
- b Be associated with the lives of persons important in our past;
- c Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;
- d Have yielded, or is likely to yield, information important for research on prehistory or history;
- e Have an important traditional cultural value to the native Hawaiian people or to another ethnic group of the state due to associations with traditional cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group’s history and cultural identity.

The significance and recommended treatment for the five recorded sites is presented in Table 5 and discussed below.

Table 5. Site significance and treatment recommendation.

<i>Site #</i>	<i>Site Type</i>	<i>Temporal Affiliation</i>	<i>Significance</i>	<i>Previous Treatment</i>	<i>Recommended Treatment</i>
32184		Historic	a, d	No further work	No further work*

*Treatment recommendation is for features identified in the current project area.

SITE 31284

Site 31284 was assessed to be significant under Criteria a and d as a result of the Barna and Kepa‘a (2022) AIS. The site consists of remnant elements of the infrastructure built and used by the Hāwī Mill and Plantation Company and its successor, the Kohala Sugar Company, and now includes the six additional features identified in the current project area. The integrity of these newly recorded features varies widely, from the largely intact Feature AI (a concrete-lined ditch) to Feature AL, a portion of which has partially eroded away while the majority of it is buried. Most of the newly documented features extend outside of the current project area, and have only been partially recorded. On the whole, the site still retains fair to good integrity of design as the general layout of this portion of the plantation fields can be discerned by the features of the site. Integrity of materials is also generally good, as what remains of the features appears to be original to the period of use. Integrity of workmanship has been substantially diminished by the degradation of the features over time. Integrity of location, setting, and feeling remain good, even though the site is no longer surrounded by agricultural fields but grazing lands, and the features themselves are not divided among multiple state- and privately-owned parcels. Integrity of association remains somewhat good, as the surviving features are original to the plantation and camp during the period of significance.

The infrastructure elements that make up Site 31284 within the current project area played a background, but still important, role in transforming the traditional agricultural landscape of coastal ‘Opīhipau into the intensive commercial sugar plantation that operated there from ca. 1904 to 1975. As a result of the current fieldwork, archaeological evidence of the Kohala Sugar Company’s alteration of the landscape, particularly its irrigation practices, was documented. This provided detailed information about these aspects of commercial sugar cultivation and their effects on this portion of the Kohala coast. Thus, Site 31284 remains assessed to be significant under Criterion a for its association with the development of the sugar industry in North Kohala and under Criterion d for the information yielded during the current study relative to sugar industry practices. Site 31284 has been adequately documented by the current study and no further historic preservation work is recommended.

6. DETERMINATION OF EFFECT

The proposed project would develop the existing ‘USGS Observation ‘Upolu Well J-B (7451-02) and install a new above ground water tank near the southeast corner of the project area. There are no historic properties located at the proposed water tank site. While the existing ‘USGS Observation ‘Upolu Well J-B (7451-02) is located near the berm of Site 31284 Feature AI (the Hāwī Mill and Plantation Company’s Reservoir No. 4), the minor improvements and operation of the well pump will not cause adverse impacts to that feature. The potential future phases of the project, which could involve development of agricultural lots within the current project area, may result in impacts to the features of Site 31284 identified during the current study. These features, however, are considered significant only for the information yielded during the current study. Because they have been adequately documented, and no further historic preservation work is recommended, the recommended determination of effect for the proposed project is “no historic properties affected.”

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**‘Upolu Well and Agricultural Water
Distribution System/Agricultural Park
Environmental Assessment**

APPENDIX 4

Archaeological Literature Review of TMK: (3) 5-5-006:003

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Literature Review for the Development of the USGS Observation 'Upolu Well J-B (7451-02)

TMK: (3) 5-5-006:003 (por.)

'Opihipau and Hukia'a Ahupua'a
North Kohala District
Island of Hawai'i

DRAFT VERSION



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**A Literature Review
for the Development of the USGS Observation
'Upolu Well J-B (7451-02)**

TMK: (3) 5-5-006:003 (por.)

'Opihipau and Hukia'a Ahupua'a
North Kohala District
Island of Hawai'i



EXECUTIVE SUMMARY

At the request of Akinaka and Associates, LTD., on behalf of the Engineering Division of the Department of Land and Natural Resources (DLNR), ASM Affiliates conducted a literature review of an approximately 150-acre portion of Tax Map Key (TMK): (3) 5-5-006:003 (the “project area”) within ‘Opihipau and Hukia‘a *ahupua‘a*, North Kohala District, Island of Hawai‘i. The project area is the proposed location of a potential Agricultural Park that could be developed pending successful development of the development of the U.S. Geological Survey (USGS) Observation ‘Upolu Well J-B (State Well ID 7451-02).

The culture-historical context and summary of previously conducted archaeological and cultural research presented below are based on research conducted by ASM Affiliates at various physical and digital repositories. Primary English language and Hawaiian language resources were found at multiple state agencies, including the State Historic Preservation Division, Hawai‘i State Archives, and the Department of Accounting and General Services Land Survey Division. Digital collections provided through the Office of Hawaiian Affairs Papakilo and Kīpuka databases, Waihona ‘Āina, the Ulukau Hawaiian Electronic Library, the Hawai‘i Genealogical Indexes, and Newspapers.com provided further historical context and information. Lastly, secondary resources stored at ASM Affiliates’ Hilo office offer general information regarding the history of land use, politics, and culture change in Hawai‘i, enhancing the broad sampling of primary source materials cited throughout this cultural impact assessment.

The results of the literature search indicate that the current project area was under commercial sugarcane cultivation beginning in the late nineteenth century. It has been heavily impacted by land altering activities undertaken by the Hāwī Mill and Plantation Company, its successor the Kohala Sugar Company, and subsequent lessees, who converted the sugarcane fields to other agriculture and pasture uses. These types of activities have included earth-moving, road building and maintenance, plowing, and the installation and removal of water irrigation infrastructure such as flumes, pipes, and ditches. These activities, especially those associated with sugarcane cultivation, have likely destroyed evidence of Precontact land use and human occupation pre-dating to the establishment of the sugar plantation. One exception to this could be on the summit of the *pu‘u* named Mauna Kea that is located in the northwest corner of the project area.

Archaeological features that are likely to exist in the project area include remnants of plantation infrastructure associated with three previously identified historic properties. These properties include SIHP 50-10-02-30913, the original alignment of ‘Upolu Point Road; SIHP 50-10-02-30914, a system of intra-field roads documented as erosion control ditches by Haun and Henry (2020); and features of SIHP 50-10-02-31284, the “Hō‘ea Mill infrastructure” site that includes plantation water and transportation features in the Hāwī Mill and Plantation Company’s fields previously identified by Barna and Kapa‘a (2022). These features could include inter- and intra-field roads, irrigation systems such as flumes, pipes, and ditches, and clearance piles created before, during, and after commercial sugarcane cultivation. Many of these features can be seen in historical aerial photographs and historic maps reproduced in this report.

Given the results of the current literature review, an archaeological inventory survey is likely to be required is historic preservation review under HRS Chapter 6E-8 or 6E-42 are triggered within the project area. Subsurface testing may be appropriate in undisturbed depositional environments—in this case possibly on the *pu‘u* named Mauna Kea. The results of the CIA consultation regarding the *pu‘u*, however, should also be considered prior to the development of an inventory strategy. Otherwise, a combination of pedestrian and unmanned aerial vehicle survey are recommended should and AIS be necessary.

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1. INTRODUCTION

At the request of Akinaka and Associates, LTD., on behalf of the Engineering Division of the Department of Land and Natural Resources (DLNR), ASM Affiliates conducted a literature review of an approximately 150-acre portion of Tax Map Key (TMK): (3) 5-5-006:003 (the “project area”) within ‘Opihipau and Hukia‘a *ahupua‘a*, North Kohala District, Island of Hawai‘i (Figures 1, 2, and 3). The project area is the proposed future location of an Agricultural Park associated with the development and conversion of the existing U.S. Geological Survey (USGS) Observation ‘Upolu Well J-B (State Well ID 7451-02) on the neighboring TMK (3) 5-5-006:002, located east of the project area and across ‘Upolu Airport Road. The DLNR in conjunction with the Department of Agriculture (DoA) intend to convert the existing well to supply non-potable water for farming, dairying, and ranching uses. The current project represents a future phase (Agricultural Park) of the DoA plans if there is sufficient additional water produced by the well after existing agricultural uses, and there is demand for more land with available agricultural water. The current project area could potentially become an Agricultural Park with lots for lease. The purpose of this literature review is to provide information about potential historic properties present within the 150-acre project area. This literature review will inform a programmatic Environmental Assessment that will consider the general impacts of a future Agricultural Park which may extend into the project area and will not meet requirements of the Hawai‘i Administrative Rules (HAR) §13-275 or 276. It contains an overview of the project area and a background section that presents a culture-historical context and previous archaeological work in the vicinity of the project area followed by expectations for potential historic properties within the project area.

PROJECT AREA DESCRIPTION

The project area (Figures 4 and 5) consists of approximately 150-acres of the 404.12 acre state-owned agriculturally-zoned parcel located on former sugarcane plantation land. It is located between 97 and 158 meters (320 and 520 feet) above mean sea level and 1.5 to 2.38 kilometers (0.9 to 1.47 miles) inland from the coast at ‘Upolu Point. The project area is access from the ‘Upolu Airport Road, via the Akoni Pule Highway. It is bound to the north and south by the remainder of the subject parcel, consisting of pasturage, to the east by the ‘Upolu Airport Road, and to the west by undeveloped pasturage of the neighboring TMK parcel.

The geology in this portion of the North Kohala District is generally blanketed in a combination of alkalic and tholeiitic basalt *pāhoehoe* lava flows mapped as Pololu Volcanics that originated from Kohala Volcano between 260,000 and 500,000 years ago during the Pleistocene epoch (labeled Qpl and Oplc in Figure 6) (Lanphere and Frey 1987; Sherrod et al. 2021; Wolfe and Morris 1996). Soils are mapped as Kohala silty clay on 0 to 20 percent slopes (labeled 416, 435, and 436 in Figure 7). Kohala silty clays are deep, well drained soils that formed in material weathered from basic volcanic ash and residuum from basaltic lava. Topography in the project area is characterized by a gentle to moderate slope toward the north (*makai*) and west. The study area is relatively level, with the westerly slope becoming more pronounced as the parcel extends westward near the center of the project area. At the northwest corner is a *pu‘u* named Maunakea which stands 400 feet above mean sea level (Figure 8). There are no perennial or intermittent streams present within the project area. The climate at this elevation in North Kohala is moderately cool, with a mean annual temperature of between 70° to 75° Fahrenheit throughout the year (Giambelluca et al. 2013). The lands in the vicinity of the project area receive a mean annual rainfall of approximately 1,234 millimeters (48 inches), with the highest rainfall occurring during the spring month of March, and the least amount of rainfall occurring during the autumn month of September. Strong trade winds often blow from east to west across this region, except when *kona* winds are blowing (typically during the summer months), and the wind pattern is reversed. The study area is primarily vegetated with grasses, reflecting their long-time use for low-intensity grazing. Occasional ironwood (*Casuarina equisetifolia*) are dispersed throughout the study area and utilized as a windbreak along the ‘Upolu road.

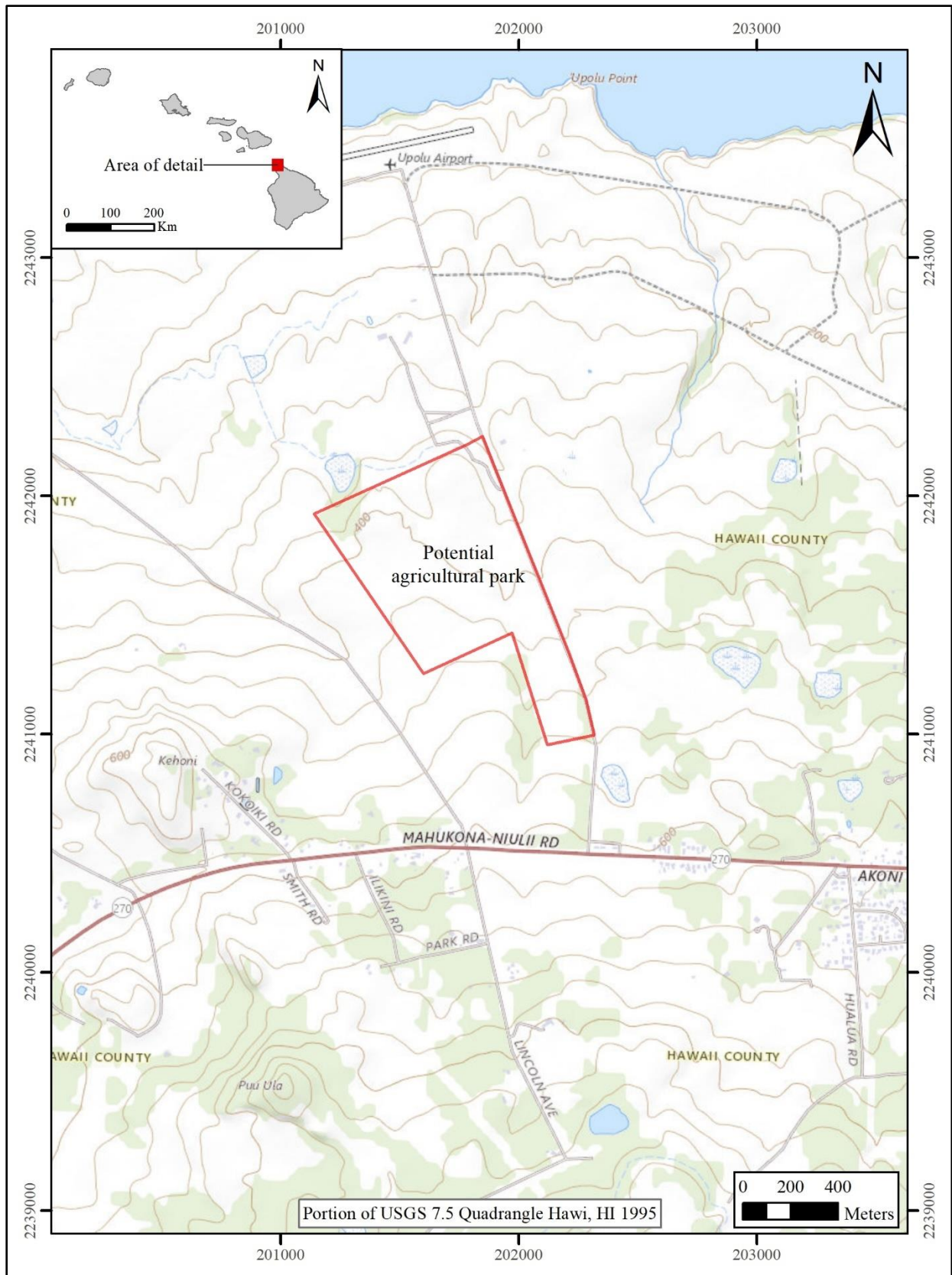


Figure 1. Project area location.

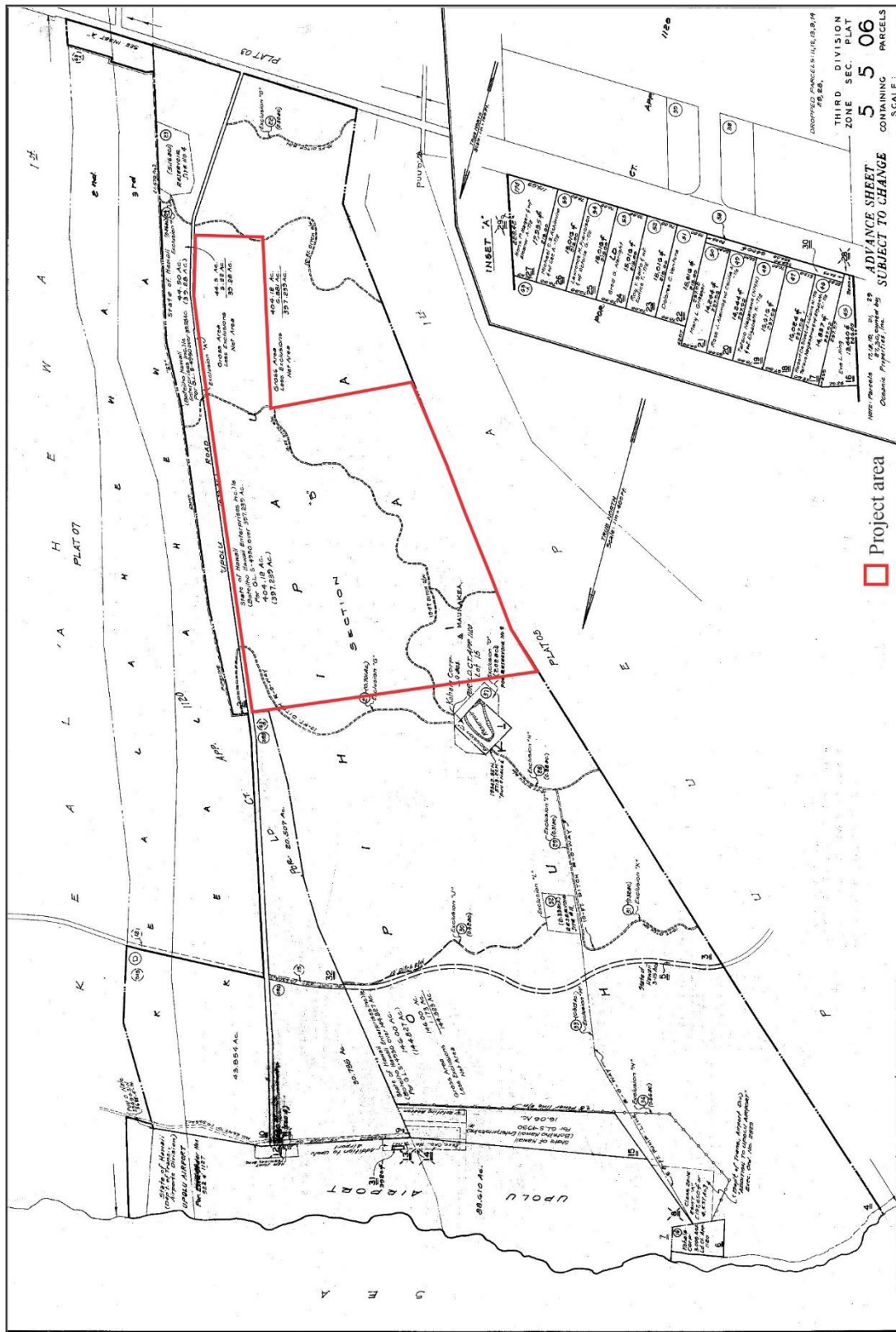


Figure 2. TMK: (3) 5-5-006 showing the current project area, a portion of parcel 003.



Figure 3. Google Earth image showing the current project area (outlined in yellow).



Figure 4. Overview of the project area, view to the north.



Figure 5. Southeastern portion of the project area, view to the south.

I. Introduction

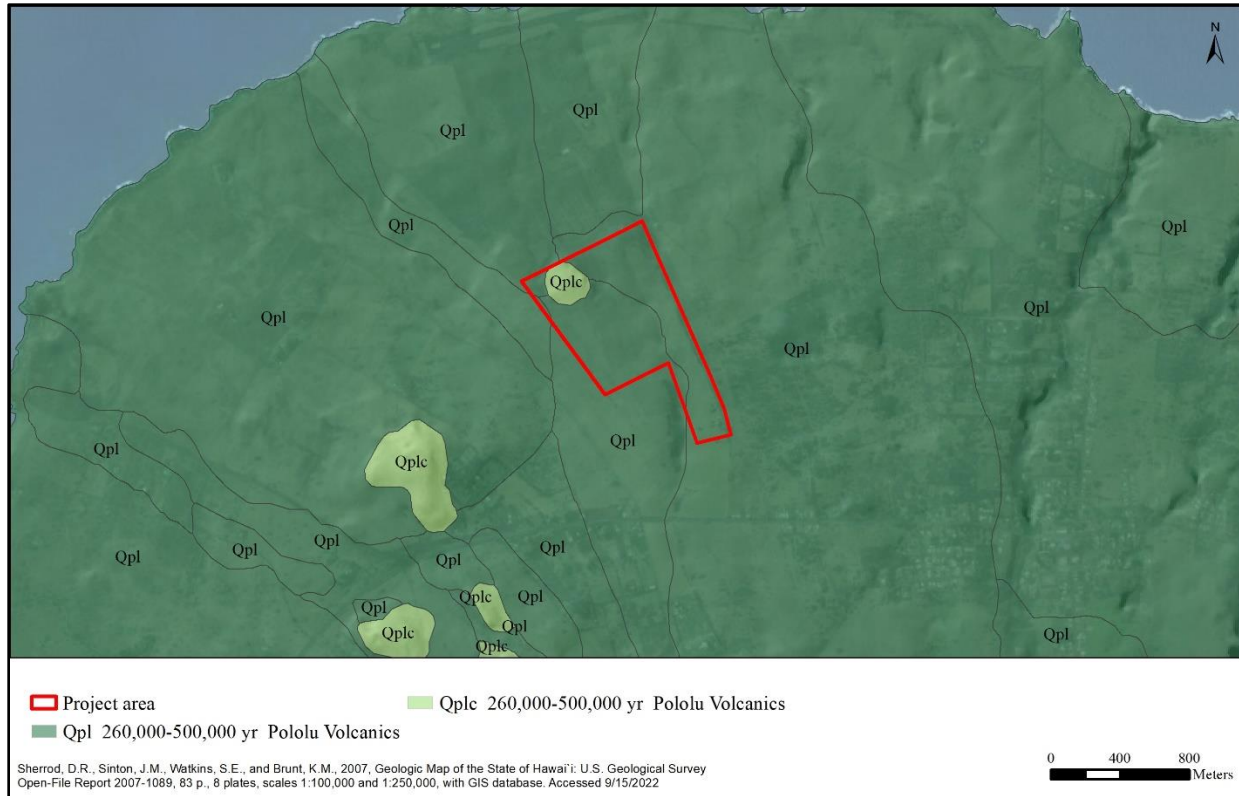


Figure 6. Geology underlying the current project area (Sherrod et al. 2021).

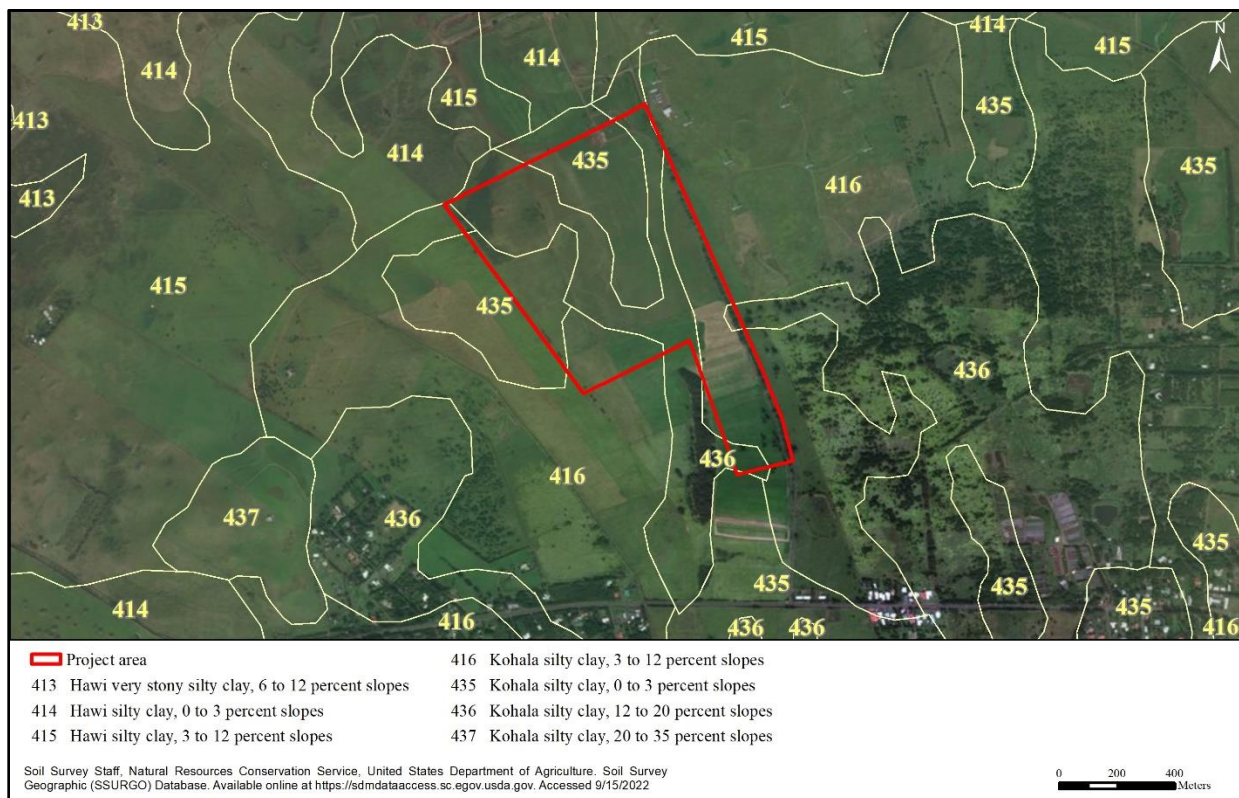


Figure 7. Soils mapped in the current project area (Soil Survey Staff, 2022b).



Figure 8. Maunakea *pu'u* located in the northwest corner of project area, view to the west.

2. BACKGROUND

To generate a set of expectations regarding the nature of archaeological resources that might be encountered within the current study area, and to establish an environment within which to assess the significance of any such resources, a general culture-historical context for the North Kohala region that includes specific information regarding the known history of 'Opihipau and Hukia'a *ahupua'a* and the study area is presented. This is followed by a discussion of relevant prior archaeological studies conducted in the vicinity of the study area.

The culture-historical context and summary of previously conducted archaeological and cultural research presented below are based on research conducted by ASM Affiliates at various physical and digital repositories. Primary English language and Hawaiian language resources were found at multiple state agencies, including the State Historic Preservation Division, Hawai'i State Archives, and the Department of Accounting and General Services Land Survey Division. Digital collections provided through the Office of Hawaiian Affairs Papakilo and Kīpuka databases, Waihona 'Āina, the Ulukau Hawaiian Electronic Library, the Hawai'i Genealogical Indexes, and Newspapers.com provided further historical context and information. Lastly, secondary resources stored at ASM Affiliates' Hilo office offer general information regarding the history of land use, politics, and culture change in Hawai'i, enhancing the broad sampling of primary source materials cited throughout this cultural impact assessment.

CULTURE-HISTORICAL CONTEXT

The chronological summary presented below begins with the peopling of the Hawaiian Islands and includes a presentation of a generalized model of Hawaiian Prehistory containing legendary references to and a discussion of the general settlement patterns for North Kohala. The discussion of prehistory is followed by a summary of historical events in the district that begins with the arrival of foreigners in the islands and then continues with the history of land use in Kohala in the vicinity of 'Opihipau and Hukia'a *ahupua'a* during the nineteenth and twentieth centuries. The summary includes a discussion of the changing lifeways and population decline during the early Historic Period, a review of land tenure in the study *ahupua'a* during the *Māhele 'Āina* of 1848, the use of the project area vicinity for commercial sugarcane cultivation, and the transition away from sugar during the last half of the twentieth century.

A Generalized Model of Hawaiian Prehistory

While the question of the timing of the first settlement of Hawai'i by Polynesians remains unanswered, the current archaeological consensus derives from various sources of information (i.e., archaeological, genealogical, mythological, oral-historical, radiometric). With data from advances in palynology and radiocarbon dating techniques, Kirch (2011) and others (Athens et al. 2014; Wilmshurst et al. 2011) have argued that Polynesians arrived in the Hawaiian Islands, sometime between A.D. 1000 and A.D. 1200 and expanded rapidly thereafter. Other versions of the peopling of the islands, including various native Hawaiian traditions, place the event earlier in time—and as early as the creation of the world (e.g., Beckwith 1951; Liliuokalani 1978; Malo 1951). What is more widely accepted is the answer to the question of where Hawaiian populations came from and the transformations, they went through on their way to establishing a uniquely Hawaiian culture. The initial migration to Hawai'i is believed to have occurred from Kahiki (the ancestral homelands of Hawaiian gods and people) with long-distance voyages occurring fairly regularly through at least the thirteenth century. It has been generally reported that the sources of the early Hawaiian populations originated from the southern Marquesas Islands (Emory in Tatar 1982). In these early times, Hawai'i's inhabitants were primarily engaged in subsistence-level agriculture and fishing (Handy et al. 1991). This was a period of widespread environmental modification when early Hawaiian farmers developed new subsistence strategies by adapting their familiar patterns and traditional tools to their new environment (Kirch 1985; Pogue 1978). According to Fornander (1969), the Hawaiians brought from their homeland certain Polynesian customs and belief: the major gods Kāne, Kū, Lono, and Kanaloa; the *kapu* system of law and order; and the concepts of *pu'uhonua* (places of refuge), *'aumakua* (ancestral deity), and *mana* (divine power).

For generations following initial settlement, communities were clustered along the watered, *ko'olau* (windward) shores of the Hawaiian Islands. Along the *ko'olau* shores, streams flowed and rainfall was abundant, and agricultural production became established. The *ko'olau* region also offered sheltered bays from which deep-sea fisheries could be easily accessed, and nearshore fisheries, enriched by nutrients carried in the freshwater, could be maintained in fishponds and coastal waters. It was around these bays that clusters of houses where families lived could be found (McEldowney 1979). In these early times, Hawai'i's inhabitants were primarily engaged in subsistence-level agriculture and fishing (Handy and Handy 1972).

Following the initial settlement period, areas with the richest natural resources became populated and perhaps crowded, and by about A.D. 1200, the population began expanding to the *kona* (leeward side) and more remote regions of the island (Cordy 2000). Along the *kona* coast of Hawai'i Island, communities were initially established near sheltered bays with access to fresh water, where an abundance of marine resources were readily available. As indicated by the archaeological record, historic documentation, and legendary accounts, this shoreline zone was used primarily for habitation and related activities, such as recreation, ceremonial practices, canoe storage, fishing and associated rituals, and burial (Johnson and Wolforth 2006). Smaller temporary habitations associated with fishing activities were also common along the shore (Cordy 1995).

By the early 17th century, the Hawaiian royalty built chiefly centers within the shoreline zone of central Kona with royal compounds located at Kailua in the vicinity of Kamakahonu and Kaiakeakua, Kahalu'u-Keauhou, Ka'awaloa-Kealakekua, and Hōnaunau. Such royal centers included dwellings for chiefs, their court, and local *maka'āinana* (common people) in addition to public structures, such as *heiau*, sporting grounds and places of refuge (Cordy 1995). As the population continued to expand so did social stratification, which was accompanied by major socioeconomic changes and intensive land modification. Most of the ecologically favorable zones of the windward and coastal regions of all major islands were settled and the more marginal leeward areas were being developed. During this expansion period, additional migrations to Hawai'i occurred from Tahiti in the Society Islands (Kamakau 1976).

Rosendahl (1972) has proposed that settlement along the leeward coast of Hawai'i Island at this time was seasonal and recurrent, and that coastal sites were primarily occupied during the drier summer to exploit marine resources, while the upland sites were primarily occupied during the wetter winter months to focus on agriculture. An increasing reliance on agricultural products may have eventually caused a shift in social networks, as Hommon (1976) argues kinship links between coastal settlements disintegrated as those links within the *mauka-makai* settlements expanded to accommodate the exchange of agricultural products for marine resources. This shift is believed to have resulted in the establishment of the *ahupua'a* system sometime during the A.D. 1400s (Kirch 1985), which added another component to an already well-stratified society. The implications of this model include a shift in residential patterns from seasonal, temporary occupation to the permanent dispersed occupation of both coastal and upland areas. The *ahupua'a* became the equivalent of a local community, with its own social, economic, and political significance. *Ahupua'a* were ruled by *ali'i 'ai ahupua'a* or lesser chiefs; who, for the most part, had complete autonomy over this

generally economically self-supporting piece of land, which was managed by a *konohiki*. *Ahupua'a* were usually wedge or pie-shaped, incorporating all of the eco-zones from the mountains to the sea and for several hundred yards beyond the shore, assuring a diverse subsistence resource base (Hommon 1986). This form of district subdividing was integral to Hawaiian life and was the product of strictly adhered to resource management planning. In this system, the land provided fruits and vegetables and some meat for the diet, and the ocean provided a wealth of protein resources (Rechtman and Maly 2003).

The name of an *ahupua'a* sometimes indicates its importance, records its history, or reveals something about its resources or population. Neither 'Opihipau nor Hukia'a are listed in *Place Names of Hawai'i* (Pukui et al. 1974), but Hukia'a is included in the dictionary compiled by Andrews and Parker (1922) as a land section in Kohala whose name is translated as "pulling roots." Although 'Opihipau is not mentioned in *Place Names*, it could be literally translated to mean a place where 'opihī (a limpet) is consumed (Pukui and Elbert 1986).

The *ali'i* and the *maka'āinana* (commoners) were not confined to the boundaries of the *ahupua'a*; when there was a perceived need, they also shared with their neighbor *ahupua'a ohana* (Hono-ko-hau 1974). The *ahupua'a* were further divided into smaller sections such as the 'ili, mo'o'aina, pauku'aina, kihapai, koele, hakuone, and kuakua (Hommon 1986, Pogue 1978). The chiefs of these land units gave their allegiance to a territorial chief or mo'i (king). *Heiau* building flourished during this period as religion became more complex and embedded in a sociopolitical climate of territorial competition. Monumental architecture, such as *heiau*, "played a key role as visual markers of chiefly dominance" (Kirch 1990:206). This pattern continued to intensify from A.D. 1500 to Contact (A.D. 1778), and there is evidence that suggests that there were substantial changes to the political system as well. Within Kohala, the Great Wall complex at Koai'e is organized with platforms in the complex apart from contemporaneous features. Griffin et al. (1971) interpret this as symbolizing class stratification.

Handy et al. (1991:528) relate that "North Kohala, in old Hawaiian times, was the wet taro area, but was intensively cultivated in dry and forest taro, sweet potatoes, bananas, and cane, as well." According to Handy and Handy (1991), dry taro was planted fairly continuously over all of the grassy *kula* lands of the district between Pololū and Hāwī. To prepare the ground, Hawaiian planters would first burn off the grass, then pull out the stubble, and allow it to rot before planting their starts. Upland forest plantations were also developed in the clearings of the North Kohala forest. Sugarcane was often planted near taro and sweet potato patches. Handy and Handy explain:

In dry-taro and sweet-potato fields on the sloping *kula* or in the lower forest zone, cane was planted as hedges along the lines of stone and rubbish thrown up between the fields. Thus it helped the planter to utilize to the maximum his soil and water, and acted as a windbreak against the gusty breezes which blow in most valley bottoms, along the coasts, and on the uplands where taro is grown (1991:186).

Sugarcane (*Saccharum officinarum*) was a Polynesian introduction that served a variety of uses. The *kō kea* or white cane was the most common, usually planted near Hawaiian homes for medicinal purposes, and to counteract bad tastes (Handy and Handy 1991:185). Sugarcane was a snack, condiment, famine food; fed to nursing babies, and helped to strengthen children's teeth by chewing on it (Handy and Handy 1991:187). It was used to thatch houses when *pili* grass (*Heteropogon contortus*) or *lau hala* (*Pandanus odortissimus*) were not abundant (Malo 1903). Pukui (1983) cites a proverb that reference Kohala. She provides an explanation and notes that Hawaiian proverbs have layers of meaning that are best left to the imagination of the reader:

I 'ike 'ia no o Kohala i ka pae kō, a o ka pae kō ia kole ai ka waha One can recognize Kohala by her rows of sugar cane which can make the mouth raw when chewed.

Pukui interprets this proverb as follows:

When one wanted to fight a Kohala warrior, he would have to be a very good warrior to succeed. Kohala men were vigorous, brave, and strong (1983:127).

By the seventeenth century, large areas of Hawai'i Island (*moku 'aina* – districts) were controlled by a few powerful *ali'i 'ai moku*. There is island-wide evidence to suggest that growing conflicts between independent chiefdoms were resolved through warfare, culminating in a unified political structure at the district level. The legend of Kapunohu (set about A.D. 1600), relates that in North Kohala, the chiefs of Kukuipahu ruled the leeward *ahupua'a* of the district, and the chiefs of Niuli'i ruled the windward *ahupua'a* of the district, and that Wainaiā Gulch was the boundary between the two domains (Erkelens and Athens 1994). In about A.D. 1600, the armies of the two polities met on the battlefield of Hinakahua at Kapa'au (east of the present day town of Kapa'au), and the forces of Kukuipahu were defeated, thus control of the district was united under the chiefs of Niuli'i (Fornander 1916:215-220).

‘Umi-a-Līloa was a renowned Pili line *ali‘i* who ruled from Waipi‘o Valley, son of high ranking *ali‘i* Līloa. ‘Umi’s fame stemmed from his successful unification of all the districts of Hawai‘i Island (Kamakau 1992), and his reign lasted until around ca. A.D. 1620 (Cordy 1994). It has been suggested that the unification of the island resulted in a partial abandonment of portions of leeward Hawai‘i, with people moving to more favorable agricultural areas (Barrera 1971; Schilt and Sinoto 1980). Near the end of ‘Umi’s rule, he relocated to Kona where the weather was more favorable (Kamakau 1992).

One of ‘Umi-a-Līloa’s heirs to the Hawaiian kingdom was his son, Keawe-nui-a-‘Umi, who presided over Hilo. Lono-i-ka-makahiki was Keawe-nui-a-‘Umi’s son, and was a ruler of Ka‘ū and Puna (Kamakau 1992). Following the death of his father, Lono-i-ka-makahiki waged a war for the supremacy of Hawai‘i Island against rebel forces in Kohala. After a battle in leeward North Kohala, Lono-i-ka-makahiki pursued his rivals to Hinakahua at Kapa‘au, where they prepared to fight once again before retreating to the east and being defeated at Pololū Valley in windward North Kohala (Erkelens and Athens 1994). Upon achieving this final victory, Lono-i-ka-makahiki celebrated at the *heiau* of Mulei‘ula at Apuakaohau (Fornander 1916:324). Neither of Lono-i-ka-makahiki’s two sons were heirs to the government, and in the wake of his death, rule of Kohala, Kona, and Ka‘ū was instead split between the descendants of his brother, Kanaloa-kua‘ana.

The late seventeenth to late eighteenth century was marked by both political intensification and stress. Wars occurred regularly between intra-island and inter-island polities, and this period was one of continual conquest by the reigning *ali‘i*. At the beginning of this period, Hawai‘i Island was not united under one rule, but was split amongst the chiefs of Kona and Hilo (Kamakau 1992). Keawe, the son of Kanaloakapulehu, was the ruler of Kohala, Kona, and Ka‘ū. When Keawe died he split the rule of his lands between two of his sons; Kalaninui‘iamamao became the ruling chief of Ka‘ū, and Ke‘eaumoku became the ruling chief of Kona and Kohala (Kamakau 1992). Wars between the *ali‘i* continued unabated through this transition.

After Keawe’s death, Alapa‘inui, the son of former Kona war chief Kauauanui a Mahi, a former war chief of Kona, desired to wrest control of Hawai‘i Island from the other chiefs (Kamakau 1992). Alapa‘inui, who had been living on Maui since the death of his father, returned to Hawai‘i Island and waged war against the chiefs of Kona and Kohala. Alapa‘inui was eventually victorious and took the chiefs of those districts captive, proclaiming Kona and Kohala his own. Kekaulike, the ruler of Maui, however, preferred the former chiefs and wished to help them reclaim their lands. The Maui forces attacked Alapa‘inui, but were unable to defeat him. Although Alapa‘inui’s forces were never beaten, the frequent attacks by Kekaulike did prevent him from taking the chiefs of Hilo and Ka‘ū captive (Alapa‘inui did eventually take control of these districts however). Alapa‘inui later fought and defeated the forces of O‘ahu on Moloka‘i, and after Kekaulike’s death he fought Kauhi, his rival’s oldest son, on Maui where he was also victorious. Alapa‘inui ruled for many years, but at the end of his reign, after moving to Kikiako‘i in Kawaihae, he became seriously ill, and there at the *heiau* of Mailekini, he appointed his son Keawe‘opala ruler of the island (Kamakau 1992).

It was during this time of warfare, following the death of Keawe, that Kamehameha was born in the North Kohala District in the *ahupua‘a* of Kokoiki, near the Mo‘okini Heiau (Kamakau 1992). There is some controversy about the year of his birth, but Kamakau (1992:66–68) places the birth event sometime between A.D. 1736 and 1758, and probably nearer to the later date. The Kamehameha’s ancestral homeland was in Halawa, North Kohala (Williams 1918).

It was in 1754 that Keawe‘opala became the ruler of Hawai‘i, but many of the chiefs who were deprived of their lands fought against him. Keawe‘opala was soon defeated in South Kona by Kalani‘ōpu‘u, who then became the ruler of Hawai‘i Island (Kamakau 1992). Kalani‘ōpu‘u was a clever and able chief, and a famous athlete in all games of strength, but according to Kamakau (1992), he possessed one great fault: he loved war and had no regard for others’ land rights. Although Kalani‘ōpu‘u would maintain his rule over the island for nearly thirty years, his reign was not free of turmoil and strife.

About A.D. 1759, Kalani‘ōpu‘u conquered East Maui, defeating his wife’s brother, the Maui king Kamehamehanui, by using Hāna’s prominent Pu‘u Kau‘iki as his fortress. He appointed one of his Hawai‘i chiefs, Puna, as governor of Hāna and Kīpahulu. Following this victory, Ke‘eaumoku, the son of Keawepoepoe who had originally supported Kalani‘ōpu‘u against Keawe‘opala, rebelled against the Hawai‘i chief. He set up a fort on a hill between Pololū and Honokāne Valleys in windward North Kohala, but Kalani‘ōpu‘u attacked him there and was victorious. Using ropes, Ke‘eaumoku escaped to the sea and fled in a canoe to Maui where he lived under the protection of the Maui chiefs.

In A.D. 1766, Kamehamehanui, the king of Maui, died following an illness and Kahekili became the new ruler of that island. Ke‘eaumoku took Kamehamehanui’s widow, Namahana, a cousin of Kamehameha I, as his wife, and their

daughter, Ka'ahumanu, the future favorite wife of Kamehameha I, was born in a cave at the base of Pu'u Kau'iki, Hāna, Maui in A.D. 1768 (Kamakau 1992). In A.D. 1775, Kalani'ōpu'u and his Hāna forces raided and destroyed the neighboring district of Kaupō in Maui, and then launched several more raids on Moloka'i, Lāna'i, Kaho'olawe, and parts of West Maui. It was at the battle of Kalaeoka'ilio that Kamehameha, a favorite of Kalani'ōpu'u, was first recognized as a great warrior and given the name of Pai'ea (hard-shelled crab) by the Maui chiefs and warriors (Kamakau 1992). During the battles between Kalani'ōpu'u and Kahekili (1777–1779), Ka'ahumanu and her parents left Maui to live on the island of Hawai'i (Kamakau 1992). Kalani'ōpu'u was fighting on Maui when the British explorer Captain James Cook first arrived in the islands. The arrival of foreigners in Hawai'i marked the end of the Precontact Period and the beginning of the Historic Period.

History After Contact

Captain James Cook and his crew on board the ships the H.M.S. *Resolution* and *Discovery* first arrived in the Hawaiian Islands on January 18, 1778. Ten months later, on a return trip to Hawaiian waters, Kalani'ōpu'u, who was still at war with Kahekili, visited Cook on board the *Resolution* off the East coast of Maui. Kamehameha observed this meeting, but chose not to participate. It was during this visit to the islands that Lt. King of the Cook expedition explored the North Kohala countryside, presumably on the windward side, and reported:

As far as the eye could reach, seemed fruitful and well inhabited. [Three and four miles inland, plantations of taro and potatoes and *wauke*] neatly set out in rows. The walls that separate them are made of the loose burnt stone, which are got in clearing the ground; and being entirely concealed by sugar-canecan planted close on each side, make the most beautiful fences that can be conceived. [The exploring party stopped six or seven miles from the sea.] To the left a continuous range of villages, interspersed with groves of coconut trees spreading along the sea-shore; a thick wood behind this; and to the right, an extent of ground laid out in regular and well-cultivated plantations . . . as they passed, they did not observe a single foot of ground, that was capable of improvement, left unplanted (in Handy and Handy 1972:528).

In 1793 Archibald Menzies (1920:52), a naturalist wrote:

From north-west point of the island [‘Upolu Point], the country stretches back for a considerable distance with a very gradual ascent, and is destitute of trees or bushes of any kind. But it bears every appearance of industrious cultivation by the number of small fields into which it is laid out, and if we might judge by the vast number of houses we saw along the shore, it is by far the most populous part we had yet seen of the island.

In January [1779], Cook and Kalani'ōpu'u met again at Kealakekua Bay and exchanged gifts. The following month, Cook set sail for Maui; however, a severe storm off the coast of Kohala damaged a mast of one of the ships and they were forced to return to Kealakekua Bay. While back at the bay a skirmish broke out on the shores of Ka'awaloa over a stolen skiff and Captain Cook was killed (Kuykendall and Day 1976; Sahlins 1985).

After the death of Captain Cook and the departure of H.M.S. *Resolution* and *Discovery*, Kalani'ōpu'u moved to Kona, where he surfed and amused himself with the pleasures of dance (Kamakau 1992). While he was living in Kona famine struck the district. Kalani'ōpu'u ordered that all the cultivated products of that district be seized, before setting out on a circuit of the island. Kalani'ōpu'u then went to Hinakahua in Kapa'au where he amused himself with “sports and games such as hula dancing, *kilu* spinning, *maika* rolling, and sliding sticks” (Kamakau 1991:106). During his stay in Kohala, Kalani'ōpu'u proclaimed that his son Kiwala'ō would be his successor, and he gave the guardianship of the war god Kūka'ilimoku to Kamehameha. However, Kamehameha and a few other chiefs were concerned about their land claims, which Kiwala'ō did not seem to honor (Fornander 1996; Kamakau 1992). The *heiau* of Moa'ula was erected in Waipio at this time (ca. A.D. 1781), and after its dedication Kalani'ōpu'u set out for Hilo to quell a rebellion by a Puna chief named Imakakolo'a.

Imakakolo'a was defeated in Puna by Kalani'ōpu'u's superior forces, but he managed to avoid capture and hide from detection for the better part of a year. While the rebel chief was sought, Kalani'ōpu'u “went to Ka-‘u and stayed first at Punalu'u, then at Waiohinu, then at Kama'oa in the southern part of Ka-‘u, and erected a *heiau* called Pakini, or Halauwailua, near Kama'oa” (Kamakau 1992:108). Imakakolo'a was eventually captured and brought to the *heiau*, where Kiwala'ō was to sacrifice him as an offering. “The routine of the sacrifice required that the presiding chief should first offer up the pigs prepared for the occasion, then bananas, fruit, and lastly the captive chief” (Fornander 1996:202). However, before Kiwala'ō could finish the first offerings, Kamehameha, “grasped the body of Imakakolo'a and offered it up to the god, and the freeing of the tabu for the *heiau* was completed” (Kamakau 1992:109). Upon observing this single act of insubordination, many of the chiefs believed that Kamehameha would eventually rule over

all of Hawai'i. After usurping Kiwalao's authority with a sacrificial ritual in Ka'ū, Kamehameha retreated to his home district of Kohala. While in Kohala, Kamehameha farmed the land, growing taro and sweet potatoes (Handy and Handy 1972). Kalani'ōpu'u died in April of 1782 and was succeeded by his son Kiwala'ō.

The Rule of Kamehameha I (1782-1819)

After Kalani'ōpu'u died, several chiefs were unhappy with Kiwala'ō's division of the island's lands, and civil war broke out. Kiwala'ō, Kalani'ōpu'u's son and appointed heir, was killed at the battle of Moku'ōhai, South Kona in July of 1782. Supporters of Kiwala'ō, including his half brother Keoua and his uncle Keawemauhili, escaped the battle of Moku'ōhai with their lives and laid claim to the Hilo, Puna, and Ka'ū Districts. According to Ii (1963) nearly ten years of almost continuous warfare followed the death of Kiwala'ō, as Kamehameha endeavored to unite the island of Hawai'i under one rule and conquer the islands of Maui and O'ahu. Keoua became Kamehameha's main rival on the island of Hawai'i, and he proved difficult to defeat (Kamakau 1992). Keawemauhili would eventually give his support to Kamehameha, but Keoua never stopped resisting. Around 1790, in an effort to secure his rule, Kamehameha began building the *heiau* of Pu'ukohola in Kawaihae, which was to be dedicated to the war god Kūka'ilimoku (Fornander 1996).

When Pu'ukohola Heiau was completed in the summer of 1791, Kamehameha sent his two counselors, Keaweheulu and Kamanawa, to Keoua to offer peace. Keoua was enticed to the dedication of the Pu'ukohola Heiau by this ruse and when he arrived at Kawaihae he and his party were sacrificed to complete the dedication (Kamakau 1992). The assassination of Keoua gave Kamehameha undisputed control of Hawai'i Island by A.D. 1792 (Greene 1993).

In 1790 two Western ships, the *Eleanora* and *Fair American*, were trading in Hawaiian waters. As retribution for the theft of a skiff and the murder of one of the sailors, the crew of the *Eleanora* massacred more than 100 natives at Olowalu [Maui]. The *Eleanora* then sailed to Hawai'i Island, and one of its crew, John Young, went ashore, where he was detained by Kamehameha. The other vessel, the *Fair American*, was captured by the forces of Kamehameha off the Kekaha coast and its crew was killed except for one member, Isaac Davis. Guns, and a cannon later named "Lopaka," were recovered from the *Fair American*, which Kamehameha kept as part of his fleet (Kamakau 1992). Kamehameha made Young and Davis his advisors, and with their aid, along with his new ship and foreign arms, by 1796 he had conquered all the island kingdoms except Kauai. It wasn't until 1810, when Kaumuali'i of Kauai gave his allegiance to Kamehameha, that the Hawaiian Islands were unified under one ruler (Kuykendall and Day 1976).

Demographic trends during this period indicate population reduction in some areas, due to war and disease, yet increases in others, with relatively little change in material culture. However, there was a continued trend toward craft and status specialization, intensification of agriculture, *ali'i* controlled aquaculture, upland residential sites, and the enhancement of traditional oral history. The Kū cult, *luakini heiau*, and the *kapu* system were at their peaks, although western influence was already altering the cultural fabric of the Islands (Kent 1983; Kirch 1985). Foreigners had introduced the concept of trade for profit, and by the time Kamehameha I had conquered O'ahu, Maui and Moloka'i, in 1795, Hawai'i saw the beginnings of a market system economy (Kent 1983). This marked the end of the Proto-Historic Period and the end of an era of uniquely Hawaiian culture.

Hawai'i's culture and economy continued to change drastically as capitalism and industry established a firm foothold. The sandalwood (*Santalum ellipticum*) trade, established by Euro-Americans in 1790 and turned into a viable commercial enterprise by 1805 (Oliver 1961), was flourishing by 1810. This added to the breakdown of the traditional subsistence system, as farmers and fishermen were ordered to spend most of their time logging, resulting in food shortages and famine that led to a population decline. Kamehameha, who resided on the Island of O'ahu at this time, did manage to maintain some control over the trade (Kuykendall and Day 1976; Kent 1983).

Upon returning to Kailua in 1812, Kamehameha ordered men into the mountains of Kona to cut sandalwood and carry it to the coast, paying them in cloth, *tapa* material, food, and fish (Kamakau 1992). This new burden added to the breakdown of the traditional subsistence system. Farmers and fishermen were ordered to spend most of their time logging, resulting in food shortages and famine that led to a population decline. Kamakau indicates that, "this rush of labor to the mountains brought about a scarcity of cultivated food . . . The people were forced to eat herbs and tree ferns, thus the famine [was] called Hi-laulele, Haha-pilau, Laulele, Pualele, 'Ama'u, or Hapu'u, from the wild plants resorted to" (1992:204). Once Kamehameha realized that his people were suffering, he "declared all the sandalwood the property of the government and ordered the people to devote only part of their time to its cutting and return to the cultivation of the land" (ibid.:204). In the uplands of Kailua a vast plantation named Kuahewa was established where Kamehameha himself worked as a farmer. Kamehameha enacted the law that anyone who took one taro or one stalk of sugarcane must plant one cutting of the same in its place (Handy et al. 1991). While in Kailua, Kamehameha resided

at Kamakahonu, from where he continued to rule the islands for another nine years. He and his high chiefs participated in foreign trade, but also continued to enforce the rigid *kāpu* system.

The Death of Kamehameha I and the Abolition of the *Kapu* System

Kamehameha I died on May 8, 1819 at Kamakahonu in Kailua-Kona, and the changes that had been affecting the Hawaiian culture since the arrival of Captain Cook in the Islands began to accelerate. Following the death of a prominent chief, it was customary to remove all of the regular *kapu* that maintained social order and the separation of men and women and elite and commoner. Thus, following Kamehameha's death a period of '*ai noa* (free eating) was observed along with the relaxation of other traditional *kapu*. It was for the new ruler and *kahuna* to re-establish *kapu* and restore social order, but at this point in history traditional customs were altered:

The death of Kamehameha was the first step in the ending of the tabus; the second was the modifying of the mourning ceremonies; the third, the ending of the tabu of the chief; the fourth, the ending of carrying the tabu chiefs in the arms and feeding them; the fifth, the ruling chief's decision to introduce free eating ('*ainoa*) after the death of Kamehameha; the sixth, the cooperation of his aunts, Ka-ahu-manu and Ka-heihei-malie; the seventh, the joint action of the chiefs in eating together at the suggestion of the ruling chief, so that free eating became an established fact and the credit of establishing the custom went to the ruling chief. This custom was not so much of an innovation as might be supposed. In old days the period of mourning at the death of a ruling chief who had been greatly beloved was a time of license. The women were allowed to enter the heiau, to eat bananas, coconuts, and pork, and to climb over the sacred places. You will find record of this in the history of Ka-ula-hea-nui-o-ka-moku, in that of Ku-ali'i, and in most of the histories of ancient rulers. Free eating followed the death of the ruling chief; after the period of mourning was over the new ruler placed the land under a new tabu following old lines. (Kamakau 1992: 222)

Immediately upon the death of Kamehameha I, Liholiho (his son and to be successor) was sent away to Kawaihae to keep him safe from the impurities of Kamakahonu brought about from the death of Kamehameha. After purification ceremonies Liholiho returned to Kamakahonu:

Then Liholiho on this first night of his arrival ate some of the tabu dog meat free only to the chiefesses; he entered the *lauhala* house free only to them; whatever he desired he reached out for; everything was supplied, even those things generally to be found only in a tabu house. The people saw the men drinking rum with the women *kahu* and smoking tobacco, and thought it was to mark the ending of the tabu of a chief. The chiefs saw with satisfaction the ending of the chief's tabu and the freeing of the eating tabu. The *kahu* said to the chief, "Make eating free over the whole kingdom from Hawaii to Oahu and let it be extended to Kauai!" and Liholiho consented. Then pork to be eaten free was taken to the country districts and given to commoners, both men and women, and free eating was introduced all over the group. Messengers were sent to Maui, Molokai, Oahu and all the way to Kauai, Ka-umu-ali'i consented to the free eating and it was accepted on Kauai. (Kamakau 1992: 225)

When Liholiho, Kamehameha II, ate the *kapu* dog meat, entered the *lauhala* house and did whatever he desired it was still during a time when he had not reinstated the eating *kapu* but others appear to have thought otherwise. Kekuaokalani, caretaker of the war god *Ku-Kailimoku*, was dismayed by his cousin's (Liholiho) actions and revolted against him, but was defeated.

With an indefinite period of free-eating and the lack of the reinstatement of other *kapu* extending from Hawai'i to Kaua'i, and the arrival of the Christian missionaries shortly thereafter, the traditional religion had been officially replaced by Christianity within a year following the death of Kamehameha I. By December of 1819 Kamehameha II had sent edicts throughout the kingdom renouncing the ancient state religion, ordering the destruction of the *heiau* images, and ordering that the *heiau* structures be destroyed or abandoned and left to deteriorate. He did, however, allow the personal family religion, the '*aumakua* worship, to continue (Oliver 1961; Kamakau 1992).

With the end of the *kapu* system, changes in the social and economic patterns began to affect the lives of the common people. Liholiho moved his court to O'ahu, lessening the burden of resource procurement for the chiefly class on the residents of Hawai'i Island. Some of the work of the commoners shifted from subsistence agriculture to the production of foods and goods that they could trade with early Western visitors.

Kohala 1820-1848: A Land in Transition

In October of 1819, seventeen Protestant missionaries set sail from Boston to Hawai‘i. They arrived in Kailua-Kona on March 30, 1820 to a society with a religious void to fill. Many of the *ali‘i*, who were already exposed to western material culture, welcomed the opportunity to become educated in a western style and adopted their dress and religion. Soon they were rewarding their teachers with land and positions in the Hawaiian government. During this period, the sandalwood trade was wreaking havoc on the commoners, who were weakening with the heavy production, exposure, and famine just to fill the coffers of the *ali‘i* who were no longer under any traditional constraints (Oliver 1961; Kuykendall and Day 1976). The lack of control of the sandalwood trade was to soon lead to the first Hawaiian national debt as promissory notes and levies were initiated by American traders and enforced by American warships (Oliver 1961). The Hawaiian culture was well on its way towards Western assimilation as industry in Hawai‘i from the sandalwood trade, to a short-lived whaling industry, to the more lucrative, but environmentally destructive sugar industry.

Some of the earliest written descriptions of Kohala come from the accounts of the first Protestant Missionaries to visit the island. In 1823, regarding the sandalwood trade in Kohala, the Reverend William Ellis wrote:

About eleven at night we reached Towaihae [Kawaihae], where we were kindly received by Mr. Young. . . . Before daylight on the 22nd, we were roused by vast multitudes of people passing through the district from Waimea with sandal-wood, which had been cut in the adjacent mountains for Karaimoku, by the people of Waimea, and which the people of Kohala, as far as the north point, had been ordered to bring down to his storehouse on the beach, for the purpose of its being shipped to Oahu. There were between two and three thousand men, carrying each from one to six pieces of sandal-wood, according to their size and weight. It was generally tied on their backs by bands of ti leaves, passed over the shoulders and under the arms, and fastened across their breasts. (Ellis 2004:405-406)

During his 1823 tour of the island Ellis also briefly describes Kapa‘au as “an inland village, where with some difficulty, we collected a congregation of about fifty, principally women, to whom a short discourse was addressed” (Ellis 2004:400). In 1825 Artemus Bishop, another Protestant missionary who had accompanied Ellis on his tour, returned to Kohala. Travelling from Māhukona over the leeward slopes to the windward side of the district he wrote:

. . . we began to descend; here the land is intercepted with many deep ravines, whose sides are covered with bread-fruit and kukui, the former so useful in furnishing food for man, and the latter celebrated for the oil-nut, that is used for torches, burning with a brilliant light and sending forth a fragrant odour [sic]. At the bottom of many of the ravines murmurs the brook and waterfall, as it descends towards the sea irrigating numerous taro beds in its way. The dwelling houses and farms are thickly scattered over this most fertile region, from the seashore on the north to the summit of the interior [sic], presenting a more numerous population than perhaps any other part of the island of the same extent. (Damon 1927)

At Honopueo Bishop preached to an assembly of nearly 200 individuals. He then moved on to Kapa‘au where he preached to another congregation in a recently erected school house (Erkelens and Athens 1994). Afterwards, he noted that he had “a pleasant conversation with Walawala, a chief woman of distinction residing at this place” (Damon 1927:53). For several years during the early nineteenth century Protestant missionaries continued to travel through Kohala, preaching to the inhabitants of the district, and recording their work in mission station reports and letters. It wasn’t until 1832, however, when the Rev. Lorenzo Lyons was assigned to the Mission Station in Waimea, that Kohala had a permanent missionary presence (Erkelens and Athens 1994).

A missionary census taken in 1835 recorded 6,175 people living in Kohala at that time, including 2,262 men, 2,323 women, and 1,590 children (Schmitt 1973). Within the current project area, only ‘Opihipau Ahupua‘a is listed in the 1835 census with a total of 58 people (21 men, 21 women, and 16 children).

In 1837 two more Protestant missionaries, Isaac Bliss and Edward Bailey, were permanently stationed in North Kohala. In 1841 the Reverend Elias Bond relieved Mr. Bliss at the North Kohala mission (Wolforth 2008). The arrival of the American missionary Elias Bond was the start of a transition that eventually helped North Kohala burgeon as a major force in the sugar industry (KTF 1975). In her comprehensive study of North Kohala, Tomonari-Tuggle describes the impacts of this transition:

The arrival in 1841 of Elias Bond, of the Protestant American Board of Commissioners for Foreign Missions, to Kohala marked the beginning of a 22-year period of transition in the district’s history. In those years a new religion, a new land tenure system, and a changing economy altered the

lifestyles and worldview of the indigenous population of the district. The Kohala community was in flux, attempting to find a firm footing in a changing world, in a much larger network of social, political, and economic interactions than had previously existed. (Tomonari-Tuggle 1988:I-23)

When Elias Bond directed his efforts to initiating sugar as a major agricultural industry in Kohala, he could not have foreseen the incredible success of his modest venture. His primary concern was to develop a means for the Hawaiian people of the district to compete successfully in the market economy that had evolved in Hawaii. What resulted was a vigorous, stable, and competitive industry which survived over a century of changing economic situations. For the Hawaiian people, however, the impact was not what Bond anticipated. (Tomonari-Tuggle 1988:I-39)

In 1841, the same year that Rev. Bond arrived in North Kohala, 'Aikō established the first commercial sugar operation in the district at 'Iole to the east of the current project area (Wolforth 2008). The sugar operation had three buildings for making sugar and molasses: a cane building, a boiling house, and a storage shed. The buildings were thatched in the native style, except for the cane building which was used for grinding cane. It contained an oxen powered mill that was made of native wood, and was described in the diary of A.O. Forbes as a kind of shed with a top like that of a Chinese umbrella that had open sides (Wolforth 2008). The juice removed from the cane travelled through an underground trough to a vat in the boiling house. The juice was then dipped into pots and boiled until proper consistency, and then set to drain in pots. The remains of the cane, after it passed through the mill, were stored in a long storage shed (Wolforth 2008).

With the arrival of foreigners in Hawai'i, the introduction of a western economy, and the rise of the sugar and cattle industries, life in Kohala began to drastically change. Population of the district also declined rapidly as native populations were decimated by disease and a depressed birth rate. Epidemics in 1848 and 1849 killed more than 10,000 people in twelve months throughout the Hawaiian Islands (Tomonari-Tuggle 1988). In North Kohala in 1848, Rev. Bond reported that 100 people had died within a three week period, and in October of that year he reported that a measles epidemic had nearly every resident of the district in the hospital (Damon 1927). Following these epidemics the population of the district had been reduced to nearly half of the more than 6,000 people reported in the 1835 census (Schmitt 1977).

By the mid-nineteenth century, leeward settlement shifted to the windward side of North Kohala as the leeward, agriculturally marginal, areas were abandoned in favor of more productive and wetter sugarcane lands. According to Tomonari-Tuggle (1988), the remnant leeward population nucleated into a few small coastal communities and dispersed upland settlements. These settlements were no longer based on traditional subsistence patterns, largely because of the loss of access to the full range of necessary resources. The windward *kula* slopes were a focus of the shifting settlement pattern and eventually became the population center of North Kohala. Tomonari-Tuggle clarifies some of the reasons for this migration:

Outmigration and a demographic shift from rural areas to growing urban centers reflected the lure of a larger world and world view on previously isolated community. Foreigners, especially whalers and merchants, settled around good harbors and roadsteads. Ali'i and their followers gravitated towards these areas, which were the sources of Western material goods, novel status items which would otherwise be unavailable. Associated with the emergence of the market, cash-based economy, commoners followed in search of paying employment. (1988:33)

The Legacy of the Māhele 'Āina of 1848

By the mid-nineteenth century, the Hawaiian Kingdom was an established center of commerce and trade in the Pacific, recognized internationally by the United States and other nations in the Pacific and Europe (Sai 2011). As Hawaiian political elites sought ways to modernize the burgeoning Kingdom, and as more Westerners settled in the Hawaiian Islands, major socioeconomic and political changes took place, including the formal adoption of a Hawaiian constitution by 1840, the change in governance from an absolute monarchy to a constitutional monarchy, and the shift towards a Euro-American model of private land ownership. This change in land governance was partially informed by ex-missionaries and Euro-American businessmen in the islands who were generally hesitant to enter business deals on leasehold lands that could be revoked from them at any time. *Mō'ī* (Ruler) Kamehameha III, through intense deliberations with his high-ranking chiefs and political advisors, separated and defined the ownership of all lands in the Kingdom (King n.d.). They decided that three classes of people each had one-third vested rights to the lands of Hawai'i: the *Mō'ī*, the *ali'i* and *konohiki*, and the native tenants (*hoa'āina*). In 1846, King Kamehameha III formed the Board of Commissioners to Quiet Land Titles (more commonly known as the Land Commission) to adopt guiding

principles and procedures for dividing the lands, grant land titles, and act as a court of record to investigate and ultimately award or reject all claims brought before them (Bailey in Commissioner of Public Lands 1929). All land claims, whether by chiefs for an entire *ahupua'a* or *'ili kūpono* (nearly independent *'ili* land division within an *ahupua'a*, that paid tribute to the ruling chief and not to the chief of the *ahupua'a*), or by *hoa'āina* for their house lots and gardens, had to be filed with the Land Commission within two years of the effective date of the Act (February 14, 1846) to be considered. This deadline was extended several times for chiefs and *konohiki*, but not for native tenants (Soehren 2005).

The King and some 245 chiefs spent nearly two years trying unsuccessfully to divide all the lands of Hawai'i amongst themselves before the whole matter was referred to the Privy Council on December 18, 1847 (King n.d.; Kuykendall 1938). Once Kauikeaouli and his chiefs accepted the principles of the Privy Council, the *Māhele 'Āina* (Land Division) was completed in just forty days (on March 7, 1848). The names of nearly all of the *ahupua'a* and *'ili kūpono* of the Hawaiian Islands, as well as the names of the chiefs who claimed them, were recorded in the *Buke Māhele* (*Māhele* Book) (Buke Māhele 1848; Soehren 2005). As this process unfolded, King Kauikeaouli, who received roughly one-third of the lands of Hawai'i, realized the importance of setting aside public lands that could be sold to raise money for the government and also purchased for fee simple title by his subjects. Accordingly, the day after the division when the name of the last chief was recorded in the *Buke Māhele*, the King commuted about two-thirds of the lands awarded to him to the government (King n.d.). Unlike Kauikeaouli, the chiefs and *konohiki* were required to present their claims to the Land Commission to receive their Land Commission Awards (LCAw.). The chiefs who participated in the *Māhele* were also required to provide to the government commutations of a portion of their lands in order to receive a Royal Patent giving them title to their remaining lands. The lands surrendered to the government by the King and chiefs became known as "Government Land." The lands personally retained by the King became known as "Crown Land." Lastly, the lands received by the chiefs became known as "Konohiki Land" (Chinen 1958:vii; 1961:13). To expedite the work of the Land Commission, all lands awarded during the *Māhele* were identified by name only, with the understanding that the ancient boundaries would prevail until the lands could be formally surveyed. During this process, 'Opihipau and Hikiaa *ahupua'a* ultimately became Government land, with 'Opihipau returned by Victoria Kamamalu, and Hikiaa returned by William Leleiohoku.

As the *Mō'i* and *ali'i* made claims to large tracts of land during the *Māhele*, questions arose regarding the protection of rights for the native tenants. To address this matter, on August 6, 1850, the *Kuleana* Act or Enabling Act was passed, allowing native tenants to claim a fee simple title to any portion of lands which they physically occupied, actively cultivated, or had improved (Garovoy 2005). Additionally, the *Kuleana* Act clarified rights to gather natural resources, as well as access rights to *kuleana* parcels, which were typically landlocked. Lands awarded through the *Kuleana* Act were and still are, referred to as *kuleana* awards or *kuleana* lands. The Land Commission oversaw the program and administered the *kuleana* as Land Commission Awards (Chinen 1958). Native tenants wishing to claim land were required to register their claim in writing (either in the Hawaiian or English language) by submitting a register to the Land Commission who assigned the claimant a number, and that number was used to track the claimant through the entire claims process. Subsequently, the claimant had to get supporting testimony from two individuals (typically neighbors) to confirm their claim to the land. The document generated as part of this process was known as a Native or Foreign Testimony depending upon the language used by the claimant. Upon successful submittal of the required documents, the Land Commission rendered their decision, and if successful, the tenant was issued the LCAw. A total of 13,514 *kuleana* were claimed by native tenants throughout the islands, of which 9,337 were awarded (Maly 2000). No *kuleana* were awarded within the current project area. Two *kuleana* were claimed in Hukia'a *Ahupua'a* by Kalakapu, but not awarded. A witness (Kahiolo) for Kalakapu testified that Kalakapu's land was located within the *'ili* of Pohokinikini and was dry, uncultivated, unfenced and that the only house was for himself, Kahiolo, and not for Kalakapu. No *kuleana* were claimed or awarded within 'Opihipau *Ahupua'a*.

Boundary Commission Testimony (1862-1876)In 1862, the Commission of Boundaries (Boundary Commission) was established in the Hawaiian Kingdom to legally set the boundaries of all the *ahupua'a* that had been awarded as a part of the *Māhele*. Subsequently, in 1874, the Commissioners of Boundaries were authorized to certify the boundaries for lands brought before them. The primary informants for the boundary descriptions were old native residents of the lands, many of which had also been claimants for *kuleana* during the *Māhele*. This information was collected primarily between 1873 and 1885 and was usually given in Hawaiian and transcribed in English. Although hearings for most *ahupua'a* boundaries were brought before the Boundary Commission and later surveyed by Government employed surveyors, in some instances, the boundaries were established through a combination of other methods. In some cases, *ahupua'a* boundaries were established by conducting surveys on adjacent *ahupua'a*. In cases where the entire *ahupua'a* was divided and awarded as Land Claim Awards and or Government issued Land Grants (both which required formal surveys), the Boundary Commission relied on those

surveys to establish the boundaries for that *ahupua'a*. Although these surveys aided in establishing the boundaries, they lack the detailed knowledge of the land that is found in the Boundary Commission hearings. As Government lands, no Boundary Commission testimony was taken for 'Opihipau and Hukia'a *ahupua'a*, however both the neighboring lands of Pu'uepa and Kealahewa 3rd *ahupua'a* were recorded (Boundary Commission 1874). While testifying on the boundary between Kealahewa 3rd and 'Opihipau, Kanehalau lists landmarks from the *mauka* end of the boundary at Kukupahu Ahupua'a as a pile of stones, a hill called Mauna Kea, another pile of stones and lauhala trees, and then the *pali* at the sea shore. As can be seen in Figure 2, the *pu'u* located in the northwest corner of the project area is named "Mauna Kea;" if the *pu'u* listed by Kanehalau is the same *pu'u*, then the boundaries 'Opihipau and Hukia'a *ahupua'a* may have been quite different from their current configuration. In the boundary testimony for Pu'uepa, which borders Hukia'a to the west, Pahiha stated that boundary began at a long rock named Pohakuloa in the ocean and inland along an *iwi aina* (a ridge of small stones) (Maly and Maly 2003:332).

The Rise of the Sugar Industry in Kohala

Following the *Māhele* of 1848, the population along the North Kohala coast continued to decline and the inland agricultural fields were largely abandoned as they succumbed to the ravages of free-ranging cattle or were bought up by the burgeoning ranching and sugar industries. According to Tomonari-Tuggle, "the remnant leeward population nucleated into a few small coastal settlements and dispersed upland habitations," where they "entrenched themselves in a fluorescence of wall building" (1988:I-37). During this migration, which Tomonari-Tuggle surmises was probably stimulated as much by the new land tenure system that emphasized private ownership as it was by the nearly feral ranging animals across the district, *kuleana* walls were built to enclose houses, gardens, and animal pens, "as much for protection from cattle and other animals as for property boundaries" (Tomonari-Tuggle 1988:I-37).

Summarizing the changes that had occurred in North Kohala during the period between roughly 1840 and 1860, Tomonari-Tuggle writes:

By the early 1860's, Western Contact had made its inevitable mark on the community of North Kohala. Drastic population decline, virtual abandonment of [the leeward] half of the district, and growing detraction from subsistence activities characterized these brief two decades. However, the community remained essentially Hawaiian in nature and in actual numbers as well; foreigners were still a small minority.

By 1860, the population of North Kohala had dropped to 2,600 people (Schmitt 1977). Rev. Elias Bond, who had witnessed this population decline first hand, and who saw the effects that the changes in land tenure were having on the Hawaiian population, sought "some mechanism to keep the Hawaiian population in Kohala and to provide a means for their survival in the aggressive market economy (Tomonari-Tuggle 1988:I-38). Bond saw sugar as the best vehicle to accomplish this goal.

In 1862 Rev. Elias Bond formed the Kohala Sugar Company as a means of creating employment for Kohala residents and placed George C. Williams as the manager (Damon 1927). John Hind, an Englishman, completed a milling contract with Alexander and Baldwin on Maui and was interested in finding a promising new location to start his own company. After visiting his friend George C. Williams in North Kohala around 1872/1873, Hind decided to move his family over from Maui and invest in the Hawai'i Island sugar industry (Hind n.d.). In 1873 the sugar industry was still in its infancy in North Kohala, and most of the infrastructure that it would come to rely on had not yet been built. At that time only two sugar mills were operating in the district, the Kohala Sugar Company's mill at Hala'ula, and a much cruder operation at Hālawā.

During his first days in Kohala, Hind toured the district on horseback looking for a suitable location to build a plantation, and had a vast area from which to choose:

The Kohala Sugar co.'s area extended from the sea on the north to the forest line (an elevation of about 1600 ft.) on the south, and from Halawa gulch on the east to Kapaau on the west.

With the exception of a few patches of cane on upper Halawa, it was all open grass land from the Kohala Sugar Co.'s east boundary to Pololu gulch, and west from the company's west boundary at Kapa'au was also entirely open country, grass lands for a matter of five to six miles. (Hind n.d.:12)

Robert Hind eventually "secured [leased] a large tract of land at and near Puehuehu" (Hind n.d.:39) to the west of Kohala Sugar Company's lands, on which he began his plantation. By the end of 1873, Hind "entered into agreements for the planting cane with Mr. Dan Vida of Waikapu, Maui, Judge C. F. Hart of Kona, Hawaii, Mr. George F. Holmes, of Kahuā, and Mr. James Woods of Puuhue", and, "shortly after, these gentlemen were on the ground, land was being plowed, and in due time cane was planted and plans laid for the erection of the sugar factory" (Hind n.d.:39-40).

Hind built a mill, which he called Union Mill, near the boundary of Laaumama and Pūehuehu *ahupua'a, makai* of the Government Road and to the east of the current project area. When it was nearly completed, just months prior to the harvest of the first crop of cane in 1874, a fire broke out that completely destroyed the mill. The mill was rebuilt, but the following year the Union Mill was once again destroyed by fire and shortly thereafter, Robert Hind, who by this time had entered into agreements to build a mill at Hāwī, sold the Union Mill to James Renton and a group that included Daniel Vida, Theo H. Davies & Co., and the brothers Clement (Cecil) and Ralph Sneyd Kynnersley (Schweitzer 2003). Renton quickly rebuilt the mill, and “fortunately the weather had been favorable, and the loss by delay [from the fire] was not as serious as it otherwise would have been” (Hind n.d.:74).

After the sale of the Union Mill and Plantation Company, Robert Hind focused on building his new Hawi Mill to the west of his former plantation lands. By this time, six sugar mills were operating in North Kohala: Kohala Mill, Union Mill, Hawi Mill, Star Mill, Hālawa Mill, and Niuli'i Mill (Figure 9). Hind's plantation had 32 employees in 1880. By 1889 the plantation was taken over by W. G. Irwin & Co. to cover its debts (Dorrance and Morgan 2000). At this time Robert Hind, who wished to purchase certain lands in Hāwī from W. G. Irwin & Co. at the expiration of his lease, made a deal to also purchase the Star Mill Company lands, which were then jointly managed by the Hawi and Union Mill companies (Hind n.d.).

In 1901, the Hawi Mill and Plantation Company decided to construct a new mill at Hō'ea to replace the Hawi Mill, which could not handle the plantation's increased production (Hannah 1938). Construction of the mill began in 1903, and the first cane was ground in July of 1904 (Honolulu Evening Bulletin 1905). A camp was also established at the mill. A map prepared in 1905 (Figure 10) shows the Hō'ea Mill and the associated camp during this early period. The current project area does not appear to have been under sugarcane cultivation at his time. A single *pu'u* labeled “Maunakea” is shown in the northwest corner of the project area.

In 1910, the Hawi Mill and Plantation Company purchased a 3.0-acre plot of land north (*makai*) of Maunakea *pu'u* as Grant No. 6268 (Figure 11). In an aerial photograph taken in 1925 (Figure 12) sugarcane fields and associated irrigation ditches and roads can be seen traversing throughout the current project area. Several roads lead to the Maunakea *pu'u*. The 3.0-acre grant parcel, *makai* of the *pu'u* and outside of the project area, appears to be under cultivation. A plantation camp (Camp 12), is also visible at the *makai* toe of Mauna Kea.

In 1930, the Hawi Mill and Plantation Company was acquired by Castle & Cooke, which formed the Hawi Sugar Company to continue operating the plantation and mill as a subsidiary (Case 1930a). Then, in December of that same year, the Hawi Sugar Company merged with Kohala Sugar Company (Case 1930b). Land Court Application 1120 was made by Kohala Sugar Company when it consolidated its land holdings, and a map (Figure 13) made to accompany the land court application depicts the state of the plantation in 1935. Because the map is focused on parcel boundaries it there is little detail about the plantation or its infrastructure. It does show, however, Mauna Kea *pu'u* and a reservoir located within the Grant 6268 parcel (which is labeled “Lot 15”). Camp 12 is not included on the map.

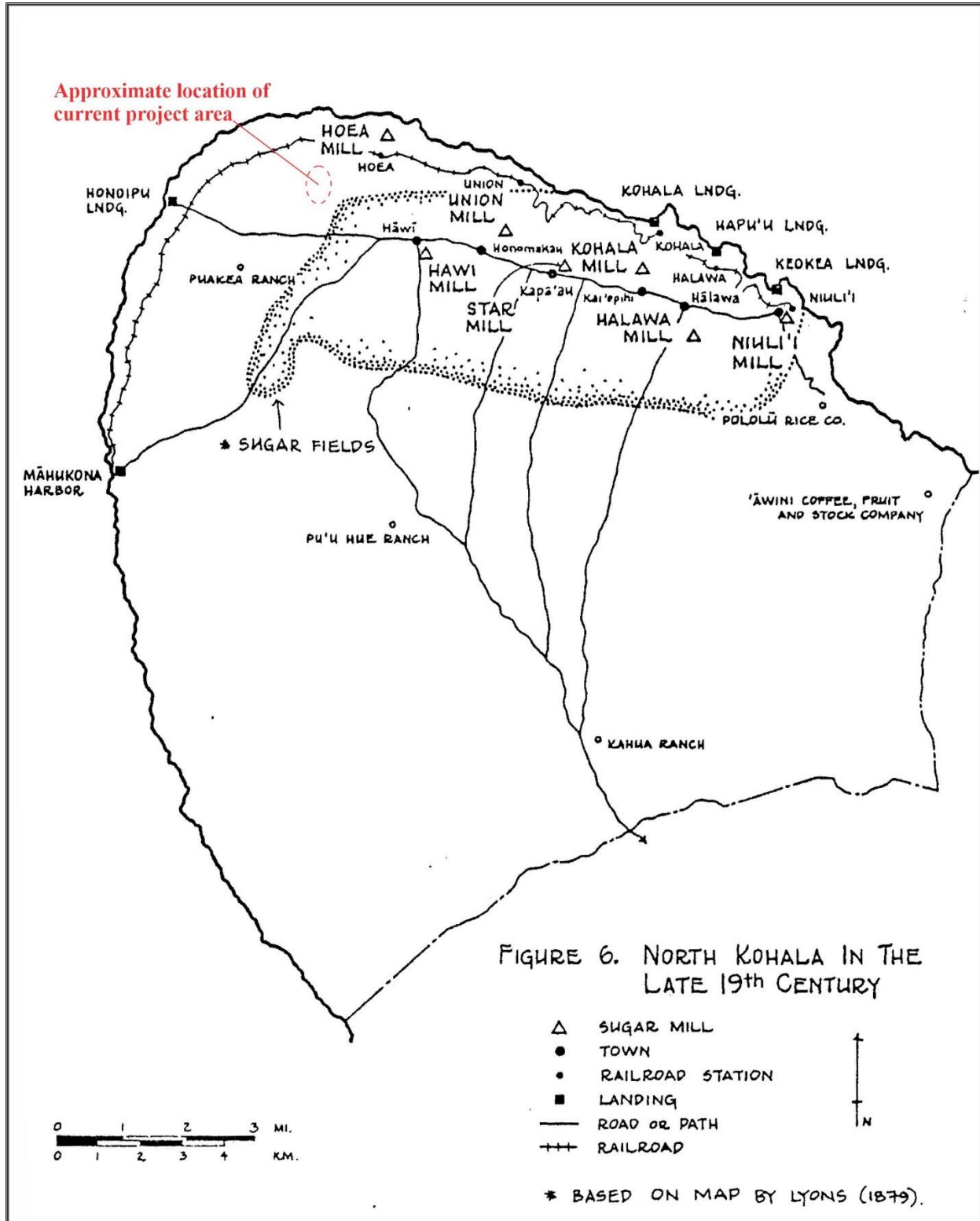


Figure 9. Map created by Tomonari-Tuggle (1988:41) based on an 1879 map by Lyons showing the sugar mills in North Kohala.

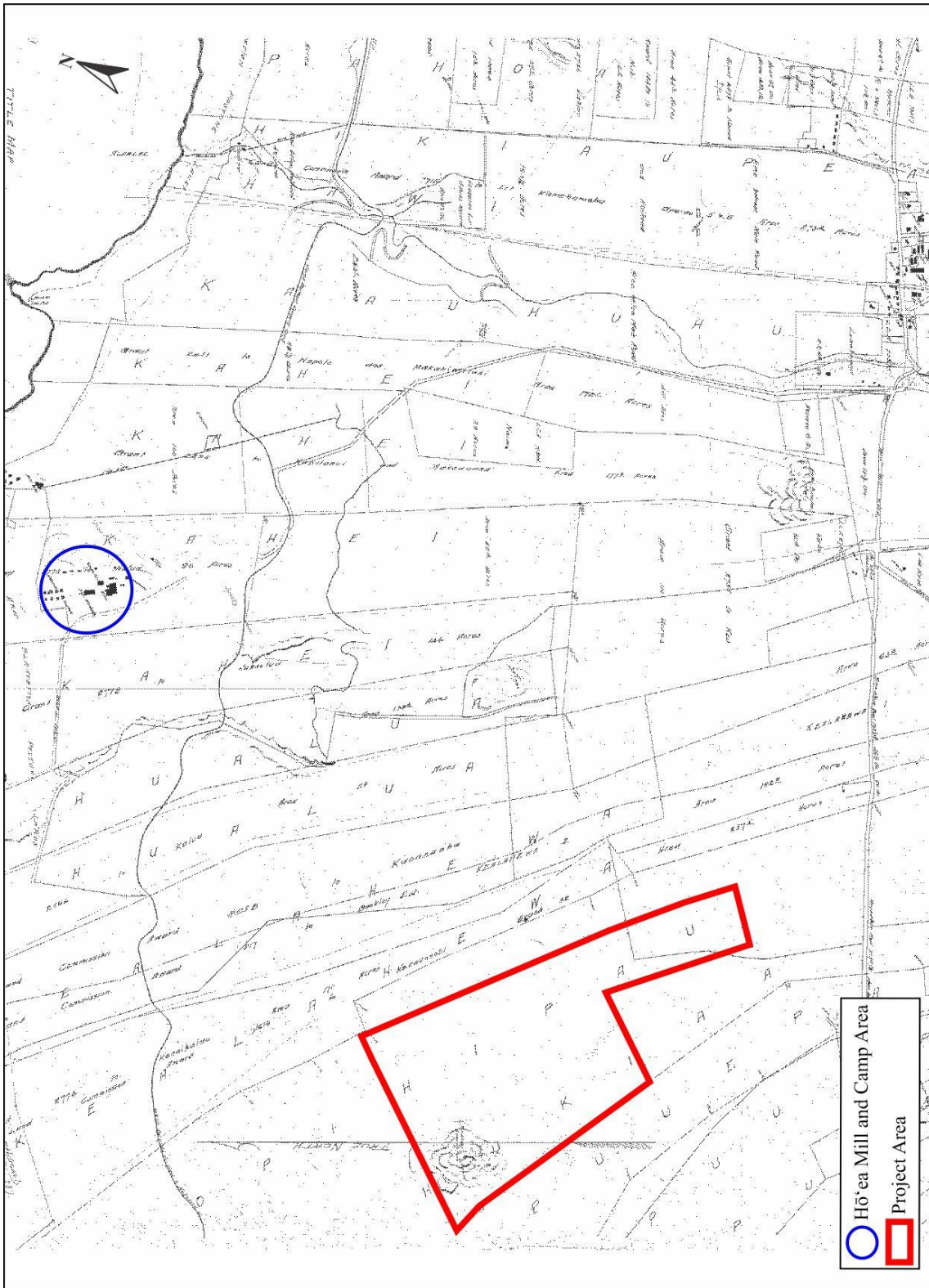


Figure 10. Portion of 1905 Registered Map No. 2384 (Dove 1905).

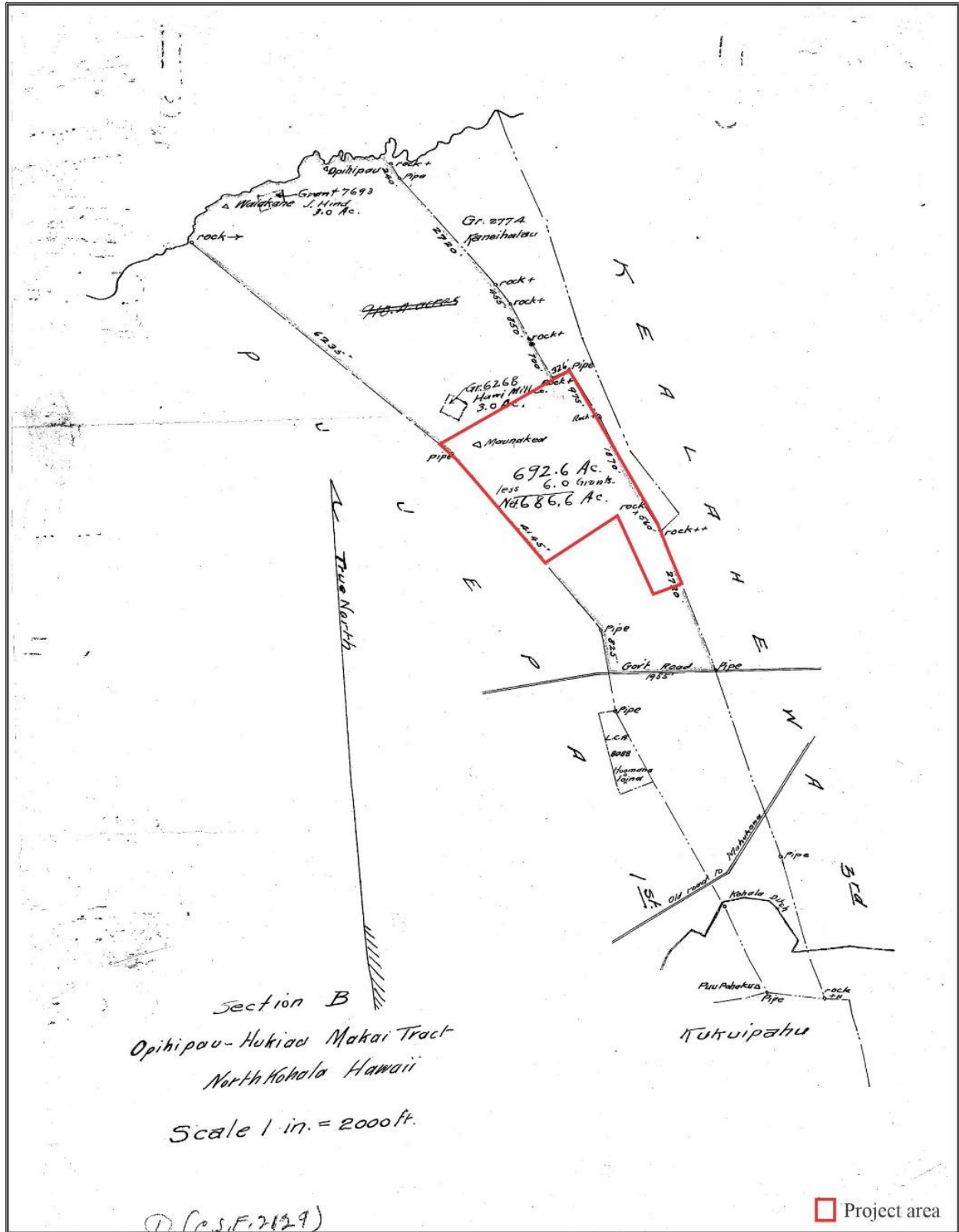


Figure 11. 1910 C.S.F. map no. 2129.



Figure 12. 1925 aerial photograph showing the current project area under sugarcane cultivation (USAAF 1925).

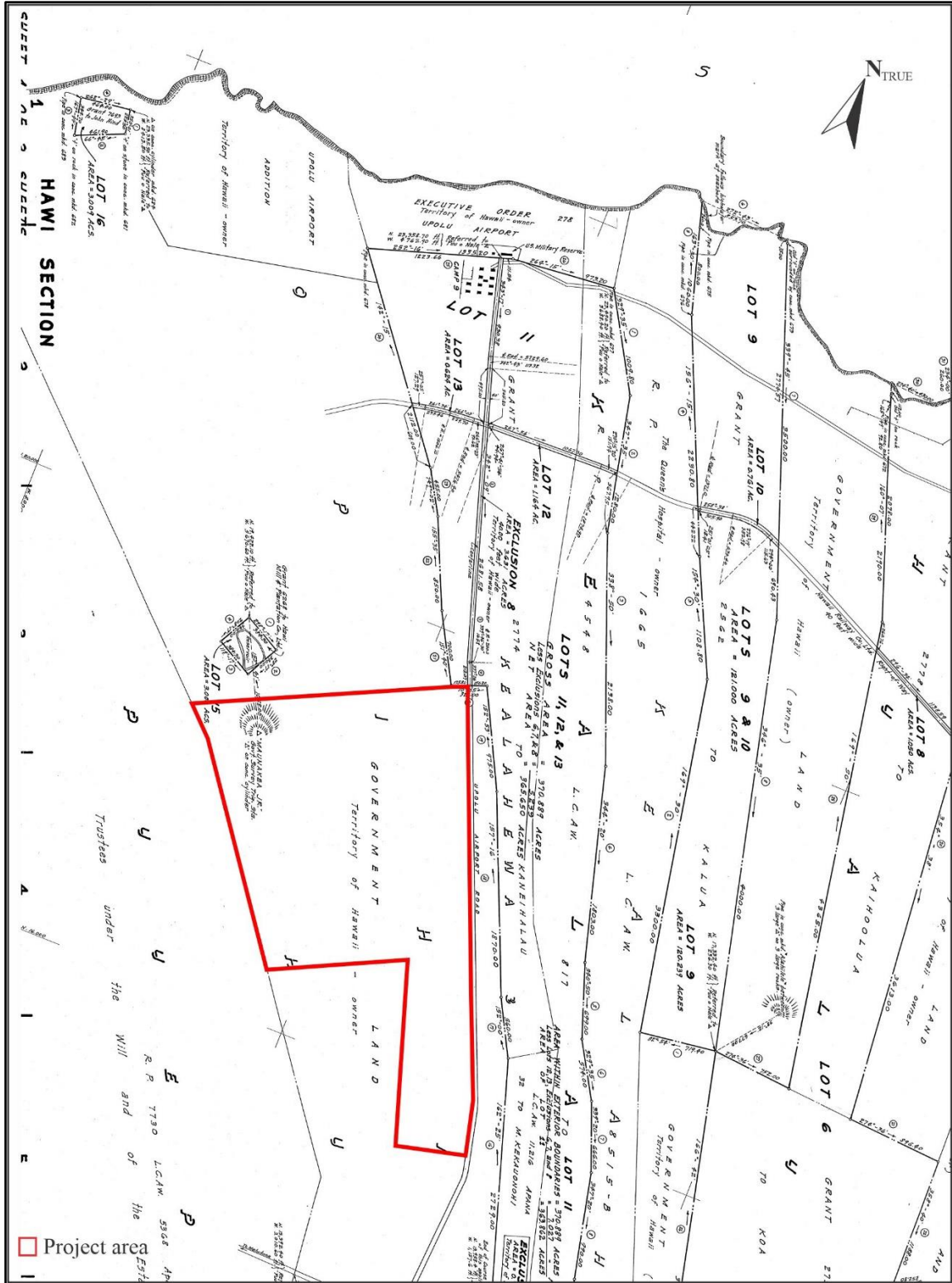


Figure 13. Portion of 1935 Land Court Application 1120 Map 1 (Kohala Sugar Company 1935).

One result of the acquisition and merger was the renovation of the overhead irrigation system at the former Hawi Mill and Plantation fields. Castle & Cooke was also the parent company of several plantations that included the Waialua Plantation on the North Shore of O‘ahu (Dorrance and Morgan 2000; Wilcox 1996). Among the innovations developed at the Waialua Plantation was an irrigation system built using portable modular concrete flumes known as Waialua Flumes (Wilcox 1996), which were developed by the Waialua Sugar Company in 1936 (The Honolulu Advertiser 1940). A map prepared in 1939 (Figure 14) shows an irrigation ditch and a flume crossing the current project area. The construction and operation of the Waialua flume system at the Waialua plantation was described in detail in a newspaper article published in 1940:

30-Inch Sections

The water goes into the fields in concrete box-flumes, with bottoms pyramidal in cross section. The sections, about 30 inches long, are laid down the slope of the field, butt to butt and joined with asphalt putty. Little side openings, spaced so that each is opposite a furrow, are opened or closed with a “gate” of galvanized iron which slides up and down in a slot cast in the concrete. The gates are bent at the top to form a flange so that it can be used to direct the flow of water into the furrow.

The flumes are widest and deepest at the top of the field, being designed to take up to 6,000,000 gallons of water from the main supply ditch, tapering gradually to the lower end. One of the plantation surveyor’s jobs is to specify sizes of the flume boxes based on the volume and velocity of the water so that the 6,000,000 gallons entering the flume intake will be shrunk to “one man’s water” at the lower end.

All Start At Once

The irrigators all start work at the same time, each opening 200 to 300 gates on his side of the flume, depending on the slope and lay of the field. The water trickles slowly along the furrows, with 1 ½ to two hours allowed to reach the far end. In other words, the ground is thoroughly soaked on each side of the flume, the irrigations amounting to a slow and steady rain. The cane furrows are laid out on a 1.5 grade. I saw one field of 98 acres where one man was in charge and he was just standing around watching his furrows.

Waialua organized a subsidiary Concrete Productions Company which operates a quarry and crusher, supplies sand, buys the cement and fabricates flume boxes, shapes, pipes and slabs, or whatever concrete work is required on the plantation. They were pouring flume boxes in steel moulds with hinged sides. A measured charge is dumped in each and then an electric vibrator is attached to the rim, which sakes down the concrete, eliminating air spaces and bubbles.

System Not So New

H. R. Shaw, irrigation superintendent, said that the staff thought they had something entirely new, four years ago [i.e., 1936] when they went over to this new irrigation system. The, somebody unearthed a U.S. department of agriculture bulletin that was published about 60 years ago, with description and drawings of practically the same thing, the difference being that the boxes were to be made of sheet iron...(The Honolulu Advertiser 1940)

The consolidation of sugar plantations in Kohala during the early 1930s also included the merger of the Union Mill and Plantation Company with the Niuli‘i Mill and Plantation Company in 1932 (Dorrance and Morgan 2000), which was followed in 1937 by the purchase of the Union Mill by the Kohala Sugar Company. With this merger, Kohala Sugar Company became the only sugar producer in North Kohala. A few months after the merger, Kohala Sugar Company began efforts to reduce operation costs by consolidating its milling operations. This included the closure of the Union Mill in 1937 and both the Niuli‘i Mill and Hō‘ea Mill in 1938 (Hannah 1938).

During the 1940s the global effects of World War II were felt in North Kohala. In 1941 Māhukona Harbor was closed for national security reasons (Tomonari-Tuggle 1988). Following the closure of this port the products of the Kohala Sugar Company were trucked fifty miles to the railhead of the Hawaiian Consolidated Railway at Pa‘auilo for transport to the open port at Hilo (Dorrance and Morgan 2000). The Kohala railroad continued to operate during the early years of the war, hauling unprocessed cane from the fields to the mills, but that too shut down in October of 1945 due to the lack of freight (Schweitzer 2003). In 1943 the Kohala Sugar Company produced 41,501 tons of sugar, the most sugar produced during any of the war years (Dorrance and Morgan 2000). A 1942 map of the Kohala Sugar Company’s lands (Figure 15) shows the current project area occupying fields “Upolu 10”, “Upolu 15”, “Upolu 16.” The irrigation ditch is shown, but not the flume.

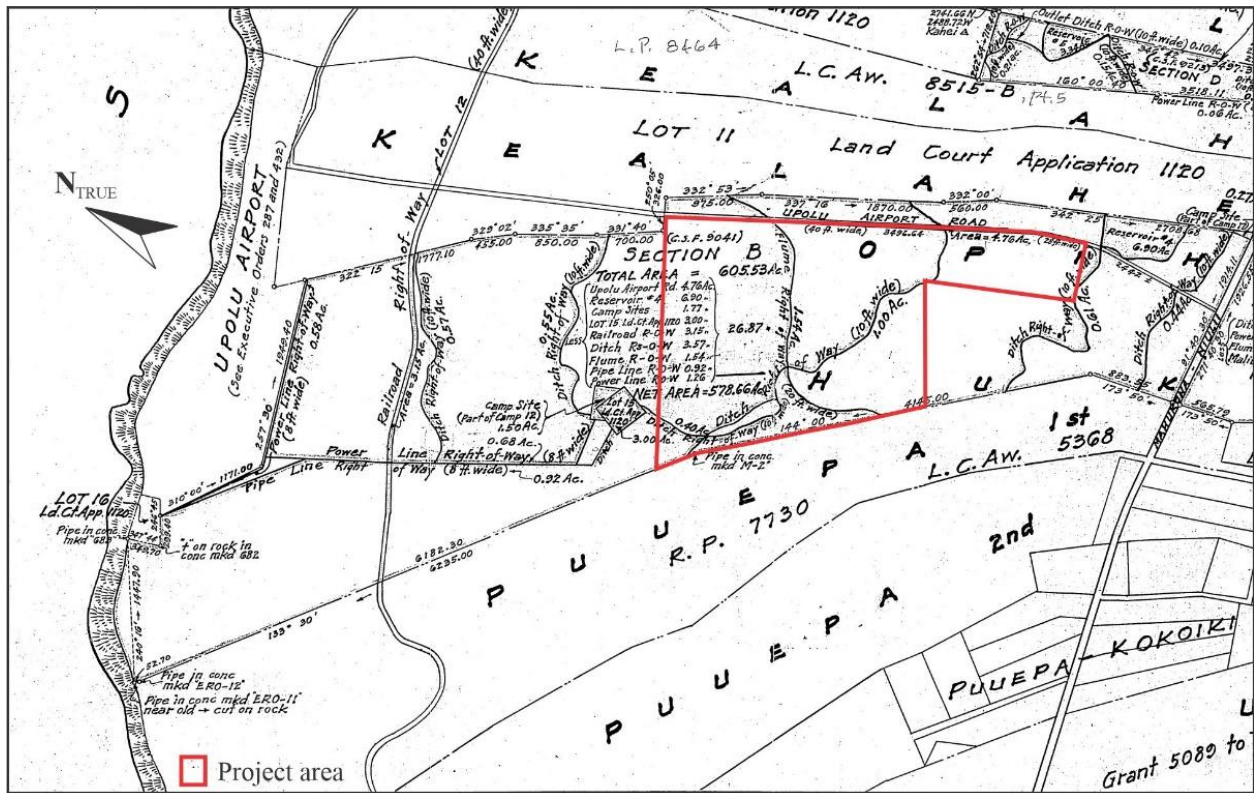


Figure 14. Portion of C.S.F. Map No. 9040-9041 prepared in 1939.

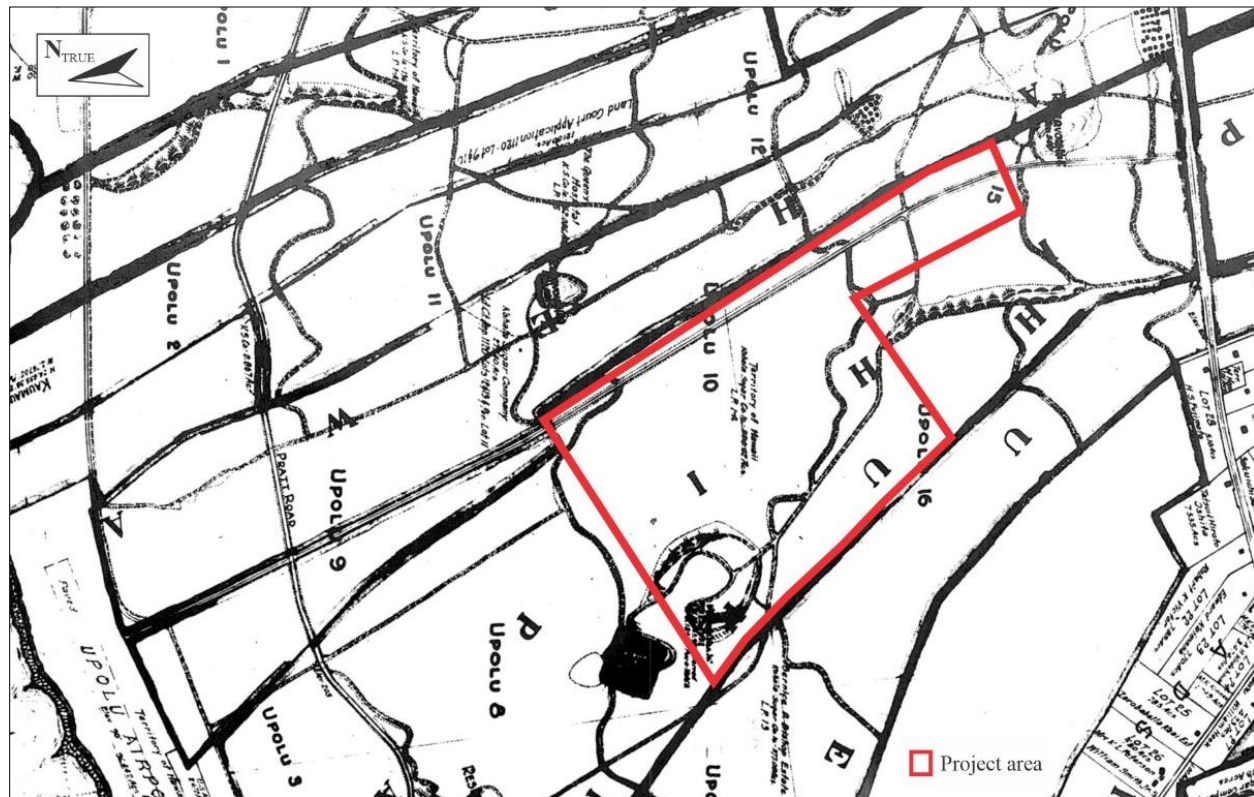


Figure 15. Portion of 1942 Kohala Sugar Company field map.

2. Background

Following the war, business at the Kohala Sugar Company returned to normal, and the plantation remained a marginally profitable operation when the weather was cooperative (Dorrance and Morgan 2000). A 1954 aerial photograph (Figure 16) shows the current project area cultivated in sugarcane, the irrigation ditch traversing across, cultivated fields to the east, and the reservoir north of the *pu'u*.



Figure 16. Portion of a 1954 aerial photograph showing the current project area (USGS 1954).

During the late 1960s, Castle & Cooke reported diminishing returns, and even financial losses from the Kohala sugar plantations (The Honolulu Advertiser 1971). Maps (Figure 17) and aerial photographs (Figure 18) during this time period show the current project area planted in sugarcane with associated irrigation ditches, roads, and reservoirs. At the same time, a growing concern about environmental pollution at the state, local, and national levels led to more stringent regulations on water and air quality, ultimately resulting in the passage of the National Environmental Policy Act of 1970. In February of 1971, the State Health Department ruled that plantations would need to cease burning sugar cane fields within three years (Kakesako 1971). On the heels of this decision, in June of 1971, the United States Environmental Protection Agency published a study on pollution in the sugar cane industry that had immense effects on North Kohala (US EPA 1971). The study found that the sugar industry was discharging materials into the ocean that resulted in violations of state water quality standards. The study recommended that discharges of trash and bagasse to coastal waters be discontinued, that all discharges be treated or controlled in compliance with state water quality standards, and that the plantations make improvements to their irrigation facilities and management practices to minimize and control discharges. For a time, plantations were granted pollution waivers, but ultimately were required to meet the new standards. With the anticipated closure of the Kohala Sugar Company in 1971, the Governor appointed a Task Force to explore the potential agricultural future of North Kohala which resulted in a report titled “Kohala Water Resources Management and Development Plan” (Bowles et al. 1974) which included a map of all the water resources in and around the current project area. A single overhead irrigation structure is depicted (Figure 19), standing sixteen feet high within the current project area that was fed from the Kohala Ditch. The irrigation system terminates at Reservoir No. 8, *makai* of Mauna Kea *pu'u*.

Profitable sugar crops and pollution waivers allowed Castle & Cooke to delay closure for two additional years (Soares, Yangson, and Carvalho, in Barna and Kepa‘a 2022), but in 1975 the last crop was ground and the Kohala Sugar Company closed its doors for good, ending its 112 years of operation (Dorrance and Morgan 2000). Once the sugarcane fields were abandoned, various diversified agricultural projects were attempted in North Kohala. During the mid-1980s, the former Kohala Sugar Plantation lands occupying the current subject parcel were leased from the state by Boteilho Hawaii Enterprises, Inc (County of Hawaii 2021) for their Clover Leaf Dairy operations. A map (Figure 20) in the tax record shows a building, no longer standing, in the current project area during this period.



Figure 17. Portion of 1963 Kohala Sugar Company Field Map.



Figure 18. Portion of a 1964 USDA aerial photograph (USDA 1964).

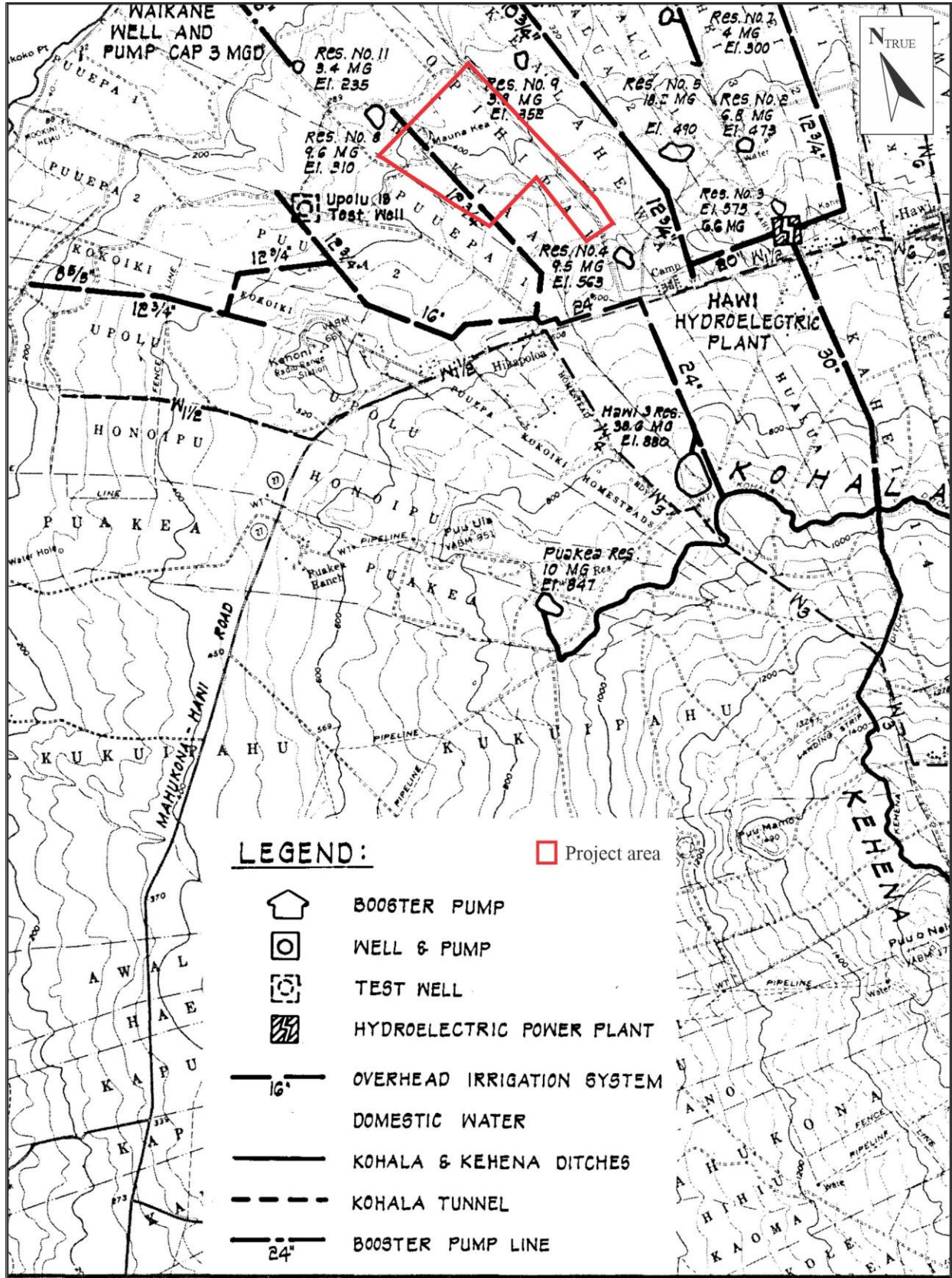


Figure 19. Portion of map showing the irrigation and water systems of North Kohala in the 1970's.

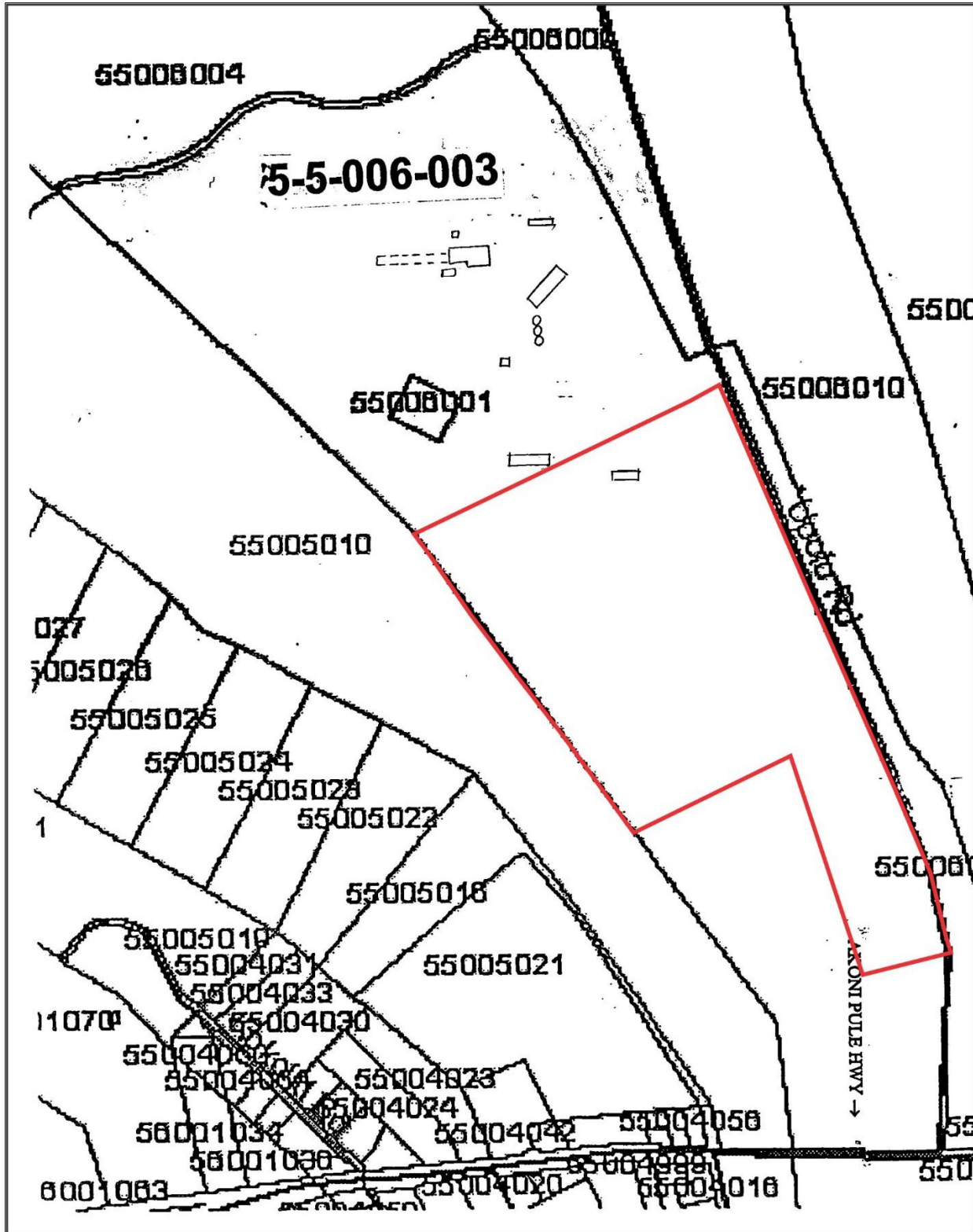


Figure 20. Map from the County of Hawaii tax records showing Boteilho Hawaii Enterprises, Inc dairy outbuildings on the subject parcel ca. 1985.

PREVIOUS ARCHAEOLOGICAL STUDIES

A review of available records at the DLNR-SHPD Kapolei Library and on HICRIS indicates that very few archaeological studies have been conducted on the coastal and former sugarcane lands in the vicinity of the current project area (Figure 21) and in ‘Opihipau *ahupua‘a* in particular. One major reason for this has been continued agricultural use of the lands since the ending of plantation-run commercial sugarcane cultivation in the 1970s. Prior to that, J.F.G. Stokes documented Mo‘okini Heiau, located just over a mile (3.0 kilometers) to the west of the current project area (Stokes and Dye 1991). After the transition away from commercial sugarcane cultivation, a large-scale review of historic resources in North Kohala was conducted by International Archaeological Research Institute, Inc. (IARII) (Tomonari-Tuggle 1988). That study established a Historic District (SIHP 50-10-02-7105) that included multiple properties associated with sugar plantations in North Kohala (none of which are in the current project area). The few compliance-driven studies in the vicinity of the current project area (Table 1, see Figure 21) have generally found a limited number of archaeological resources, and those that have been found tend to be remnants of commercial sugarcane fields and associated infrastructure, with a few exceptions immediately inland of the shoreline.

In 1988, International Archaeological Research Institute, Inc. conducted a large-scale cultural resource study of North Kohala Tomonari-Tuggle (1988). The study, which included archival and oral history research and targeted field surveys, identified 266 historic sites across the district. The Hō‘ea Mill and Camp were noted among the Historic Period sites. Tomonari-Tuggle (1988) also noted the existence of a “Kohala Sugar District” Historic property (SIHP 50-10-02-7105) in DLNR-SHPD files. This property apparently includes the mill sites, the plantation houses, and the offices of the companies that participated in the sugar industry in Kohala (Tomonari-Tuggle 1988). Records associated with Site 7105 were not available for review during the current study. Reconnaissance fieldwork did not include the current project area, but did include a coastal area between ‘Upolu Airport (about 1,200 meters north of the current project area) and the former United States Coast Guard LORAN Station. Tomonari-Tuggle (1988:70) noted that this area contained five sites (K-2 through K-6), which she described as “fragmentary at best and may be of little significance. However, their proximity to the important sites of Mo‘okini heiau and the Kamehameha birth-site, now under State control, warrants some further investigation.” These sites (SIHP numbers could not be found for them) included a small concrete foundation (K-2), a deposit containing charcoal, shell, fire-cracked rock, and a possible fire pit exposed in the beach face (K-3), a remnant stone structure (K-4), two basalt flakes in a secondary depositional context (K-5), and stone facing on a low hill overlooking the ocean on the LORAN station property (K-6).

Table 1. Previous archaeological studies conducted in the vicinity of the current project area.

<i>Year</i>	<i>Author(s)</i>	<i>Type of Study</i>	<i>Results</i>
1988	Tomonari-Tuggle	Archival review and reconnaissance	Kohala Sugar District (SIHP 50-10-02-7105); Five sites (K-2 through K-6) west of ‘Upolu Point.
1992	Streck	Reconnaissance	No archaeological resources.
1998	Rechtman and Orr	AIS	Irrigation flumes and ditch (SIHP 50-10-02-21740); Concrete foundation (SIHP 50-10-02-21741).
2012	DLNR-SHPD	Permit review	No AIS required due to disturbance.
2014	DLNR-SHPD	Permit review	Irrigation features (SIHP 50-10-02-30049).
2020	Haun & Associates	AIS	Road (SIHP 50-10-02-30191); Concrete posts (SIHP 50-10-02-31092) Road (SIHP 50-10-02-30193); Ditch complex (SIHP 50-10-02-30914)
2022	Barna and Kepa‘a	AIS	Coastal Settlement (SIHP 50-10-02-3283) Hō‘ea Mill Infrastructure (SIHP 50-10-02-31284) Hō‘ea Camp (SIHP 50-10-02-31285)

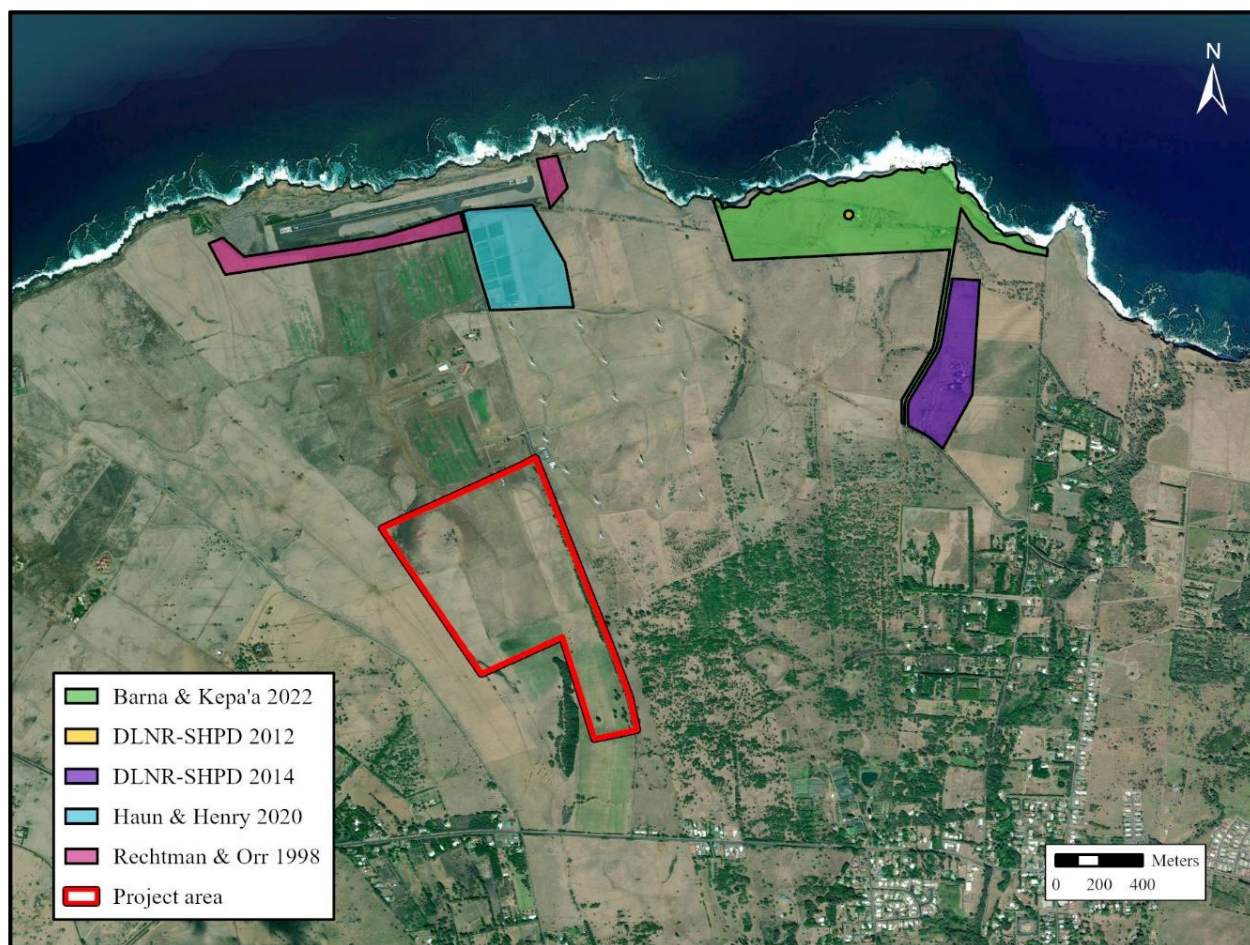


Figure 21. Location of previous archaeological studies.

In 1998, Paul H. Rosendahl, Ph.D., Inc., conducted an archaeological inventory survey (Rechtman and Orr 1998) with subsurface testing on roughly 28 acres located adjacent to ‘Upolu Airport (see Figure 21). No Native Hawaiian Precontact cultural remains were observed during the fieldwork; however, two sets of Historic Period features were recorded. In the area west of the airport, rows of concrete irrigation flumes and an irrigation ditch (SIHP 50-10-02-21740) were observed. These appear to have been associated with early twentieth century sugar cane production and were not considered significant. In the area inland from the existing airport property, the demolished remains of foundations and a standing concrete structure were recorded (SIHP 50-10-02-21741). This site was also not considered significant. Oral interviews with four long-time North Kohala residents identified no traditional cultural properties within their survey area, but noted that renewed active use of the airport, especially for commercial aviation purposes, was desirable as long as the use did not limit access to, or otherwise impact, local fishing.

In 2012, DLNR-SHPD reviewed a well permit application (Log No. 2010.0363, Doc. No. 1203MV15) to construct a potable water well near the current location of the main residence, 1.5 kilometers northeast current project area (see Figure 21). Because the proposed well location was within an area that was previously utilized for large scale agriculture and likely impacted by mechanical grading, no AIS was required.

In 2014, during the implementation of a Natural Resource Conservation Service conservation plan on TMK: (3) 5-5-0070:035 (located approximately 1.5 kilometers east of the current project area), four irrigation features associated with the Kohala Sugar Company sugarcane plantation (SIHP 50-10-02-30049) were inadvertently discovered (Log No. 2014.1774; Doc. No. 1405MV03). A report, titled *Inadvertent Discovery of SIHP 50-10-02-30049 Kahei 2nd Ahupua‘a, North Kohala District, Island of Hawaii*, appears to have been prepared, but could not be obtained from DLNR-SHPD at the time of the current study. The site was determined eligible for the National Register of Historic Places under Criteria A, C, and D. Because a 20-foot buffer around the features was incorporated into the conservation

2. Background

plan, the Section 106 consultation for the plan resulted in a no adverse effect determination and no additional mitigation measures (e.g., preservation plan) were required.

In 2018, Haun & Associates conducted an archaeological inventory survey (Haun and Henry 2020) of a 44-acre parcel located *mauka* of ‘Upolu Airport approximately 800 meters north of the current project area. The AIS report was not publicly available at the time of the current study. The survey identified five historic properties, including the two historic roads (SIHP 50-10-02-30911 and 50-10-02-30913) and historic railroad alignment identified by the National Park Service, as well as gate posts (SIHP 50-10-02-30912) and a ditch complex for flood control (SIHP 50-10-02-30914). This latter site, upon comparison with historic aerial photographs of the sugarcane fields, appear to have been the intrafield roads established ca. the early 1960s (see Figures 17 and 18). The five sites were all assessed as significant under Criterion d for their information content related to historic agriculture within the area. Two sites (Sites 12350 and 30911) were also assessed as significant for their association with the broad pattern of sugar industry development in Hawai‘i. The documentation of the five sites in the project area adequately recorded them and no further work or preservation was recommended; however, the landowner agreed to preserve Site 30911(Hō‘ea Road) as this road provided access to the coastal area to the east of the project area. An Archaeological Preservation Plan was chosen to be the instrument through which coastal access would be established, with a vehicular and pedestrian easement over the preserved site to be created within the plan.

In 2022, ASM Affiliates conducted an archaeological inventory survey (Barna and Kēpa‘a 2022) of a 105.647-acre parcel located 1,400 meters northeast of the current project area. The survey identified a portion of one previously identified historic property, Hō‘ea road (SIHP 50-10-03-30911), and portions of three previously unidentified historic properties (SIHP50-10-02-31283, the Hō‘ea Coastal Settlement; SIHP 50-10-02-31284, Hō‘ea Mill Infrastructure; and SIHP 50-10-02-31285, Hō‘ea Camp. As recorded during that survey, Site 50-10-02-31284 (Hō‘ea Mill Infrastructure) consists of 33 remnant elements of the infrastructure associated with the operation of the Hāwī Mill and Plantation Company’s Hō‘ea Mill and surrounding sugarcane fields and pasture between ca. 1904 and 1975. The recorded features include earthworks (e.g., berms, push piles, and a mechanically altered swale), portable concrete flumes, and midden/surface artifact deposits (e.g., rubbish dumps), along with foundation remnants of the plantation’s water pumphouse, wooden and concrete fence posts, a culvert, and metal stakes embedded in the sea cliff. Sites 30911 and 31283 were assessed as significant under Criterion a for their association with the broad pattern of sugar industry development in Hawai‘i and of land use and settlement patterns in Kohala during the Precontact Period into the nineteenth century. All four sites were assessed as significant under Criterion d for their information content related to historic agriculture in Hawai‘i, precontact habitation in coastal Kohala during the Precontact Period, sugar industry practices, and the history of Hō‘ea Camp. All of the sites were deemed to have been adequately documented with no further work being needed except for Site 31283, which was recommended for preservation and a preservation plan in accordance with HAR §13-277 to be prepared and reviewed by DLNR-SHPD.

3. SUMMARY AND RECOMMENATIONS

The results of the literature search indicate that the current project area was under commercial sugarcane cultivation beginning in the late nineteenth century. It has been heavily impacted by land altering activities undertaken by the Hāwī Mill and Plantation Company, its successor the Kohala Sugar Company, and subsequent lessees, who converted the sugarcane fields to other agriculture and pasture uses. These types of activities have included earth-moving, road building and maintenance, plowing, and the installation and removal of water irrigation infrastructure such as flumes, pipes, and ditches. These activities, especially those associated with sugarcane cultivation, have likely destroyed evidence of Precontact land use and human occupation pre-dating to the establishment of the sugar plantation. One exception to this could be on the summit of the *pu'u* named Mauna Kea that is located in the northwest corner of the project area. ASM's consultation for a related cultural impact assessment, which is in progress as of this draft of the literature review, may produce additional information regarding this *pu'u* and potential pre-sugarcane historic properties.

Archaeological features that are likely to exist in the project area include remnants of plantation infrastructure associated with three previously identified historic properties. These properties include SIHP 50-10-02-30913, the original alignment of 'Upolu Point Road; SIHP 50-10-02-30914, a system of intra-field roads documented as erosion control ditches by Haun and Henry (2020); and features of SIHP 50-10-02-31284, the "Hō'ea Mill infrastructure" site that includes plantation water and transportation features in the Hāwī Mill and Plantation Company's fields previously identified by Barna and Kapa'a (2022). These features could include inter- and intra-field roads, irrigation systems such as flumes, pipes, and ditches, and clearance piles created before, during, and after commercial sugarcane cultivation. Many of these features can be seen in historical aerial photographs and historic maps reproduced in this report.

Given the results of the current literature review, an archaeological inventory survey is likely to be required is historic preservation review under HRS Chapter 6E-8 or 6E-42 are triggered within the project area. Subsurface testing may be appropriate in undisturbed depositional environments—in this case possibly on the *pu'u* named Mauna Kea. The results of the CIA consultation regarding the *pu'u*, however, should also be considered prior to the development of an inventory strategy. Otherwise, a combination of pedestrian and unmanned aerial vehicle survey are recommended should an AIS be necessary.

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