PALANI WELL NO. 1
(STATE WELL NO. 4158-03)
NORTH KONA, ISLAND OF HAWAI‘I
STATE OF HAWAI‘I

DRAFT ENVIRONMENTAL ASSESSMENT

Submitted Pursuant to Chapter 343, Hawai‘i Revised Statutes (HRS)

County of Hawai‘i
Department of Water Supply

March 2009

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Tax Map Key Number: (3rd) 7-4-002:021 and 008 (por.)

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CLASS OF ACTION:

Use of County Land
Use of County 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, Hawai‘i Department of Health Administrative Rules (HAR)

SUMMARY

Lanihau Properties LLC (Lanihau) plans to convert its Palani Well No. 1 (State Well 4158-03) to a production well and to dedicate this facility to the Hawai‘i County Department of Water Supply (DWS), per an existing well development agreement. The well is located at an elevation of 1,670 feet above sea level on a private road serving Palani Ranch. The well taps a high level aquifer in the Keauhou Aquifer System of the Hualalai 809 Aquifer Sector, 77 feet above sea level, and is estimated to have a sustainable pumping rate of excellent quality water of about 1,123 gallons per minute (gpm). The project consists of the following elements:

- Production well with 1,000-gpm deep submersible pump and appurtenances
- Pump control building
- Fencing
- Access road improvements
- A 1.0 million gallon concrete reservoir
- A new 12-inch transmission line along the access road to connect to an existing 16-inch water main on Mamalahoa Highway.

With Palani Well No. 1 in place, up to 1.6 million gallons per day (mgd) of additional water will be available for DWS’s North Kona Service Area. The budget for the project, the majority of which is funded by Lanihau with a partial participation by DWS, is approximately $5.8 million, an estimate that will be refined through final design. After the EA is complete and permits are granted, Lanihau will finish design and select a contractor for construction, which is scheduled for completion in 2010. DWS funds will be used to reimburse Lanihau for part of the cost of the reservoir, which is being sized larger than Lanihau’s needs to expand DWS capacity in the area.

There are no biological, archaeological or cultural resources in the directly affected well, reservoir, and pipeline area. Minor effects to noise, erosion/sedimentation and air quality can be avoided or minimized to very minor levels through adherence to standard best management practices. Construction of a new individual wastewater system within 1,000 feet of the well will require a variance from the Department of Health. If granted, the system will need to be an “enhanced” septic system to avoid impacts to water quality. Withdrawals of groundwater by the well may reduce the flow of groundwater to the ocean, including the groundwater flowing beneath the Kaloko-Honokohau National Park. This may change the water level and salinity of groundwater in the nearshore basal lens, although both changes may be too small to actually identify.

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LIST OF ABBREVIATIONS

ALISH	Agricultural Lands of Importance to the State of Hawai‘i
ASEA	Aquifer Sector Area
ASYA	Aquifer System Area
BMP	Best Management Practice
CDUP	Hawai‘i State Conservation District Use Permit
CWRM	Hawai‘i State Commission on Water Resource Management
DHHL	Department of Hawaiian Home Lands
DLNR	Hawai‘i State Department of Land and Natural Resources
DWS	Hawai‘i County Department of Water Supply
EA	Environmental Assessment
EIS	Environmental Impact Statement
ESA	Environmental Site Assessment
FIRM	Flood Insurance Rate Map
FONSI	Finding of No Significant Impact
gpd	Gallons per day
gpm	Gallons per minute
HCWUDPU	Hawai‘i County Water Use and Development Plan Update
HDOH	Hawai‘i State Department of Health
HAR	Hawai‘i Administrative Rules
HEPA	Hawai‘i Environmental Policy Act
HCGP	Hawai‘i County General Plan
HRS	Hawai‘i Revised Statutes
IWS	Individual Wastewater System
MCL	Maximum Contaminant Level
mgd	Million gallons per day
mg/L	Milligrams per liter
OEQC	Hawai‘i State Office of Environmental Quality Control
SFHA	Special Flood Hazard Area
SHPD/O	State Historic Preservation Division/Officer
SMA	Special Management Area
UH	University of Hawai‘i
USF&WS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USNRCS	U.S. Natural Resources Conservation Service

1 PROJECT LOCATION, DESCRIPTION AND ALTERNATIVES

1.1 Project Location, Description and Purpose and Need

Project Location and Description

Lanihau Properties LLC (Lanihau) plans to convert its Palani Ranch Exploratory Well (State Well 4158-03) to a production well, which will be called Palani Well No. 1, and to dedicate this facility to the Hawai‘i County Department of Water Supply (DWS) per an existing well development agreement. The well is located at an elevation of 1,670 feet above sea level on a private road serving Palani Ranch (Figures 1-4).

Drilling of the exploratory well, which taps the Keauhou Aquifer (Aquifer Code 80091), began in September 2006, and the well was pump tested in August and October 2007. The water table was found at approximately 77 feet above sea level or about 1,593 feet below ground. The October 2007 well completion report by Waimea Water Services indicated that the production well could sustainably pump up to 1,123 gallons per minute (gpm). The well yielded water of excellent quality, with chlorides of less than 15 milligrams per liter. Accordingly, the decision was made with the concurrence of the County of Hawai‘i Department of Water Supply to convert the exploratory well to a production well. The project consists of the following elements (see Figure 4 for Site Plan):

- Production well with a 1,000-gpm deep submersible pump and appurtenances
- Pump control building
- Fencing
- Access road improvements
- 1.0 million gallon concrete reservoir
- New 12-inch transmission line along the access road to connect to an existing 16-inch water main on Mamalahoa Highway.

If pumped at the permitted rate of 1,123 gallons per minute, 24 hours a day, Palani Well No. 1 would produce about 1.6 million galls per day (MGD), which is the sustainable yield of the well. For the current project, DWS has specified a 1,000-gpm pump in order to standardize pump sizes in its North Kona system. With Palani Well No. 1 permitted and in place, up to 1.6 million gallons per day (MGD) of additional potable water will be available for DWS’s North Kona Service Area.

The budget for the project, the majority of which is funded by Lanihau with a partial participation by DWS, is approximately $5.8 million, an estimate that will be refined through final design. DWS funds will be used to reimburse Lanihau for part of the cost of the reservoir, which is being sized larger than Lanihau’s needs to expand DWS capacity in the area. After the EA is complete and permits are granted, Lanihau will finish design and select a contractor for construction, which is scheduled for completion in 2010.

Figure 1
Location Map

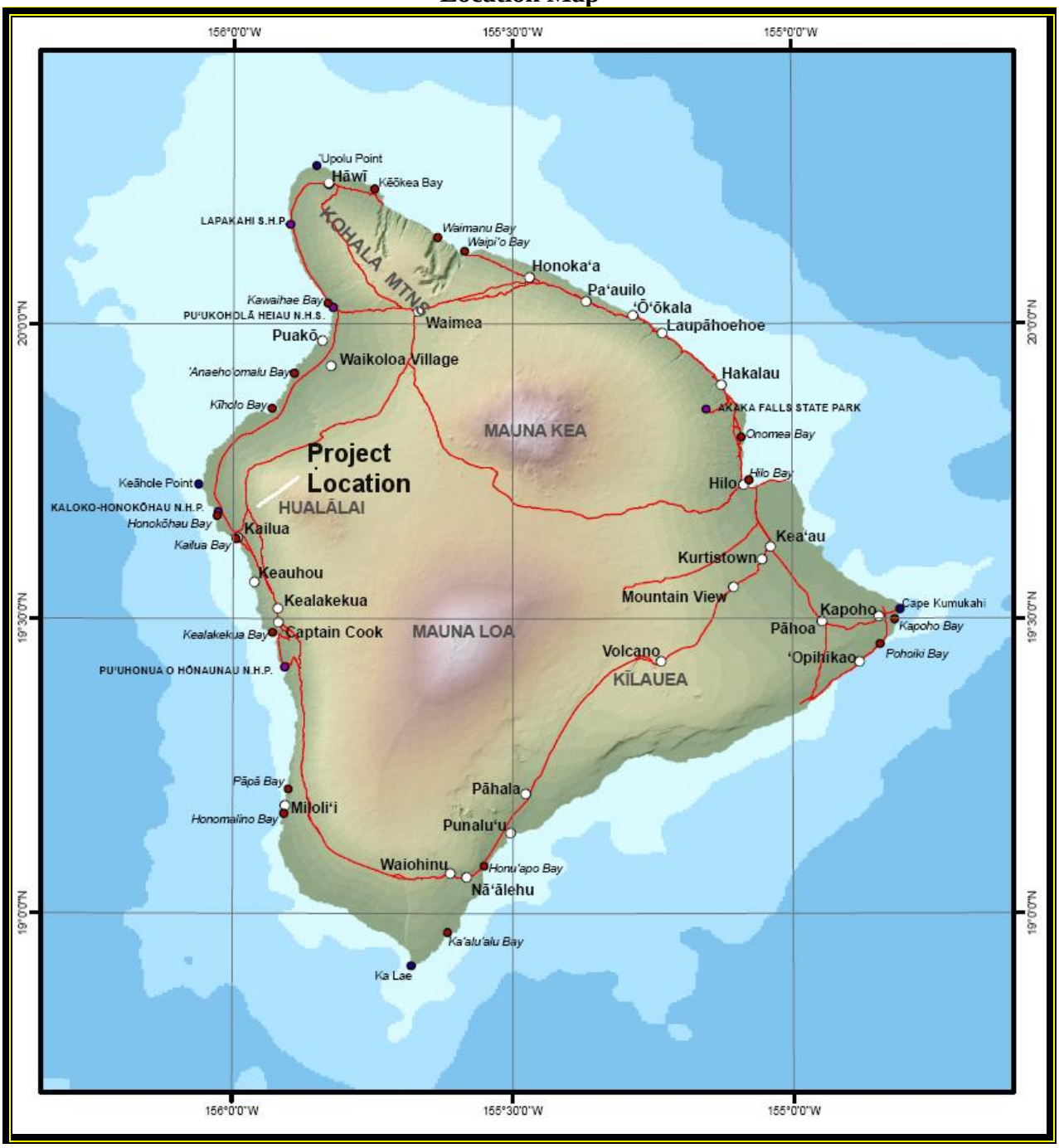


Figure 2
TMK Map

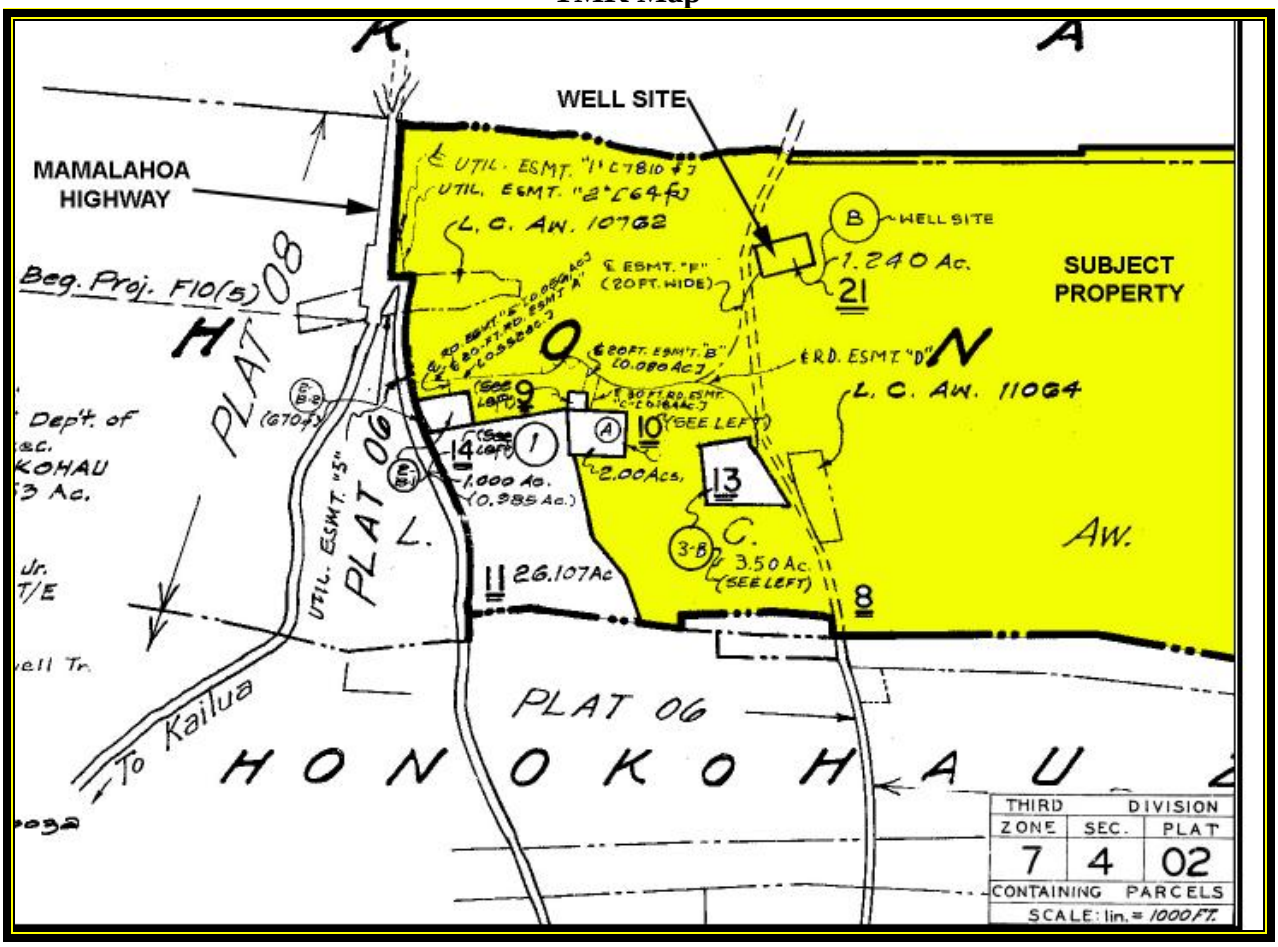


Figure 3
Project Site Photos

3a, top: Well and Reservoir Pad; 3b, bottom: Access Road, Ending at Mamalahoa Highway

Figure 4a Site Plan – General

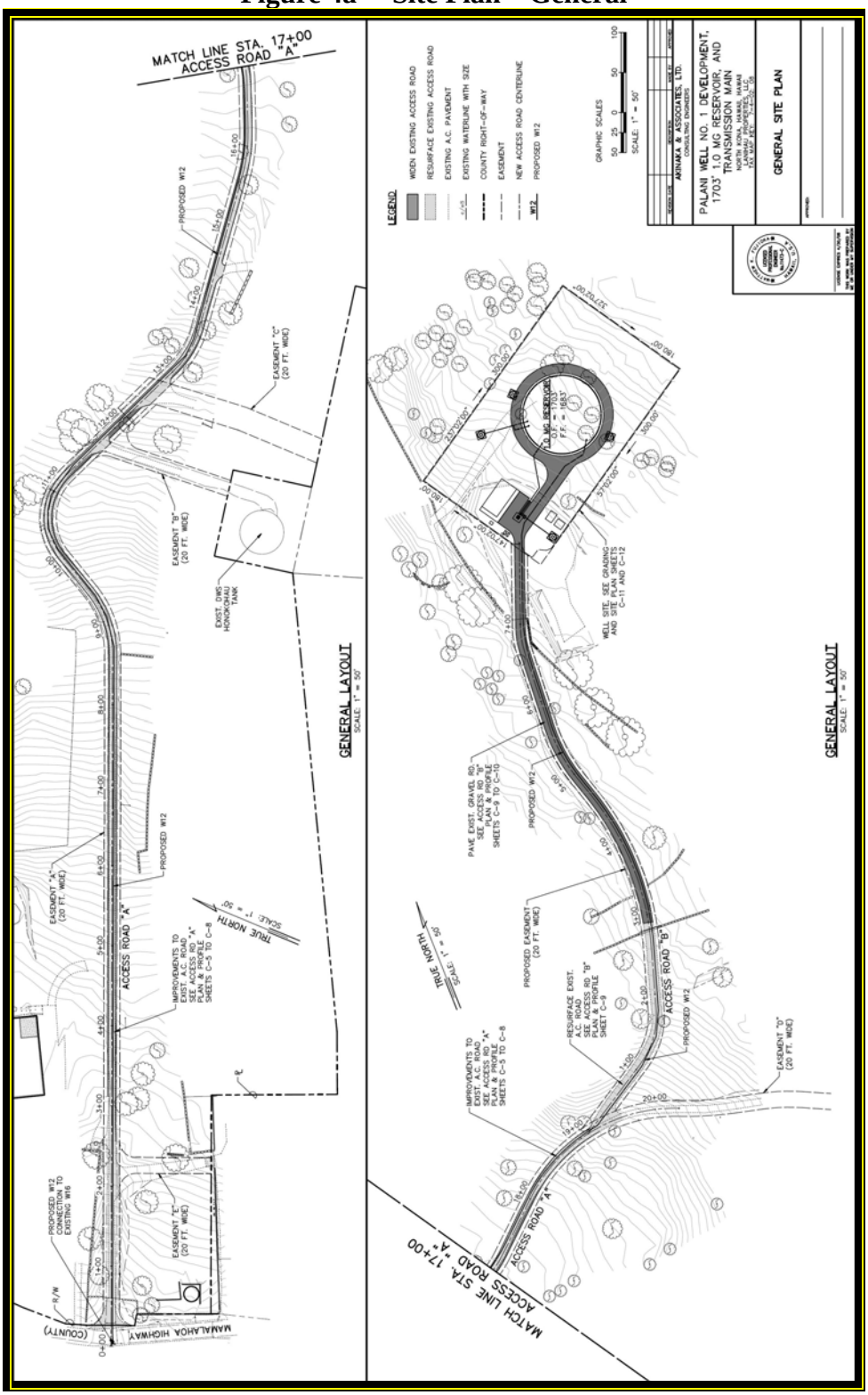
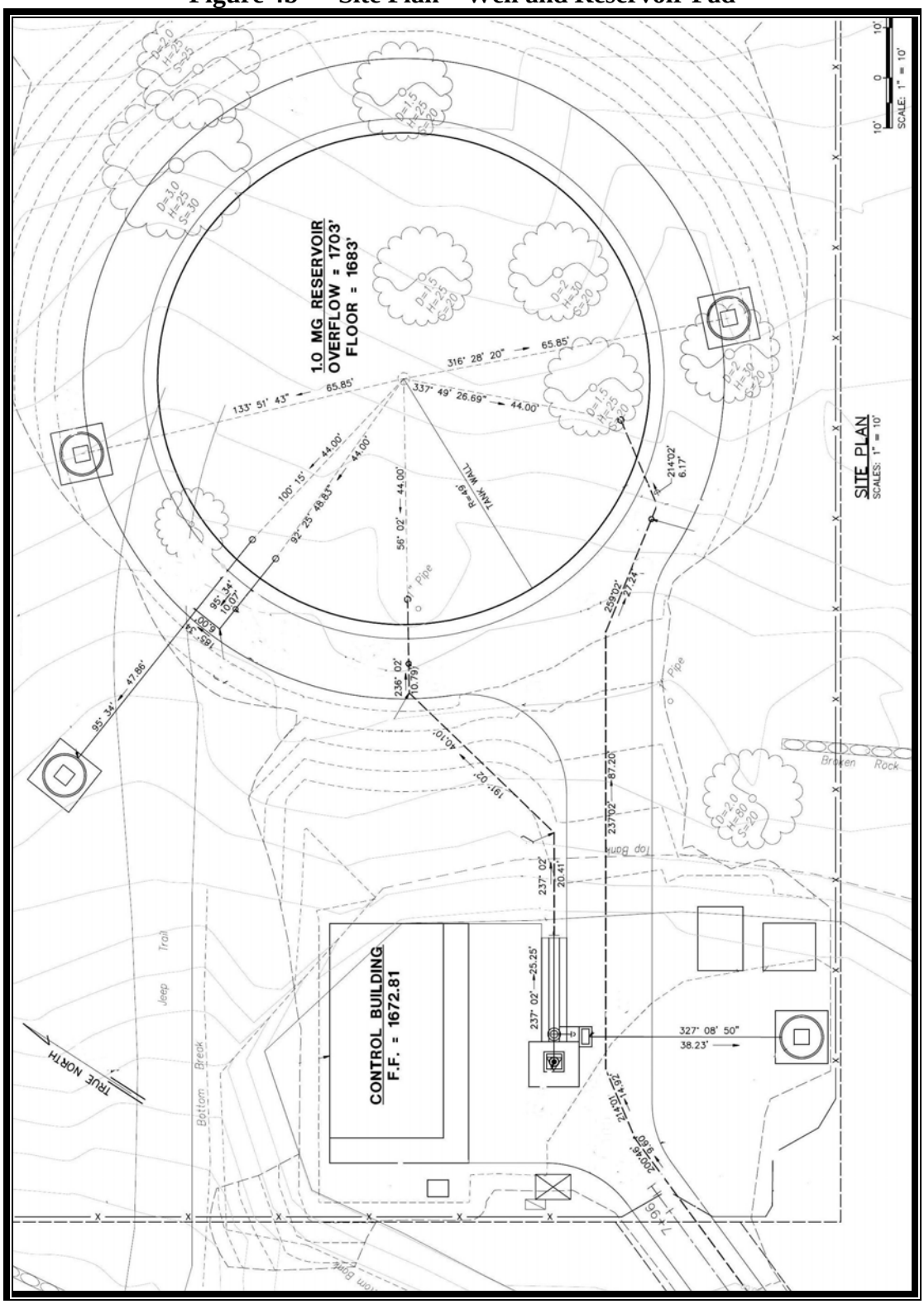


Figure 4b Site Plan – Well and Reservoir Pad



Project Background and Purpose and Need

The Hawai‘i County Department of Water Supply (DWS) provides domestic water services for the County of Hawai‘i. The DWS water system in North Kona is the second largest on the island, after the South Hilo system. Nearly all of the DWS North Kona service area is in the Keauhou Aquifer System of the Hualālai Aquifer Sector, where the current well project is proposed; at present the DWS system has minimal service in the Kiholo Aquifer System, the more northerly portion of the Hualālai Aquifer Sector. DWS in North Kona had approximately 8,950 connections in 2003. The system is currently supplied by groundwater sources consisting of 11 wells and the Kahalu‘u inclined shaft, which contains four pumps. The North Kona Water System is connected via an 8-inch water line and a valve to the South Kona Water System, which starts in the Kealakekua area and has five wells. Although transfers of water typically do not occur between the two systems, in an emergency up to 1.5 mgd can be sent in either direction.

As of 2008, the number of service connections in DWS' North Kona system is approaching 10,000 and is growing at a rate of about 2.2 percent annually. DWS estimates that demand in 2025 will be approximately 16.5 mgd for the North Kona system and 18.5 mgd for the entire Hualālai Aquifer Sector Area. According to the Draft *Hawai‘i County Water Use and Development Plan Update* (HCWUDPU) (DWS, in prep.), when agricultural demands are added to the DWS' potable use, projected demand in 2025 from the Hualālai aquifer will be 25.3 mgd. The Hawai‘i State Commission on Water Resources Management (http://hawaii.gov/dlnr/cwrm/mapsillustrations/gwhawaii.pdf) (CWRM) has estimated the sustainable yield of the Keauhou Aquifer System of the Hualālai Aquifer Sector at 38 mgd. However, this estimate was initially made in 1990 and has not been revised since. The estimate assumes that groundwater in the aquifer system is entirely basal with an equilibrium head of five feet. At this head, the computed sustainable yield is based on safe pumpage of 44 percent of rainfall-recharge over the aquifer system's 166-square mile area.

Well development since 1990 has demonstrated that high level groundwater exists across the width of the aquifer and from approximately Mamalahoa Highway inland. This amounts to more than 60 percent of the aquifer system's total area. In high level groundwater areas, the CWRM estimates the sustainable yield to be 75 percent of rainfall-recharge. When the Keauhou Aquifer System's sustainable yield is updated to reflect the existence of high level groundwater, its sustainable yield will be increased accordingly. When these estimates are further refined to include the considerable amount of fog drip which is an effective supplement to rainfall recharge, the sustainable yield will be increased by this contribution as well.

In order to provide for the orderly, planned growth of the system, there is need for new source, storage and transmission capacity. DWS' Waiaha well, State Well No. 3857-04, was put into production in March 2007. Palani Well No. 1, which can provide up to 1.6 mgd, can assist with this need.

Another need within the North Kona Water Service Area is to reduce the current dependence on the basal groundwater, particularly the amount pumped by the Kahalu‘u Shaft. Development of high-level groundwater sources, such as Palani Well No. 1, can relieve some of the demand on the shaft water, which has relatively high chlorides.

The Water Board of the County of Hawai‘i (Water Board) recognized that the orderly development of the water system to service existing and planned needs requires close coordination with developers. Accordingly, a well development agreement was signed on August 22, 2006, between the Water Board and Lanihau Properties, LLC, West Hawai‘i Business Park, LLC and Palani Ranch Company, Inc. (see Appendix 4 for full text). The purpose is to provide an additional source of potable water for the DWS Kona system and to allow for water allocations for certain Lanihau properties known as the Honokōhau Properties.

The agreement called for Lanihau to drill an exploratory well on Lanihau property that could later be dedicated to the Water Board. As initial testing of the exploratory well has met DWS minimum requirements for quantity and quality, the agreement further called for Lanihau to build a 1.0 million gallon reservoir and the additional elements of the project to interconnect with the existing system, all of which would be dedicated to County. Under the agreement, Lanihau will pay for all costs of development and construction of the water system, except for payment from the Water Board for the over-sizing of the reservoir capacity from 0.5 million gallons to 1.0 million gallons. Once the production well project is complete, Lanihau will be entitled to 85 percent of the maximum day pumping capacity of the well, which will be allocated for Lanihau developments. Those allocations will be made available by the Water Board to Lanihau for a period of 25 years from the date of dedication of the well site and water system following payment by Lanihau of water commitment fees and facility charges. The water fees and facilities charges will be reduced according to a “facility charge credit” based on set percentages for the types of infrastructure provided and the costs incurred by Lanihau for providing the well site and developing the water system, not including the cost of over-sizing the reservoir. The Palani Well No. 1 project will produce a substantial public benefit by providing additional source, storage and transmission capability for current needs and future regional development within the Kona community, while improving the availability of high-quality domestic water.

The construction of the production well and associated facilities will fully satisfy agreements related to water supply for development of 314.8 acres of land currently undergoing urbanization identified as West Hawai‘i Business Park (TMK: (3rd.) 7-4-08:13) and any future water demands for gradual development on the remaining Honokōhau Properties (TMKs: (3rd.) 7-4-02:08, 11, 13, 17, 18, and 20; 7-4-08:05, 13, 30, 47, 57, 60, 64, and 74). Lanihau plans to utilize these lands for industrial, commercial, agricultural, educational, and recreational uses. Water supply is a necessary but not sufficient condition for the ultimate use of these lands. Impacts related to the development of areas that water supply will facilitate, including Lanihau lands, are discussed in Section 3.4.1, which addresses Secondary and Growth-Inducing Impacts.

1.2 Alternatives Considered

1.2.1 Alternative Water Well Sites

The feasibility of alternative well sites was considered by Lanihau during the planning process for the exploratory well based on several criteria. These included proximity and proper elevational relation to the subject aquifer, proximity and proper elevational relation to existing transmission and storage facilities, minimization of transmission distance, minimization of potential for current or future contamination, location on Palani Ranch (with good road access), and minimization of total environmental impact. Much of the surrounding area is active pasture. The general site was the one that appeared to best meet all criteria, and it was thus selected, tested, and proven capable of supplying good water. At this stage of the process, with a successful exploratory well with no known serious environmental or land use problems, consideration of alternative well sites is unnecessary.

1.2.2 Surface Water, Catchment, Wastewater Re-Use, and Desalination

Due to the high permeability of the basaltic lava flows from Mauna Loa and Hualālai volcanoes, there is only one perennial stream in the area, Waiaha Stream. A few small springs, such as Waiaha Springs, occur in the wettest part of the Kona rain belt but can sustain only small needs. The Commission of Water Resource Management database lists eight declared private stream diversions in the Hualālai Aquifer Sector. Flow data are not available. Because surface water is more susceptible to contamination and droughts, and the U.S. Environmental Protection Agency requires that it be treated, DWS is working to replace all surface water sources with groundwater, and thus the source of water in the North Kona Water System is groundwater from wells accessing the Hualālai Aquifer Sector.

Rainfall catchment is used in many parts of Hawai‘i County, and in fact is the common water system for residents of parts of Puna, South Kona and Ka‘u where County water service is not available. There are also three public water systems using rainwater catchment on Hawai‘i Island, all in the Puna District, which serve Kilauea Military Camp, Hawai‘i Volcanoes National Park and Kulani Correctional Facility. In the project area, catchment along with surface water was the primary source of potable water until the first potable wells were placed into service in 1967. Although catchment does provide a potable water source of last resort, it has many drawbacks, including high maintenance costs and susceptibility to microbiological and chemical contamination. Sources of these contaminants vary from dead animals in the storage tank to materials eroded or leached from roofs, gutters and paint. In addition, most of the area within the
Keauhou Aquifer System does not receive sufficient rainfall to support individual catchments, although they may be viable in the wetter areas of the rain belt mauka of Mamalahoa Highway and also as an option for family agriculture users. Utilizing catchment systems to augment a municipal system might be feasible (Hawai‘i County WUDPU). The State Department of Health

(DOH) recommends using catchment water for non-consumptive needs and obtaining drinking or cooking water from regulated public water systems and/or purchased bottled drinking water.

Wastewater re-use can be an important source of water, particularly for irrigation, although treatment expense may elevate the cost of the water beyond the budget of agricultural users. In situations with critical water shortages, the cost of treated wastewater can be borne by municipal users, who then are able to utilize surface water or groundwater that would otherwise be used for irrigation. There are currently three wastewater reclamation facilities in the North Kona area. They are the He‘eia facility, which provides irrigation for the Kona and Ali‘i Country Club Golf Course; the Kealakehe facility, which serves the Swing Zone Driving Range in Kailua; and a third facility at Kona International Airport that provides landscaping irrigation. The He‘eia and Kealakehe facilities produce water that is treated to R-2 level, classified as disinfected secondary treated water, which has some restrictions on its irrigation use, while the airport facility produces R-1 or tertiary treated water, which is approved for spray irrigation without restrictions. In general, the effluent is utilized by plants and evapotranspires, avoiding significant penetration to the groundwater table. This reuse benefits agriculture and water resources. It is expected that in the future, increasingly extensive use will be made of treated wastewater for irrigation uses, but the need for additional potable demand still exists.

Similarly, DWS and other agencies concerned with developing and utilizing water on the Big Island consider desalination, an energy-intensive and expensive process, to be unjustified for cost reasons on the island of Hawai‘i and unnecessary to consider when better options exist. However, new technologies for desalination are being developed and the economic barriers may eventually disappear as the production costs come down.

1.2.3 Optimize Distribution of Existing Potable/Non-Potable Supplies

This project increases the amount of potable water available for the DWS North Kona system, where such water is sometimes used for non-potable purposes. The County Wastewater Division has plans to make wastewater available for re-use in the Kealakehe area, possibly including irrigation water for landscaping in portions of the Queen Ka‘ahumanu Highway currently being upgraded, which would decrease use of system potable water for irrigation. In some cases, individual users of the DWS North Kona system may use as much as 1,250 gpd or more for irrigation on their properties, and in general, irrigation is a substantial part of the total use in Kona. Implementing a parallel non-potable source, storage and distribution system extending throughout the North Kona system is not a practical alternative.

1.2.4 Conservation/Demand Side Strategies Alternative

According to agency officials, current conservation activities at DWS include the following:

- *100 percent customer metering*. All customer accounts are metered.

- *Meter repair/replacement programs*. Testing, repair and replacement of water meters are done on a systematic basis.
- *Water analysis/reports*. The difference between metered source production and metered sales to consumers is monitored to determine whether a leak detection program is justified.
- *Leak detection programs*. DWS is implementing investigations and repair for suspected sections of leaking pipelines.
- *Tank overflow controls/alarms*. These facilities prevent system losses from unnecessary overflows.
- *Voluntary water restriction notices*. DWS requests voluntary water conservation during dry periods and emergency water outages.
- *Public education outreach/education programs*. Exhibits in trade shows, the County fair, and public schools, among other venues, allow DWS to share information about the potable water system and water conservation.

These conservation programs have reduced and will continue to reduce the per-capita growth of future water demand. In particular, an island-wide reduction in non-metered water use continues to be realized. Rather than an alternative to developing new sources, water conservation is seen by DWS as an integral and ever-increasing part of its strategy to provide safe, affordable and reliable water service to the island of Hawai‘i in a sustainable and financially secure manner.

1.2.5 Selection of Project Alternative

Lanihau has determined that the most rational and efficient strategy for dealing with the need for a reliable supply for its Honokōhau Properties is to convert the exploratory well to production. The Water Board has agreed with that determination in that Palani Well No. 1 and the associated reservoir would be an effective component of its system to help meet future regional demand. The decision to advance this alternative was based on the successful yield and good water quality (as summarized in Section 1.1, above), the lack of impact on aquifer sustainability, and the fact that no alternative sources (such as catchment, wastewater reuse, or desalination) would provide a practical or economical source of potable water in this service area.

1.3 Consistency with Government Plans and Policies

The project is highly consistent with government plans and policies, which in general call for water systems that meet the needs of residents, support planned growth, and minimize environmental degradation. The following sections discuss consistency with key plans.

1.3.1 Hawai‘i State Plan

The Hawai‘i State Plan was adopted in 1978. It was revised in 1986 and again in 1991 (Hawai‘i Revised Statutes, Chapter 226, as amended). The Plan establishes a set of goals, objectives and policies that are meant to guide the State's long-run growth and development activities. The proposed project is consistent with State goals and objectives that call for increases in employment, income and job choices, and a growing, diversified economic base extending to the neighbor islands.

The sections of the Hawai‘i State Plan most relevant to the proposed project are centered on the theme of facility systems. The following objectives and policies are taken from the section dealing with water development.

- Objective a): Planning for the State's facility systems with regard to water shall be directed towards achievement of the objective of the provision of water to adequately accommodate domestic, agricultural, commercial, industrial, recreational and other needs within resource capacities.
- Objective b: To achieve the facility systems water objective, it shall be the policy of this State to:
  - (1) Coordinate development of land use activities with existing and potential water supply.
  - (2) Support research and development of alternative methods to meet future water requirements well in advance of anticipated needs.
  - (3) Reclaim and encourage the productive use of runoff water and wastewater discharges.
  - (4) Assist in improving the quality, efficiency, service and storage capabilities of water systems for domestic and agricultural use.
  - (5) Support water supply services to areas experiencing critical water problems.
  - (6) Promote water conservation programs and practices in government, private industry, and the general public to help ensure adequate water to meet long-term needs.

The proposed project supports all relevant objectives and policies of the Hawai‘i State Plan related to water facilities.

1.3.2 Hawai‘i Water Plan

The *Hawai‘i Water Plan* includes plans dealing with water resource protection, water quality, and development plans related to each individual county, to State projects, and to agricultural water systems. The most relevant plans for this discussion are the *Hawai‘i State Water Resources Development Plan* (Hawai‘i DLNR 1980), the *Water Resources Protection Plan* (Hawai‘i State CWRM 1992), the *State Water Projects Plan, Volume 2, Island of Hawai‘i* (Hawai‘i State Commission on Water Resources Management 2003) and the individual water use and development plans prepared for each county.

The purpose of the *Hawai‘i State Water Resources Development Plan* is to set forth specific objectives, policies, programs and projects to guide State and County governments. In summary, this plan presents guidelines for development of water resources for municipal, agricultural and industrial requirements; preservation of ecological, recreational, and aesthetic values and quality; and regulation of the use of water to assure adequate supplies for the future. The proposed project would develop a municipal water source in a rational manner to improve drinking water quality, assure adequate water for planned growth and would not adversely affect ecological, recreational or aesthetic values. The project is thus consistent with the basic guidelines of the plan.

In particular, the following objectives are noteworthy:

Objective A. Assure adequate municipal water supplies for planned urban growth.
Objective B. Support long-range municipal water supply planning by the counties.
Objective C. Promote municipal water conservation.
Objective D. Improve drinking water quality.
Objective E. Upgrade rural water systems.

The proposed project supports or is not inconsistent with each objective of the plan.

The *Water Resources Protection Plan* inventoried the water resources of the State, determined their sustainable yields based on available data, and recommended means of conserving and augmenting these resources. As discussed in Section 3.1.2, because there is no recognized current or foreseeable threat of exceeding sustainable levels of withdrawal from the Keauhou Aquifer System, it has not declared a Groundwater Management Area by the State Commission on Water Resources Management (however, see Section 3.1.2 below for discussion of impacts to other beneficial uses to aquifer).

The primary objective of the *State Water Projects Plan, Volume 2, Island of Hawai‘i* (SWPP) is to provide a framework for the planning and implementation of water development strategy for future State projects. A particularly relevant ongoing State project is the Department of Hawaiian Home Lands Villages of La‘i‘opua project. By 2020 the project will require 2.52

million gallons of potable water daily, including 0.06 mgd for non-potable uses. Another significant project in the Hualālai Aquifer Sector will be the Natural Energy Laboratory of Hawai‘i at Keahole Point which in 2005 used 0.9 mgd but will require 1.8 mgd by 2020. The Kona International Airport Master Plan being developed by the Department of Transportation calls for a supply of 0.24 mgd by 2020. The State Department of Education has a variety of school improvements planned in the Hualālai Aquifer Sector which will require approximately 0.01 mgd in that time frame. The development of the well would provide for potable water needs and free up water for non-potable needs, including those for State projects, and it is thus consistent with the SWPP.

1.3.3 Hawai‘i County Water Use and Development Plan

The *Hawai‘i County Water Use and Development Plan* (HCWUDP) (Hawai‘i County DWS 1989) is the most recent Hawai‘i County water plan to be formally adopted by DWS and CWRM. A draft update to the plan was prepared in 2006 and a final version of the update is currently being formulated. The Plan is meant to aid CWRM in granting permits for water use and designating water management areas, as well as serving as a reference document of current and future water resource conditions. The HCWUDP includes an inventory of existing water uses and developments by hydrologic units, addresses future land uses and related water needs, and is consistent with State and County land and water policies. This plan also guides DWS in future operations and to identify the improvements and facilities required to continue to provide safe, affordable and reliable water service to the island of Hawai‘i in a sustainable and financially secure manner.

The draft *Hawai‘i County Water Use and Development Plan Update* provides scenarios of low, medium, and high growth rates and estimates the public water needs for all and portions of the island for various years in the future. Common to all scenarios in all areas is a steadily increasing demand for water. The plan calculated that if all land uses currently envisioned within the Hualālai Aquifer Sector under the General Plan’s Land Use Pattern Allocation Guide Map were to be developed, a process which might take a century or more to occur, water demand would be a staggering 207 mgd at a minimum. This is compared to a sustainable yield of only 56 mgd in the sector. Even tallying only currently zoned uses, somewhere between 43 and 115 mgd would be needed, depending on to what extent agriculture used water. In the nearer term, within the Keauhou Aquifer System itself, demand under the medium growth scenario, including agricultural uses, would rise from 12.6 mgd in 2010 to 18.6 by 2025, which is still well short of the 38 mgd sustainable yield. Therefore, although near term use may not approach the sustainable yield, long term strategies involving extensive water re-use, desalination, and similar

strategies must be implemented, or land use policies must be adjusted to reduce growth. The proposed project is consistent with the HCWUDPU in that it provides an additional source of water for growth in demand over the next 15 years.

1.3.4 Hawai‘i County General Plan

The *General Plan* for the County of Hawai‘i is the document expressing the broad goals and policies for the long-range development of the Island of Hawai‘i. The latest plan was adopted by ordinance in 2005. The *General Plan* 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. Below are pertinent Goals, Objectives, Policies and Standards, and Courses of Action sections related to Water Systems Development, followed by a discussion of conformance. In addition, the most relevant sections of aspects of the General Plan are briefly discussed.

1.3.4.1 General Plan and Water Systems

POLICIES

- Water system improvements shall correlate with the County’s desired land use development pattern.
- All water systems shall be designed and built to Department of Water Supply standards.
- Improve and replace inadequate systems.
- Water sources shall be adequately protected to prevent depletion and contamination from natural and man-made occurrences or events.
- Water system improvements should be first installed in areas that have established needs and characteristics, such as occupied dwellings, agricultural operations and other uses, or in areas adjacent to them if there is need for urban expansion.
- A coordinated effort by County, State and private interests shall be developed to identify sources of additional water supply and be implemented to ensure the development of sufficient quantities of water for existing and future needs of high growth areas and agricultural production.
- The fire prevention systems shall be coordinated with water distribution systems in order to ensure water supplies for fire protection purposes.
- Develop and adopt standards for individual water catchment units.
- Cooperate with the State Department of Health to develop standards and/or guidelines for the construction and use of rainwater catchment systems to minimize the intrusion of any chemical and microbiological contaminants.

- o Cooperate with appropriate State and Federal agencies and the private sector to develop, improve and expand agricultural water systems in appropriate areas on the island.
- o Promote the use of ground water sources to meet State Department of Health water quality standards.
- o Continue to participate in the United States Geological Survey's exploratory well drilling program.
- o Seek State and Federal funds to assist in financing projects to bring the County into compliance with the Safe Drinking Water Act.
- o Develop and adopt a water master plan that will consider water yield, present and future demand, alternative sources of water, guidelines and policies for the issuing of water commitments.
- o Expand programs to provide for agricultural irrigation water.

STANDARD

- o Public and private water systems shall meet the requirements of the Department of Water Supply and the Subdivision Control Code.

COURSES OF ACTION FOR NORTH KONA

(a) Continue to pursue groundwater source investigation, exploration and development in areas that would provide for anticipated growth and an efficient and economic system operation.
(b) Continue to evaluate growth conditions to coordinate improvements as required to the existing water system in accordance with the North Kona Water System Master Plan.
(c) Explore and develop a well in Waiaha.

Discussion: The proposed project is completely consistent with all elements of the General Plan dealing with water systems. In particular, it would correlate with the County's desired growth pattern by servicing areas already identified for urban and rural growth, with established needs and characteristics. The project would be designed and built to DWS standards. As discussed in Section 3.1.2 below, the project is not expected to deplete aquifers or to contaminate them from natural and man-made sources. The project involves promotion of the use of groundwater sources (as opposed to surface water) to meet State Department of Health water quality standards. Finally, it provides a new source for Kona. Implementation of the proposed project would not conflict with any goals, policies or courses of action, and would, in fact, contribute to their fulfillment.

1.3.4.2 Other Selected Elements of General Plan

ECONOMIC GOALS

- Provide an economic environment that allows new, expanded, or improved economic opportunities that are compatible with the County's cultural, natural and social environment.

ENVIRONMENTAL QUALITY POLICIES

- Take positive action to further maintain the quality of the environment for residents both in the present and in the future.

ENVIRONMENTAL QUALITY STANDARDS

- Pollution shall be prevented, abated, and controlled at levels that will protect and preserve the public health and well being, through the enforcement of appropriate Federal, State and County standards.
- Incorporate environmental quality controls either as standards in appropriate ordinances or as conditions of approval.

HISTORIC SITES GOALS

- Protect, restore, and enhance the sites, buildings, and objects of significant historical and cultural importance to Hawaii.

HISTORIC SITES POLICIES

- Require both public and private developers of land to provide historical and archaeological surveys and cultural assessments, where appropriate, prior to the clearing or development of land when there are indications that the land under consideration has historical significance.
- Public access to significant historic sites and objects shall be acquired, where appropriate.

AGRICULTURAL LAND GOALS

- Identify, protect and maintain important agriculture lands on the island of Hawaii.
- Preserve the agricultural character of the island.

FLOOD CONTROL AND DRAINAGE GOALS

- Control pollution.
- Prevent damage from inundation.
- Reduce surface water and sediment runoff

FLOOD CONTROL AND DRAINAGE POLICIES

- Development-generated runoff shall be disposed of in a manner acceptable to the Department of Public Works and in compliance with all State and Federal laws.

FLOOD CONTROL AND DRAINAGE STANDARDS

- Applicable standards and regulations of Chapter 27, "Flood Control," of the Hawaii County Code.
- Applicable standards and regulations of the Federal Emergency Management Agency (FEMA).
- Applicable standards and regulations of Chapter 10, "Erosion and Sedimentation Control," of the Hawaii County Code.

NATURAL BEAUTY 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.

NATURAL BEAUTY POLICIES

- 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.

NATURAL RESOURCES AND SHORELINES GOALS

- o Protect and conserve the natural resources of the County of Hawaii from undue exploitation, encroachment and damage.
- o Ensure that alterations to existing land forms and vegetation, except crops, and construction of structures cause minimum adverse effect to water resources, and scenic and recreational amenities and minimum danger of floods, landslides, erosion, siltation, or failure in the event of earthquake.

Discussion: The project is consistent with these aspects of the General Plan. It will encourage economic opportunities that are compatible with the County's cultural, natural and social environment, the quality of which will be maintained. Historic sites or agricultural lands will not be adversely impacted. The improvements will be properly sited on the property to avoid encroachment into the flood zone or any other adverse drainage impact. Finally, the natural beauty and natural resources of the Kona area will not be adversely affected directly or indirectly by the proposed project, given standard expected conditions of land use approvals and permitting.

1.3.5 Kona Community Development Plan

The Kona Community Development Plan (CDP) encompasses the judicial districts of North and South Kona, and is being 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, adopted by "resolution" that served only as guidelines or reference documents to decision-makers. In September 2008, the Kona CDP was adopted by the County Council. The version referenced is this Environmental Assessment is at: http://www.hcrc.info/community-planning/community-development-plans/kona/cdp-final-drafts/KCDP_Final_Draft_Vol1_May2008_rev1.pdf.

The purposes of the Kona CDP are to:

- Articulate Kona's residents' vision for the planning area;
- Guide regional development in accordance with that vision, accommodating future growth while preserving valued assets;
- Provide a feasible infrastructure financing plan to improve existing deficiencies and proactively support the needs of future growth;
- Direct growth to appropriate areas;

- Create a plan of action where government and the people work in partnership to improve the quality of life in Kona for those who live, work, and visit;
- Provide a framework for monitoring the progress and effectiveness of the plan and to make changes and update if necessary.

The CDP emphasizes smart growth and sustainability, listing eight principles of sound development: preserving a sense of community, promoting interaction with nature, developing green building standards, minimizing energy use, avoiding environmental degradation, reducing toxic materials, achieving zero waste, and addressing climate change. The CDP states that:

> "Urban Area. Most of the future growth in Kona will be directed to an Urban Area (UA) defined in the Official Kona Land Use Map [Figure 4-7 of CDP]. Within this Kona Urban Area, growth would be directed to compact villages located along proposed transit routes or to infill areas within, or adjacent to, existing development. The general locations of these villages are within the Growth Opportunity Areas (GOAs) identified during the public meetings that evolved into the Transit-Oriented Developments (TODs)."

In the North Kona water service area, a number of TODs are called out, including the Keahuolu, Kaloko Makai, and Kalaoa neighborhood TODs, and the University Village and Honokohau regional TODs.

The CDP goes on to specify that the County policies shall "use public infrastructure to influence the location and timing of growth such as prioritizing the infrastructure that service TODs as an incentive to develop within TODs, as well as ensuring that this infrastructure supports this growth in a manner that reduces waste and pollution, conserves water, and generally minimizes environmental impacts."

The proposed improvements will assist in the orderly, planned growth of the water system to support TODs by providing new source, storage and transmission capacity in the appropriate place. It will also reduce dependence on the Kahalu‘u Shaft and improve the quality of the water.
Other especially relevant polices and actions of the Kona CDP include:

> **Policy PUB-4.6 Wastewater Reuse Area:** Recognizing the limited drinking water supply in the Kona area, every effort should be taken to develop a feasible wastewater reclamation system for non-potable uses.
> **Action ENGY-1.4b:** Install photovoltaic systems to power deep well pumps for the County Kona wells.

Wastewater reuse will gradually be implemented, relieving demand on other water sources. DWS is currently investigating the practicality and advisability of using photovoltaic powering of this and other deep well pumps.

2 ENVIRONMENTAL ASSESSMENT PROCESS

The project involves the use of County of Hawai‘i funds and land (at the Mamalahoa Highway right-of-way), and therefore requires compliance with Chapter 343, Hawai‘i Revised Statutes (HRS), the Hawai‘i Environmental Policy Act (HEPA). The County of Hawai‘i, Department of Water Supply, (DWS) is the approving agency for this Environmental Assessment (EA).

HEPA was enacted by the Hawai‘i State Legislature to require State and County agencies to consider the environmental impacts of various actions as part of the decision-making process. Agencies are required to conduct an investigation and evaluation of alternatives as part of the environmental impact analysis process, prior to making decisions that may impact the environment. The implementing regulations for HEPA are contained in Title 11, Chapter 200, Hawai‘i Administrative Rules (HAR).

This Environmental Assessment (EA) process was conducted in accordance with HEPA. According to HEPA and its implementing regulations, a Draft EA is prepared to document environmental conditions and impacts, to develop mitigation measures that avoid, minimize or compensate for adverse environmental impacts, and to determine whether or not an action has significant impacts upon the environment. Impacts are evaluated for significance according to thirteen specific criteria as presented in HAR 11-200-12. After review of public and agency comments received during a 30-day comment period, if the approving agency determines that no significant impacts would occur, it may issue a Final EA with a Finding of No Significant Impact (FONSI). When the Draft EA determines that significant impacts are present, then a Environmental Impact Statement (EIS) Preparation Notice is prepared, and the Final EA facilitates preparation of the EIS.

3 ENVIRONMENTAL SETTING AND IMPACTS

This section describes the existing social, economic, cultural, and environmental conditions surrounding the proposed project along with the probable impacts of the proposed action and mitigation measures designed to reduce or eliminate adverse environmental impacts. The No Build Alternative would result in no impacts with the exception of a lack of water for future development and increasing DWS reliance on water from the Kahaluʻu Inclined Shaft, which tends to experience increasing chlorides with an increase in pumping. Therefore, unless explicitly mentioned, discussion of impacts and mitigation relates to the Build Alternative only.

Basic Geographic Setting

The existing exploratory well, which will be converted to a production well, is located at the 1,670-foot elevation on land owned by Palani Ranch Co., Inc. on the western flank of Hualālai volcano (Figs. 1-4). A private access road to the site leads from Mamalahoa Highway near Palani Junction above Kailua. The area surrounding the well is dedicated to pasture; residential and residential/agricultural neighborhoods are present makai along Palani Road and Mamalahoa Highway, and also to the north and south.

3.1 Physical Environment

3.1.1 Surface Geology and Hazards

Existing Environment

This part of Kona is the product of Holocene lava flows from Hualālai volcano. The project site lies on a 750 to 1,500-year-old lava flow, with 3,000 to 5,000-year-old lava flows located immediately to the south and west (Wolfe and Morris 1996).

The project site is rated Lava Flow Hazard Zone 4 on a scale of ascending risk 9 to 1. The Zone 4 area consists of all of Hualālai, which is a dormant volcano with less frequent eruptions than Kilauea and Mauna Loa. Roughly 5 percent of the area has been covered with lava since 1800 and less than 15 percent of the area has been covered in the past 750 years.

In terms of seismic risk, the entire Island of Hawaiʻi is rated Zone 4 Seismic Hazard (Uniform Building Code, Appendix Chapter 25, Section 2518). Zone 4 areas are at risk from major earthquake damage, especially to structures that are poorly designed or built.

Impacts and Mitigation Measures

In general, geologic conditions impose no overriding constraints on the project, it is not imprudent to construct in terms of geological hazard, and no mitigation measures are expected to be required.

3.1.2 Groundwater Hydrology

Existing Environment

Hydrogeological Setting

No designated Principal or Sole-Source aquifers are located nearby or would be affected (Source: *Designated Sole Source Aquifers in EPA Region IX*, www.epa.gov/safewater/swp/ssa/reg9.html. U.S. Environmental Protection Agency web page, checked May 2008). There are no State Wellhead Protection Plans in force in or near the well site.

The State Commission on Water Resource Management (CWRM) classification of aquifers locates this part of Kona as being in the Keauhou Aquifer System (80901) of the Hualālai Aquifer Sector. The surface boundary of this aquifer is shown in Figure 5.

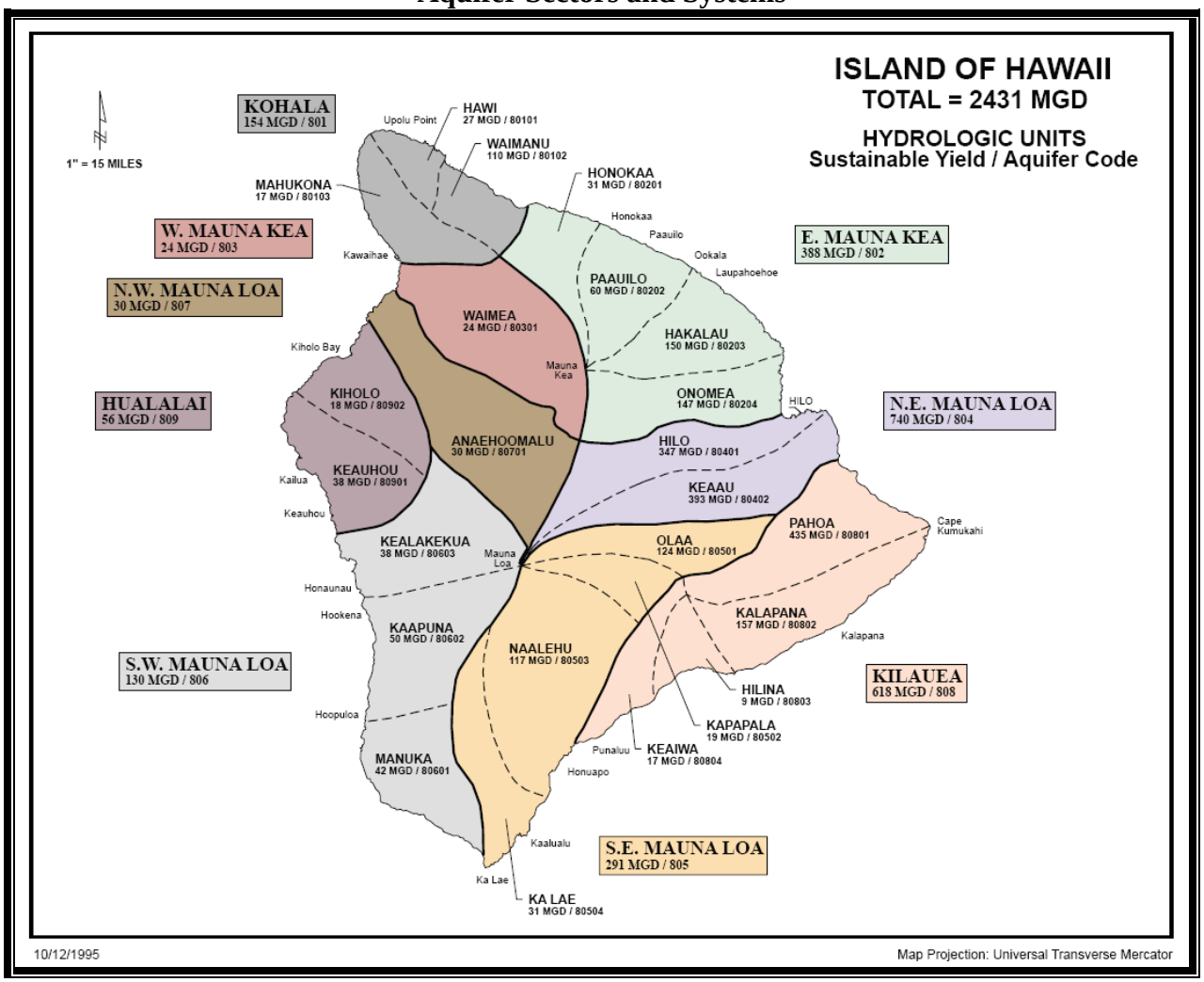
Precipitation that is not lost through evapotranspiration or runoff into the ocean percolates into the ground to collect in the aquifers before slowly making its way to the sea. As streams in Hawai‘i are generally flashy or even ephemeral, underground water is the most reliable source of water supply, because there is less daily or seasonal change in water tables. Most water is maintained in the basal freshwater lens that “floats” on the salt-water permeated rock below, but in some locations, such as on the slopes of the Hualālai and Mauna Loa volcanoes, substantial quantities of “high-level” water are known to occur.

The recharge area for the Keauhou Aquifer System is assumed to consist of essentially the surface area contained within the boundaries of the aquifer system. The Keauhou Aquifer System where the project is located has rainfall of less than 20 inches along the shoreline to about 125 inches in the Kahalu‘u Forest Reserve. As computed by the CWRM, groundwater recharge is limited to the contribution of rainfall. It does not include the contribution of fog drip, which studies have determined to be a considerable amount.

Current Estimated Installed Capacity and Water Use

CWRM maintains a database of wells that provides information on, among other aspects, the aquifer identity, user identity, installed capacity, chloride content and function. The database does not provide information on current pumpage, which instead is logged in a separate database and is derived from reports from individual well operators. Because not all well operators report their use in a timely manner, pumpage data may not be complete or up to date. Owing to security concerns after September 11, 2001, these databases are no longer accessible to the public and data must be requested from CWRM. The information provided below is based on databases maintained by CWRM, by information contained in the Draft *Hawai‘i County Water Use and Development Plan Update*, and information obtained from the Department of Water Supply and hydrology consultants.

Figure 5
Aquifer Sectors and Systems



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

The Keauhou Aquifer System currently contains 71 wells of various types, 29 of which are unused or being used as observation wells. DWS operates 11 principal municipal wells, including the Kahalu‘u Inclined Hualālai Shaft, four other Kahalu‘u Wells, and five high level wells at Holualoa, Waiaha, Honokōhau, Keahuola, and Kalaoa. There are also private wells, several of which are municipal, as well as 18 wells used solely for irrigation, one industrial well and 25 other wells. The industrial well is owned by Hawai‘i Electric Light Company, Inc., and pumps brackish water for cooling at its Keahole power plant. The majority of the “other” wells are used for aquaculture or

resort water features. There are also 24 wells that have been drilled but are categorized by the CWRM as unused or observation wells. According to information reported by well owners to the CWRM, total pumpage in the aquifer system is about 13 MGD and it does not vary substantially through the year. Of this 13 MGD total, about 11 MGD is pumped by DWS' North Kona System wells. DWS' total can further be divided into about seven MGD by its six basal wells in Kahalu‘u and Holualoa and four MGD by its five high level wells from Kalaoa to Waiaha. Four of these five high level wells are nominally upgradient of the Kaloko-Honokohau National Park (KAHO). Pumpage from these four wells began in the late 1990s and has averaged about 3.5 MGD since 2004.

Existing Drinking Water Quality

The Hawai‘i DWS regularly conducts microbiological analysis and contracts for extensive chemical testing in order to comply with U.S. Environmental Protection Agency (EPA) and Hawai‘i State standards. Table 3-1 depicts the contaminants tested for and the frequency of testing.

Annual Water Quality reports from the North Kona system for the latest full year available, 2007, (see Appendix 2), indicate that the system was compliant with all current State of Hawai‘i and U.S. Environmental Protection Agency drinking water standards. Specifically, no violations were recorded for radioactive, inorganic, organic or lead and copper contaminants, with all contaminants far below Maximum Contaminant Levels (MCLs).

Other Planned Uses in Aquifers and Issues of Concern

Aside from steady expansion of the DWS system, several new wells are reported to be in planning in the near future in the area in the North Kona area. The February 2008 issue of the *Well Pump Construction and Permit Application Bulletin*, issued by CWRM, listed eight wells, proposing a total use of over 2.4 mgd, for which well permits were issued in the Keauhou Aquifer System in 2007 and so far in 2008, including irrigation wells at Kohanaiki and a municipal well at O‘oma. There are also wells previously drilled but not fully developed for production. Completion of those wells is dependent on economic conditions. There is continuing demand, however, for potable and irrigation water.

The *State Water Projects Plan, Volume 2, Island of Hawai‘i* (SWPP) (Hawai‘i State CWRM 2003) provides a framework for the planning and implementation of water development strategy for future State projects. The SWPP recognizes the need for a number of projects involving potable and nonpotable water in the North Kona area. All told, the demand of new State projects to the year 2020 on sources within the Keauhou Aquifer System is anticipated to be 4.99 mgd. As discussed in Section 1.4.2, the Villages of La‘i‘opua alone would utilize 2.52 million gallons of potable water daily from the DWS North Kona system.

Table 3-1
Summary of Current Water Quality Monitoring Requirements

CONSTITUENT		
Bacteriological	Distribution system	Monthly; number of samples dependent on population served within distribution system
Carbamate, Nitrate, Metals, Inorganic, THM / HAA5 VOC, SOC8, Glyphosate EDB / DBCP / TCP	Entry point to distribution AND/OR Well Head (Location is dependent on contaminant being sampled for. SDWB will specify.)	Quarterly.
Asbestos	Source/distribution along AC pipe	First 3-year compliance period of 9-year cycle
Nitrate EDB / DBCP / TCP Metals, SOC8, VOC	Entry point to distribution AND/OR Well Head (Location is dependent on contaminant being sampled for. SDWB will specify.)	Annually
Lead and copper	Customer taps	For systems that have passed, once every three years. For systems that have failed, then once every six months until system passes, then once every three years thereafter.
Reduced Monitoring for Populations<=3300: Metals / VOC (ALL Groundwater sources; ALL Populations) SOC8, EDB / DBCP / TCP Glyphosate, Carbamate Herbicides	Entry point to distribution AND/OR Well Head (Location is dependent on contaminant being sampled for. SDWB will specify.)	Once every 3 years (R1/1)
Reduced Monitoring for Populations >3300: SOC8, EDB / DBCP / TCP Glyphosate, Carbamate Herbicides	Entry point to distribution AND/OR Well Head (Location is dependent on contaminant being sampled for. SDWB will specify.)	Twice every 3 years.
Radionuclides	Source	Once every 5 years.

Source: Hawai‘i County Department of Water Supply. SDWB = Hawai‘i State Department of Health, Safe Drinking Water Branch.

Impacts and Mitigation Measures

Hydrologic Impacts: Effects on Sustainable Yield

As summarized previously in Section 1.1, Lanihau contractor Water Resources International began drilling the exploratory well on December 11, 2006 and final pump-testing of the well's production was done in August and October 2007. The water table was found at approximately 77 feet above sea level, or about 1,593 feet below ground. According to an October 30, 2007 well completion report prepared by Waimea Water Services, Inc., testing of the exploratory well indicated the production well on this site was capable of a sustainable pumping rate of 1,123 gpm (see Appendix 3 for full report). The report indicated that the pumping rate should not exceed 1,200 gpm and recommended use of a submersible pump set at 57 to 77 feet below the existing water table, to provide adequate submergence for seasonal water level variations and drawdown due to pumping. The well yielded water of excellent quality, with chlorides of less than 15 milligrams per liter.

As noted above, current pumpage of 13 MGD from the aquifer system is far less than its conservatively estimated sustainable yield of 38 MGD. Palani Well No. 1 is permitted to produce up to 1.6 MGD. This amount is not significant in terms of the remaining sustainable yield of the aquifer. However, as discussed in the context of the Kaloko-Honokōhau National Historical Park below, there are concerns about whether "sustainable" use adequately protects groundwater resources in the Park.

Hydrologic Impacts: Effects on Nearby Wells

The nearest wells to Palani Well No. 1 are DWS high level wells to the north and south. DWS' Honokohau well (No. 4158-02) is 3100 feet to the south. Its initial static water level was 110 feet above sea level. DWS' Hualalai well (No. 4258-03) is 5,400 feet north of the Palani well. Its initial static level was 293 feet above sea level. The Palani well's 77-foot water level is substantially lower than the nearest wells to the south and north. Given the water level discontinuities and the very substantial spacing between wells, any significant impact by use of the Palani No. 1 well on wells to the north and south is highly unlikely.

Hydrologic Impacts: Kaloko-Honokōhau National Historical Park

Of primary relevance to the discussion of hydrological impacts from Palani Well No. 1 is the issue of Kaloko-Honokohau Park. Of specific concern is the possible lowering of the groundwater level and increasing pond salinity as a consequence of the possible reduction of the flowrate through the Park. Notable resources at National Park include Kaloko Fishpond, which is being restored for traditional and productive aquaculture use for human consumption; 'Ai'opio fishtrap, which is intensely utilized for fishing and traditional and customary cultural practices' 'Aimakapa fishpond and wetland, which is an important foraging and nesting habitat for the endangered Hawaiian stilt and the endangered Hawaiian coot, and an overall important habitat for migratory waterfowl; and the marine waters, which, like the adjacent coastal waters, are used by juvenile threatened green sea turtles and the endangered hawksbill sea turtle. The endangered Hawaiian monk seal is an occasional visitor to Park waters and rests on the shoreline. Brackish water ecosystems within the National Park are therefore important for the cultural landscape and cultural practices as well as habitat for native species, including endangered species.

The two-dimensional numerical modeling in Oki et al., 1999, despite its obvious limitations, can be used to provide an indication, at least to an order of magnitude, of the possible effect of withdrawing up to 1.6 MGD from the Palani Well:

- Reduction of the Groundwater Flowrate through the Park. Based on Figure 21 of Oki et al., 1999, withdrawals of 5.22 MGD by the four high level wells upgradient from the Park (Keahuolu, Honokohau, Hualalai, and Kalaoa) would produce a 0.76 MGD reduction of flow through the Park. In other words, the reduction of flow through the Park was about 15 percent of the upgradient, high level well pumpage. The Palani Well is in the middle of this group of four active high level wells. Based on Oki et al., 1999, its withdrawal of 1.6 MGD might reduce the flow through the Park by about 0.24 MGD. This represents about four (4) percent of the present flow of about 6.0 MGD through the Park (also from Oki et al., 1999).
- Reduction of Groundwater Levels in the Park. Mean groundwater levels in the Park, based on May 2000 water level recordings in the three monitor wells and Aimakapa Fishpond in the Park, vary from 1.2 to 2.2 feet above the mean ocean level. As a first order approximation, these might drop on the order of four percent or less than 0.1 feet as a result of full use of the Palani Well. This water level change is substantially less than the groundwater fluctuations due to natural phenomenon (storms and other large scale weather phenomenon) which produce basal groundwater level changes of up to a foot seasonally and from year to year.

- Increase in Salinity. Although difficult to quantify (and possibly to measure), a slight (four percent) reduction of groundwater flowrate would produce a very modest salinity increase, one that is probably less than the seasonal variation of salinity. While these changes are small, particularly with respect to the large changes in salinity within anchialine shoreline pond systems from natural oscillations in the mixing of groundwater and ocean water, there is concern regarding the effects of changing salinity to pond biota. For the last several decades, the majority of research conducted on the native fauna of anchialine ponds has been conducted by two individuals, Dr. Richard Brock and Mr. David Chai (pers. comm, Dr. Steve Dollar, University of Hawai‘i, February 2009). While not formally documented, both of these researchers have indicated that native pond fauna are extremely euryhaline, being able to tolerate nearly the entire salinity range from freshwater to ocean water with no adverse consequences. In fact, Mr. Chai, who manages ponds in West Hawai‘i, has used this tolerance to salinity by native species as a means to rid ponds of invasive non-native species that do not have the same physiological tolerances to wide ranges in salinity. Mr. Chai has found that surcharging the ponds with high salinity water results in removal of invasive species with little effect on native forms. Thus, the small increases in salinity in ponds downslope from the Palani well that may result from flow changes should have little or no negative effect on anchialine pond biota.

Water Quality

GK Environmental LLC (GKE) performed a Phase I Environmental Site Assessment (ESA) of portions of the properties on which Palani Well No. 1 is located, TMK 7-4-002:021 and 008. The Phase I ESA examined areas within 2,000 feet of the well to assist in determining if there were any sources of contaminants. The main portion of the Phase I ESA is attached as Appendix 5 and summarized below. The ESA involved site reconnaissance, interviews, records review, and historical review in order to identify potential and actual recognized environmental conditions at the subject site.

The Phase I ESA identified an area with a number of waste containers. Under the “Used Oil Rule” (40 CFR Part 279), used oil must be assumed to be hazardous until it is recognized to be otherwise. Lanihau was contacted regarding the find and confirmed that the fluids observed in unlabeled containers are composed entirely of waste motor oil; the find therefore can be treated as nonhazardous, and does not represent a recognized environmental condition. Subsequent to the site visit, Palani Ranch Company started the process of cleaning up the area, and have now removed and disposed of all of the containers of oil and has drained and properly disposed of the fluids in the vehicles. Apart from this area, GKE observed no evidence of the presence of above or underground storage tanks, PCBs, or other hazardous materials on the subject site. GKE identified no issues on adjacent or nearby properties that may constitute recognized environmental conditions. In summary, no evidence of recognized environmental conditions was noted in connection with the property, and GKE recommended no further investigations for the subject site at this time.

Since this area of North Kona has no sewer service, every residence in the area has an Individual Wastewater System (IWS) – more likely a cesspool than a septic tank. There are a number of residences within 2,000 feet of the well site, and several are within 1,000 feet (see Figure 3 of Appendix 5 for locations). There are likely no cesspools or septic tanks on the subject properties located uphill, the assumed source of groundwater flow. A number of residences within 2,000 feet of the well site are located in the Kaloko Mauka subdivision, with the nearest of these about 600-800 feet north. Hawai‘i Administrative Rules (HAR) require that a new IWS be a minimum of 1,000 feet from a potable water well. However, the converse is not true, i.e., it is not required to locate a potable well 1,000 feet from an existing IWS. Nevertheless, whenever a well is located within 1,000 feet of and an IWS, the Department of Health and DWS are concerned with any potential contamination to the proposed well via improper wastewater treatment and disposal from any nearby source. The geological context is important, and it is also necessary to have mechanisms in place to check water quality periodically to ensure protection of public health.

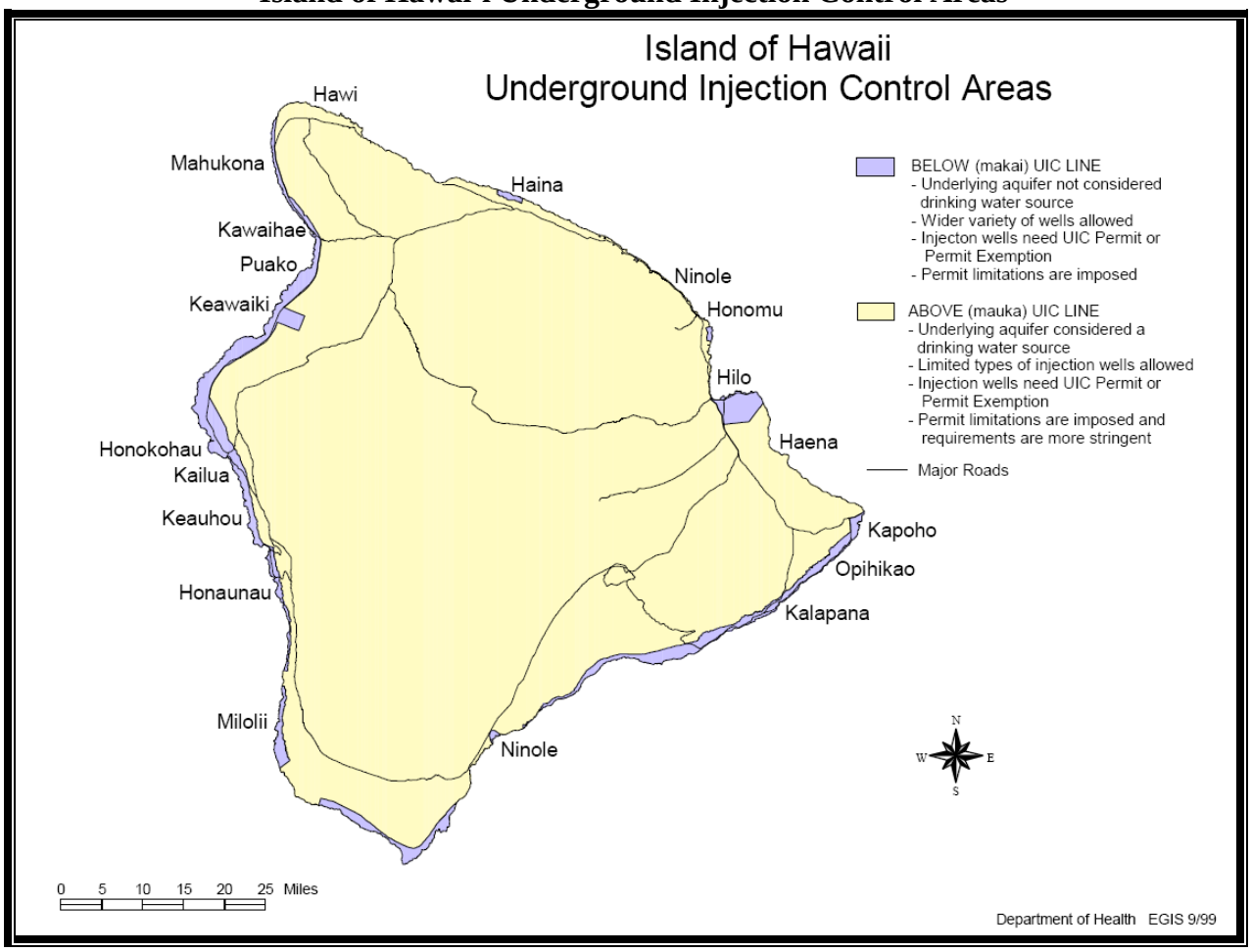
The aquifer below the well site is about 1,600 feet below the surface and even deeper in the well's recharge area upgradient. The nature of the land use upgradient, the underlying geology and the depth to the aquifer indicate that the possibility for aquifer contamination is slight. Since the well will be fully grouted to a depth of 1,580 feet, no surface or near-surface contamination of the groundwater aquifer is expected to occur beyond that of pre-development conditions. DWS periodically performs comprehensive and stringent tests of well water quality to ensure that public health is protected. Considering the depth of the well and the lack of past or current potential sources of contamination, good water quality was expected from the exploratory well. Water quality tests confirmed this and indicated that the well was suitable for incorporation in the DWS water system.

Neighboring landowners who propose an Individual Wastewater System within 1,000 feet of the well may be prohibited by the Department of Health from installing a cesspool and may be required to build an "enhanced" treatment septic system that costs more than a standard system. This requirement is in place to protect public health. Property owners within 1,000 feet of the well have been notified of the proposed well and invited to comment on the proposal.

The Underground Injection Control (UIC) line in North Kona is located at about the mid-point between the project area and the coastline approximately 4 miles away (Figure 6). The well site and its recharge area are thus mauka of the UIC line, where underlying aquifers are considered drinking water sources and injection wells may be prohibited and if permitted are subject to stringent requirements to ensure they do not contaminate aquifers.

In terms of findings related to water quality, the area near the proposed well appears to be reasonably free of any major source of contaminants. The motor oil observed on the property does not appear to pose any significant contamination threat and has been cleaned up by the landowner.

Figure 6
Island of Hawai`i Underground Injection Control Areas



No upslope properties are currently, or expected to be, used for agriculture, residences or industry. A few cesspools or septic tanks are present within 1,000 feet but not upslope of the property. Future IWS within the 1,000-foot radius will be required to meet stringent requirements to ensure public health. Injection wells that could affect this portion of the aquifer will be prohibited. The water from the production well will continue to be tested by a qualified laboratory to ensure the water quality meets the potable water source requirements of the Hawai‘i State Department of Health, which tests for a variety of organic and volatile compounds and total and fecal coliform, among other parameters. The project will be in full compliance with all requirements of the Safe Drinking Water Act, (42 U.S.C §300H-3[e]).

The project will be designed in accordance with the “Water System Standards, Department of Water Supply, County of Hawai‘i, 2002”. The design will be coordinated with the appropriate County and State agencies. Given the proper design and appropriate agency coordination, there will be negligible hazard to the public or the natural environment, including impacts on water quality.

3.1.3 Floodplains and Surface Water Quality

Existing Environment

Annual rainfall in the area averages about 50 inches. The Flood Insurance Rate Maps (FIRM) show that the project site is in Flood Zone X, outside the 100-year floodplain. The Keopu Drainageway is located about two miles to the south. No known areas of local (non-stream related) flooding are present.

Impacts and Mitigation Measures

Finishing of the project well pad, installation of the control building and associated features, and the widening of the access road will add minimally to the area of impermeable surface and will not adversely affect drainage. In any project, uncontrolled excess sediment from soil erosion during and after excavation and construction has the potential to impact natural watercourses, water quality and flooding potential. Contaminants associated with heavy equipment and other sources during construction have the potential to impact ground water if not mitigated effectively.

Provisions will be made during the construction grading and earthwork to minimize soil erosion and off-site sediment transport. A Pollution Control Plan and a Stormwater Pollution Prevention Plan will be implemented to ensure that the proposed improvements do not cause drainage or water quality impacts. Best Management Practices (BMPs) such as standard soil erosion and sediment control shall be implemented. These may include measures such as the following:

- Limiting the amount of surface area graded at any given time to reduce the area subject to potential erosion;
- Utilizing soil erosion protective materials such as mulch or geotextiles on areas where soils have a high potential for erosion until permanent provisions such as lawns and grasses can be developed;
- Planting vegetation as soon as grading operations permit to minimize the amount of time soils are exposed to possible erosion; and
- Building sedimentation basins to collect sediment that might enter runoff waters.

The project will be regulated through review and approval by the Hawai‘i County Department of Public Works (DPW) to ensure compliance with standards related to storm runoff containment.

3.1.4 Climate and Air Quality

Existing Environment

The project site is located near Palani Junction at an elevation of 1,670 feet. Average annual rainfall at the project site is about 50 inches (Giambelucca et al 1986). The average maximum temperature is approximately 78 degrees F, with an average minimum of 65 degrees (U.H. Hilo-Geography 1998:57).

Impacts and Mitigation Measures

The proposed project will not produce any permanent substantial air quality impacts. Access road improvements have the potential to produce very localized and temporary fugitive dust emissions, although the moist, highly vegetated landscape is not prone to production of dust. There are no dust-sensitive land uses nearby. Nevertheless, a dust control plan will be implemented for construction activities with potential to generate substantial dust. The elements of the plan may include some or all of the following:

- Watering of active work areas;
- Cleaning adjacent paved roads affected by construction;
- Covering of open-bodied trucks carrying soil or rock;
- Limiting area to be disturbed at any given time;
- Mulching or stabilizing disturbed inactive areas with geotextile; and
- Paving and landscaping as soon as practical in the construction schedule.

3.1.5 Noise and Scenic Value

Existing Environment

Noise levels on the site are low and are derived mainly from the vehicle traffic on the private road servicing the ranch, along with distant sounds from residential areas makai. The well pad is about 600 to 1,000 feet from residences and other sensitive uses.

The well pad lacks any intrinsic scenic value and is essentially concealed from view from uphill, downhill and cross-slope vantages.

Impacts and Mitigation Measures

Construction will elevate noise levels during short periods over the course of several months. Due to the site's isolation from sensitive uses, no noise mitigation requirements are needed.

As far as permanent impacts, the well will be outfitted with a submersible pump, which would be located within the well, over 1,500 feet below the ground surface, and thus barely audible on the site. The distance of the well from any sensitive uses will prevent any impacts from the minor noise produced by occasional maintenance activities. The control building will also be equipped with alarms that will be connected to the Department of Water Supply's SCADA system. Given that the well is isolated from any noise-sensitive uses, there is little potential for ongoing noise impacts from any source.

The facilities would be barely visible from any adjacent sites, owing to the terrain, vegetation and the distance to any private land or public viewpoints. The reservoir will be 100 feet in diameter and 22 feet high, and all other structures 10 feet high or less, but because of its setting, and no structures will protrude into views of the coast or mountains from nearby roads.

3.2 Biological Environment

Existing Environment

The well pad was sited on active ranch land that was cleared and fully graded during drilling of the exploration well (see Figure 3 for photos). The well pad site now supports on its fringes a few native ʻohiʻa (*Metrosideros polymorpha*) trees along with alien vegetation, including kikuyu grass (*Pennisetum clandestinum*), African tulip (*Spathodea campanulata*), kukui (*Aleurites moluccana*), silk oak (*Grevillea robusta*), thimbleberry (*Rubus rosifolius*), sensitive plant (*Mimosa pudica*), buddleia (*Buddleia asiatica*), asparagus fern (*Asparagus densiflorus*), begonia (*Begonia sp.*), lilikoi (*Passiflora edulis*), waiawi (*Psidium cattleianum*), guava (*Psidium guajava*) and sword fern (*Nephrolepis multiflora)*. Aside from ʻohiʻa, few natives, and no rare, threatened or endangered plant species (U.S. Fish and Wildlife Service 2009), are present on or near the well pad or access road. No botanical resources of conservation concern are present or would be affected.

Most vertebrates found in Kona are alien species, and those native birds found in the alien vegetation of the site are likely to be common. Mammals likely to be present are common domestic or feral species, including horses, domestic cattle, pigs, goats, dogs, cats, and various species or rats and mice. Birds observed on the project site were all alien, including Spotted Doves (*Streptopelia chinensis*), Common Mynas (*Acridotheres tristis*), Japanese White Eyes (*Zosterops japonicus*), and Zebra Doves (*Geopelia striata*). However, the endangered Hawaiian Hawk (*Buteo solitarius*) and the Hawaiian Hoary Bat (*Lasiurus cinereus semotus*) are often found in alien as well as native vegetation in a variety of locations throughout the island of Hawaiʻi. It is unlikely that either species would find the weedy vegetation of the well pad, access road, or adjacent areas useful habitat for nesting/roosting.

No streams, ponds or wetlands are present in the surface area that would be affected by the proposed project. The Keopu Drainageway is located about two miles south of the project area. Groundwater in the aquifers tapped by the wells in the Kona area presumably makes its way to the Pacific Ocean via very slow pathways in the basal aquifer or through seeps and springs into ponds and marine waters. The presence of ecosystems that rely, directly or indirectly, on the quantity of groundwater flowing to the shoreline is discussed in Section 3.1.1, above, in the context of National Park concerns.

Impacts and Mitigation Measures

As none are present, no impact upon rare, threatened or endangered plant species is expected. Although Hawaiian Hawks and Hawaiian Hoary Bats, both endangered, may forage in the area, neither would likely be impacted by any project activities, which would occur in the disturbed well pad and access road within a working ranch and would not affect their habitat. The issue of whether there may be indirect effects of groundwater withdrawal on the aquatic biology ponds and coastal waters is discussed in Section 3.1.2, above.

3.3 Socioeconomic

3.3.1 Land Use, Social Factors and Community Identity

Existing Environment

TMK 7-4-002:021 is a 1.240-acre property that was subdivided for the well pad, and 7-4-002:008 is the larger 576.404-acre parcel that surrounds it and contains the access road. Both are currently owned by Palani Ranch Company, Inc. According to the Hawai‘i County Planning Department, the project site is within the State Land Use Agricultural District and the County Zoning on the property is Agricultural (A-1 and A-20). It is designated on the County General Plan Land Use Designation Maps (LUPAG) as Urban Expansion for the portion closest to Mamalahoa Highway, with the remainder Important Agricultural Lands. The site is not within the Special Management Area. The facility is a permitted use on the subject parcels, but will require Plan Approval prior to obtaining a building permit.

Table 3-2 shows the population and socioeconomic characteristics of both Hawai‘i County and the North Kona District.

Table 3-2
Selected Socioeconomic Characteristics

Characteristic	Hawai'i County	North Kona	Characteristic	Hawai'i County	North Kona
Total Population	148,677	28,543	21 to 65 Years, Disabled (%)	19.2	17.4
Median Age	38.6	39.4	Employed and Disabled, 21 to 65 Years, (%)	51.8	64.1
Older Than 65 Years (%)	13.5	11.8	65 Years of Older, Disabled (%)	40.3	38.1
Race (%)			Employment in:		
White	31.5	47.1	Management	30.2	26.6
Asian	26.7	16.3	Service	22.2	24.3
Hawaiian	9.7	8.9	Sales	25.1	27.8
Other Pacific Islander	1.5	1.8	Office	3.8	2.2
Two or More Races	28.4	23.5	Farming, Fishing and Forestry	9.9	10.4
Hispanic (Any Race)	9.5	7.9	Production, Transportation	8.9	8.8
Family Households (%)	69.6	68.6	Families Below Poverty Line (%)	11.0	5.6
Households with Female Householder, no Husband, With Children (%)	7.7	6.7	Households with Female Householder, no Husband, With Children, Below Poverty Line (%)	28.1	17.5
Householder Lives Alone (%)	23.1	20.1	Individuals Below Poverty Line (%)	15.7	9.7
Average Household Size	2.75	2.70	Over 65 Below Poverty Line	7.2	5.3
Average Family Size	3.24	3.13	Median Household Income ($)	39,805	47,610
Over 25 Years Old With High School Diploma (%)	84.6	87.7	Housing Owner-Occupied (%)	64.5	58.5
Married Now (%)	52.0	53.9	Housing Rented (%)	34.5	41.5
Widowed (%)	6.3	4.9	Housing Vacant (%)	15.5	19.7
Divorced Now (%)	10.7	11.4	Median Home Value, 1999 ($)	153,700	233,900
Veterans (%)	14.5	14.8	Median Rent, 1999 ($)	645	745
Over 16 in Labor Market (%)	61.7	69.2	Rent is Greater Than 25% of Income (%)	46.0	47.2
Residence 5 Years Ago (%)			Poverty by Race:		
Same Home	57.7	49.9	White	14.5	8.8
Different Home, Same County	26.5	28.8	Asian	7.3	6.2
Different County in Hawai`i	4.8	3.5	Native Hawaiian/Pacific Islander	26.4	15.8
Different State/Country	11.0	17.8	Two or More Races	20.4	10.3

Source: U.S. Bureau of the Census, May 2001. *Profiles of General Demographic Characteristics, 2000 Census of Population and Housing, Hawai'i.* (U.S. Census Bureau Web Page).

Impacts and Mitigation Measures

The project would not cause relocation of residences, businesses, community facilities, farms or other activities. In the long term, project impacts to the social environment may be regarded as largely beneficial, because the well and reservoir would improve the quality, quantity and reliability of potable water for residences and businesses. All water projects require consideration for the secondary effects of growth induction; this topic is covered in Section 3.4.

3.3.2 Public Services, Facilities and Utilities

Utilities

The well and supporting facilities will require electrical power. This will be provided via existing overhead lines adjacent to the access road by the Hawai‘i Electric Light Company (HELCO). The power demands of the well pump, control building and reservoir will not adversely affect the ability of HELCO to provide power.

Roadways

Access to all sites for construction and maintenance will be via the existing private service road. In a letter of February 19, 2008, the Department of Transportation expressed concern about traffic disruption during construction, an issue repeated by the Police Department in a letter of February 22, 2008 (see Appendix 1). Apart from limited work near Mamalahoa Highway, construction is focused on a private road away from existing traffic. Lanihau and its contractor will schedule work to avoid disruption of traffic during peak hours and will develop a professional traffic control plan. Very few trips will be necessary for maintenance of the facility, and there will be no adverse impacts to public roads, either individually or cumulatively.

Police, Fire, Emergency Medical, Recreation, Schools, and Other Public Facilities and Services

All such facilities and services are present in the Kailua area. No such facilities or services would be directly affected in any adverse way.

3.3.3 Cultural and Archaeological Resources

Cultural Background and Resources

The traditional cultural value of the well and reservoir pad and access road area was assessed by determining whether it supports any traditional gathering uses, is vital for access to traditional cultural sites, or has other important symbolic associations for native Hawaiians or other cultural groups. The land in this part of Kona has a long history of dedication to ranching.

The project site is located in the Honokōhau 1st ahupua‘a in the district of Kona. Archival documents and historical literature conducted for the lands of Honokōhau analyzed by Kepā Maly (2000) were a source of cultural information along with an archaeological inventory survey prepared by International Archaeological Research Institute, Inc. (IARII) in 2006 (see Appendix 6) for the affected areas of the property. The first study used both archival-historical research and oral history interviews with descendants of the native Hawaiian families and others who were known to be familiar with the natural and cultural landscape and history of land use in Honokōhau and the Kekaha region. All of the interview participants had lived upon or worked the lands of Honokōhau and provide documentation gained from personal experiences dating back to the 1890s. Several

participants were descended from families who lived at Honokōhau since at least the 1840s. Kona was apparently first settled along the sheltered and watered bays in the region extending south from Kailua. As population increased, people began establishing permanent settlements in arid Kekaha. Kona, like other large districts on Hawai‘i, was divided into ‘okana or kalana (ancient regions). In the region now known as Kona ‘akau (North Kona), there are several kalana. The southern portion of North Kona was known as "Kona kai ‘ōpua" (interpretively translated by Maly as "Kona of the distant horizon clouds above the ocean"), and included the area extending from Lanihau (the present-day vicinity of Kailua Town) to Pu‘uohau. The northernmost portion of North Kona was called "Kekaha", a term used to describe an arid coastal region. Native residents of the region affectionately referred to their home as Kekaha-wai-‘ole o nā Kona ("Waterless Kekaha of the Kona district"), or simply as the ‘āina kaha.

Only a few early (pre-nineteenth century) historical accounts specifically name Honokōhau, as most of the accounts describe the area in the context of the larger Kekaha region. One of the earliest datable accounts that describes the importance of the Kekaha region comes from the mid-sixteenth century, following ‘Umi-a-Līloa's unification of the island of Hawai‘i under his rule. Writing in the 1860s, native historian Samuel Kamakau (1961) recounted the reign of ‘Umi and his visits to Kekaha:

> "Umi-a-Līloa did two things with his own hands, farming and fishing...and farming was done on all the lands. Much of this was done in Kona. He was noted for his skill in fishing and was called Pu‘ipu‘i a ka lawai‘a (a stalwart fisherman). Aku fishing was his favorite occupation, and it often took him to the beaches (Ke-kaha) from Kalahuipua‘a to Makaula."

Working fishponds in the Honokōhau-Kaloko vicinity date back to at least the early seventeenth century. In Kamakau's (Ibid.) description of events that occurred in the life time of Lono-i-ka-Makahiki, ‘Umi's grandson, the ponds are mentioned as well.

> "Soon the fishing canoes from Kawaihae, the Kaha lands, and ‘O‘oma drew close to the ship to trade for the pa‘i‘ai (hard poi) carried on board, and shortly a great quantity of aku lay silvery-hued on the deck. The fishes were cut into pieces and mashed; and all those aboard fell to and ate, the women by themselves."

Historian John Papa I‘i also stated that Honokōhau had one of the famous surf breaks of the region (I‘i 1959).

In 1819, following the death of Kamehameha I, Liholiho (Kamehameha II) retreated to Kawaihae. Following the period of mourning and purification, he returned to the Kailua. Kamakau (1961) reported that on the way there he stopped at Honokōhau and dedicated a heiau to his god and prepared for his return. It was soon after this that Liholiho declared ai noa (free eating), a breaking of the kapu (restrictions) of the gods that quickly led to the demise of the ancient religious system.

While historical references are few, some vivid pictures of life in this arid region were written. In 1840-41, Charles Wilkes of the U.S. Exploring Expedition wrote:

> "A considerable trade is kept up between the south and north end of this district. The inhabitants of the barren portion of the latter are principally occupied in fishing and the manufacture of salt, which articles are bartered with those who live in the more fertile regions of the south, for food and clothing." (Wilkes 1845)

In 1924, J.W.H.I. Kihe wrote a series of accounts in the Hawaiian language newspaper *Ka Hōku o Hawai'i.* One discussed the depopulation of Kekaha:

> "The lands of Honokōhau were filled with people in those days, there were many women and children with whom I traveled with joy in the days of my youth. Those families are all gone, and the land is quiet. There are no people, only the rocks remain, and a few scattered trees growing, and only occasionally does one meet with a man today [1924]. One man and his children are all that remain."

According to cultural historian Kepā Maly, despite the lack of water, the lands of Honokōhau were among the favored lands of the North Kona District. Honokōhau, which extended from the sea to the forests of Hualālai (including the project site), was carefully managed for resources. There were both open ocean and nearshore fisheries (ko'a) as well as intricate loko i'a (fishponds and fish traps). Springs were vital and protected resources. A wide range of environmental zones (wao), extending from near shore to upland forests provided the natural resources and materials necessary for the development of a sophisticated agricultural system. These resources allowed the native residents of the lands to meet their immediate community needs as well as contribute to the overall support of the larger Hawaiian social, economic, religious and political system of Kona. The project site itself is situated within the 'apa'a zone of the Kona Field System within Honokōhau, a mid-elevation zone used for dryland cultivation of taro, sugar cane, sweet potato, and ti.

Valued natural, cultural and historical resources are still present in various parts of Honokōhau. Koa fishing grounds and the natural landmarks such as pu'u (hills) that guide fishermen to them are examples. Springs, ponds, and other coastal water features have not only biological but also cultural significance. Burial sites for 'iwi kupuna, including caves, are important resources to protect. On a wider level, the entire range of wao, from the kahakai (shoreline) to the wao akua (cloud forests), that make up the ahupua'a have a level of cultural importance.

According to an archaeological study by IARII (2006), the ahupua'a of Honokōhau 1st, which is also known as Honokōhau Nui, which contains the project area, was acquired by H.N. Greenwell in 1876. The project area was included in Land Grant 8087 given to Frank R. Greenwell.

The project area has been used since the 1880s for the raising of cattle and horses, along with family residences and subsistence agriculture. A former wagon road built in the late 1800s but abandoned in the early 1900s is found on the property at about the 1,650-foot elevation.

As part of the early consultation process, the Honolulu and West Hawai‘i offices of the Office of Hawaiian Affairs and the Kona Hawaiian Civic Club were contacted about the project. None identified any natural, cultural or historical resources of concern in the specific area of the well pad, access road or adjacent areas. The issue of whether there may be indirect effects of groundwater withdrawal on the ponds and coastal waters that support cultural practices is discussed in Section 3.1.2, above. Visual inspection of the graded well pad and access road revealed no evidence of structures, unique natural features or activities that would be valuable for gathering, ceremonial or access purposes.

Cultural Resources: Impacts and Mitigation Measures

It is reasonable to conclude that based upon the lack of resources, the exercise of native Hawaiian rights related to gathering, access or other customary activities will not be affected, and there will be no adverse effect upon cultural practices or beliefs. The Honolulu and West Hawai‘i offices of the Office of Hawaiian Affairs and the Kona Hawaiian Civic Club have been supplied a copy of the Draft EA in order to confirm this conclusion.

Archaeological Resources: Existing Environment

An archaeological inventory survey of the project site was conducted by IARII. The survey is included as Appendix 6 and is summarized below. The archaeological inventory study involved a survey of a roughly 10-foot wide corridor on either side of the existing road providing access to the well site, which was expanded at points where the existing road may be widened or diverted, and of a similar corridor around the tentative survey stakes and anticipated development areas on the subject parcel. Limited probing in that area revealed very rocky clay loam and loamy silt less than 4 inches thick over basalt bedrock, which is also exposed in many areas. The vast majority of the project area consists of rocky terrain with no potential for subsurface archaeological deposits. Subsurface cultural deposits were not encountered, nor were any anticipated given previous archaeological surveys of similar areas of the ahupua‘a. The survey revealed 318 surface features in 13 sites. The only cultural deposit found during excavations of stonework features was a lone concentration of probable goat bones. No funerary remains were found. Most of the surface features are associated with historic ranching activities and cultivation practices, although some historic residential features were also found. One set of walls represents a remnant of a historic wagon road. Most of the features appear to date to the post-Contact period, although some are possible pre-Contact. The 13 sites were examined and are unlikely to yield additional information, and as such the archaeologist recommended no further investigation at the project site.

Archaeological Resources: Impacts and Mitigation Measures

In a letter of May 12, 2008 (see Appendix 1), the State Historic Preservation Division (SHPD) confirmed that it reviewed the archaeological inventory survey as part of the exploratory well construction and concurred with the recommendations of the archaeologist in a letter of September 21, 2006. SHPD asked in the May 12, 2008 letter whether the well pad, 12-inch transmission line, and water tank locations were included in the area of the survey. The archaeological inventory survey was intended to cover these project features, and as a comparison of the project area for the (Appendix 6, Figure 3 on p. 9) and the Site Plans (Figure 4 of this document) indicate, the area for them has been entirely covered. Upon review of the EA, SHPD is expected to concur that there will be no adverse effect to historic properties, and the Final EA will report upon the consultation.

In the unlikely event that archaeological resources are encountered during future development activities within the project site, work in the immediate area of the discovery will be halted and DLNR-SHPD contacted as outlined in Hawai‘i Administrative Rules 13§13-275-12.

3.4 Growth-Inducing, Cumulative and Secondary Impacts

3.4.1 Secondary and Growth Inducing Impacts

Secondary Impacts

Infrastructure expansion projects – whether highways, sewage treatment plants, school construction, or water supply – can induce secondary physical and social impacts that are only indirectly related to the project. The primary mechanism for these secondary impacts from infrastructure projects is through the induction of growth that would otherwise not occur or whose pace would be significantly accelerated because of the infrastructure.

Analysis of growth-inducing impacts examines the potential for a project to induce unplanned development, substantially accelerate planned development, encourage shifts in growth from other areas in the region, or intensify growth beyond the levels anticipated and planned for without the project. Provision of needed infrastructure such as roads, water supply, sewer facilities, etc., is often seen as growth-inducing.

The proposed increase to the water supply at the Palani Well No. 1 and Reservoir is in response to two needs, that of expansion in capacity of the general North Kona Water System, and that of providing water for Lanihau’s growth. To some extent these are related, as the system grows in response to proposals from individual developers. Because of the complexity of the timing and distribution of requests for water, as well as the interconnectedness of the system that does not tie development to water produced in its own direct area, it is not possible to predict exactly which private and public development projects will be facilitated by the addition to the water supply

and storage capability that the project makes possible. However, as approval for Lanihau's developments depend in part upon developing the proposed project, its land use plans are directly relevant. These are mapped in Figure 7, and details about the current LUPAG (General Plan Land Use Pattern Allocation Guide Map) designation, permitting requirements and development timeframe are provided in Table 3-3. Other less directly related development projects are discussed in Section 3.4.2 in the context of cumulative impacts.

As mentioned above, of key importance is whether infrastructure fulfills existing demands/needs of planned growth, or whether it instead enables unplanned growth and/or diverts growth away from planned areas. Also of interest is whether the growth is subject to additional environmental analysis to ensure that impacts are not examined or mitigated for.

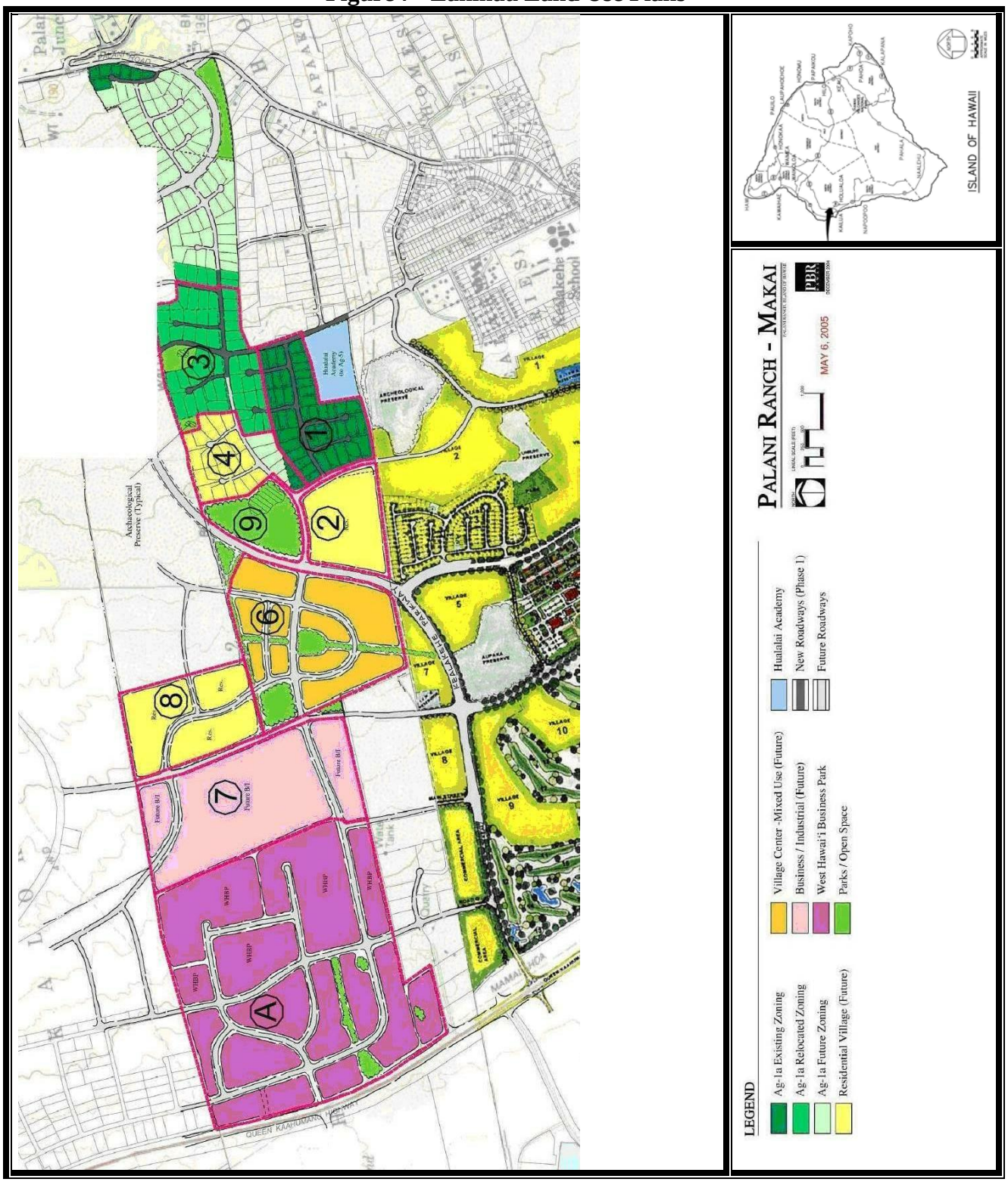
Growth in the County of Hawai'i occurs as a result of private, County and State initiatives. It is regulated by land use regulations on the State level, which control the uses within the State Land Use Urban, Rural, Agricultural and Conservation Districts; by the County General Plan, which expresses the broad goals and policies for the long-range development; on the Community Development Plan level, which translate broad General Plan Goals, Policies, and Standards into implementation actions as they apply to specific geographical regions around the County; on the

Table 3-3
Lanihau Projects in Planning

Project Name/ Map Key	Scale	Existing LUPAG	Entitlements and Environmental Documentation	Timeframe
West Hawai'i Business Park **A**: Current Phase	86 units, 250 acres (net)	Industrial	Complete: EIS, State Land Use Boundary Amendment (SLUBA), Change of Zone, Bulk Subdivision.	1st phase in initial phases of development.
West Hawai'i Business Park or other use. **7**	96 acres (net)	Industrial	Complete: EIS, State Land Use Boundary Amendment, for 54.5 acres. Future EIS, SLUBA, Change of Zone for remainder	2015-2035
Agricultural Lots **1** and **3**	86 acres	Low Density Urban	Subdivision approval	2015-2020
Residential Lots **2, 4**, **6** and **8**	865 units, 158 acres	Low Density Urban and Urban Expansion	Future EIS, SLUBA, Change of Zone	2015-2035
Business Commercial **6**	26 acres	Urban Expansion	Future EIS, SLUBA, Change of Zone	2015-2035
Various civic and community uses **6** and **9**	43 acres	Urban Expansion	Future EIS, SLUBA, Change of Zone	2015-2035

See Figure 7 for location; Timeframes are approximate; (net) indicates acreage net of roadways and other non-developable areas.

Figure 7 Lanihau Land Use Plans



County zoning level, which dictates more specifically the uses within various subcategories of these districts; and the level of the County Planning Commission, which reviews development near the coast within the Special Management Area according to federal, State and County regulations and also grants permits for certain types of uses within the Urban District (Use Permit) and Agricultural District (Special Permit). In addition, ministerial permits related to subdivision and building impose a number of conditions and restrictions that help to shape and limit growth.

There are therefore numerous controls on the type, rate and distribution of development. Water supply is only one of the many factors that go into the determination of whether, how and when growth will occur. DWS has taken a conservative approach in defining service areas, in effect limiting them to areas that have appropriate planning and zoning approvals in place. As a result, DWS expansion is seen as servicing the orderly development of planned growth, and not inducing unplanned growth or accelerating planned growth.

The growth planned for Lanihau's properties is orderly growth that is consistent with the General Plan of the County, and would thus not be considered induced growth. Furthermore, it has been and/or would be subject to extensive environmental reviews on the State and County levels, and there are many mechanisms to impose mitigation for environmental impacts. It should be noted that for almost all of the development discussed above, separate environmental documents that have been prepared previously or will be prepared in the future, when plans for the lands are ready, will serve as the primary documentation in the context of Chapter 343, HRS. Concerning the Lanihau properties, an Environmental Impact Statement for the West Hawai‘i Business Park portion of their properties was prepared in 2002 (Lanihau Properties LLC 2002).

3.4.2 Cumulative Impacts

Cumulative impacts result when implementation of several projects that individually have minor impacts combine to produce more severe impacts or conflicts among mitigation measures.

The fast-growing North Kona District is the center of the visitor industry and real-estate development that powers the economy of the island. Existing population and land use in this part of the Kona District are discussed generally in Section 3.3.1. In addition, there are many public and private projects being planned at any given time, the details of which often change daily in response to market conditions and the regulatory process. The description below is meant to provide some context for development occurring in the area north of Kailua-Kona.

A variety of large-scale market and affordable housing projects are underway here. At the Villages of Laʻiʻōpua in Kealakehe, about a mile downslope of Palani Junction (the intersection of Palani Road and Mamalahoa Highway, about a half mile downslope from the well), the Department of Hawaiian Home Lands is developing about 1,740 homes for lease to Native Hawaiians who qualify under the Hawaiian Homes Act. The Keahuolu Affordable Housing Project is being undertaken by the Hawaiʻi Housing Finance and Development Corporation, which is building on about 270 acres of land two miles down Palani Road from Palani Junction. Various alternatives are under consideration, one of which has as many as 2,330 planned dwelling units.

The Shores at Kohanaiki, located makai of Queen Kaʻahumanu Highway downslope from the project site, includes a 500-home golf course community featuring a shoreline park, public parking for more than 120 cars and an 8,000 square foot beach facility with a snack bar, restrooms and showers. Directly north of Kohanaiki, Kona Village, LLC has proposed the ʻOʻoma Beachside Village, a master-planned shoreline community on 300 acres of land. The project would include a mixture of single-family lots, affordable homes, several mixed-use villages, a coastal preserve/open space and shoreline park with a public canoe club hale, a private beach club, and various other parks and preserves.

Hiluhilu Development Company has obtained approvals for its Palamanui project, a master-planned community with a mix of single-family and multiple-family residential units, commercial spaces, a village inn, 18-hole golf course, and related improvements and infrastructure. Kaloko Makai is a potential residential development on 1,150 acres of land that is currently in early planning stages. The Kula Nei project will provide approximately 270 homes including 50 to 70 affordable homes in a 150-acre site between the existing Kona Acres and the future Kaloko Heights subdivisions. The Kona Kai Ola project proposes a marina, hotel, time-share and retail development near Honokōhau Harbor.

Various infrastructure projects are also in planning or construction. In water supply infrastructure, DWS is upgrading its water system by providing a new transmission line from Mamalahoa Highway to Palani Road, about a mile from the project site. DWS is also converting an exploratory well on its Keopu-Puʻuhonua site to a 650-gallon per minute capacity production well and building a one million gallon reservoir to provide storage. The Department of Transportation is widening Queen Kaʻahumanu Highway to four lanes from Kailua-Kona to the Kona International Airport. The Department of Public Works is building two roads in Kealakehe within two miles of the project site. The Ane Keohokalole Extension, often called the Mid-Level Road in planning documents, will connect Henry Street to Palani Road and beyond to the future West Hawaiʻi Civic Center (another long-range County of Hawaiʻi project), the Kealakehe Schools, and the Villages of Laʻiʻōpua. A smaller project is the nearly complete Manawalea Connector, which will link the Kealakehe Schools with residential areas located above, bypassing Queen Kaʻahumanu Highway and improving traffic circulation.

Several large-scale natural resource protection and restoration projects are also underway in the area. The Honua‘ula Forest Reserve Reforestation Project is being undertaken by the Department of Land and Natural Resources Division of Forestry and Wildlife, which proposes to stimulate the regeneration of native koa trees within approximately 1,000 acres of heavily degraded native forest areas in the Honua‘ula Forest Reserve, about three miles from Palani Junction. The ‘Ola‘a-Kilauea Partnership is undertaking the North Kona Protective Fencing Project, which would build up to 22 miles of ungulate-proof fencing, eventually enclosing approximately 13,000 acres on the slopes of Mauna Loa in North Kona on the island of Hawai‘i. The Department of Hawaiian Home Lands is building a system of dry forest plant preserves at Kealakehe, about a mile downslope of the project.

Although it is difficult if not impossible to systematically determine the complex interaction of environmental impacts in this fast-growing region, the following resource-by-resource discussion provides some analysis.

Water Quality. Each new project contributes in some measure to the potential depletion and alteration of groundwater, as well as loading of surface waters, groundwater, and receiving waters with sediments and chemical pollutants. As discussed in Section 3.1.2 above, which deals with the effects of withdrawal of water from Palani Well No. 1 on the groundwater at Kaloko-Honokōhau National Historical Park, the issue is not just individual projects but cumulative impacts. There is concern about the effects of withdrawals to service Lanihau’s developments, when combined with those of the ‘O‘oma Beachside Village, the Shores at Kohanaiki, Kaloko Makai, the Villages of La‘i‘ōpua, and many of the other projects. All such developments bring with them a need for more water withdrawals, and unless the water supply involves long-distance water transfer from areas where coastal groundwater seepage does not supply biologically important areas, then increasing salinity in some coastal ponds may occur, though whether slight salinity rises are primarily adverse rather than beneficial impacts is not certain.

The issue is complex and is not likely to be completely solved soon, but it bears reiteration that a number of parties including resources managers, landowners, and County and State agencies including DWS are participating in a working group to determine whether a Ground Water Management Area should be established, leading to tight management, or whether there are special provisions, restrictions, conditions, monitoring, and mitigation that can be imposed upon development to reduce impacts to acceptable levels. In terms of cumulative pollutant loading, permits that will be required for nearly all of the actions proposed by the developments listed above will have Stormwater Pollution Prevention Plans that incorporate Best Management Practices to reduce erosion and pollution discharge. Development activities with potential to produce substantial pollutant discharges require National Pollutant Discharge Elimination System permits from the

Hawai‘i State Department of Health (HDOH). In addition, the National Park Service is seeking, and in many cases obtaining (e.g., with Lanihau's West Hawai‘i Business Park), more stringent conditions regarding treatment of storm water, IWS standards, and training, monitoring and operational Best Management Practices for businesses.

Air Quality. As discussed in Section 3.1.4, despite the presence of vog, Kona generally has good air quality, which results from few sources of pollution, the dispersive effects of trade winds, and the island's isolation from outside sources of pollution. Pollutants are generally well within State and federal air quality standards. Because of increased output from Kilauea Volcano recently, elevated levels of sulfur dioxide (SO_2) and fine particulates 2.5 microns or smaller in size ($PM_{2.5}$) have led to exceedances of the $PM_{2.5}$ standards on Kona on three occasions since April 1, 2008, (http://hawaii.gov/health/environmental/air/cab/cabmaps/pdf/vog_05_28_08.pdf), which was rare before that time. The Hawai'i State Department of Health is urging Hawai'i County residents to take precautions to protect their health The extent to which vog can interact with pollution from motor vehicles, construction equipment, and industrial and commercial operations to exceed particulate standards is currently unknown, although it is known that natural (volcanic) sources produce at orders of magnitude greater than the man-made sources of particulates, which will only make a small fraction of the total. Cumulative human-induced impacts to air quality do not appear to be significant, and several additional factors serve to mitigate this. As time goes on, older, more polluting vehicles are phased out and newer vehicles with better emissions characteristics take their place. New electrical power generation sources are also required to be cleaner than some of the old plants utilizing diesel or bunker oil. Finally, the rock quarries and cement plants that represent other sources of particulates in the area are likely to be phased out over the next 20 years in this area as urban development takes over (Lanihau Properties 2002: p. 2-3).

Noise. Noise effects associated with the developments discussed above tend to be highly localized and do not tend to accumulate on a regional scale. The exception is an airport, which services all development; a busier flight schedule at Kona International Airport itself may be considered part of the secondary impacts of increased development in the area. Although noise impacts from the airport are noticeable, flight patterns have been strictly regulated to minimize the effects to the extent possible. Additional flights will produce slightly more frequent, but probably not more severe, noise impacts. It is noteworthy that Aloha Airlines, which operated noisy jetcraft in Hawai‘i under a federal exemption, has gone out of business and such aircraft are no longer allowed to fly, reducing noise at all major airports in Hawai‘i.

Drainage and Floodplains. As opposed to agriculture, the type of existing land use and development planned for this area of Kona is highly regulated in terms of drainage by government agencies. Virtually all development projects in the County of Hawai‘i must adhere to mitigation required by Chapter 27 of Hawai‘i County Code. The statute helps ensure that activities that may

adversely affect the timing, intensity and/or level of floods may not legally be constructed. The U.S. Army Corps of Engineers regulates any activities that involve dredge and fill in waters of U.S. Fills of substantial size or impact in these waters must be thoroughly analyzed for alternatives, and mitigation for adverse impacts must be proposed and implemented. Any modification that involves adverse impacts to beneficial floodplain values must be avoided or mitigated. If activities include potential discharges into Waters of the U.S., the Hawai‘i State Department of Health must examine the project and ensure proper mitigation through permits associated with Section 401 of the Clean Water Act. Projects and activities subject to this permit must implement Best Management Practices that avoid, minimize or mitigate for adverse effects. The result of these various, sometimes overlapping permits is strict regulation of activities with the potential to adversely affect drainage, streams and floodplains. Based on all the regulatory constraints and monitoring described above, all floodplain values will remain viable and the cumulative effect on floodplains in the area will not be adverse.

Native Biota and Threatened and Endangered Species. Most of the area covered by the projects discussed above consists of highly alien vegetation that offers little in the way of valuable habitat. Exceptions are present in portions of Honokōhau, Kaloko and Kealakehe where endangered species and valuable habitat are present in pockets. Many of these areas are protected by plant preserves (e.g., within four plant preserves in the Villages of La‘i‘ōpua in Kealakehe) or National Park status. Protection in other areas is currently less secure. However, there are no adverse impacts to native biota associated with activities at or near Palani Well No. 1 or on Lanihau’s Honokōhau Properties land that would accumulate with other impacts to native biota in the region.

Historic Sites and Other Cultural Resources. There are no adverse effects to historic sites associated with the activities at or near Palani Well No. 1. Historic sites on Lanihau’s Honokōhau Properties have been inventoried and protected where appropriate. In general, development planned for this area of Kona is regulated by the State Historic Preservation Division to ensure that historic sites are properly inventoried and treated, whether through data recovery research or preservation, if warranted. There is an increasingly large inventory of protected historic sites. There would likely be little cumulative adverse effect on historic sites in the area. Sites important for traditional ceremonial or gathering resources have been more difficult than other cultural resources to inventory. Kona has a large variety of resources, with many, but not all, concentrated at the shoreline. Lanihau is one of the few landowners in the area who early in their planning process sought to develop a full inventory of the physical and non-tangible cultural resources associated with their properties (Maly 2000). Activities at or near Palani Well No. 1 would not impact any known cultural resources; in other parts of Lanihau’s Honokōhau Properties, precautions have been taken to identify areas such as trails, burial caves, forest groves, and other cultural resources considered important by native Hawaiians long familiar with the ahupua‘a of Honokōhau and Kaloko. There are no adverse impacts to cultural resources that would be expected to accumulate with those from other developments.

Visual Quality. Many areas north of Kailua-Kona have expansive views of the shoreline and/or the forested slopes and summit of Hualālai, although the built landscape of structures and utility poles and lines intrudes into many viewplanes. Many new developments are required during State Land Use Boundary amendments, rezonings, or subdivisions to minimize the potential for disharmonious visual impacts through setbacks, grading plans, landscaping, design elements, and height limits. Increasingly, these requirements are being strengthened through documents such as the upcoming Kona Community Development Plan. Activities at and near Palani Well No. 1 would not produce adverse impacts that would accumulate with other impacts. Development activities in other parts of the area north of Kailua-Kona, including Lanihau's Honokōhau Properties, may have the cumulative effect of blocking ocean or mountain views or of imposing elements that do not match the spectacular physical landscape. As such, it will be important that land use approvals protect viewplanes identified in the General Plan and Kona Community Development Plan to avoid cumulative degradation of the scenic landscape.

Agricultural Resources. Agriculture in Kona is concentrated principally in the upper Kona Coffee Belt, at elevations above 800 feet, where not only coffee but also avocados, macadamia nuts, and flowers are grown. The General Plan and the Kona Community Development Plan seek to protect such areas from the pressure of development. Lands in the areas to be developed as described above Kona are generally of marginal agricultural value. Based on the low quality of agricultural land that is being directly (through well or reservoir infrastructure) or indirectly (through conversion of agricultural land as a result of development) displaced by the project, cumulative impacts of the projects identified above plus the proposed project are not expected to be adverse to agriculture.

Growth Induction. On a very general level, cumulative impacts to regional resources owing to development that could ensue from the provision of water are more wide-ranging and are more appropriately addressed globally as part of County General Plan and Kona Community Development Plans, and on a case-by-case basis as warranted during the approval and permit process for individual developments. In the big picture, developments bring with them direct costs to governmental services and programs include police protection, fire protection, public oversight agencies, infrastructure services, recreational demands, educational needs, infrastructure costs, and various other services and financial commitments. Direct tax benefits to the State and County coffers that could pay for these services and facilities would primarily flow from three major sources: real property taxes, gross excise tax receipts, and State income taxes. Different types of projects (e.g., affordable housing, industrial parks, resort residential) bring with them different costs and different benefits that must be accounted for as each project is evaluated and assessed. In general, it is clear that growth will bring with it an increased demand for public services and facilities and increased opportunities to pay for these.

In sumary, the direct impacts (i.e., on and near the well site) of Palani Well No. 1 and Reservoir, when considered cumulatively against the backdrop of existing projects and planned development, are not adverse in any resource category. Despite regulatory controls, there are likely to be adverse cumulative indirect impacts of supplying more water, both for Lanihau projects and for general growth in the area north of Kailua-Kona. Visual, cultural, coastal ecosystem, energy use, and public service/facilities impacts are likely to occur. These impacts will require both systemic approaches (e.g., new laws, regulation and policies) and case-by-case examination when each new development is proposed. Because of the multi-stage land use approval process and additional environmental permit regulations, there are sufficient safeguards in place to address and mitigate for cumulative impacts, which will unfold slowly over time, although there will undoubtedly be conflict and controversy as this process occurs. The building of a new well and reservoir, although necessary for development, are by no means sufficient. While it is important to take stock of the big picture of how infrastructure relates to cumulative impacts of development, it is inappropriate and impractical to mitigate for the such broad regional impacts as part of minor infrastructure improvement projects such as Palani Well No. 1.

3.5 Required Permits and Approvals

Several permits and approvals would be required to implement this project. They are listed here under their granting agencies.

Hawai'i State Commission on Water Resources

1. Well Construction Permit 2. Pump Installation Permit

Hawai'i State Department of Health

1. Approval of Preliminary Engineering Report

Hawai'i Planning Department

1. Plan Approval

4 COMMENTS AND COORDINATION

4.1 Agencies and Organizations Contacted

The following agencies received a letter inviting their participation in the preparation of the Environmental Assessment.

County of Hawai'i

- Planning Department
- Public Works Department
- County Council
- Parks and Recreation Department

State of Hawai'i

- Department of Health
- Department of Land and Natural Resources, Director
- Hawai'i State Commission on Water Resource Management
- Office of Hawaiian Affairs, Honolulu Office
- Office of Hawaiian Affairs, Kailua-Kona Office
- Department of Transportation

The following organizations/individuals received a letter and/or personal invitation soliciting their participation in the preparation of the Environmental Assessment:

- Sierra Club
- Kona Hawaiian Civic Club
- Kona Outdoor Circle

Copies of correspondence from agencies with substantive comments during the preparation of the EA are included in Appendix 1 and are cited in appropriate sections of the text of this EA.

5 LIST OF DOCUMENT PREPARERS

This Environmental Assessment was prepared for the County of Hawai‘i, Department of Water Supply by Ron Terry, Ph.D., of Geometrician Associates, with assistance from Akinaka and Associates, Ltd., the engineering contractor for the well project, and GKE, the preparer of the Phase I ESA report. An archaeological inventory survey from IARII prepared for the exploratory well was also utilized for this document.

6 STATE OF HAWAIʻI ENVIRONMENTAL ASSESSMENT FINDINGS

Section 11-200-12 of the State Administrative Rules sets forth the criteria by which the significance of environmental impacts shall be evaluated. The following discussion paraphrases these criteria individually and evaluates the project's relation to each.

1. *The project will not involve an irrevocable commitment or loss or destruction of any natural or cultural resources*. The well pad and access road support alien species, and no significant natural resources will be irrevocably committed or lost. The State Historic Preservation Division concurred with the determination that no effect to historic properties will occur. Cumulative impacts related to development are discussed in No. 9, below.

2. *The project will not curtail the range of beneficial uses of the environment*. Future beneficial uses of the environment will in general be maintained by the proposed project. Sufficient water will remain, well within the sustainable yield of the aquifer, to promote other beneficial withdrawals of groundwater in the Kona region; however, withdrawal of well water may contribute in a cumulative way to minor alteration of coastal water characteristics four miles away. This issue is being addressed through collaborative efforts led by the Kaloko-Honokōhau National Historical Park.

3. *The project will not conflict with the State's long-term environmental policies*. 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. A number of specific guidelines support these goals. The project's goals of providing potable water to support adequate supply and orderly development of planned growth while working with resource agencies to conserve natural resources, including other beneficial uses of groundwater, satisfies the State's environmental policies.

4. *The project will not substantially affect the economic or social welfare of the community or State*. The improvements will benefit the social and economic welfare of Hawaiʻi by improving the potable water supply system in Kona.

5. *The project does not substantially affect public health in any detrimental way*. No adverse effects to public health are anticipated. Public health will be benefited by improving the potable water supply system for Kona.

6. *The project will not involve substantial secondary impacts, such as population changes or effects on public facilities*. No adverse secondary effects are expected. The project will not enable development in itself, but will instead assure adequate supply of an improved source of water to existing customers and serve growth that has explicitly been specified in the Hawaiʻi County General Plan and Kona Community Development Plan.

7. *The project will not involve a substantial degradation of environmental quality*. The implementation of best management practices for all construction will ensure that the project will not degrade environmental quality in any substantial way.

8. *The project will not substantially affect any rare, threatened or endangered species of flora or fauna or habitat*. No endangered species of flora or fauna are known to exist on the project site or would be affected in any way by the project. Cumulative impacts related to development are discussed in No. 9, below.

9. *The project is not one which is individually limited but cumulatively may have considerable effect upon the environment or involves a commitment for larger actions*. It can be argued that as a result of growth that will be partially enabled by the project, cumulative impacts to certain coastal ecosystems, the visual landscape, cultural resources, energy use, and public services and facilities may occur. These impacts will require both systemic approaches (e.g., new laws, regulation and policies) and case-by-case examination when each new development is proposed. Because of the multi-stage land use approval process and additional environmental permit regulations, there are sufficient safeguards in place to address and mitigate for cumulative impacts, which will unfold slowly over time, although there will undoubtedly be conflict and controversy as this process occurs. The building of a new well and reservoir, although necessary for development, are by no means sufficient. While it is important to take stock of the big picture of how infrastructure relates to cumulative impacts of development, it is inappropriate and impractical to mitigate for the such broad regional impacts as part of minor infrastructure improvement projects such as Palani Well No. 1.

10. *The project will not detrimentally affect air or water quality or ambient noise levels.* The project will have negligible effects in terms of water quality, air quality and noise.

11. *The project will not affect or will likely be damaged as a result of being located within an environmentally sensitive area such as flood plains, tsunami zones, erosion-prone areas, geologically hazardous lands, estuaries, fresh waters or coastal waters*. No floodplains, tsunami zones, geologically hazardous areas, or other such sensitive land is involved in the area planned for development.

12. *The project will not substantially affect scenic vistas and viewplanes identified in county or state plans or studies.* No protected viewplanes will be impacted by the project, which will have no adverse scenic effects.

13. *The project will not require substantial energy consumption*. Some, but not substantial, input of energy is required for the construction of the facilities and the operation of the pump. Cumulative impacts related to development are discussed in No. 9, above.

Based on the findings above, it is anticipated that the County of Hawai‘i, Department of Water Supply, will determine that the proposed project will not have any significant effect in the context of Chapter 343, Hawai‘i Revised Statues and section 11-200-12 of the State Administrative Rules, and will issue a Finding of No Significant Impact (FONSI). This conclusion will be finalized after review of comment letters on the Draft EIS.

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PALANI WELL NO. 1
(STATE WELL NO. 4158-03)
NORTH KONA, ISLAND OF HAWAI‘I
STATE OF HAWAI‘I

ENVIRONMENTAL ASSESSMENT

County of Hawai‘i
Department of Water Supply

Appendix 1
Agency Coordination Letters and Public Involvement
Part 1 Letters in Response to Early Consultation

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

KEN C. KAWAHARA
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
601 KAMOKILA BOULEVARD, ROOM 555
KAPOLEI, HAWAII 96707

May 12, 2008

Mr. Ron Terry, Principal
Geometrician Associates, LLC
P.O. Box 396
Hilo, Hawaii 96721

LOG NO: 2008.0585
DOC NO: 0805TD10
Archaeology

Dear Mr. Terry:

SUBJECT: Early Consultation for a Draft Environmental Assessment for a Water Well and Associated Facilities (Conversion of State Well 4158-0 to a Production Well) Honokahau 1st Ahupua`a, North Kona District, Island of Hawai`i TMK: (3) 7-4-02: 08

This is in response to your letter dated February 7, 2008 regarding a proposal to convert an existing State well to a production well and to dedicate it to the Hawai`i County Department of Water Supply. As described in your letter, it is not certain whether the facilities associated with this well have been built, or are proposed as part of the conversion process. We have previously reviewed an application for construction of a well and pump at this location (Melanie Chinen letter to Dean Nakano, September 21, 2006; Log No. 2006.3121, Doc No. 0609JT66), however, we have found no reference to a review of the water tank, access road and transmission line.

In our previous review of the well and pump, we determined that no historic properties would be affected. This determination followed the completion and approval of an archaeological inventory survey of the affected area as identified in 2006. Thirteen historic properties were identified within the study area, and all sites were assessed as significant for information content (HAR §284-6 Criterion "d"). No further archaeological work was recommended at these sites (Melanie Chinen letter to Mike Carson, September 21, 2006; Log No. 20006.2986, Doc No. 0609JT02).

At this time, we are not certain whether the new 1.0 million gallon concrete water tank, 12-inch transmission line, and access road are within the area included in the 2006 survey. We request that during preparation of the Draft Environmental Assessment, you compare maps showing the location of these facilities and a map from the 2006 survey report (International Archaeological Research Institute, Inc., Report No. IARII 200601, Carson) showing the area that has been previously surveyed. If some of the facilities are outside the surveyed area, it is likely that additional inventory survey work will be needed for this project.

If you have any questions or would like to discuss this project in greater detail, please do not hesitate to call Theresa Donham at 987-5001 or email Theresa.K.Donham@hawaii.gov.

Aloha,

Nancy A. McMahon, Archaeology and Historic Preservation Manager
State Historic Preservation Division

Harry Kim
Mayor

Christopher J. Yuen
Director

Brad Kurokawa, ASLA
LEED® AP
Deputy Director

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PLANNING DEPARTMENT
101 Pauahi Street, Suite 3 • Hilo, Hawaii 96720-4224
(808) 961-8288 • FAX (808) 961-8742

March 12, 2008

Mr. Ron Terry
Geometrician Associates, LLC
P.O. Box 396
Hilo HI 96721

Dear Mr. Terry:

SUBJECT: Pre-Consultation on Draft Environmental Assessment
Applicant: Lanihau Properties LLC (Lanihau)
Project: Conversion of the Palani Ranch Exploratory Well to a Production Well
Tax Map Key: 7-4-2:8, Honokohau 1st, North Kona, Hawaii

This is in response to your February 7, 2008 letter requesting our comments on the above-referenced project.

According to your submittal, Lahinau plans to convert the Palani Ranch Exploratory Well to a production well and dedicate this facility to the Hawaii County Department of Water Supply. Associated with the well are a production pump and appurtenances, pump control building, fencing, access road improvements and a 1.0 million gallon concrete reservoir adjacent to the well. The water will be transmitted from the new reservoir via a new 12-inch transmission line down the access road which will connect to an existing 16-inch water main in Mamalahoa Highway.

The subject parcel is designated Agricultural by the State Land Use Commission and is zoned Agricultural (A-1a and A-20a) by the County. The General Plan designation is Important Agricultural Land and Urban Expansion Area. It is not located within the County's Special Management Area.

According to Hawaii Revised Statutes, Section 205-4.5(a)(7), permitted uses within the agricultural districts includes *"Public, private, and quasi-public utility lines and roadways, transformer stations, communications equipment buildings, solid waste transfer stations, major water storage tanks, and appurtenant small buildings such as booster pumping stations, but not including offices or yards for equipment, material, vehicle storage, repair or maintenance, treatment plants, corporation yards, or other similar structures."* Therefore, the conversion of the Palani Ranch Exploratory Well to a production well is considered to be a permitted use on the subject parcel.

Please note, however, that Hawaii County Code, Chapter 25, Section 25-4-11(b) states that *"Any substation used by a public utility for the purpose of furnishing telephone, gas, electricity, water, radio, or television shall be a permitted use in any district provided that the use is not hazardous or dangerous to the surrounding area and the director has issued plan approval for such use."* Therefore, Plan Approval is required from the Planning Director prior to obtaining a building permit for the proposed improvements.

Finally, by letter dated January 26, 2001 to Dr. Alan Haun of Haun & Associates, the Department of Land and Natural Resources, Historic Preservation Division required that mitigation commitment for sites 22479, 22483 and 22485 be resolved prior to any permit application. We have enclosed a copy of this letter for your information.

If you have questions, please feel free to contact Esther Imamura of this office at 961-8288, extension 257.

Sincerely,

CHRISTOPHER J. YUEN
Planning Department

ETI:cs
P:\wpwin60\ETI\EAdraftPre-consul\terry Palani Ranch Well 7-4-2-8.rtf

Enclosure
xc: Planning Department - Kona

LINDA LINGLE
GOVERNOR

BRENNON T. MORIOKA
INTERIM DIRECTOR

Deputy Directors
MICHAEL D. FORMBY
FRANCIS PAUL KEENO
BRIAN H. SEKIGUCHI

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

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

IN REPLY REFER TO:
HWY-H 08-2.0118

February 19, 2008

Mr. Ron Terry
Principal
Geometrician Associates, LLC
P.O. Box 396
Hilo, Hawai'i 96721

Dear Mr. Terry:

SUBJECT: Early Consultation on Environmental Assessment for Water Well and Associated Facilities at Honokohau 1st, North Kona
T.M.K. 3rd Div. 7-4-002:008
Project No. F-10(5)
Route 190 and Route 180 Mamalahoa Highway

Thank you for your transmittal requesting our review of the subject project.

The project appears to have no direct connection to our highway facilities as the project location map is very general in nature. We are concerned about the duration and traffic diversion that will be connected with the construction associated with this work. It is our understanding that the County of Hawaii has jurisdiction over the work to occur on this section of Route 180 Mamalahoa Highway.

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

If you have any questions please call Mr. Clinton Yamada at 933-1951.

Very truly yours,

STANLEY M. TAMURA
Hawai'i District Engineer

Harry Kim
Mayor

Lawrence K. Mahuna
Police Chief

Harry S. Kubojiri
Deputy Police Chief

County of Hawaii

POLICE DEPARTMENT
349 Kapiolani Street • Hilo, Hawaii 96720-3998
(808) 935-3311 • Fax (808) 961-2389

February 22, 2008

Mr. Ron Terry
Principal
Geometrician Associates
P.O. Box 396
Hilo, Hawaii 96721

Dear Mr. Terry:

SUBJECT: Early Consultation on Environmental Assessment (EA) for Water Well and Associated Facilities at Honokohau 1st, North Kona
TMK: (3rd) 7-4-02:08

This responds to your February 7, 2008 letter requesting comments prior to the completion of an Environmental Assessment (EA).

We have reviewed the above referenced document and submit the following comments:

- Recommend the EA address issues or concerns related to traffic safety and flow.
- Ensure any traffic mitigation on public roadways affected by the construction of the pipeline address emergency response.
- Implement strategies to address pedestrian safety.

Should you have any questions, please contact Acting Captain Chad Basque, Commander of Kona Patrol, at 326-4646, extension 249.

Mahalo,

LAWRENCE K. MAHUNA
POLICE CHIEF

HENRY J. TAVARES JR.
ASSISTANT CHIEF
AREA II OPERATIONS

CB:dmv

PHONE (808) 594-1888

FAX (808) 594-1865

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

HRD08/3499

March 5, 2008

Ron Terry
Principal
Geometrician Associates
P.O. Box 396
Hilo, HI 96721

RE: Early consultation on an Environmental Assessment for a proposed water well and associated facilities, Honokōhau, North Kona, Hawai'i Island; TMK: 7-4-002: 008

Dear Ron Terry,

The Office of Hawaiian Affairs (OHA) is in receipt of your February 7, 2008, request for comments on the above project, which would include plans for Lanihau Properties LLC to convert its Palani Ranch Exploratory Well (State Well 4158-03) to a production well. OHA offers the following comments.

OHA looks forward to reviewing the forthcoming Draft Environmental Assessment and its presumed analysis of impact on the sustainable yield of the applicable aquifer. OHA urges the applicant to assure that the EA addresses both the sustainable yield of the ground water to be tapped and any planning processes in place (of which there should be at least one) to ensure that enough water exists for any reasonably foreseeable projects that would use the aquifer in the future.

We will rely on the applicant's assurances that should this project go forward, and should iwi or Native Hawaiian cultural or traditional deposits be found during ground disturbance or excavation, work will cease, and the appropriate agencies will be contacted pursuant to applicable law.

Thank you for the opportunity to comment. If you have further questions, please contact Heidi Guth at (808) 594-1962 or e-mail her at heidig@oha.org.

Sincerely,

Clyde W. Nāmu'o
Administrator

C: Ruby McDonald
Community Resource Coordinator
OHA – Kona Office
75-5706 Hanama Place, Suite 107
Kailua-Kona, HI 96740

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

April 5, 2008

Geometrician Associates, LLC
Box 396
Hilo, Hawaii 96721

Attention: Mr. Ron Terry, Principal

Gentlemen:

Subject: Early consultation on Environmental Assessment for Water Well and Associated Facilities at Honokohau 1st, North Kona, Hawaii, Tax Map Key: (3) 7-4-2:8

Thank you for the opportunity to review and comment on the subject matter. The Department of Land and Natural Resources' (DLNR) has no other comments to offer on the subject matter. Should you have any questions, please feel free to call our office at 587-0433. Thank you.

Sincerely,

Morris M. Atta
Administrator

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

March 3, 2008

MEMORANDUM

TO: **DLNR Agencies:**
_x_Div. of Aquatic Resources
_Div. of Boating & Ocean Recreation
_x_Engineering Division
__Div. of Forestry & Wildlife
_Div. of State Parks
_x_Commission on Water Resource Management
_Office of Conservation & Coastal Lands
_x_Land Division – Hawaii District

FROM: for Morris M. Atta Charlene
SUBJECT: Early consultation on Environmental Assessment for water well and associated facilities
LOCATION: North Kona, Hawaii, TMK: (3) 7-4-2:8
APPLICANT: Geometrician Associates, LLC

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by March 15, 2008.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

( ) We have no objections.
( ) We have no comments.
( ) Comments are attached.

Signed: _____
Date: _____

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

January 25, 2008

Mr. Stephen P. Bowles, President
Waimea Water Services, Inc.
P.O. Box 326
Kamuela, HI 96743-0326

RECEIVED
JAN 28 2008
AKINAKA & ASSOCIATES, LTD.

PALANI RANCH WELL (STATE WELL NO. 4158-03)
TAX MAP KEY 7-4-002:008

We have reviewed the subject Well Completion Report by Waimea Water Services dated October 30, 2007, and find it acceptable as submitted. This also confirms that we have determined that the well in its current as-built condition is acceptable with the caveat that final acceptance of the well is subject to the New Source Test for water quality and approval by the State of Hawai'i, Department of Health.

Based on the Well Completion Report, we will accept oversizing of the well up to 1,200 gallons per minute (gpm); however, calculations to address water unit allocation in accordance with the Well Development Agreement dated August 22, 2006, by and among Lanihau Properties LLC, et al. and the Water Board of the County of Hawai'i (also known as the Agreement) will be based on 1,123 gpm (or 1,617,120 GPD). This pumping rate is stated in the Well Completion Report as being the "best estimate based on available data."

Accordingly, we now confirm that pursuant to the terms of the Agreement, the Owner's Water Allocation Share as described in Section 3(c) of the Agreement shall be (85% X 1,617,120 =) 1,374,552 GPD which is equal to 2,291 Equivalent Units.

Should you have any questions, please call Mr. Kurt Inaba of our staff at 961-8070, extension 238.

Sincerely yours,

Milton D. Pavao, P.E.
Manager

KYI:dms

copy - DWS Water Resource and Planning Branch
DWS Water Quality and Assurance Control Branch
Mr. Sheldon Yamasato, Akinaka & Associates, Inc.
Mr. James S. Greenwell, Lanihau Properties LLC

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PALANI WELL NO. 1
(STATE WELL NO. 4158-03)
NORTH KONA, ISLAND OF HAWAI‘I
STATE OF HAWAI‘I

ENVIRONMENTAL ASSESSMENT

County of Hawai‘i
Department of Water Supply

Appendix 2
Annual Water Quality Report, North Kona System, Year 2007

Sources of drinking water

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals and, in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity.

Contaminants that may be present in source water include:

•Microbial contaminants, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.

•Inorganic contaminants, such as salts and metals, which can be naturally-occurring or result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming.

•Pesticides and herbicides, which may come from a variety of sources such as agriculture, urban stormwater runoff, and residential uses.

•Organic chemical contaminants, including synthetic and volatile organic chemicals, which are byproducts of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, and septic systems.

•Radioactive contaminants, which can be naturally-occurring or be the result of oil and gas production and mining activities.

In order to ensure that tap water is safe to drink, the Environmental Protection Agency (EPA) prescribes regulations which limit the amount of certain contaminants in water provided by public water systems. Food and Drug Administration regulations establish limits for contaminants in bottled water which must provide the same protection for public health.

Source Water Assessment Program

In 2004, the preliminary source water assessment report was released. The purpose of the source water assessment report is to enable the public and decision-makers to make well-founded decisions for the protection and preservation of our drinking water. The source water assessment report identifies the potential contaminating activities for each source of water.

In the report, North Kona Water System sources are potentially vulnerable to contaminants associated with the following activities: cesspools, residential parcel, SQG Resource Conservation and Recovery Act, roads, septic tanks, cemetaries, utility stations, and diversified agriculture. Note: the list of potential contaminating activities has not necessarily been associated with anything found in the water. For more information, please contact Keith Okamoto, P.E., at 961-8670.

Is my water safe?

Yes it is. Last year, as in years past, your tap water met all U.S. Environmental Protection Agency (EPA) and State drinking water health standards. The Department of Water Supply vigilantly safeguards its water supplies and once again we are proud to report that your system has complied with all drinking water standards.

Why are there contaminants in my drinking water?

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the Environmental Protection Agency's Safe Drinking Water Hotline 1-(800) 426-4791. If you have any questions regarding this Water Quality Report, please call Keith Okamoto, P.E., at 961-8670.

Do I need to take special precautions?

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. EPA/CDC guidelines on appropriate means to lessen the risk of infection by *Cryptosporidium* and other microbial contaminants are available from the Safe Drinking Water Hotline at 1-(800) 426-4791 .

How can I get involved?

The Water Board meets the fourth Tuesday of every month. Call for the time and location of the meeting.

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**

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Department of Water Supply
345 Kekuanao'a Street, Suite #20
Hilo, Hawai'i 96720

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2007 North Kona Water System Annual Water Quality Report

county of Hawaii

Department of Water Supply

North Kona System Water Quality Data Tables

The table below lists the drinking water contaminants that we detected during the calendar year of this report. The presence of contaminants in the water does not necessarily indicate that the water poses a health risk. Unless otherwise noted, the data presented in this table is from testing done in the calendar year of the report. The EPA or the State requires us to monitor for certain contaminants less than once per year because the concentrations of these contaminants do not change frequently. Some of our data, though representative, are more than one year old.

			Waiaha Well/Honokohau Well/Keahuolu Well (QLT)/Hualalai Well/Kalaoa Well			Waiaha Well/Honokohau Well/ Keahuolu Well (QLT)/Hualalai Well			Waiaha Well/Honokohau Well/Hualalai Well			Honokohau Well/Hualalai Well			Holualoa Well			Kahaluu Shaft/ Kahaluu Well Nos. A, B, C, D				
Contaminants (units)	MCL	MCLG	Level Found	Range of Detections	Sample Date	Level Found	Range of Detections	Sample Date	Level Found	Range of Detections	Sample Date	Level Found	Range of Detections	Sample Date	Level Found	Range of Detections	Sample Date	Level Found	Range of Detections	Sample Date	Violation	Typical Source of Contaminant
Regulated Contaminants																						
Microbiological Contaminants																						
Total coliform	No more than one sample per month is positive.	N/A	Highest # of monthly positive samples = 1	N/A	2007	Highest # of monthly positive samples = 1	N/A	2007	Highest # of monthly positive samples = 1	N/A	2007	Highest # of monthly positive samples = 1	N/A	2007	N/A	N/A	N/A	N/A	N/A	N/A	No	Naturally present in the environment.
Inorganic Contaminants																						
Barium (ppm)	2	2	ND	ND - ND	2007	ND	ND - ND	2007	ND	ND - ND	2007	ND	ND - ND	2005	0.013	0.012 - 0.013	2005	ND	N/A	2006	No	Discharge of drilling wastes; erosion of natural deposits
Chromium (ppb)	100	100	2.0	2.0 - 2.0	2007	2.0	2.0 - 2.0	2007	2.0	2.0 - 2.0	2007	3.0	2.0 - 3.0	2005	ND	ND - ND	2005	2.0	N/A	2006	No	Erosion of natural deposits.
Fluoride (ppm)	4	4	0.50	0.23 - 0.50	2007	0.50	0.23 - 0.50	2007	0.50	0.23 - 0.50	2007	0.50	0.39 - 0.50	2007	0.24	ND - 0.24	2007	0.25	0.22 - 0.25	2007	No	Erosion of natural deposits.
Nitrate (ppm)	10	10	1.20	0.92 - 1.20	2007	1.20	0.92 - 1.20	2007	1.10	0.92 - 1.10	2007	1.10	0.92 - 1.10	2007	1.00	0.90 - 1.00	2007	1.1	1.1 - 1.1	2007	No	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits.
Organic Contaminants																						
m-Xylene (ppm)	10	10	0.00046	ND - NQ	2007	0.00046	ND - NQ	2007	0.00046	ND - NQ	2007	ND	ND - ND	2006	ND	ND - ND	2006	ND	ND - ND	2006	No	Discharge from petroleum factories; discharge from chemical factories.
p-Xylene (ppm)	10	10	0.00046	ND - NQ	2007	0.00046	ND - NQ	2007	0.00046	ND - NQ	2007	ND	ND - ND	2006	ND	ND - ND	2006	ND	ND - ND	2006	No	Discharge from petroleum factories; discharge from chemical factories.
Disinfection By-Products																						
Haloacetic acids (ppb)	60	N/A	1.93	ND - 4.2	2007	1.93	ND - 4.2	2007	1.93	ND - 4.2	2007	1.93	ND - 4.2	2007	1.43	ND - 2.5	2007	2.55	ND - 4.20	2007	No	Byproduct of drinking water disinfection.
Total Trihalomethanes (TTHMs) (ppb)	80	N/A	11.1	2.9 - 18.0	2007	11.1	2.9 - 18.0	2007	11.1	2.9 - 18.0	2007	11.1	2.9 - 18.0	2007	6.7	4.3 - 9.4	2007	13.05	11.3 - 16.7	2007	No	Byproduct of drinking water disinfection.

Haloacetic Acids or "HAA5" means the sum of the concentration of the haloacetic acids (monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, monobromoacetic acid, and dibromoacetic acid).
Total Trihalomethanes or "TTHM" means the sum of the concentration of the trihalomethane compounds [trichloromethane (chloroform), dibromochloromethane, bromodichloromethane, and tribromomethane (bromoform)].

Sodium (Not Regulated by State or Federal Government)

			Waiaha Well/Honokohau Well/ Keahuolu Well (QLT)/Hualalai Well/Kalaoa Well			Waiaha Well/Honokohau Well/ Keahuolu Well (QLT)/Hualalai Well			Waiaha Well/Honokohau Well/ Hualalai Well			Honokohau Well/ Hualalai Well			Holualoa Well			Kahaluu Shaft/ Kahaluu Well Nos. A, B, C, D				
Contaminants (units)	MCL	MCLG	Level Found	Range of Detections	Sample Date	Level Found	Range of Detections	Sample Date	Level Found	Range of Detections	Sample Date	Level Found	Range of Detections	Sample Date	Level Found	Range of Detections	Sample Date	Level Found	Range of Detections	Sample Date	Violation	Typical Source of Contaminant
Inorganic Contaminants																						
Sodium (ppm)	N/A	none	15.0	15.0 - 15.0	2007	15.0	15.0 - 15.0	2007	15.0	15.0 - 15.0	2007	28.0	24.0 - 28.0	2005	134.0	131.0 - 134.0	2005	121.0	N/A	2006	No	Erosion of naturally occurring deposits; saltwater intrusion.

Lead and Copper Rule Compliance

			North Kona Water System				
Contaminant	AL	MCLG	Level Found	# of Sites > AL	Sample Date	Violation	Typical Source of Contaminant
Copper (ppm)	1.3	1.3	0.06	0/31	2007	No	Corrosion of household plumbing systems; erosion of natural deposits.

Key definitions of terms used in this report

- **MCLG** = Maximum Contaminant Level Goal: The level of a contaminant in drinking water below which there is no known or expected risk for health. MCLGs allow for a margin of safety.
- **MCL** = Maximum Contaminant Level: The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.
- **AL** = Action Level: The concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a water system must follow.
- **ND** = Not Detected: If a contaminant is not measured at or above its minimum detection limit, it is reported as Not Detected - detection limits are available upon request.
- **ppm** = Parts per million. One ppm corresponds to a single penny in $10,000 or about one minute in two years.
- **ppb** = Parts per billion. One ppb corresponds to a single penny in $10,000,000 or about one minute in two thousand years.
- **N/A** = not applicable
- **NQ** = not quantifiable

Sodium in drinking water

There is no State or Federal maximum contaminant level for sodium. Although required, monitoring for sodium is performed primarily to gather information for the consumers, the Safe Drinking Water Branch, and the Department of Water Supply. The EPA Drinking Water Advisory recommends that the sodium concentration in drinking water not exceed a range of 30 to 60 ppm because of the possible adverse effects on taste at higher concentrations. For persons on a sodium-restricted diet, sodium concentrations greater than 120 ppm could be problematic. If you are on a sodium-restricted diet, you should consult your physician about the level of sodium in the drinking water.

Lead and drinking water

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing and not usually from the source water. The Department of Water Supply is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may choose to have your water tested by contacting private laboratories that are certified by the State for doing drinking water analyses. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at http://www.epa.gov/safewater/lead.

Where does my water come from?

This year, a new source, Waiaha Well, was added to the North Kona water system. The sources of water for the North Kona Water System are Waiaha Well, Kalaoa Well, Hualalai Well, Honokohau Well, Keahuolu Well No. 1 (QLT), Holualoa Well, Kahaluu Wells A, B, C, and D, and Kahaluu Shaft (all of which are groundwater sources). The source(s) may change depending on the supply and demand. In previous years we have included a map of the distribution system. However, because we are taking measures to safeguard your water supply, we are not including the map in this year's water quality report. Thank you for your understanding.

PALANI WELL NO. 1
(STATE WELL NO. 4158-03)
NORTH KONA, ISLAND OF HAWAI‘I
STATE OF HAWAI‘I

ENVIRONMENTAL ASSESSMENT

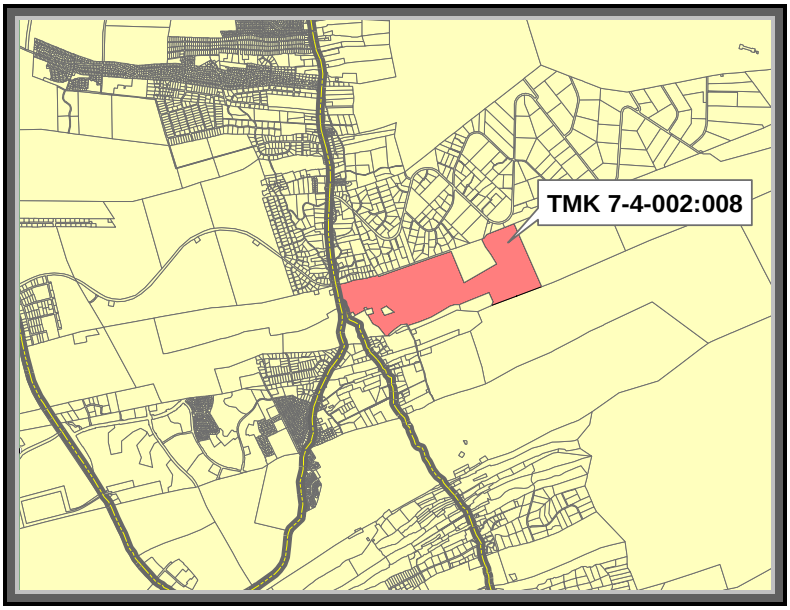
County of Hawai‘i
Department of Water Supply

Appendix 3
Pump Test Results for Exploratory Well

Completion Report

Palani Ranch Well

(State Well No. 4158-03)



October 30, 2007

waimea water services inc.

P.O. Box 326, Kamuela, HI 96743
Phone (808) 885-5941 Fax (808) 885-7851
e-mail: waiono@wws-ius.com

Background

Planning of the Palani Ranch Well (State Well No. 4158-03) began with an agreement between Lanihau Properties and the Hawaii Department of Water Supply. An understanding was reached, through which the proposed well would be dedicated to the DWS, with the water served to the County users.

Construction

Water Resources International was the contracted driller, with Waimea Water Services acting as the owner's representative. Civil design and project management was handled by Akinaka & Associates, Ltd.

A pre-construction meeting was held on September 15th, 2006, leading to the mobilization of WRI on-site. Drilling activities began with a pilot borehole, using a 13 ¾ inch bit, taken to a total depth of 1,755 feet on December 11th. Water was encountered at a depth of 1,593.4 feet from ground level, with the ground level elevation established at 1,670.76 feet (mean sea level). This inspection served as an initial field indication of the expected high level water, standing at an elevation of 77 feet (msl).

Further verification of the high level source required a pump test, which was performed on January 12th, 2007. The test pump was installed into the open bore, and run for a total of 5 hours at an average rate of 195 gallons per minute (gpm). After an initial drawdown of 1.5 feet, the water level rose above the static level seen at the beginning of the test (figure 1). The rise in level is attributed to instrument error, and is summarized as practically no drawdown at nearly 200 gpm pumping rate. Water quality was observed to be excellent (less than 15 mg/l chlorides).

After the favorable test results, an agreement was made between the Owner and Department of Water Supply to ream a 26-inch diameter. This sizing was preferred by the DWS in order to accommodate a 20-inch casing, and a low-rpm well motor/pump. Also, the department requested stainless steel casing for the submerged well sections.

Well casing, stainless and carbon steel

The final well design was formalized in January 2007, and handled as a change order. Casing was staged on-site and installed, with grouting complete by the third week in May. Grouting was followed by the installment of a temporary pump, for testing of the cased well.

Testing

A specific capacity (step drawdown) test was staged in conformance with State requirements. This entailed pumping of the well at three rates for a minimum of thirty minutes at each rate. The resulting data produces a description of the well's drawdown characteristics over a short duration.

Unfortunately, the initial installation of a line-shaft test pump was unsuccessful. With fifty feet of pump column remaining, the assembly came lose, causing damage to the lower section of well screen. While the oil tube and column was retrieved, several ruined pieces of test pump remained at the bottom of hole, despite numerous attempts to fish them out. A down-hole video survey revealed damage to the bottom eight feet of well screen.

Top left - snapshot from down hole video survey, showing pieces of test pump and tears in perforated casing at the well bottom

Top right – warped/destroyed pieces of test pump after being removed from well

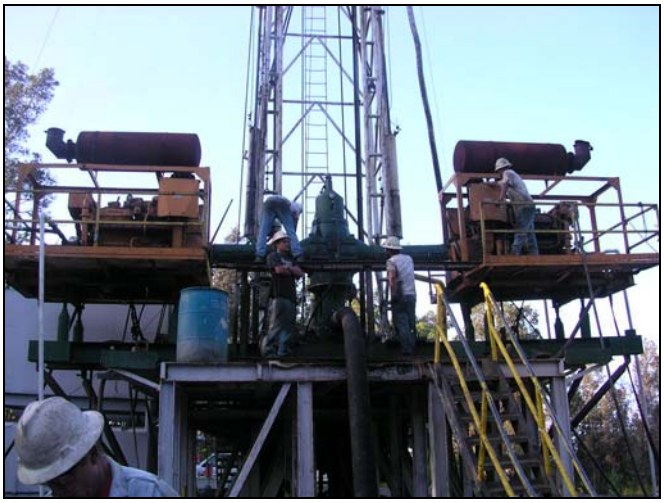
The decision was made to leave the pump pieces in place, rather than grouting them, in order to preserve flow potential from the well bottom. An as-built of the final well is shown in Appendix A.

On August 24th, WRI successfully re-installed a second lineshaft test pump, capable of 1,233 gallons per minute (gpm) production. This pump was driven by two direct drive diesel engines, pictured on the following page.

A preliminary test was run at four rates for a short duration (747, 906, 1,032 and 1,256 gpm). The highest rate was achieved by running the pump into its safety factor, which was done cautiously to prevent a failure.

On the following day (August 25th) three similar pumping rates were run for a full thirty minutes each (788, 996 and 1,233 gpm). This data was plotted, and is displayed in figure 2 with a corresponding trend line. A maximum of 3.28 feet of drawdown was observed at the highest test rate of 1,233 gpm. This provides a description of the well's specific capacity at given pumping rates.

A second test was performed following the specific capacity, at a constant rate and a longer time period. The time span is decided by State requirements, based on the planned production from the final well. In this case, for over 1,000 gpm proposed capacity, 96 hours of constant pumping was required. This data was then used to describe the well's response to sustained pumping.



Twin direct diesel drives, from initial testing configuration

For the long term test, the test pump continued to run at 1,233 gpm subsequent to the final rate of specific capacity testing. Shortly thereafter, a down-hole failure brought testing to a halt. The field supervisor for WRI predicted a sheared collar near the pump, which was verified by the later removal of the down-hole hardware.

Bottom of test pump assembly with sheared pump shaft

In order to complete the long term pump test, as per contract specs, WRI began procurement and installation of a third test pump, capable of 170 hours of continuous operation at 1,400 gpm. This effort was completed by October 16th. However, installing a pump and motor of this capacity was both an expensive and arduous task.

With the loss of their high capacity pump, WRI looked to the mainland for rental options. This resulted in the acquisition of a 900 horsepower submersible motor with variable speed controls. Also rented were four, 400 kilowatt diesel gensets, which consumed nearly 50 gallons of diesel per hour. Fortunately, these were custom silenced generators, producing little noise on site and practically no noise within a hundred yards.

Top left – four silenced gen-sets with trailered variable speed pump controller and step-up transformer

Top right – one of three discharge hoses for 1,400 gpm of pumpage

Testing occurred for 96 continuous hours, in compliance with State regulations. Using the aforementioned variable speed controller, WRI held the pumpage to just over 1,400 gpm. Early on in the test, the drawdown settled to just over 4 feet for an 8-hour period. Following this initial period, the drawdown characteristic showed a progressive decline before reaching 5.3 feet at the conclusion of the test. When viewed on a semi-log plot, this appears as a near linear trend (figures 3 & 4).

The pump was started on October 16th at 11:20 am, and was shut down on the 20th at 1:20 pm. Following the test, the well's recovery was tracked over the next five days (figure 5).

Plumbness and Alignment

As per contract specs, a plumbness and alignment survey were performed on the final cased well. This survey took place on September 11th, 2007.

Data for a deviation survey is displayed in figures 6 and 7, for the North-South and East-West planes. This was achieved using a 40-foot cage, with an outer diameter of 19.5 inches. Finally, an alignment dummy of matching diameter was run to a depth of 1,736 feet.

Results

Throughout the 98-hour duration of the long term pump test at a rate of slightly more than 1400 gpm, the water quality remained excellent, with a total dissolved solid content of just over 100 mg/l. This corresponded with chloride testing of less than 15 mg/l. Being that this is a high level source, the sustained quality was expected.

Following the initial 10 minutes with a drawdown of 4.1 feet, the water level dropped steadily for 5,880 minutes. At about 360 minutes, a boundary was struck resulting in a steeper rate of drop (figure 3 & 4) to a final drawdown of 5.3'. Regardless, the continuing drawdown is minimal and the well is capable of producing a sustained high rate of pumping for many months at a time.

Full recovery (figure 5) of the water level was witnessed 123 hours after the conclusion of pumping. The recovery time is considered in conjunction with the total volume of water removed over the testing periods (8,299,060 gallons in 98 hours). This data suggests a sustainable pumping rate of 1,123 gpm. It must be noted that this is only a best estimate based on available data.

Furthermore, the data gathered thus far occurs over a very limited time span. Data over the long term operation is needed for a true determination of the well's capacity. It is absolutely essential that the water level in this well be monitored on a regular basis to provide a real indication of what this source can reliably produce. It is our recommendation that the Department of Water Supply, as the future operator of Palani Well, responsibly measure and record this water level, and reducing the pumping day if a reduction of water level is seen.

In summary, the water from this well is of excellent quality, and the data presently available suggests a robust source. Our present estimate is that the sustained pumping rate of the well should not exceed 1200 gpm. The intake for the permanent pump should be set at between elevation 0 and +20 feet to allow for dewatering of the high level compartment.

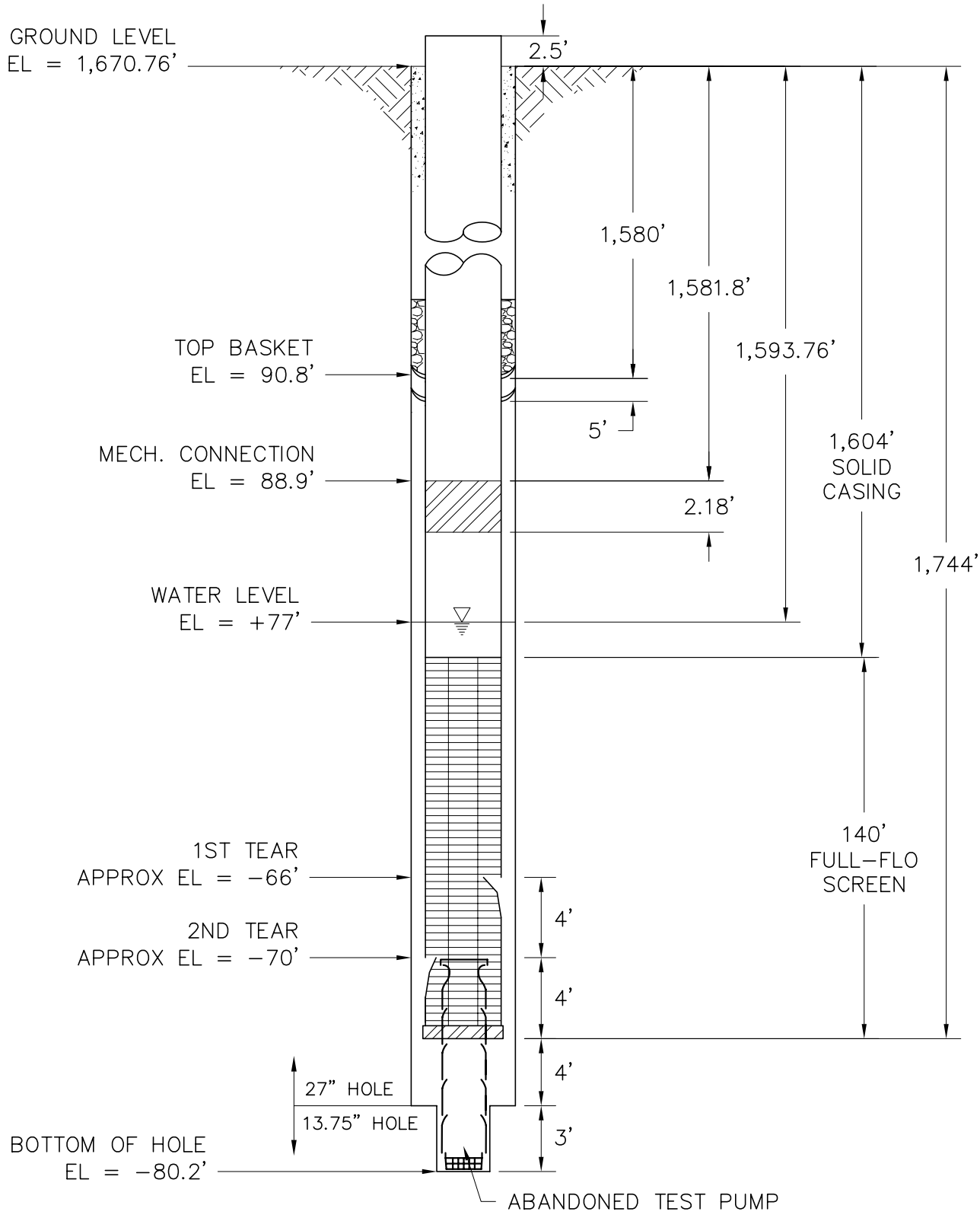
Sincerely,

Stephen P. Bowles
President
Waimea Water Services

waimea water services inc.

P. O. Box 326, Kamuela HI 96743 Phone (808) 885-5941 Fax (808) 885-7851

Appendix A: Well As-Built Drawing



NOTE – ELEVATIONS REFERENCE MEAN SEA LEVEL

PALANI WELL

HOLUALOA, HAWAII

AS-BUILT DRAWING

SHEET NO.
1
OF 1 SHEETS

DESIGNED BY:	
CHECKED BY:	
PROJECT NO.:	
DRAWING NAME:	
DATE:	

waimea water services
P.O. BOX 326
KAMUELA, HAWAII 96743
PHONE: (808) 885-5941
FAX: (808) 885-7851

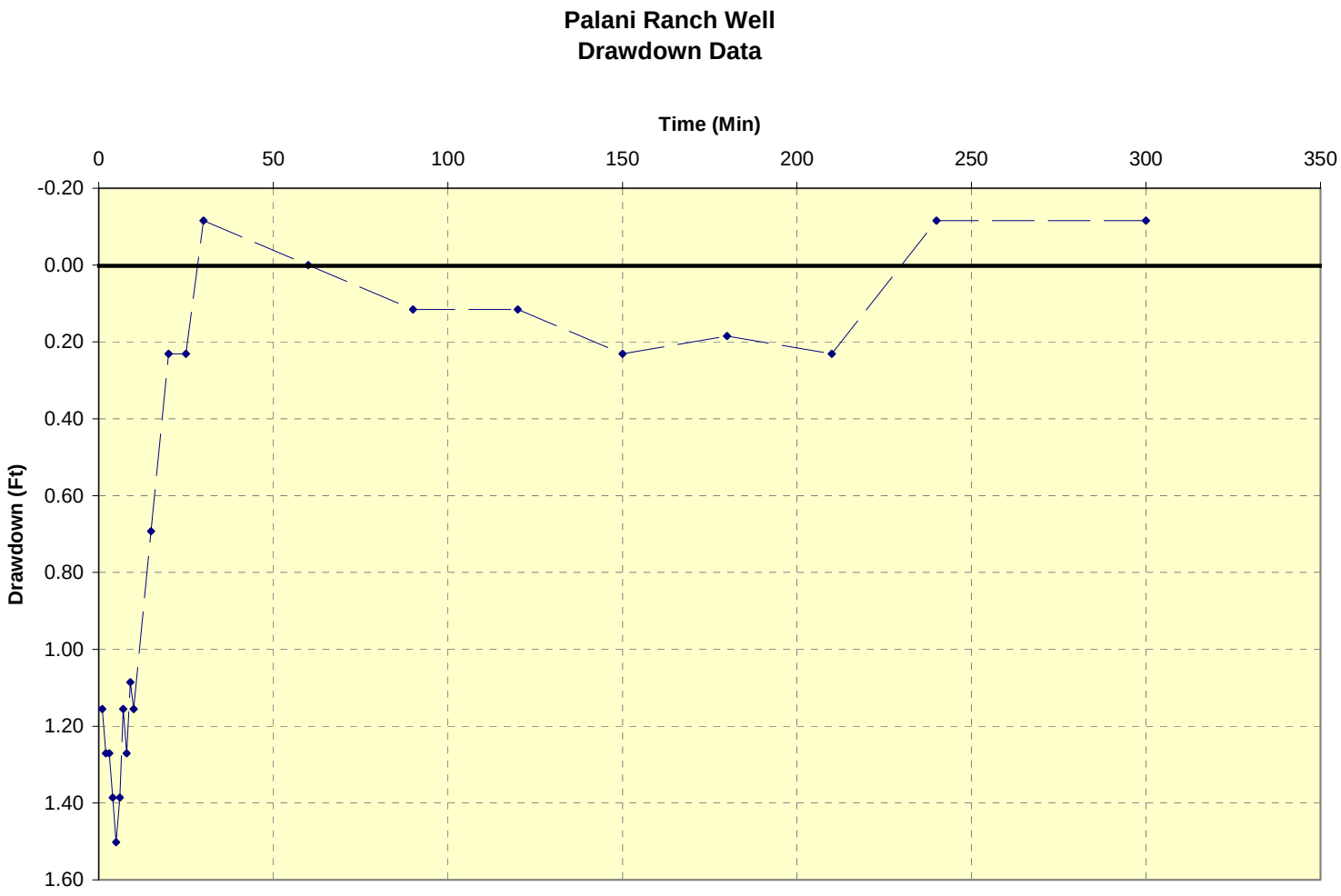


Figure 1. Open-hole drawdown data

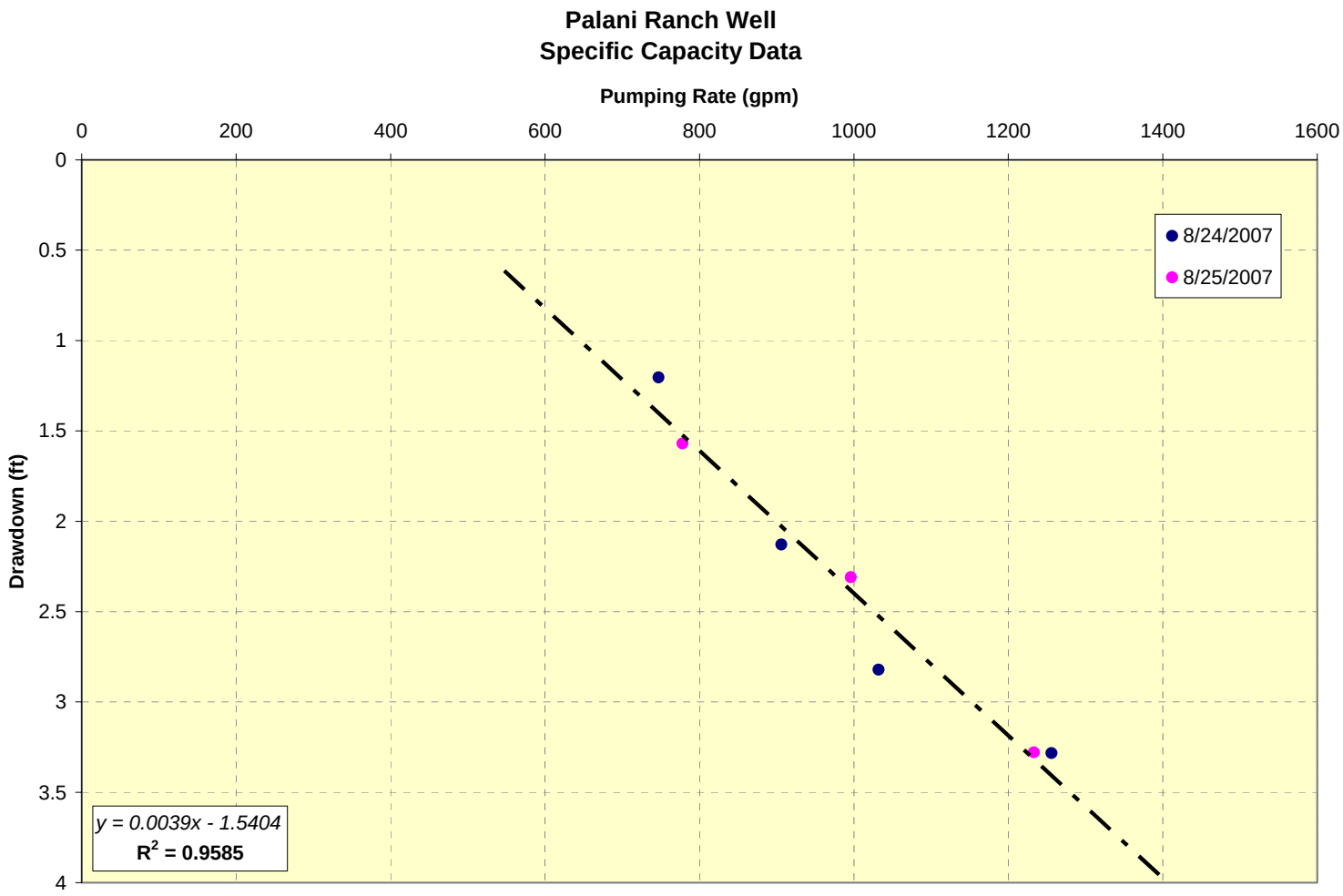


Figure 2. Specific capacity drawdown data

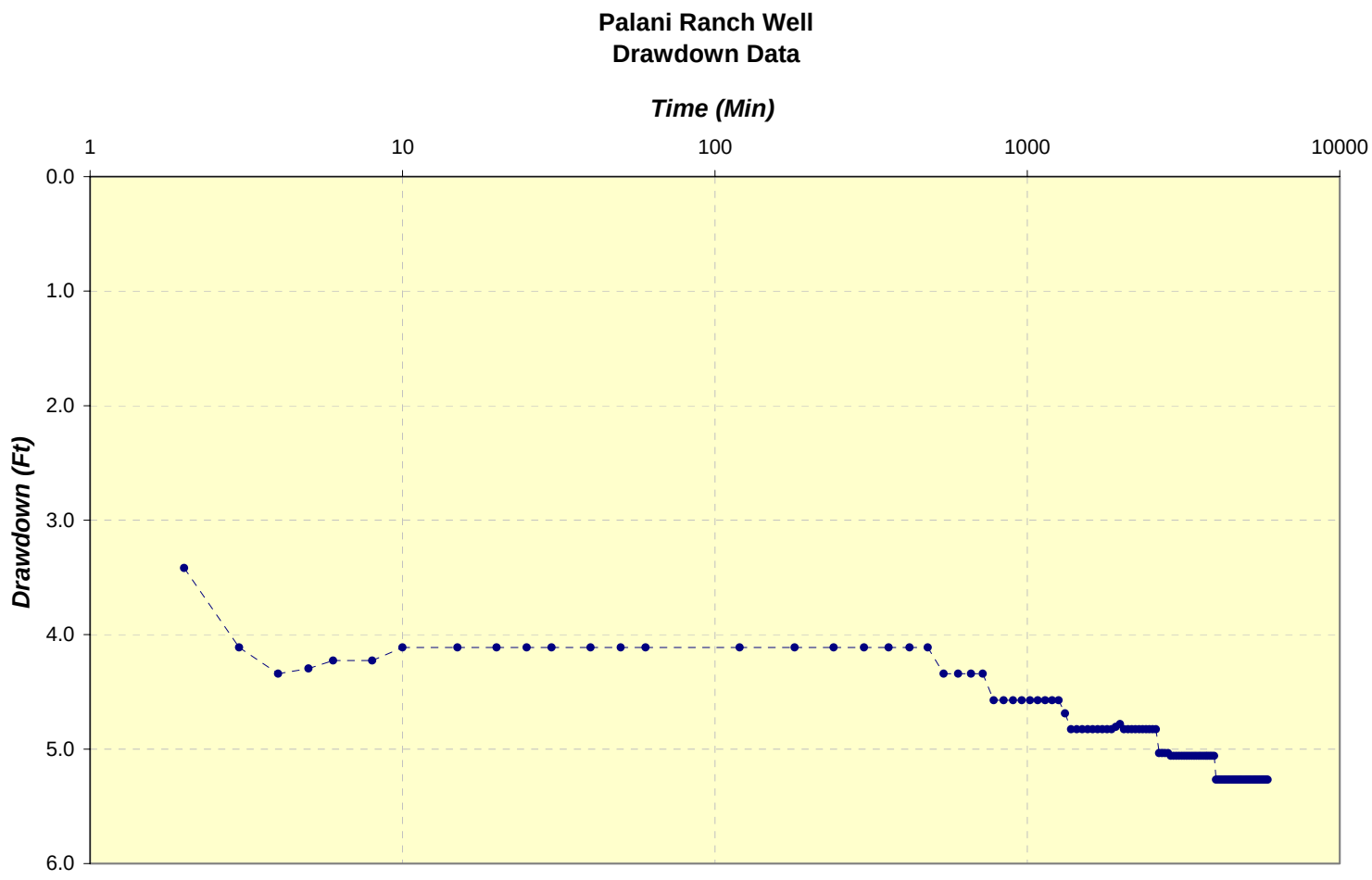


Figure 3. Long term drawdown data

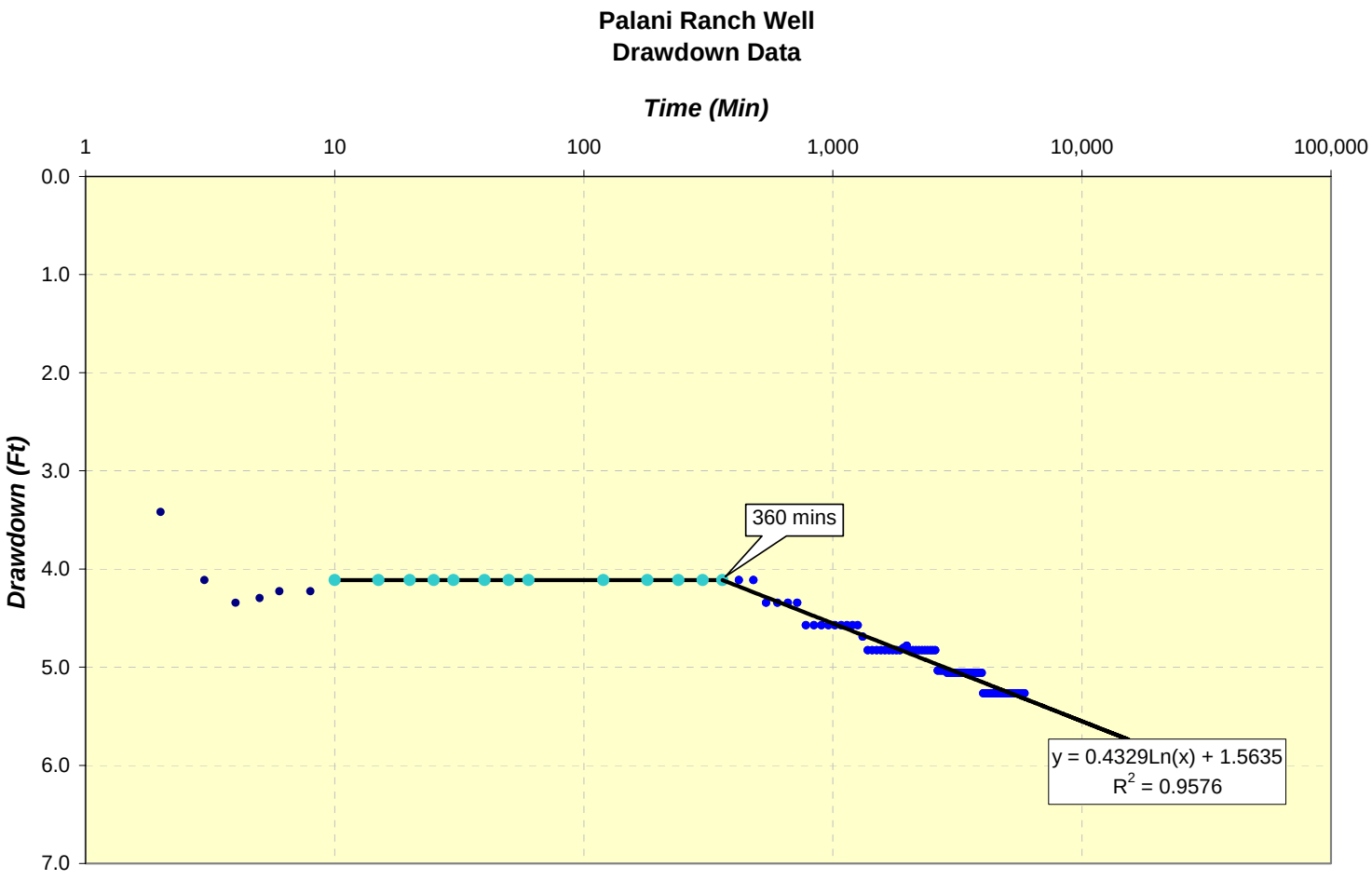


Figure 4. Long term drawdown data with trend line

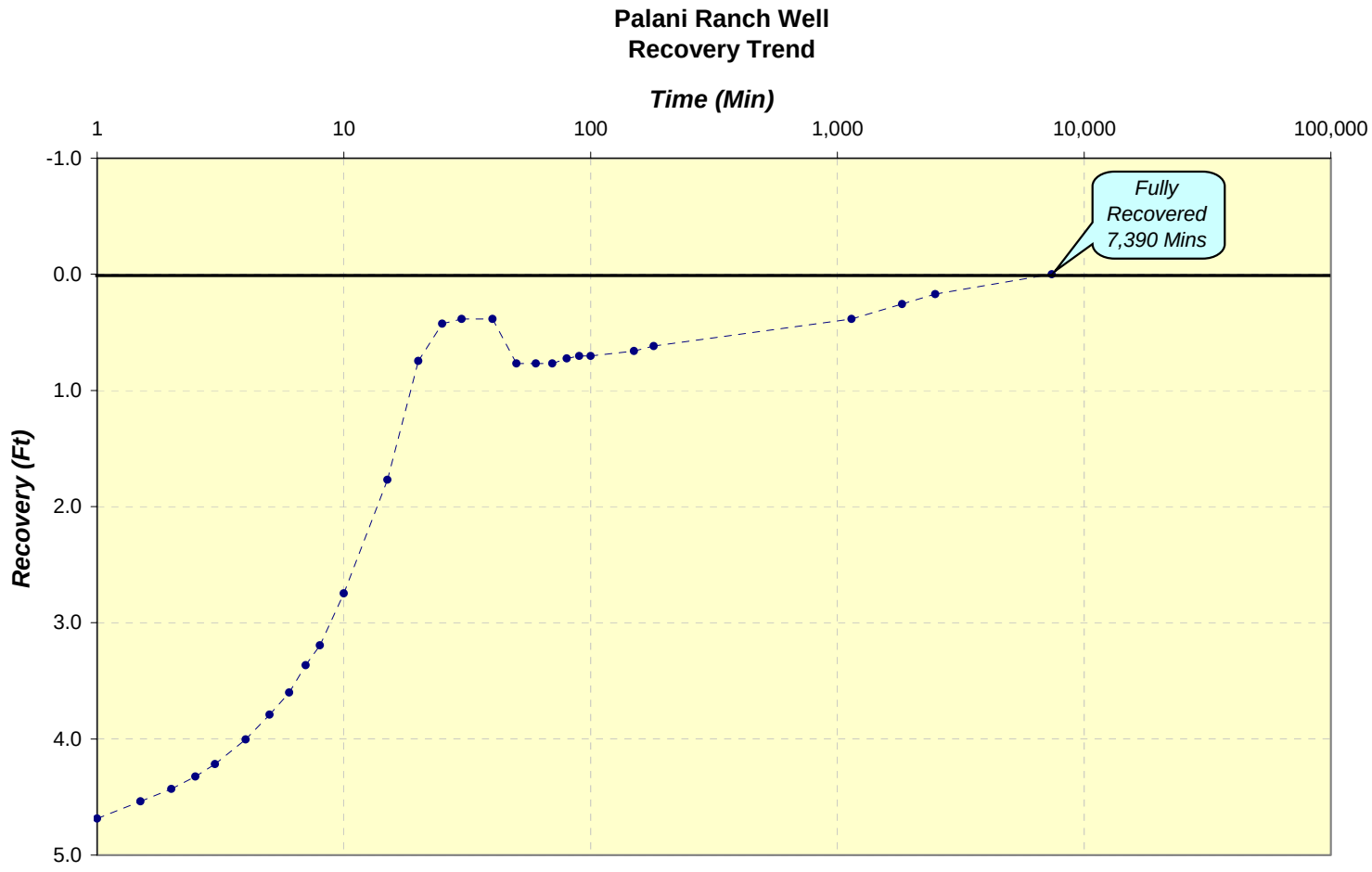


Figure 5. Long term recovery data

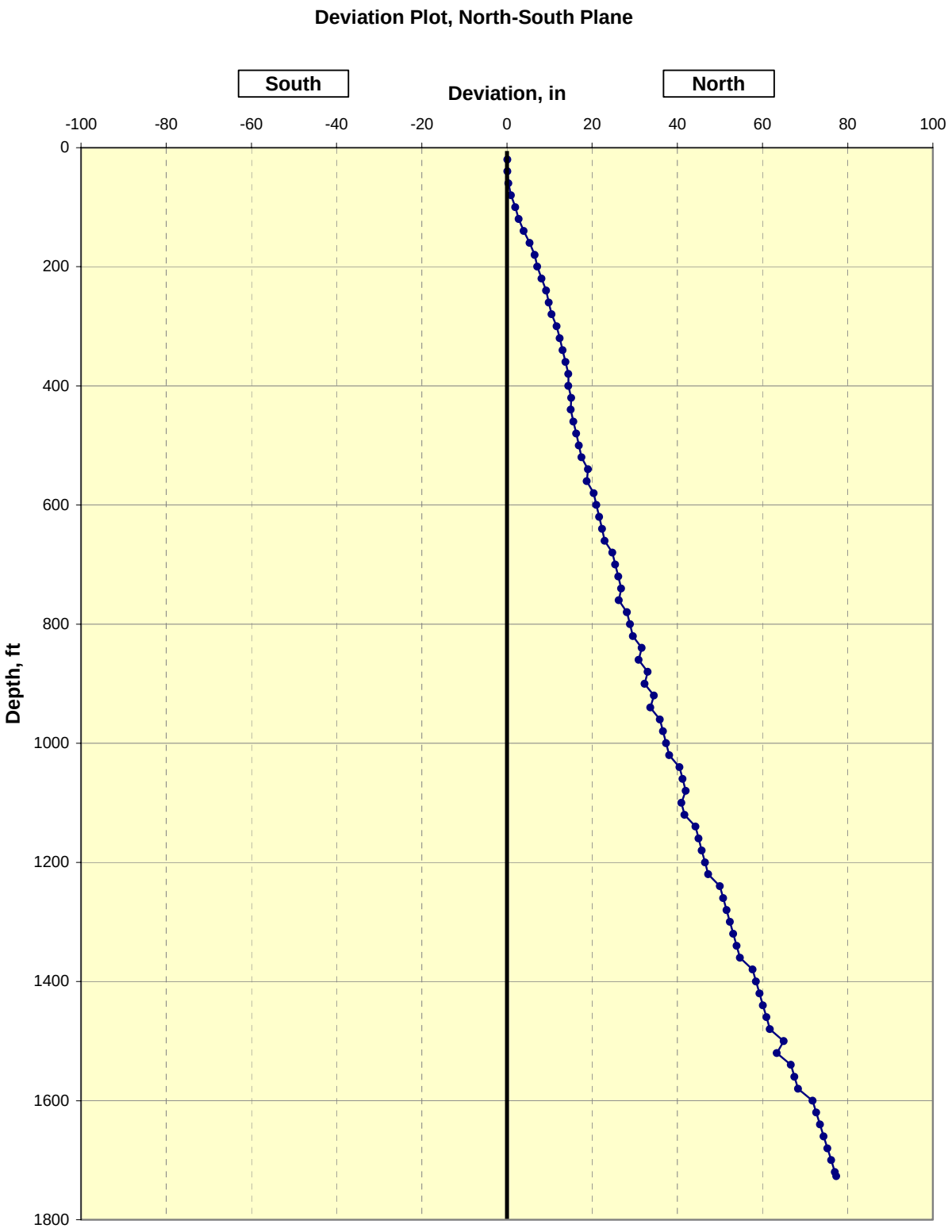


Figure 6. Casing deviation plot (N-S)

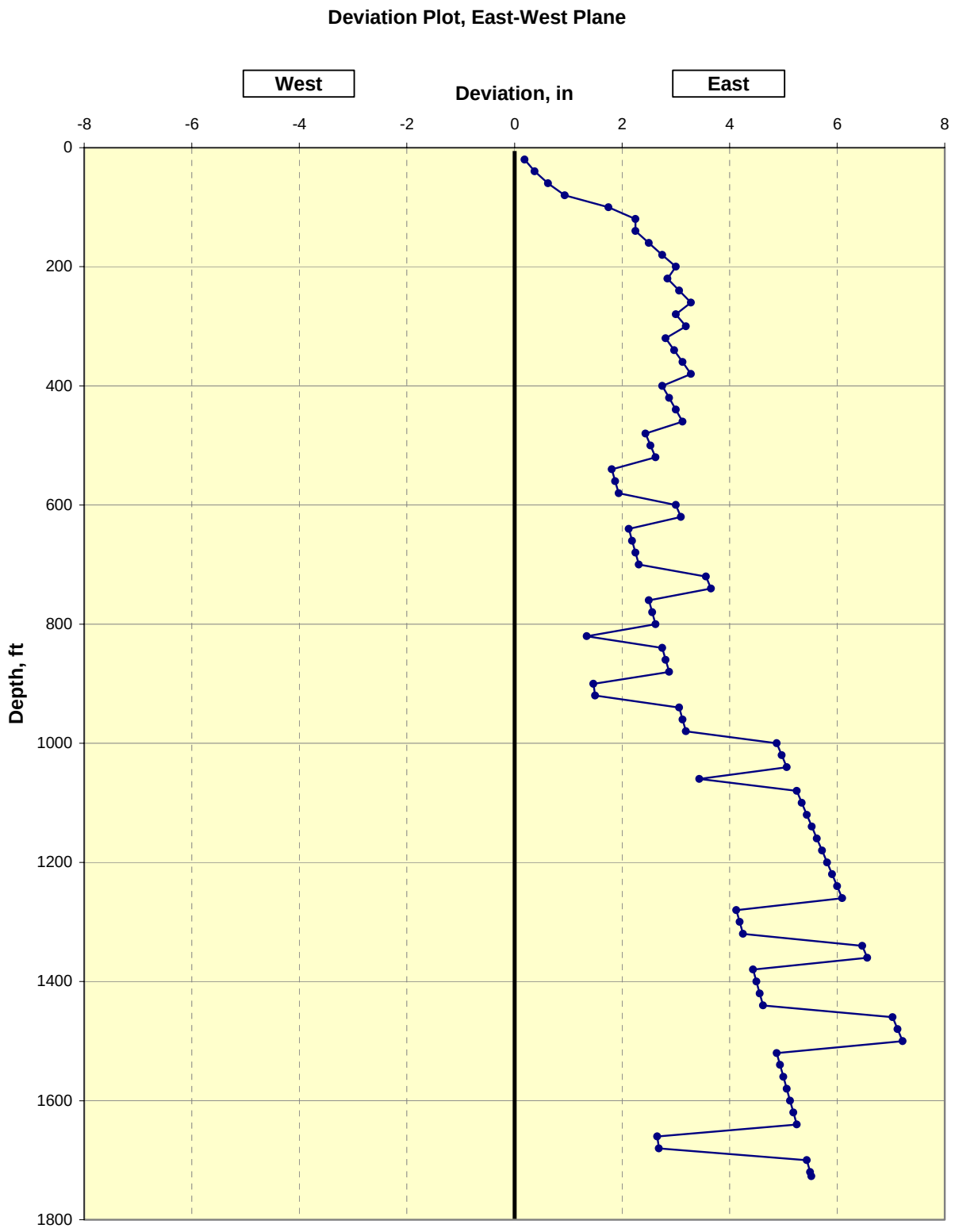


Figure 7. Casing deviation plot (E-W)

PALANI WELL NO. 1
(STATE WELL NO. 4158-03)
NORTH KONA, ISLAND OF HAWAI‘I
STATE OF HAWAI‘I

ENVIRONMENTAL ASSESSMENT

County of Hawai‘i
Department of Water Supply

Appendix 4
Well Development Agreement

FILE COPY

WELL DEVELOPMENT AGREEMENT

THIS **WELL DEVELOPMENT AGREEMENT** (the "Agreement"), made August 22, 2006, by and among **LANIHAU PROPERTIES, LLC**, a Hawaii limited liability company, **WEST HAWAII BUSINESS PARK, LLC**, a Hawaii limited liability company, **PALANI RANCH COMPANY, INC.**, a Hawaii corporation, and for their successors or assigns (collectively the "OWNERS"), and **WATER BOARD OF THE COUNTY OF HAWAII** ("BOARD") the governing board of the **DEPARTMENT OF WATER SUPPLY**, a semi-autonomous agency of the County of Hawaii ("DWS").

WITNESSETH:

WHEREAS, OWNERS own various properties within the ahupua'a of Honokohau 1 and 2 ("Honokohau Properties"), North Kona, Hawaii; and

WHEREAS, OWNERS have long-term plans to continue development of certain of the Honokohau Properties; and

WHEREAS, the long-term development of the Honokohau Properties will require sufficient amounts of potable water; and

WHEREAS, the DWS operates a public water system in the district of North Kona that serves certain properties within and beyond the ahupua'a of Honokohau 1 and 2; and

WHEREAS, BOARD desires to add potable water wells to the existing DWS water system in North Kona in order to serve the future regional demand; and

WHEREAS, OWNERS desire to develop a potable water well, well site improvements, and transmission improvements that will be acceptable for dedication to BOARD as part of the DWS's water system; and

WHEREAS, in consideration for their development of the water system improvements for the purpose of dedication to the BOARD and their conveyance to BOARD of fee simple title to their respective interests in the well, the well site, the well site improvements, storage reservoir, transmission improvements, including all appropriate easements necessary for the maintenance and operation of the water system, OWNERS desire to obtain water allocations for the Honokohau Properties from BOARD; and

WHEREAS, the parties hereto have entered into this Agreement in order to facilitate and expedite the development of the water system improvements;

NOW, THEREFORE, in consideration of the premises and for other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the parties agree as follows:

1. **DEFINITIONS** .

(a) "Honokohau Properties" means those certain properties located at Honokohau 1 and 2, North Kona, County of Hawaii, and designated by Tax Map Key Nos.(3) 7-4-02:08, 11, 13, 17, 18, and 20 and (3) 7-4-08:05, 13, 30, 47, 57, 60, 64, and 74, all of which may be serviced by DWS and are depicted in Exhibit "A."

(b) "Utilize or utilization" means the application of the Owner's water commitments earned pursuant to this Agreement in conjunction with the issuance of tentative subdivision approval or of plan approval from the Planning Department, County of Hawaii, for uses of properties that are the subject of this Agreement.

(c) "Water System" means the facilities and improvements that are included within the terms "Well," "Well Site Improvements," and "Water Transmission Improvements," as defined in this paragraph.

(d) "Water System Bond" means a surety bond or letter of credit, or other security arrangement in favor of the DWS acceptable in form and content to the DWS.

(e) "Water Transmission Improvements" means all of the ordinary and necessary water lines and related facilities, excluding those that are located on the Well site, that are necessary to transmit the water from the Well to the DWS's water system in the vicinity of the Palani Road/Mamalahoa Highway intersection.

(f) "Equivalent Unit" means the amount of potable water equivalent to six hundred (600) gallons per maximum day. "Maximum day" is defined as 1.5 times the average daily usage.

(g) "Water Commitment" means an agreement by BOARD to make a water unit available for use in relation to a specific property.

(h) "Well" means a new potable water source that OWNERS are willing to develop and drill on a portion of OWNERS' property, and which OWNERS are willing to convey to BOARD if such Well is able to produce potable water of the quantity and quality that is acceptable to BOARD.

(i) "Well Site" means an area of approximately one acre in size within OWNERS' property, located at approximately 1,700 feet in elevation and approximately 3,000 feet north of BOARD's existing Honokohau II well otherwise meeting with the approval of DWS, upon which the Well and related improvements will be developed, together with all non-exclusive easements appurtenant thereto.

(j) "Well Site Improvements" means the Well, a water storage facility, piping from the Well to the new storage facility, pumps, electrical equipment and controls, and all

other facilities appurtenant to the Well that are located on the Well Site and/or are necessary to operate and maintain the Well and to connect the Well to the DWS water system.

2. OWNERS' OBLIGATIONS

(a) Exploratory Well.

OWNERS shall proceed promptly to undertake to drill an exploratory well on OWNERS' Property to determine that the quantity and quality of the water resources are adequate to produce a potable water source acceptable to the BOARD/DWS pursuant to the terms of this Agreement.

(b) Land and Facilities to be Provided for Water System Improvements.

(i) OWNERS shall make available at no cost a portion or portions of OWNERS' Property that may be required for the drilling of an exploratory well and subsequent outfitting of a production well.

(ii) OWNERS shall use good faith efforts to complete the drilling and testing of the exploratory well in accordance with a schedule to which the parties have agreed. If the testing of the exploratory well does not indicate that the Well is capable of producing a minimum of .5 million gallons a day (MGD) of potable water in accordance with the DWS standards, the parties, individually or collectively, shall have no further obligations under this Agreement, and this Agreement may be formally terminated by either party. OWNERS make no representation or warranty to BOARD that OWNERS' property or the Well to be developed by OWNERS will be capable of providing a source of potable water that is acceptable in quality and quantity to BOARD/DWS.

(iii) OWNERS shall be obligated to install a single well with 16" casing, sized and fixtured, to produce up to 1,000 gpm, which is equivalent to 1.4 MGD; provided, however, that if the preliminary pump test of the exploratory well supports a reasonable probability that the sustainable yield will exceed 1.4 MGD, then the well will be upsized by OWNERS at OWNERS' expense to a 20" casing and fixtured to produce up to 1400 gpm, which is equivalent to 2.0 MGD.

(iv) If the exploratory well is test-proven to meet the minimum capacity in subparagraph 2(b)(ii) above, OWNERS shall be obligated to construct a reservoir storage tank with a minimum capacity of 500,000 gallons, in conjunction with the completion of the Well; provided, that within thirty (30) days after receipt of the pump test report from OWNERS, BOARD, through DWS, may elect to inform OWNERS in writing that the reservoir capacity should be increased to 1,000,000 gallons. If DWS elects to pay any portion of the cost of oversizing, OWNER shall be responsible for securing all applicable permits and approvals, including an environmental assessment and Environmental Impact Statement, if necessary, and for payment of all related costs. OWNERS understand that they will not receive any credit against the Facilities Charges for the reservoir.

(v) OWNERS shall construct certain transmission lines (pursuant to DWS standards) to connect the Well into existing system at Mamalahoa Highway makai of the Well Site. The cost of these transmission lines shall be deemed eligible for inclusion in the calculation of the Facilities Charge credits which shall be granted to OWNERS as outlined in this Agreement. OWNERS shall, in addition, construct other improvements as determined to be necessary by further engineering and as mutually agreed between the parties.

(vi) Upon OWNERS' completion of the Water System pursuant to plans approved by DWS, OWNERS shall formally offer the Well Site and Water System for dedication to BOARD.

(c) **Engineering and Construction Plans.**

OWNERS shall be solely responsible for the preparation of all required engineering studies and drawings and all constructions plans for the Water System and shall pay for all costs incurred in preparation of the required engineering and construction documents. All reports, studies, surveys, drawings and plans that require approvals shall be approved in writing by OWNERS, DWS, and other appropriate regulatory agencies. All parties to this agreement shall not unreasonably withhold their approval to any of the engineering and construction reports, studies, surveys, drawings and plans prepared in accordance with the terms of this Agreement.

(d) **Responsibility for Construction and Costs.**

In addition, OWNERS shall be responsible for all subsequent costs for the development and construction of the Water System. OWNERS shall also be responsible for and shall secure any permits, licenses, or approvals required by any governmental agency for the construction of the Water System, including the Well. OWNERS shall exercise due care in connection with the design, development and construction of the Water System, which shall conform to DWS standards and to all applicable County, State and Federal Laws.

(e) **Subdivision of the Well Site.**

OWNERS acknowledge that a subdivision of the Well Site from OWNERS' property will be required in order to formally dedicate to BOARD the Well Site and that portion of the Water System which is located thereupon. OWNERS shall prepare and file an

application to obtain approval from the County of Hawaii for the subdivision of the Well Site from OWNERS' property. BOARD, through DWS, agrees to reasonably assist OWNERS in securing the subdivision pursuant to section 23-11, Chapter 23, Hawaii County Code, relating to "public utility or public rights of way subdivisions."

(f) **Hazardous Materials.**

OWNERS shall not cause or permit the escape, storage, disposal or release of any hazardous materials in, upon or from the Well Site, except as permitted by law. OWNERS shall not allow the storage or use of such materials in any manner not sanctioned by law for storage and use of such materials, nor allow to be brought upon the Well Site any such materials, except as may be necessary for use in the ordinary course of undertaking the exploratory well project and the development of the Water System.

(g) **Burial Sites.**

In the event that burial sites or archaeological or historical artifacts or sites are uncovered during the course of OWNERS' drilling of the exploratory well or the development or construction of the Water System, work in the immediate vicinity shall cease and the Department of Land and Natural Resource's State Historic Preservation Division ("SHPD") shall be contacted. OWNERS shall comply strictly with the requirements of Chapter 6E, Hawaii Revised Statutes, and agency rules that implement Chapter 6E.

(h) **Indemnification.**

OWNERS shall indemnify and hold BOARD and DWS harmless from and against any and all damages, losses, liabilities, claims, demands, costs and expenses arising out of or in connection with the drilling of the exploratory well and any subsequent work done with respect to the Water System, or by its agents and employees, in connection with the

design, development and construction of the Water System. Furthermore, OWNERS shall name BOARD and DWS as additional insureds on OWNERS' liability insurance policy for the Well Site.

3. **BOARD'S OBLIGATIONS**

(a) **Cooperation during Construction.**

BOARD, directly or through DWS, shall cooperate with OWNERS wherever possible and appropriate in the OWNERS' efforts to secure any permits, licenses, or approvals required for the construction of the Water System, , provided that BOARD shall not be required to incur any cost, expense, or monetary obligations with regard thereto.

(b) **Dedication to BOARD of Well Site and Water System.**

Upon OWNERS' completion of the Well that produces potable water in such quantity and quality that is acceptable to DWS, BOARD shall, through DWS, commence appropriate administrative efforts to facilitate OWNERS' dedication of the Well Site and Water System to BOARD. Upon the completion and acceptance of the Water System in accordance with construction plans approved by DWS, BOARD shall accept the dedication of the Well Site and the Water System.

(c) **Provision of Owners' Water Allocation Share.**

Upon OWNERS' development of the Well that provides water in such amount that satisfies the requirements of this Agreement and of such quality that is acceptable to DWS, BOARD shall confirm in writing to OWNERS that OWNERS are entitled to eighty-five percent (85%) of the maximum day pumping capacity of the Well, as determined by the pump test of the production well (hereinafter referred to as "OWNERS' Allocation"). If the quality

and quantity of the water is not acceptable to DWS, then DWS shall so inform OWNER and DWS may terminate this Agreement with no further obligations hereunder.

BOARD agrees that OWNERS shall allocate one (1) Equivalent Unit per single family residential unit, each water unit consisting of 600 gallons per maximum day. Water allocation for multiple family residential units, commercial, industrial and other uses shall be based on an engineer's assessment of the project water use based on accepted industry standards, review of water use, or similar activities or based on other methods to which BOARD, through DWS, and OWNERS may mutually agree.

(d) **Water Commitments and Limitations on Transferability.**

BOARD, through DWS, shall issue water commitments and make potable water available to OWNERS based upon OWNERS' Allocation under this Agreement in conjunction with the future use of or assignment to the Honokohau Properties. Such allocations and commitments may not be assigned to third parties who are not successors or assigns of OWNERS' respective interests in the Honokohau Properties, provided, that OWNERS' Allocation may, at OWNERS' discretion, be used for water commitments that are assigned and utilized for properties that are adjacent to the Honokohau Properties and that are either acquired by OWNERS, consolidated and/or resubdivided with adjacent Honokohau Properties, or affected by adjustments to boundaries with the Honokohau Properties.

Notwithstanding the foregoing provisions, nothing herein shall be construed to prevent BOARD, from approving the use and transfer of such water commitments for properties held by the Department of Hawaiian Home Lands (DHHL), State of Hawaii, at Kealakehe, North Kona, Hawaii, designated by TMK Nos. 7-4-21:15 and 16, subject to the prior approval of and agreement of BOARD, DHHL, and OWNERS.

(e) **Term of Entitlement.**

OWNERS' water allocations shall be reserved by BOARD for the benefit of the Honokohau Properties and shall be made available by BOARD through water commitments to be secured by OWNERS, their successors and assigns, through payment of water commitment fees and facility charges, provided that OWNERS shall have a period of twenty-five (25) years within which to utilize such water allocations and resulting water commitments for the Honokohau Properties under this Agreement. This period will commence on the date that the BOARD accepts dedication of the well site and Water system and continue for twenty-five years thereafter, unless, for reasonable justification, BOARD approves and the parties agree to a longer period. Any water commitments unused after 25 years or any extended period pursuant to BOARD's approval shall revert to DWS and be deemed surrendered by OWNERS.

OWNERS' Allocation, as qualified under paragraph 3(d) under this Agreement shall remain appurtenant to the land to which they are assigned.

Within thirty(30) days after each anniversary date of the effective date of this Agreement, OWNERS shall file a report with DWS that includes the status of water commitments that have been utilized within the previous year, providing a comprehensive accounting of all of Honokohau Properties as to the assignment of OWNERS' Allocation to specific properties and a cumulative account of water utilized and remaining for such properties, including an accounting of units eligible for the water facilities charge credit that is addressed in subparagraph 3(f) below.

(f) **Credit Against Water Facilities Charges.**

BOARD hereby grants to OWNERS a credit against any water facilities charges due for development within the Honokohau Properties. The credit shall be appurtenant to OWNERS' allocations and shall not be transferred or assigned separately from OWNERS' allocation units and shall be calculated as set forth in paragraph 6 below.

4. **ASSURANCE AND SECURITY FOR CONSTRUCTION OF WATER SYSTEM.**

Upon completion of testing to determine that a production well will produce water that meets applicable potable water standards and that the estimated quantity of water is greater than 500,000 gallons per day of pumping capacity, OWNERS may elect to provide to BOARD a Water System Bond to assure construction of the Water System improvements, including, but not limited to, outfitting of the Well, and completion of Well Site Improvements necessary to bring the Well into production. The value of the Water System Bond will be based on the estimated cost to complete the Water System plus an additional thirty percent (30%) and shall be subject to approval by BOARD. Upon delivery to BOARD of such Water System Bond, deposit of deeds to all sites and grants of easements for all necessary infrastructure, and satisfaction of requirements of the Hawaii County Code relating to subdivisions of land, OWNERS shall be entitled to secure Equivalent Units earned under this Agreement. However, until the system is complete water service will not be granted.

5. **EXISTING AVAILABILITY FROM COUNTY WATER SYSTEM**

OWNERS' water allocations that result from the Well under this Agreement shall be additional to the prevailing water availability at the time of development from the DWS water system.

6. **WATER FACILITIES CHARGE CREDITS.**

Upon execution of this Agreement by all parties and in recognition of the development of the Water System by OWNERS and the contemplated dedication of the Well Site and Water System by OWNERS at no cost to the BOARD/DWS, OWNERS of the Honokohau Properties shall be credited for a percentage of their development costs for the Water System which shall be a credit against the prevailing water facilities charges at the time of development due for proposed development within the Honokohau Properties. The following credits apply to OWNERS' Water System development costs:

(a) 22 % credit for the design, drilling and casing of the exploratory well;

(b) 15 % credit for the design and outfitting of the Well and installation of control building and facilities; and

(d) 24 % credit for the design and construction of transmission lines from the Well to the County water system.

The sum of all such credits shall collectively be referred to as "Facility Charge Credit" and shall apply to the Equivalent Units determined as follows: total cost of development of the Water System divided by $5,500 per dwelling unit or Equivalent Unit. The resulting amount shall be the basis of the total number of Equivalent Units against which the Facility Charge

Credit shall be applied. (This calculation is being done solely for the purpose of determining the amount of Equivalent Units for which the Facility Charge Credit applies.)

Exhibit "B" attached hereto and incorporated herein by reference, illustrates the water credit calculation for the number of Equivalent Units, estimated cost of water system improvements, and facilities reserve charges in a case scenario where a 2.016 MG 24-hour pump capacity well is utilized with credit for well and transmission only (no reservoir). The actual determination of Facility Charge Credit shall be based on the actual installed well pump capacity and costs incurred. Once the improvements are completed, OWNERS shall submit an affidavit outlining the actual costs incurred which shall include all soft and hard costs directly associated with the project, its permitting and its construction, which will be subject to review and approval by DWS.

Within the Honokohau Properties, credit against water facilities charges shall be applied to those Equivalent Units as designated by the Owners up to the determined amount as outlined above.

All other Equivalent Units shall be subject to the payment of 100% of the then-prevailing facilities charge.

7. **EXECUTION DOCUMENTS; APPROVALS REQUIRED UNDER THIS AGREEMENT.**

(a) Each Party agrees that it shall each execute, acknowledge, and deliver to the other Party, upon request of that Party, such documents as may be required for the development, construction and dedication of the Well Site and Water System or any portions

thereof, as described in this Agreement, including any applications, permits, dedication deeds, easements or other instruments.

(b) OWNERS agree that upon the securing of final subdivision approval of the Well Site, OWNERS shall forward to BOARD an executed dedication deed, following the standard form used by BOARD, conveying the Well Site to BOARD and shall deposit said deed with an escrow company of their choice for recordation as set forth below. OWNERS further agree that as soon as boundaries are surveyed for an access road and utility corridors for the water transmission improvements and appurtenant facilities over OWNERS' property and are approved by BOARD, OWNERS shall execute a grant of easement to BOARD. Said easement shall follow the standard form used by BOARD and shall grant such easements that are necessary for the access road, utility corridors, water transmission improvements and appurtenant facilities. Further, OWNERS shall then deposit such grant of easement with the escrow company for recordation within fifteen days of receipt of written confirmation from the Board that the OWNERS' respective water allocations from the Well under this Agreement have become irrevocable pursuant to Paragraph 8 below.

8. **IRREVOCABILITY OF WATER COMMITMENTS.**

OWNERS' respective water allocations from the Well under this Agreement shall become irrevocable, subject to the twenty-five year entitlement period described in paragraph 3(e) above, upon BOARD, through DWS, has approved the Water System and the quality and quantity of the potable water from the Well, and BOARD has accepted the Water System for dedication and use in the DWS' water system.

9. **VOLUNTARY TERMINATION OF AGREEMENT.**

(a) Notwithstanding any provision of this Agreement to the contrary, OWNERS, at their option, may terminate this Agreement by providing written notice thereof to BOARD upon the occurrence of any of the following:

(i) OWNERS are unable to obtain any one or more of the State or County permits or approvals required to develop the Water System or any part thereof; or

(ii) OWNERS reasonably determine that the development of the Water System is commercially impractical; or

(iii) OWNERS reasonably determine, after conducting appropriate tests, that the ground water source is not suitable or adequate for OWNERS' needs; or

(iv) BOARD does not accept the dedication of the Water System; or

(v) The Well does not meet the requirements of the DWS/BOARD and the State Department of Health as a potable water source; or

(vi) The capacity of the Well is less than 500,000 gallons per day.

(b) Notwithstanding any provision of this Agreement to the contrary, BOARD may, at its option, terminate this Agreement by providing written notice thereof to OWNERS upon the occurrence of any of the following:

(i) The Well is not acceptable to the DWS as to sufficient quality and quantity;

(ii) The Well does not meet the requirements of the State Department of Health as a potable water source; or

(iii) The capacity of the Well is less than 500,000 gallons per day; or

(iv) OWNERS do not fulfill the terms and conditions of this Agreement.

(c) In the event of the termination of this Agreement pursuant to this paragraph, OWNERS shall pay for all costs incurred for the development of the Water System up to the date of termination. Upon termination of this Agreement, all improvements made or caused to be made by OWNERS and all related fixtures shall remain the property of OWNERS, and BOARD hereby waives any and all claims thereto as well as any claim for compensation therefore. The termination of this Agreement shall release OWNERS of any and all responsibility for the development of the Water System, as described in this Agreement, and BOARD/DWS are released from any obligation to provide any Equivalent Units, Facility Charge Credits, or any other obligation as provided in this Agreement and OWNERS waive any and all claims thereto as well as any claim for compensation therefore.

10. **GOVERNING LAW.**

This Agreement has been negotiated and executed in the State of Hawaii and shall be governed and construed under the laws of the State of Hawaii, and any action shall be brought in the Third Circuit Courts.

11. **NOTICE REQUIREMENTS**. Whenever any notice, demand or request is required or permitted hereunder, such notice, demand or request shall be in writing and shall be deemed to have been properly given or served (i) when delivered in fact to the other proper party (and including all individuals that are required to receive copies), or (ii) when deposited

in the United States mail, with adequate postage prepaid and sent by registered or certified mail with return receipt requested, to the addresses set out below or at such other addresses as are specified by written notice so given in accordance herewith, or (iii) when deposited with Federal Express, Express Mail or other overnight delivery service for next day delivery addressed to the appropriate party at the addresses set forth below:

OWNERS: LANIHAU PROPERTIES, LLC
WEST HAWAII BUSINESS PARK, LLC
PALANI RANCH COMPANY, INC.

c/o Lanihau Properties, LLC
3465 Waialae Ave. Suite 260
Honolulu, Hawaii 96816
Attn: James S. Greenwell

With Copy To: R. Ben Tsukazaki
Tsukazaki Yeh & Moore
85 W. Lanikaula Street
Hilo, Hawaii 96720

BOARD: WATER BOARD
Department of Water Supply
County of Hawaii

c/o Manager
Department of Water Supply
County of Hawaii
345 Kekuanaoa Street Suite 20
Hilo, Hawaii 96720

With Copy To: Office of the Corporation Counsel
County of Hawaii
101 Aupuni Street, Suite 245.
Hilo, Hawaii 96720

12. **ENTIRE AGREEMENT.**

This Agreement contains the entire understanding between the parties, and there are not any agreements, understandings, warranties or representations between OWNERS and BOARD except as set forth herein. Any and all oral or written representations, correspondence, letters of intent and agreements are merged into and superseded by this Agreement and shall be of no force or effect.

13. **GENDER AND NUMBER.**

In this Agreement, unless the context requires otherwise, the masculine, feminine and neuter genders and the singular and the plural shall be deemed to include one another, as appropriate.

14. **CAPTIONS.**

The captions used in this Agreement are for convenience of reference only, and are not a part of this Agreement, and do not in any way limit or amplify the terms and provisions hereof.

15. **AMENDMENTS.**

No addition to or modification of any provision contained in this Agreement shall be effective unless fully set forth in a writing signed by the parties hereto.

16. **PARTIAL INVALIDITY.**

If any provision of this Agreement is adjudged by a court of competent jurisdiction to be void or unenforceable for any reason, the same shall in no way affect any other provision of this Agreement or the validity or enforceability of this Agreement as a whole, provided that the essential purposes of this Agreement can nonetheless be accomplished.

17. **RECORDATION OF MEMORANDUM OF THIS AGREEMENT.**

This Agreement or a memorandum thereof shall be recorded in the Bureau of Conveyances of the State of Hawaii.

18. **BINDING AGREEMENT.**

This Agreement shall run with the land and shall inure to and be binding on the heirs, devisees, personal representatives, successors and assigns of OWNERS and any official or governmental entity that may be formally authorized to succeed BOARD or DWS in their respective legal capacities.

IN WITNESS WHEREOF, the parties hereto have executed these presents this 22nd day of August, 2006.

"OWNERS"

LANIHAU PROPERTIES, LLC

By: _____
Its

By: _____
Its

RECOMMENDED FOR APPROVAL:
DEPARTMENT OF WATER SUPPLY

By: _____

PALANI RANCH COMPANY, INC.

By: _____
Its President

By: _____
Its

WEST HAWAII BUSINESS PARK, LLC

By: _____
Its:

By: _____
Its: _____

APPROVED AS TO FORM AND
LEGALITY:

Deputy Corporation Counsel
County of Hawaii

DATED: Aug. 16, _____, 2006

"BOARD"

WATER BOARD OF THE
COUNTY OF HAWAII

By: _____
Its Chairperson
Loren H. Heck

STATE OF HAWAII)
) ss.
CITY & COUNTY OF HONOLULU)

On this 31st day of July, 2006, before me personally appeared James S Greenwell, to me known (or who has proven to me on the basis of satisfactory evidence) to be the person described in and who executed the foregoing **"WELL DEVELOPMENT AGREEMENT"**, who, being duly sworn, did say that he/she is the President of **LANIHAU PROPERTIES, LLC**, a limited liability company organized under the laws of the State of Hawaii, that said instrument was signed on behalf of said limited liability company as authorized under its operating agreement and/or by authority of its member(s), and who acknowledged said instrument to be the free act and deed of said limited liability company.

L.S.

[Seal]

(Notary signature) Shirley J. Miller

(Print notary name) Shirley J. Miller
Notary Public, State of Hawaii

My commission expires: 4/21/2010

STATE OF HAWAII)
) ss.
CITY & COUNTY OF HONOLULU)

On this 31st day of July, 2006, before me personally appeared Norman S. Hom, to me known (or who has proven to me on the basis of satisfactory evidence) to be the person described in and who executed the foregoing **"WELL DEVELOPMENT AGREEMENT"**, who, being duly sworn, did say that he/she is the Vice President of **LANIHAU PROPERTIES, LLC**, a limited liability company organized under the laws of the State of Hawaii, that said instrument was signed on behalf of said limited liability company as authorized under its operating agreement and/or by authority of its member(s), and who acknowledged said instrument to be the free act and deed of said limited liability company.

L.S.

[Seal]

(Notary signature) Shirley J. Miller

(Print notary name) Shirley J. Miller
Notary Public, State of Hawaii

My commission expires: 4/21/2010

STATE OF HAWAII)
) ss.
CITY & COUNTY OF HONOLULU)

On this 31st day of July, 2006, before me personally appeared James S. Greenwell to me known (or who has proven to me on the basis of satisfactory evidence) to be the person(s) described in and who executed the foregoing instrument, who, being duly sworn, did say that he/she is the President of **PALANI RANCH COMPANY, INC.**, a Hawaii corporation, that said instrument was signed on behalf of said corporation by authority of its Board of Directors, and that said officer(s) acknowledged said instrument to be the free act and deed of said corporation.

L.S.

(Notary signature) Shirley J. Miller

(Print notary name) Shirley J. Miller
Notary Public, State of Hawaii

[Seal]

My commission expires: 4-21-2010

STATE OF HAWAII)
) ss.
CITY & COUNTY OF HONOLULU)

On this 31st day of July, 2006, before me personally appeared Norman S. Hom, to me known (or who has proven to me on the basis of satisfactory evidence) to be the person(s) described in and who executed the foregoing instrument, who, being duly sworn, did say that he/she is the Vice President of **PALANI RANCH COMPANY, INC.**, a Hawaii corporation, that said instrument was signed on behalf of said corporation by authority of its Board of Directors, and that said officer(s) acknowledged said instrument to be the free act and deed of said corporation.

L.S.

[Seal]

(Notary signature) Shirley J. Miller

(Print notary name) Shirley J. Miller
Notary Public, State of Hawaii

My commission expires: 4/21/2010

STATE OF HAWAII)
) ss.
CITY & COUNTY OF HONOLULU)

On this 31ST day of July, 2006, before me personally appeared James S. Greenwell, to me known (or who has proven to me on the basis of satisfactory evidence) to be the person described in and who executed the foregoing **"WELL DEVELOPMENT AGREEMENT"**, who, being duly sworn, did say that he/she is the President of **WEST HAWAII BUSINESS PARK, LLC**, a limited liability company organized under the laws of the State of Hawaii, that said instrument was signed on behalf of said limited liability company as authorized under its operating agreement and/or by authority of its member(s), and who acknowledged said instrument to be the free act and deed of said limited liability company.

L.S.

[Seal]

(Notary signature) Shirley J. Miller

(Print notary name) Shirley J. Miller
Notary Public, State of Hawaii

My commission expires: 4/21/2010

STATE OF HAWAII)
) ss.
CITY & COUNTY OF HONOLULU)

On this 31st day of July, 2006, before me personally appeared Norman S. Horn, to me known (or who has proven to me on the basis of satisfactory evidence) to be the person described in and who executed the foregoing **"WELL DEVELOPMENT AGREEMENT"**, who, being duly sworn, did say that he/she is the Vice President of **WEST HAWAII BUSINESS PARK, LLC**, a limited liability company organized under the laws of the State of Hawaii, that said instrument was signed on behalf of said limited liability company as authorized under its operating agreement and/or by authority of its member(s), and who acknowledged said instrument to be the free act and deed of said limited liability company.

L.S.

[Seal]

(Notary signature) Shirley J. Miller

(Print notary name) Shirley J. Miller
Notary Public, State of Hawaii

My commission expires: 4/21/2010

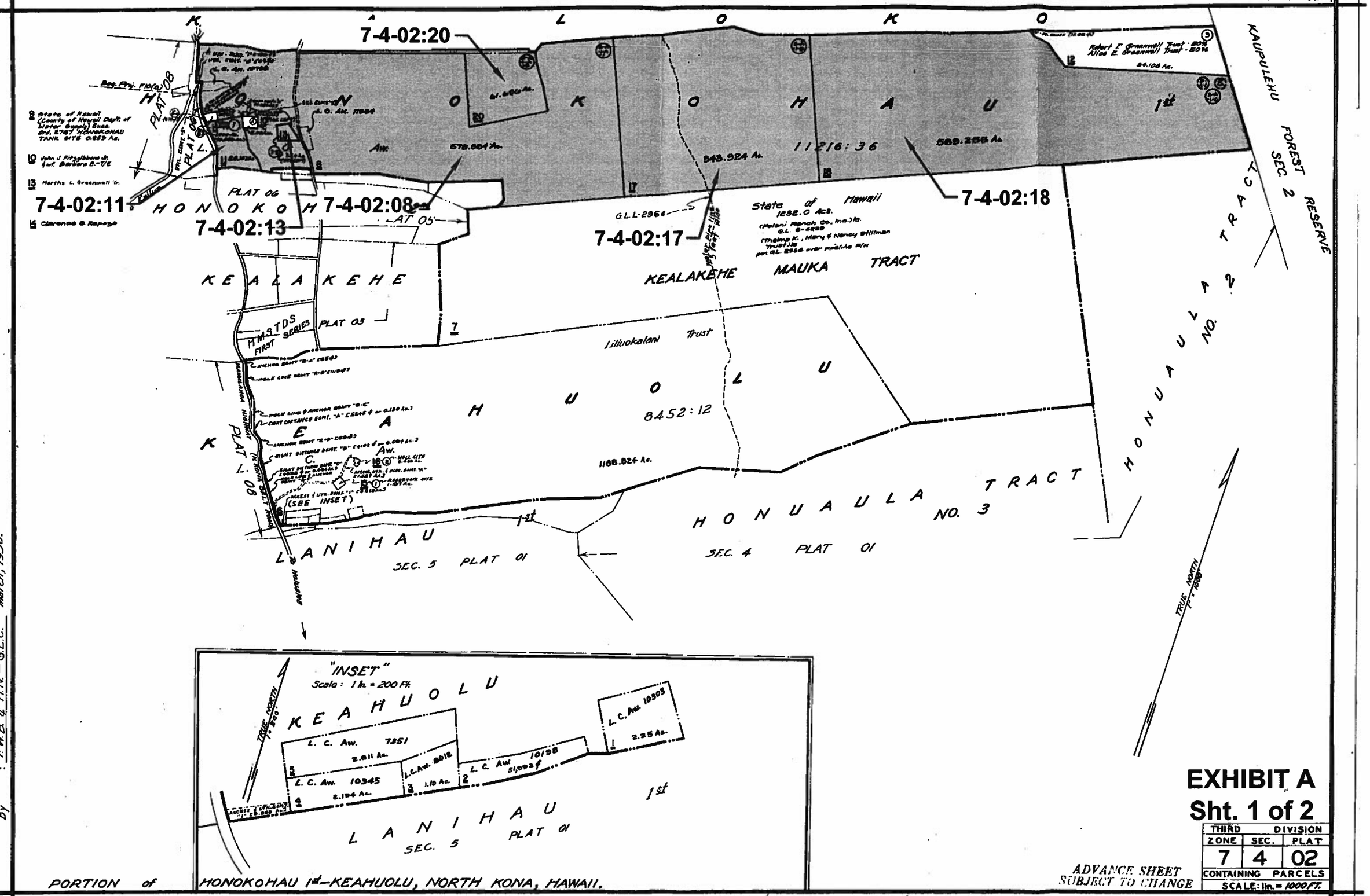
STATE OF HAWAI'I)
) SS.
COUNTY OF HAWAI'I)

On this 22nd day of August, 2006, before me appeared LOREN HECK to me personally known, who, being by me duly sworn, did say that he is the Chairman of the Water Board of the County of Hawai'i and that the seal affixed to the foregoing instrument is the seal of the Department of Water Supply of the County of Hawai'i, and that the instrument was signed and sealed in behalf of the Water Board by authority of the Water Board and said LOREN HECK acknowledged the instrument to be the free act and deed of the Water Board.

L. S.

Doreen M. Shirota
Notary Public - Doreen M. Shirota
State of Hawai'i

My commission expires: 7/9/2010



Dwg. No.: 2634
Source: Tax Maps Bureau
By: F.W.B. & H.N. - S.L.C. March, 1936.

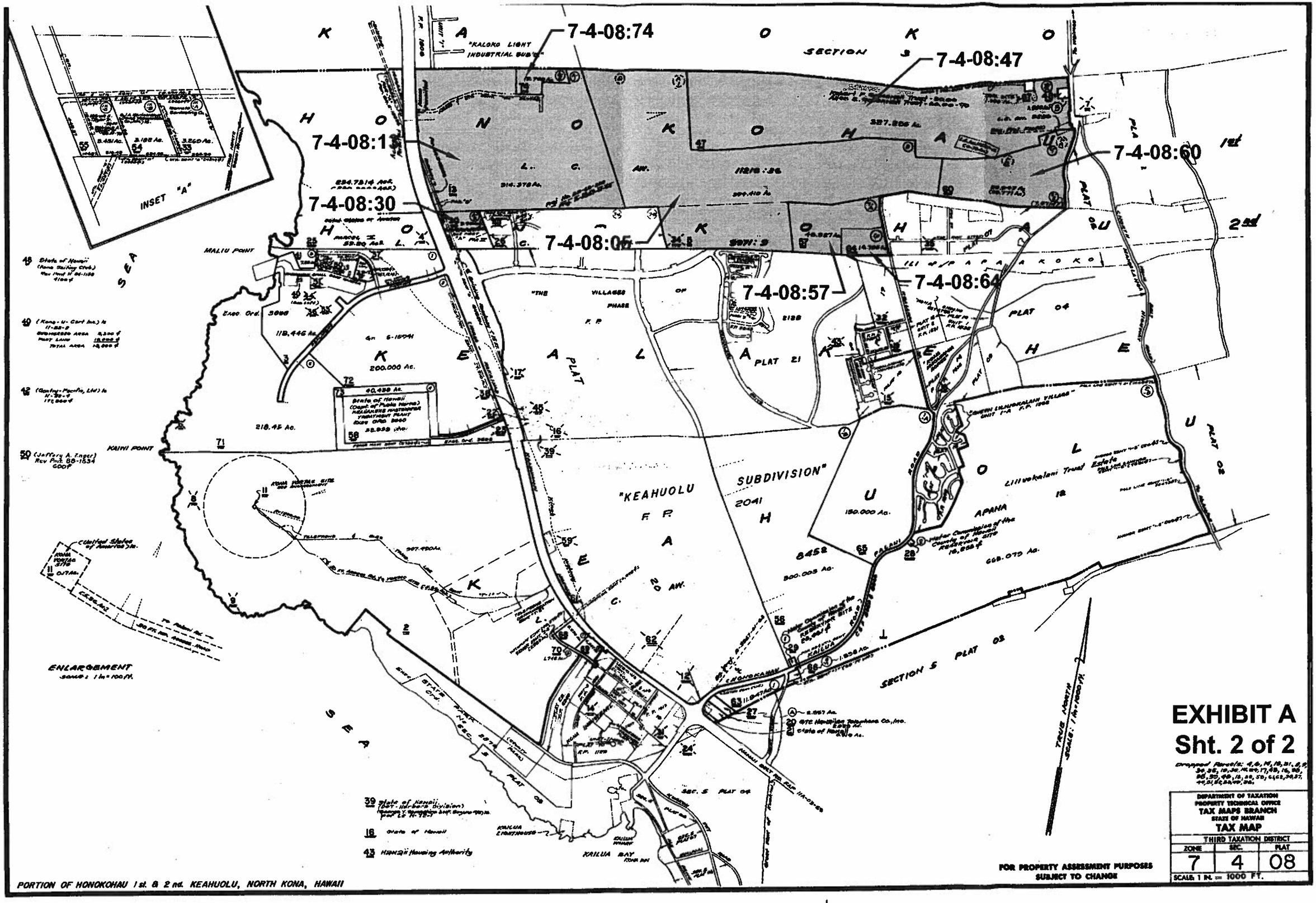
PORTION of HONOKOHAU 1st-KEAHUOLU, NORTH KONA, HAWAII.

EXHIBIT A
Sht. 1 of 2

THIRD		DIVISION
ZONE	SEC.	PLAT
7	4	02
CONTAINING		PARCELS
SCALE: 1in. = 1000 FT.		

ADVANCE SHEET SUBJECT TO CHANGE

PRINTED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7-4-08:30
7-4-08:05
7-4-08:57
7-4-08:64
SECTION 3
INSET "A"
MALIU POINT
KAINI POINT
"KEAHUOLU F.P. SUBDIVISION"
SECTION 5 PLAT 03
ENLARGEMENT
KAILUA BAY
TRUE NORTH
EXHIBIT A
Sht. 2 of 2
DEPARTMENT OF TAXATION
PROPERTY TECHNICAL OFFICE
TAX MAPS BRANCH
STATE OF HAWAII
TAX MAP
THIRD TAXATION DISTRICT
ZONE 7
SEC. 4
PLAT 08
SCALE: 1 IN. = 1000 FT.
FOR PROPERTY ASSESSMENT PURPOSES
SUBJECT TO CHANGE
PORTION OF HONOKOHAU 1st. & 2nd. KEAHUOLU, NORTH KONA, HAWAII

EXHIBIT "B" - Water Credit Calcs

BASIS - 2.016 MG 24-HR PUMP CAPACITY W/CREDIT FOR WELL & TRANSMISSION ONLY (NO RESERVOIR)

NUMBER OF WATER CREDITS

Date: February 21, 2007

DWS WATER ALLOCATION POLICY	LANIHAU	DWS	TOTAL
Current Allocation	85%	15%	100%
24-Hr. Max. Day Pump Capacity (2,016,000) GPD (1400 gpm)	1,713,600	302,400	2,016,000
Water Units (600) GPD/Unit	2,856	504	3,360

ESTIMATED COST OF WATER

Item	Estimated Cost	Allowable % Credit per DWS Rules & Regs	Applicable % Credit per DWS Rules & Regs.
Design, Drill, Case & Test Well	$1,852,000	22%	22%
Well Pump Station & Appurtenances	$1,385,500	15%	15%
Reservoir (0.5 MG) off-site reservoir	$1,801,000	26%	N/A
Transmission Main (2900 lf, 16")	$789,800	24%	24%
Booster Pump (per Station, 6.5% if one pump)	N/A	13%	N/A
TOTAL EST. CONSTRUCTION COST	$5,828,300	100%	**61%**

FACILITIES CHARGES - LANIHAU vs. DWS

Item		Lanihau	DWS Allocation	Total
Total Water Units		2,856	504	3,360
Facilities Charges per Water Unit		$5,500	$5,500	$5,500
Water Units Eligible for Credit Application		1,060	N/A	1,060
FC % for Eligible Water Units	39%	$2,145	N/A	$2,145
Total Facilities Charge for Eligible Water Units		$2,273,037	N/A	$2,273,037
Water Units Not Eligible for Credit Application		1,796	504	2,300
Facilites Charge Payments for Non-Eligible Water Units		$9,878,000	$2,772,000	$12,650,000
Lanihau's Average Facilities Charge Per Water Unit		$4,255	N/A	N/A
TOTAL FACILITIES CHARGE PAYMENTS		$12,151,037	$2,772,000	$14,923,037

1. IF LANIHAU PAYS FOR IMPROVEMENTS & REDUCED FACILITIES CHARGE

Total Cost to Lanihau = $5,828,300 + $12,151,037 = **$17,979,337**

Lanihau's Cost per Water Unit = **$6,295**

2. IF LANIHAU PAID FACILITIES CHARGE FOR WATER UNITS

Total Cost to Lanihau = 2,856 x $5,500 = **$15,708,000**

DIFFERENCE = #1 IS MORE BY $2,271,337

TOTAL COUNTY REVENUE = $14,923,037

NOTE:

1) Hawaii DWS planning standards: Well pump shall meet average day demand with an operating time of 16-hrs. or meet maximum day demand with an operating time of 24-hrs.
2) One water credit is equal to 400 gallons per day (average day) or 600 gallons per day (maximum day).

PALANI WELL NO. 1
(STATE WELL NO. 4158-03)
NORTH KONA, ISLAND OF HAWAI‘I
STATE OF HAWAI‘I

ENVIRONMENTAL ASSESSMENT

County of Hawai‘i
Department of Water Supply

Appendix 5
Phase I Environmental Site Assessment

Phase I Environmental Site Assessment

Palani Ranch Production Well Site

TMK: (3rd) 7-4-002:008

North Kona District, County of Hawai‘i

May 15, 2008

PREPARED FOR:

Geometrician Associates LLC
P.O. Box 396
Hilo, Hawai‘i 96721

PREPARED BY:

GK Environmental LLC
P.O. Box 1363
Honoka‘a, Hawai‘i 96727

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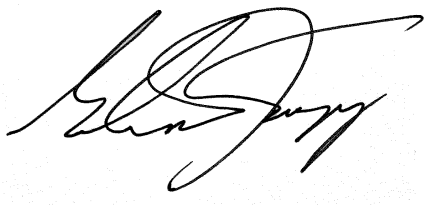
Geometrician Associates
P.O. Box 396
Hilo, Hawai‘i 96721

Phase I Environmental Site Assessment
Palani Ranch Production Well Site
North Kona District, County of Hawai‘i
TMK: (3rd) 7-4-002:008

Date: May 15, 2008



Graham P. Knopp, Ph.D.
Environmental Scientist

GK Environmental LLC
P.O. Box 1363
Honoka‘a, Hawai‘i 96727
(808) 775-1520

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LIST OF ABBREVIATIONS

AST: Aboveground Storage Tank
ASTM: American Society for Testing and Materials
CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS: Comprehensive Environmental Response, Compensation and Liability Information System
CFR: Code of Federal Regulations
CORRACTS: RCRA Facilities that are undergoing corrective action
EDR: Environmental Data Resources, Inc.
EPA: Environmental Protection Agency
ERNS: Emergency Response Notification System
ESA: Environmental Site Assessment
HDOH: Hawai‘i Department of Health
HEER: Hazard Evaluation and Emergency Response
LUST: Leaking Underground Storage Tank
NPL: National Priorities List
PCBs: Polychlorinated Biphenyls
RCRA: Resource Conservation and Recovery Act
REC: Recognized Environmental Conditions
TRIS: Toxic Release Inventory System
TSD: Treatment, Storage, and Disposal (of hazardous waste)
TMK: Tax Map Key, a unique numerical sequence designating a particular parcel
USACE: United States Army Corps of Engineers
USDA: United States Department of Agriculture
USGS: United States Geological Survey
UST: Underground Storage Tank
UXO: Conventional Unexploded Ordnance

Executive Summary

GK Environmental LLC (GKE), acting at the request of Geometrician Associates, conducted a Phase I Environmental Site Assessment (ESA) of portions of a privately-owned property, TMK (3rd) 7-4-002:008, located in the County of Hawai‘i in the North Kona District with a street address of 74-4777 Mamalahoa Highway. For the purposes of this assessment the subject site is considered to be a 2000-foot radius around the well site within the subject property. This ESA was performed by GKE in general conformance with the scope and limitations of requirements recently issued by the U.S. Environmental Protection Agency in 40 CFR Part 312, *Standards and Practices for All Appropriate Inquiries, Final Rule*, dated November 1, 2005 (“Final EPA AAI Rule”).

The site reconnaissance, interviews, records review, and historical review conducted as part of the Phase I ESA were performed to identify potential and actual recognized environmental conditions at the subject site. On the basis of this assessment, the following major findings and conclusions have been drawn. The reader is advised to review these in conjunction with the remainder of the report.

This Phase I Environmental Site Assessment (ESA) identified an area with a number of waste containers. Under the “Used Oil Rule” (40 CFR Part 279), used oil must be assumed to be hazardous until it can be shown that it contains less that 1000ppm of halogens, the “rebuttable presumption”. Because the landowner has stated that the fluids observed in unlabeled containers are composed entirely of waste motor oil, it therefore can be treated as nonhazardous and is does not represent a recognized environmental condition.

Apart from this area, GKE observed no evidence of the presence of above or underground storage tanks, PCBs, or other hazardous materials on the subject site. GKE identified no issues on adjacent or nearby properties that may constitute recognized environmental conditions. During this assessment GKE identified no evidence of recognized environmental conditions in connection with the property. GKE recommends no further investigations for the subject site at this time.

Section 1
Introduction

1.1 Background

GKE, acting at the request of Geometrician Associates, conducted a Phase I ESA of the subject site located in the County of Hawai‘i in the *ahupua‘a* of Honokohau, district of North Kona (Figure 1). The subject site is a portion of the 576.404-acre parcel designated TMK (3rd) 7-4-002:008, which has a street address of 74-4777 Mamalahoa Highway. The subject site is defined, at the discretion of Geometrician Associates, as a 2000-foot radius around the well site (located at UTM5 coordinates 188702mN, 2179933mE), within the subject property. Geometrician Associates LLC retained GKE to perform the Phase I ESA as part of the due diligence process for development of a production well on a portion of the site.

Figure 1 - Subject Site Area Map

1.2 Purpose

The purpose of a Phase I ESA is to identify recognized environmental conditions associated with a property. Recognized environmental conditions are defined as the presence or likely presence of any hazardous substances (as defined by the Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA]) or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water of the property.

The standard for performance of Phase I ESAs is defined by ASTM E1527-05 (ASTM 2005). This new standard took effect on November 1, 2006 (EPA 2005) and is known as the "All Appropriate Inquiries" (AAI) final rule. The AAI final rule sets new standards with respect to interviews, investigation of site history, evaluation of so-called "data gaps" and evaluation of the impact of Recognized Environmental Conditions upon purchase price of the subject site. This work meets the standards of the AAI final rule.

1.3 Scope of Services

This Phase I ESA was conducted in accordance with the scope of work and the terms and conditions specified in GKE's proposal to Geometrician Associates LLC dated April 19, 2008 for a Phase I ESA, and as such, meets the requirements of the AAI final rule and those of American Society for Testing and Materials (ASTM 2005) Standard E 1527-05 *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process.*

The following activities were conducted as part of the Phase I ESA:

- A review of published information on surface and subsurface conditions at the site and surrounding area were reviewed. This information included topography, drainage, surface water bodies, subsurface geology, and groundwater occurrence in the area and was used to assess the potential for any nearby hazardous material releases to affect the subject site (Section 2);
- A review of available historical aerial photographs, topographic maps, available government records, and city directories (see Section 3);
- A search for environmental liens and activity and use limitations placed on the subject site (see Section 3);
- A review of available local, state, and federal environmental agency records within the minimum search distance for the property as specified by the ASTM standard, including the following records (Section 3, see Appendix A for descriptions):
    - National Priorities List (NPL)
    - Resource Conservation and Recovery Act (RCRA) facilities that are undergoing "corrective action" (CORRACTS)
    - RCRA-Treatment, Storage, & Disposal (TSD)

- Comprehensive Environmental Response, Compensation & Liability Information System (CERCLIS) List
- Solid Waste & Landfill
- Leaking Underground Storage Tank (LUST)
- Water Wells
- RCRA-Violators/Enforcement
- Underground Storage Tank (UST) list
- Emergency Response Notification System (ERNS)
- RCRA-Large Generator
- RCRA-Small Generator
- Spills

- A visual inspection of readily accessible areas of the subject site on May 2, 2008 (see Section 4);
- Interviews with employees and others who have knowledge of the property to assess current and historical property use or releases of hazardous substances or petroleum products at the property (Section 5); and
- An assessment of data gaps encountered during the investigation, as well as an assessment of the impacts of recognized environmental conditions, if found, upon the anticipated value of the property.

The Phase I ESA did not include sampling and testing of soil and potentially hazardous materials, including PCBs and lead-based paint, radon, mold, urea formaldehyde, critical, endangered or threatened species or habitats, wetlands, floodplains, or cultural resources.

1.4 Limitations and Exceptions of Assessment

The reader is advised that the Phase I ESA conducted at the site is a LIMITED INQUIRY into a property's environmental status and is not sufficient to discover every potential source of environmental liability, if any, at the site. ***Therefore, GKE cannot under any circumstances make a statement of warranty or guarantee, express or implied, that the subject site is free of recognized environmental conditions, environmental impairment, or that the subject site is "clean" or that impairments, if any, are limited to those that were discovered while GKE was performing the ESA.*** This limiting statement is not meant to compromise the findings of this report; rather it is meant as a statement of limitations within the intended scope of this assessment.

GKE's findings and opinions are based on information that was available and obtained at the time of the assessment through site reconnaissance, standard investigatory techniques used in the industry at the time, records review, and other related activities. It is possible that other information exists or may subsequently become known that may impact or change the site after GKE's observation.

In conducting the Phase I ESA and preparing this report, GKE reviewed, interpreted, and relied upon information provided by others, including but not limited to the client, tenants of the site,

individuals, government authorities, subcontractors, and other entities. GKE did not perform an independent evaluation of the accuracy or completeness of such information, and GKE will not be responsible for any errors or omissions contained in such information.

Section 2
Site Description

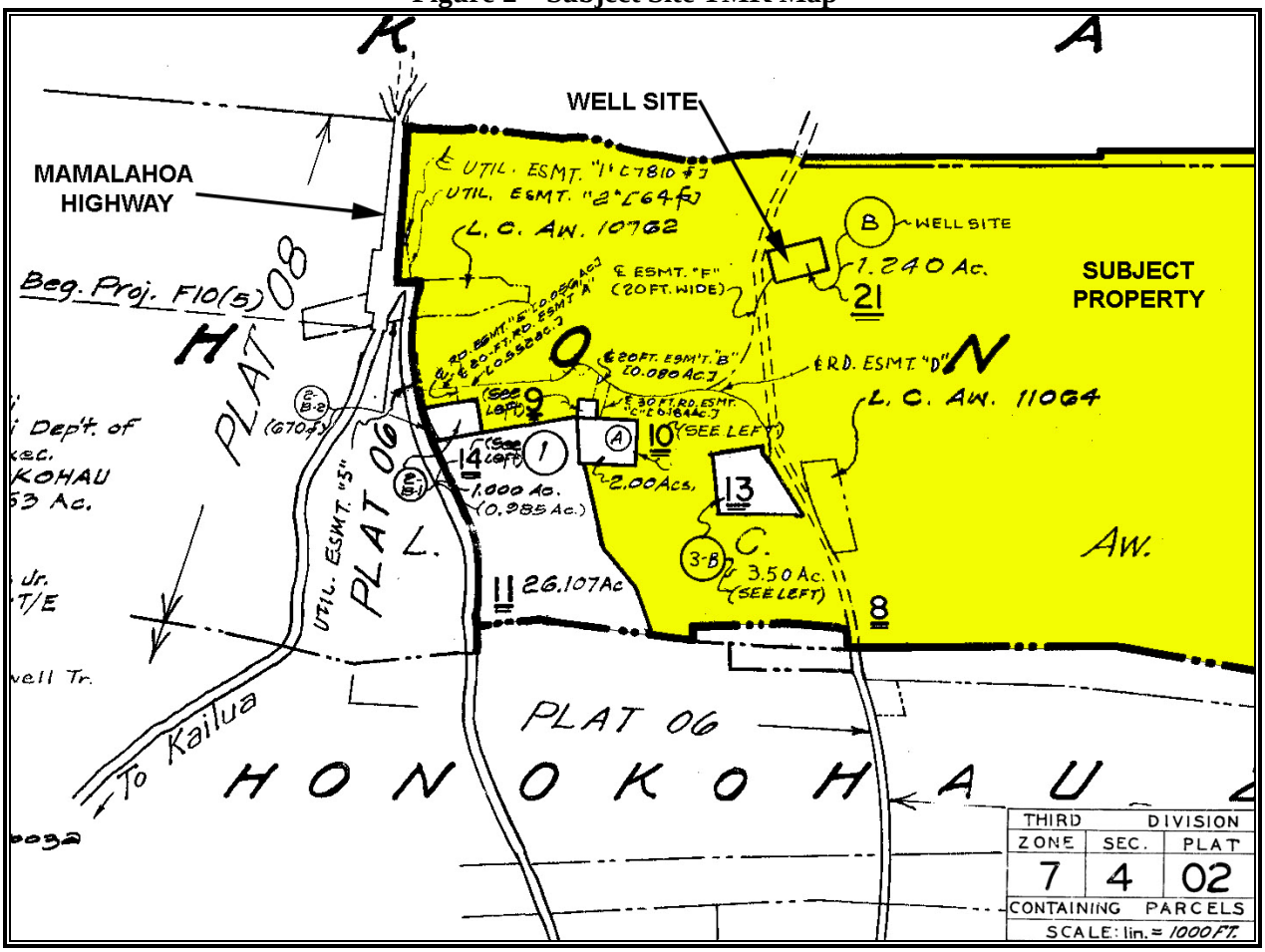
2.1 Subject Site Location

The subject site is located in the *ahupua‘a* of Honokohau, North Kona District, County of Hawai‘i, State of Hawai‘i and is within the parcel with the street address of 74-4777 Mamalahoa Highway. The general location of the subject site is shown in Figure 1 and Figure 2 shows a County of Hawai‘i TMK map (i.e., “plat” map) of the subject site. The term “subject site” refers only to the well pad and a 2000-foot radius from it while subject property designated TMK (3rd) 7-4-002:008, and does not refer to surrounding or adjacent areas.

2.2 Site and Vicinity Characteristics

The subject site is located about 4.0 miles northeast of Downtown Kailua near the Mamalahoa Highway (SR190). The surroundings are primarily used for residential purposes, with some ranching at higher elevations. Privately-owned parcels of the Kaloko residential subdivision are located to the north of the subject property beginning at approximately 600 feet north of the well site. Several other parcels exist within the subject site parcel and contain several single-family residences, including parcels TMK 7-4-002:010 and 013.

Figure 2 – Subject Site TMK Map



2.3 Physical Characteristics of the Subject site

The well site is located at approximately 1700 feet above mean sea level (MSL) and the subject site is steeply sloping, varying in elevation from approximately 1380 to 1980 feet above mean sea level. The area's average high temperatures vary from approximately 70° Fahrenheit (F) in the winter to 77° F in the summer. Temperature lows average approximately 55° F in the winter and 62° F in the summer. Mean annual rainfall in the project area is about 60 inches (UH-Hilo Dept. of Geography 1998). The site is partially forested, primarily with ohi'a (*Metrosideros polymorpha*).

Geologically, the subject site is located on the lower flank of Hualalai, and the surface consists of lava flows of the Ka'u Basalt series of age 750 to 1,500 years old (Wolfe and Morris 1996). Bauer (2003) notes that because Hualalai and Mauna Loa are contemporaneous there may be interbedding of lava flows from each.

The site's soil is classified by the National Resource Conservation Service (formerly Soil Conservation Service) as Kona extremely rocky muck with 6 to 20% slopes (rKYD), a soil found at intermediate elevations on Mauna Loa and Hualalai (US SCS 1973). This is an organic soil of about 5 inches thickness overlying pahoehoe bedrock. Its permeability is rapid, runoff is medium, and the erosion hazard is slight. Kona series soils are mostly used for pasture and watershed with small areas used for coffee and macadamia nuts. A triangularly-shaped portion of the subject site is surfaced by Papai extremely stony muck with 3 to 25% slopes (rPAE). This soil is about 8 inches thick and is underlain by ʻaʻa lava flows. Permeability for this soil is rapid, runoff is slow, and erosion hazard slight.

The entire Big Island is subject to geologic hazards, especially lava flows and earthquakes. Volcanic hazard as assessed by the United States Geological Survey in this area of North Kona is 4 on a scale of ascending risk 9 to 1 (Heliker 1990). The high hazard risk is based on the fact that Hualalai is an active volcano, having most recently erupted in 1801. Volcanic hazard zone 4 areas have had about 5% of land surface area covered by lava or ash flows since the year 1800, and less than 15% of land surface area covered in the last 750 years. All of Hualalai, including the lower flanks, is considered volcanic hazard zone 4 because Hualalai is steeply sloping with a relatively short distance from vents to the coast, compared to Mauna Loa and Kilauea, for example.

In terms of seismic risk, the entire Island of Hawaiʻi is rated Zone 4 Seismic Probability Rating (*Uniform Building Code, 1997 Edition*, Figure 16-2). Zone 4 areas are at risk from major earthquake damage, especially to structures that are poorly designed or built. The subject site does not appear to be subject to subsidence, landslides or other forms of mass wasting

There are no streams or other surface water features on the subject site or in the surrounding area; the nearest surface water features are more than five miles away. The Flood Insurance Rate Map (FIRM) for the area, 1551660707C, is unprinted, indicating that entire area on this map, including the subject site, is designated Flood Zone X, located outside of the 100- or 500-year flood plain (FEMA 2008). The project site is located above the Underground Injection Control (UIC) line, indicating that the ground water beneath the site is considered as useful for drinking water by the State of Hawaiʻi Department of Health (DOH 1999).

The subject site is located within the Hualalai Hydrologic Unit, Kaeuhou Subunit, which has an estimated sustainable yield of 38mgd (million gallons per day) and an estimated existing water use (in 2005) of 10.723mgd (CWRM 2007). Basalt lava flows such as those underlying the subject site may have very high hydraulic conductivities, ranging upwards from 500 ft/day to much greater values (Oki 1999).

Subsurface geology and hydrogeology of North and South Kona are described at length by Bauer (2003) who uses a data set of 40 wells in the area to assess relationships and trends in ground water conditions. Hualalai and Mauna Loa have produced thin-bedded permeable basaltic pahoehoe and ʻaʻa flows in most cases, with denser, relatively impermeable trachyte lava flows found at depth. Basal ground water levels in North and South Kona vary from 1.5 feet to 12.5 feet above mean sea level and are found in areas below about 1000 feet above mean sea level.

Ground water levels in higher elevation areas are found well above basal levels up to several hundred feet above mean sea level. The Honokohau DWS production well, for example, located at about 1500 feet above mean sea level, has a water level located at approximately 100 feet above mean sea level. Given the absence of subsurface data, explanations for the high ground water level observed in North and South Kona are hypothetical, and include dike complexes, buried fault systems, and buried, massive lava flows (Oki 1999). In geologies with no discontinuities in hydraulic permeability groundwater will move downward with respect to the potentiometric surface, which, according to the data provided by Bauer, would roughly imply a direction of ground water travel of west-southwest.

The site vicinity is not serviced by sewerage, according to the County of Hawaiʻi Department of Environmental Management Wastewater Division (DEM 2008).

Section 3
Records Review

3.1 State and Federal Environmental Record Sources

GKE reviewed various state and federal record sources to assess the environmental status of the subject site and surrounding area. These sources list properties with identified or possible contamination, facilities that generate hazardous waste, sites with underground storage tanks (USTs), and properties involved in state and federal enforcement actions. The following information is based on information provided by Environmental Data Resources, Inc. (EDR 2008), a computerized database service that routinely updates its databases from federal and state sources.

GKE also reviewed State of Hawai‘i Department of Health, Office of Hazard Evaluation and Emergency Response (HEER) records of the storage of hazardous substances, releases of hazardous substances to the environment, and site cleanup actions on May 1, 2008. These files had been last updated on April 4, 2008.

The database and the search radii reviewed for the property conform to ASTM Standard E 1527-05 (ASTM 2005) for Phase I ESAs and the All Appropriate Inquiries Final Rule (EPA 2005). The database search is included in Appendix B.

The findings of the records search are summarized in Table 1, which includes the search radius for each particular database (see Appendix A for descriptions of each database).

The subject site was not identified on any of the databases searched. Nor were any adjacent or nearby sites identified on any of the databases searched.

Table 1. Findings of Records Search

Search Type	Distance Searched	Findings
Federal NPL Site List	1.0 mile	None
Proposed NPL Site List	1.0 mile	None
Delisted NPL Site List	1.0 mile	None
Federal RCRA CORRACTS Facilities List	1.0 mile	None
State-Equivalent CERCLIS (SHWS)	1.0 mile	None
Federal CERCLIS List	0.5 mile	None
Federal RCRA Non-CORRACTS TSD Facilities List	0.5 mile	None
Federal CERCLIS NFRAP List	0.5 mile	None
Federal/State institutional control/engineering control registries	0.5 mile	None
Federal/State/County Brownfield Lists	0.5 mile	None
State Landfill and/or Solid Waste Disposal Site List	0.5 mile	None
State Leaking Storage Tank List	0.5 mile	None
State Voluntary Cleanup Sites	0.5 mile	None
Federal RCRA Generators List	0.25 mile	None
State Registered Storage Tank List	0.25 mile	None
Federal ERNS List	Subject site	None
State HEER Spill List	Subject Site	None

The EDR database review also identified certain records called "orphans" in the vicinity of the subject site that could not be plotted on the overview map due to the lack of address information. The characteristics of those orphans that may be located in the general subject site vicinity are detailed in Table 2 below. The orphans are unlikely to impact the subject site; those orphans that are the site of releases are located a large distance from the subject site and are not upgradient with respect to the assumed direction of ground water flow. The remainder of the orphans are listed because they are wells, the site of USTs or hazardous waste generators, and are not the site of releases.

The records review, including the HEER list search, identified no recognized environmental conditions concerning the subject site or adjacent properties.

3.2 Title, Lease and Tax Records

GKE reviewed tax records located at the County of Hawai‘i Real Tax Office in Kailua-Kona. The records date to as early as 1940 and describe the subject property as being utilized by the Greenwell family, their employees and lessees, as well as the Palani Ranch Co., Inc and the

Palani Land Trust (I & II) for residences, ranching activities, and a small acreage of intensive agriculture (i.e., coffee). The tax records revealed no indicated of use for industrial activities, including equipment maintenance. Tax records also showed that nearby properties, including those on plates 7-4-05, 7-4-05, and those in the bordering Kaloko subdivision on plats 7-3-8, 12, 24, 25, 26 & 48, as used for residential and agricultural purposes. Planning department zoning maps indicate that these areas listed above are zoned only agricultural.

The history of ownership demonstrated by the County of Hawai‘i tax records the subject site property's uses appear to be limited to agricultural (i.e., ranching and limited cultivation) and residential. The presence of industrial activities is not suggested the tax.

Examination of County of Hawai‘i Real Tax Department Records revealed no recognized environmental conditions with respect to the subject site or adjacent properties.

Environmental Lien Search

GKE contracted EDR to perform a search for environmental liens on the subject site property. No records of environmental liens, or activity and use limitations (AULs), for the subject site were found. The summary pages of this environmental lien search is attached as Appendix C.

3.3 Aerial Photographs

GKE viewed aerial photographs provided by R.M. Towill Corp. of Honolulu and by EDR. A summary of land use information taken from these aerial photographs is shown in Table 2.

Table 2. Aerial Photograph Summary

DATE	MAP ID NO.	COMMENT
8/20/1950	378-9	State Roads 180, 190 and Palani Road have approximately present-day routes. Access road into site and old government road visible. Subject site property is partially grazed. Seven structures visible, all probable single-family dwellings, on subject site property near SR 190.
9/23/1972	5790-11	Major roadways largely in existing configuration. Many (approx. 12) single-family dwellings visible on subject site property, all but one located near SR 190. One structure is a water tank. Majority of subject site property appears to be grazed with scattered trees.
11/19/1972	5836-9	Site features note noticeably different from above.
11/19/1972	5836-10	Site features note noticeably different from above. Image center is of mauka portion of subject site property, which contains no structures. Kaloko Dr. and Hao St. are visible to north of site.
11/19/1972	5836-11	Site features note noticeably different from above.

Table 2. Aerial Photograph Summary

DATE	MAP ID NO.	COMMENT
8/11/1973	5959-20	Site features note noticeably different from above. Twelve structures visible on subject site property including one water tank and residences.

3.4 Fire Insurance Maps

A search for fire insurance maps was performed by EDR but none were available for the subject site or adjacent properties.

3.5 City Directories

A city directory search of Polk's City Directory was performed by EDR and returned results for nearby properties for the years 1997, 2003 and 2008, although the subject site was not listed in any of these directories. No addresses past 73-4730 are listed for the directory years 2003 and 2008. In 1997 Orchard Marine Corp (74-4820 Mamalahoa Hwy.), Makua Lani Christian School (74-4979 Mamalahoa Hwy.) and Encore Talent Agency (74-4989 Mamalahoa Hwy.) are listed. The directories do not list the type business or facility that may represent a potential recognized environmental concern, nor are they located in such a way that may impact the subject site should they contain a release.

3.6 Historical Topographic Maps

7.5 minute USGS topographic maps of the Kailua Quadrangle were available from 1959, 1982, and 1996. Observations of these maps are summarized in Table 3 below. No recognized environmental conditions are indicated in these topographical maps.

Table 3. Historical Topographic Map Summary

YEAR	SERIES/SCALE	COMMENTS
1959	7.5'/1:24,000	No structures shown on interior of site. Old Government road traverses site near 1680 foot contour.
1982	7.5'/1:24,000	Two water tanks mapped in subject site, one several hundred feet south of well site. Other structures mauka of highway are located along access road and in vicinity of existing Honokohau Reservoir. Kaloko Drive and Hao Street exist with only several structures along them.
1996	7.5'/1:24,000	Several additional structures mapped in subject site, including present-day multi-structure residence located about 1000 feet south of well site. Kaloko mauka subdivision contains scores of houses, including about ten within 1000 feet of well site.

3.7 Previous Phase I Reports

No previous environmental reports were provided to GKE.

Section 4
Site Reconnaissance

4.1 Methodology and Limiting Conditions

On May 2, 2008 GKE conducted a visual survey of the subject site and adjacent properties, including a drive-by of properties bordering the subject site property in the Kaloko-Mauka subdivision. GKE thoroughly walked the interior of the subject site within 2000 feet of the well site and observed adjacent properties from the subject site and roadways. The purpose of the walk-through was to inspect the subject site, for potential environmental conditions, including, but not limited to, the following:

- Hazardous substance and waste management activities;
- Evidence of potential hazardous substance spills or releases (*e.g.*, stressed vegetation, discolored soil, etc.);
- USTs (*e.g.*, protruding fill or vent pipes);
- Disposal areas, ground water wells, and sumps;
- Equipment potentially containing polychlorinated biphenyls (PCBs); and
- Potential property or adjacent property activities that could affect the environmental condition of the subject site.

Photographs taken during the site visit are included in Appendix D.

4.2 General Site Setting and Observations

The site is generally steeply sloping and used for pasturing. It is interlaced with a large number of stone walls and is partially forested. Several four-wheel drive paths traverse the site, mostly the mauka-makai direction. Within 2000 feet of the well site there are several residences, a wooden water tank, and the Honokohau Reservoir. The Palani Ranch office and vehicle storage shed is located near the highway (SR 190) approximately 2100 feet from the well site. These features, including the locations of the nearest residences, are shown in Figure 3, Site Map.

The visual survey did not identify any of the following on the subject site not in connection with the site noted below:

- Suspect containers not in connection with property use;
- Unidentified containers;
- Electrical or mechanical equipment likely to contain PCBs;
- Drains, sumps, ponds, or lagoons;
- Chemical use or storage;
- Stained soil indicative of spills;
- Wastewater discharges;

- Ponds, or lagoons, or other pools of standing water;
- Areas containing fill soil;
- Illegally dumped household or construction waste; and
- Odors.

Vehicle Storage Area

GKE observed an area containing a number of vehicles and waste storage containers located around UTM 188404mN 2179716mE, approximately 1200 feet west-southwest of the well site and 210 feet lower in elevation. This area contained 15 apparently non-operational vehicles, 22 55-gallon drums, 2 ASTs of approximately 100- and 200-gallon capacity, about ten 1-2 gallon plastic waste containers, and chemical fertizer. Most of these drums and containers were both unlabeled and empty. The large ASTs appeared to be empty. Some of the 55-gallon drums and smaller containers were corroded, but no spillage was apparent around or from these containers. Three 55-gallon containers were labeled as containing "waste oil" (full), "foam soap" (empty), and "sodium hydroxide" (containing about 1 gallon of a clear petroleum hydrocarbon); the remainder of the drums were unlabeled. Those non-empty containers appeared to contain a dark petroleum hydrocarbon. An odor of motor oil was noted in this area. No staining of the ground surface was noted, although this was partially prevented by the vehicles and waste containers themselves.

No above-ground storage tanks (ASTs) were observed on the subject site apart from thos described above located in the vehicle storage area. No evidence of under-ground storage tanks (USTs) was observed, nor would any be expected to be located on the site. No disturbed ground indicative of excavation was observed apart from the well pad. The Palani Ranch equipment shed contains two ASTs in its fueling area, although this area is located more than 2000 feet from the well site.

Nearby Cess Pools and Septic Tanks

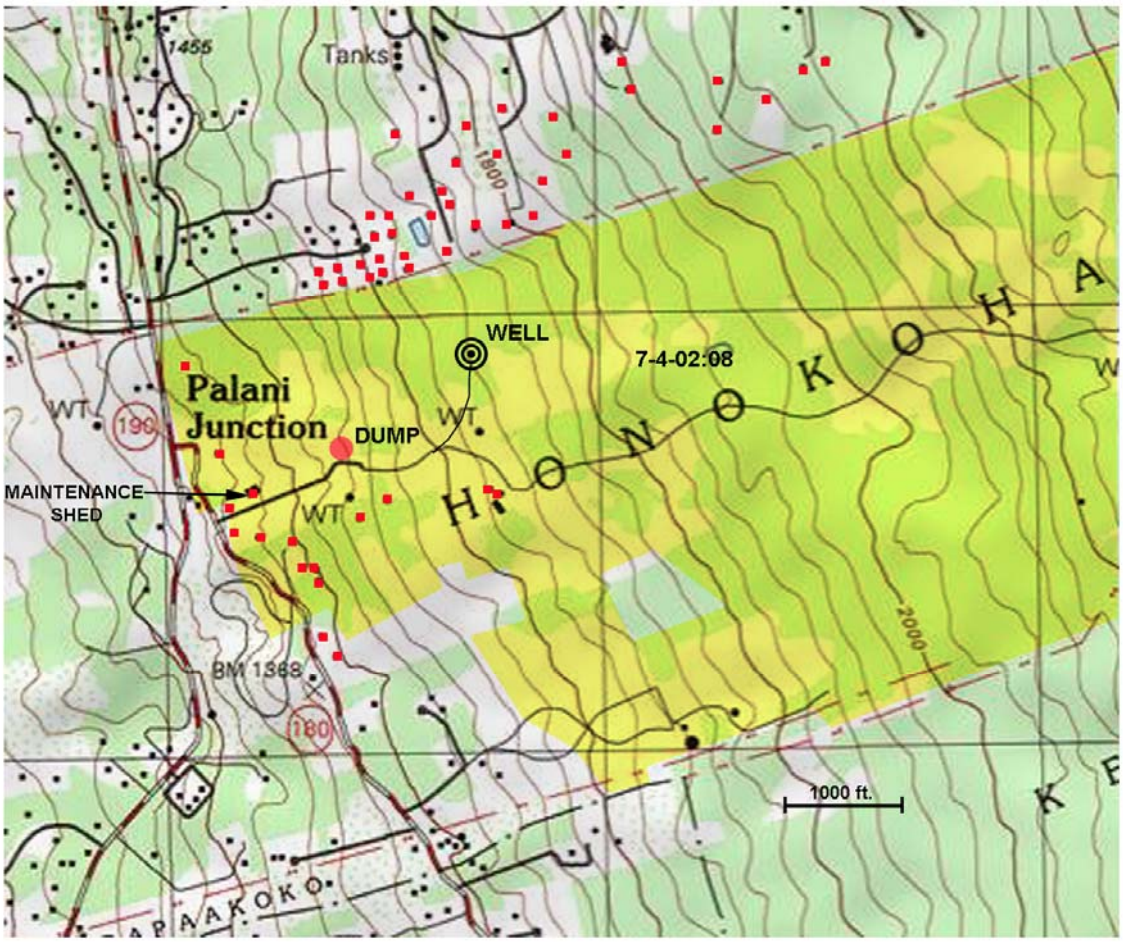
Since the site vicinity has no sewer service, we can assume that every residence has a cess pool or septic tank. There are a number of residences within 2000 feet of the well site that have cess pools and septic tanks. The locations of a number of these are shown in Figure 3. The nearest of these within the subject property is located about 1100 feet south of the well site, at approximately 1650 feet above mean sea level. There are likely no cess pools or septic tanks on the subject site property located upgradient with respect to the assumed direction of ground water flow. A large number of residences within 2000 feet of the well site are located in the Kaloko-Mauka subdivision, with the nearest of these about 600 feet North.

4.3 Adjacent Parcel Observations

GKE visually surveyed adjacent sites from the subject site and also during a drive-by survey from Kaloko Drive and Hao Streets. Adjacent properties are used primarily for residential

activities, with some limited agricultural uses (i.e., pasturing). No activities were noted that may could be reasonably expected to produce the potential for a hazardous material release.

Figure 3 – Site Map



■ - Nearby/upgradient home or structure with cess pool or septic tank
Note: Shaded area is subject site property TMK 7-4-02:08.

Section 5
Interviews

GKE interviewed property owners James Greenwell and David Greenwell in a manner consistent with the User/Owner Questionnaire suggested in Appendix X3 of ASTM E1527-05 *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process*, published on 21 November 2005 (ASTM 2005). Both interviewees were queried about environmental liens or activity and land use limitations that may be imposed on the subject site, and requested any specialized knowledge of the user/owner regarding known or suspected environmental conditions at the subject site.

Mr. James Greenwell was interviewed by telephone on May 7, 2008. Mr. Greenwell stated that there has been industrial use on the subject property, and that vehicle storage and minor maintenance is performed only at the storage shed near SR 190. Mr. Greenwell is aware of no releases of hazardous materials on the subject site. Mr. Greenwell further stated that the abandoned vehicles were cannibalized for parts and referred GKE to Mr. David Greenwell concerning the used vehicles and waste containers.

Mr. David Greenwell was interviewed by telephone on May 9, 2008. Mr. Greenwell stated that he was aware on no hazardous material releases on the subject site. Mr. Greenwell stated that the waste fluids stored at the identified abandoned vehicle site were composed entirely of waste motor oil, moved there for temporary storage "several years ago." Mr. Greenwell also stated that this motor oil was no more than six years of age and that no parts washing or use of hydraulic equipment had occurred on the site.

Both interviewees stated that they were not aware of environmental liens of activity and use limitations in place with respect to the subject property.

Section 6
Findings

This section summarizes recognized environmental conditions, data gaps that may have prevented their identifications, and GKE's opinion of impact of recognized environmental conditions on the property.

6.1 Identified Recognized Environmental Conditions

A recognized environmental condition is defined as the presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water of the property.

This Phase I Environmental Site Assessment (ESA) identified an area with a number of waste containers. Under the "Used Oil Rule" (40 CFR Part 279), used oil must be assumed to be hazardous until it can be proven that it contains less that 1000ppm of halogens, the "rebuttable presumption". Because the landowner has stated that the fluids in these containers are composed entirely of waste motor oil, it therefore can be treated as nonhazardous and does not represent a recognized environmental condition.

Apart from this area, GKE observed no evidence of the presence of above or underground storage tanks, PCBs, or other hazardous materials on the property. GKE identified no issues on adjacent or nearby properties that may constitute recognized environmental conditions.

6.2 Data Gaps

No significant data gaps were encountered during preparation of this assessment.

6.3 Impact of REC's on Property Value

No recognized environmental conditions were identified that can be expected to affect the value of the property.

Section 7
Conclusions and Recommendations

GKE has performed a Phase I ESA in conformance with the scope and limitations of ASTM Practice E 1527-05 (ASTM 2005) and the *All Appropriate Inquiries* standard (ASTM 2005) for a portion of parcel TMK (3rd) 7-4-002:008 centered on a well site (UTM 188702mN 2179933mE), located in the district of North Kona, County of Hawai‘i. This section has been developed based on the discussion of the issues provided in Section 6.

During this assessment GKE identified no evidence of recognized environmental conditions in connection with the property. GKE recommends no further investigations for the subject site at this time.

Section 8
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NOTE: For reasons of bulk, appendices not included; they are available for inspection as a pdf file by emailing rterry@hawaii.rr.com

PALANI WELL NO. 1
(STATE WELL NO. 4158-03)
NORTH KONA, ISLAND OF HAWAI‘I
STATE OF HAWAI‘I

ENVIRONMENTAL ASSESSMENT

County of Hawai‘i
Department of Water Supply

Appendix 6
Archaeological Inventory Survey

Archaeological Inventory Survey in a Portion of Upland Honokōhau, North Kona District, Hawai‘i Island

Hawai‘i Island Tax Map Key 7-4-02:08

Prepared by

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Prepared for

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INTERNATIONAL ARCHAEOLOGICAL RESEARCH INSTITUTE, INC.

AUGUST 2006

ARCHAEOLOGICAL INVENTORY SURVEY IN A PORTION OF UPLAND HONOKŌHAU, NORTH KONA DISTRICT, HAWAIʻI ISLAND

Hawaiʻi Island Tax Map Key 7-4-02:08

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August 2006

ABSTRACT

At the request of Lanihau Properties, LLC and with the cooperation of property owner Palani Ranch, Inc., International Archaeological Research Institute, Inc. (IARII) conducted an archaeological inventory survey at a portion of a property located in Honokōhau, North Kona District, Island of Hawai‘i, Tax Map Key (TMK) 7-4-02:08, between 396 and 549 m (1300 and 1800 ft) elevation. The purpose of the survey was to identify possible archaeological or historical resources in the vicinity of a planned road improvement and construction of a well and reservoir.

The survey recorded 318 surface features in 13 site areas. No subsurface cultural deposits were identified in nine formal test excavations. The vast majority of the project area consists of rocky terrain with no potential for subsurface archaeological deposits.

Most of the surface features are associated with historic ranching activities and cultivation practices, and some historic residential features are also present. One set of walls represents a remnant segment of a historic wagon road. Most of the features appear to be post-Contact in age, yet some are possibly earlier.

The current work was conducted to satisfy archaeological inventory survey requirements for the project area. All surface features were recorded in sufficient detail to document location, form, content, probable function, and estimate time period of use. No subsurface cultural deposits were identified, nor are any expected in the project area. The physical environment, cultural and historic setting, and prior archaeological work have been reviewed to provide a context for the current findings.

The 13 site areas (Sites 50-10-27-24947 through -24959) retain their integrity of place, design, and association as archaeological ruins, and they have yielded important information about archaeology and history of land use in the project area. However, they are unlikely to yield additional information beyond what has been recorded in the present report. No further archaeological work is recommended in the project area.

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INTRODUCTION

At the request of Lanihau Properties, LLC and with the cooperation of landowner Palani Ranch, Inc., International Archaeological Research Institute, Inc. (IARII) conducted an archaeological inventory survey at a portion of a property located in Honokōhau, North Kona District, Island of Hawai‘i, Tax Map Key (TMK) 7-4-02:08 (Fig. 1). The purpose of the survey was to identify possible archaeological or historical resources in an area of a planned road improvement and well construction.

On 5 January and 1 and 2 May 2006, the survey recorded 13 site areas, comprised of 148 walls or alignments, 157 mounds, 12 mounded platforms, and one concrete pad. Limited testing revealed little or no potential for subsurface cultural deposits.

Most of the surface features appear to relate to historic ranching activities and to cultivation practices. Many of these features probably post-date AD 1880 but pre-date AD 1950, and some are possibly earlier. The lack of formal excavation precluded radiocarbon dating.

Mike T. Carson, Ph.D. was the project director, and Timothy M. Rieth, B.A. was field assistant. J. Stephen Athens, Ph.D. was the principal investigator for the project. H. David Tuggle, Ph.D. provided important information about the general area.

No archaeological materials were collected during this project, and curation concerns are not relevant. All field records are in digital form with the global positioning system (GPS) data collection or as digital photographs, and this information is archived in IARII project records.

This report presents the research procedures, project context, survey findings, and conclusions to satisfy an archaeological inventory survey for the Hawai‘i State Historic Preservation Division (SHPD). No additional archaeological work is recommended in the project area.

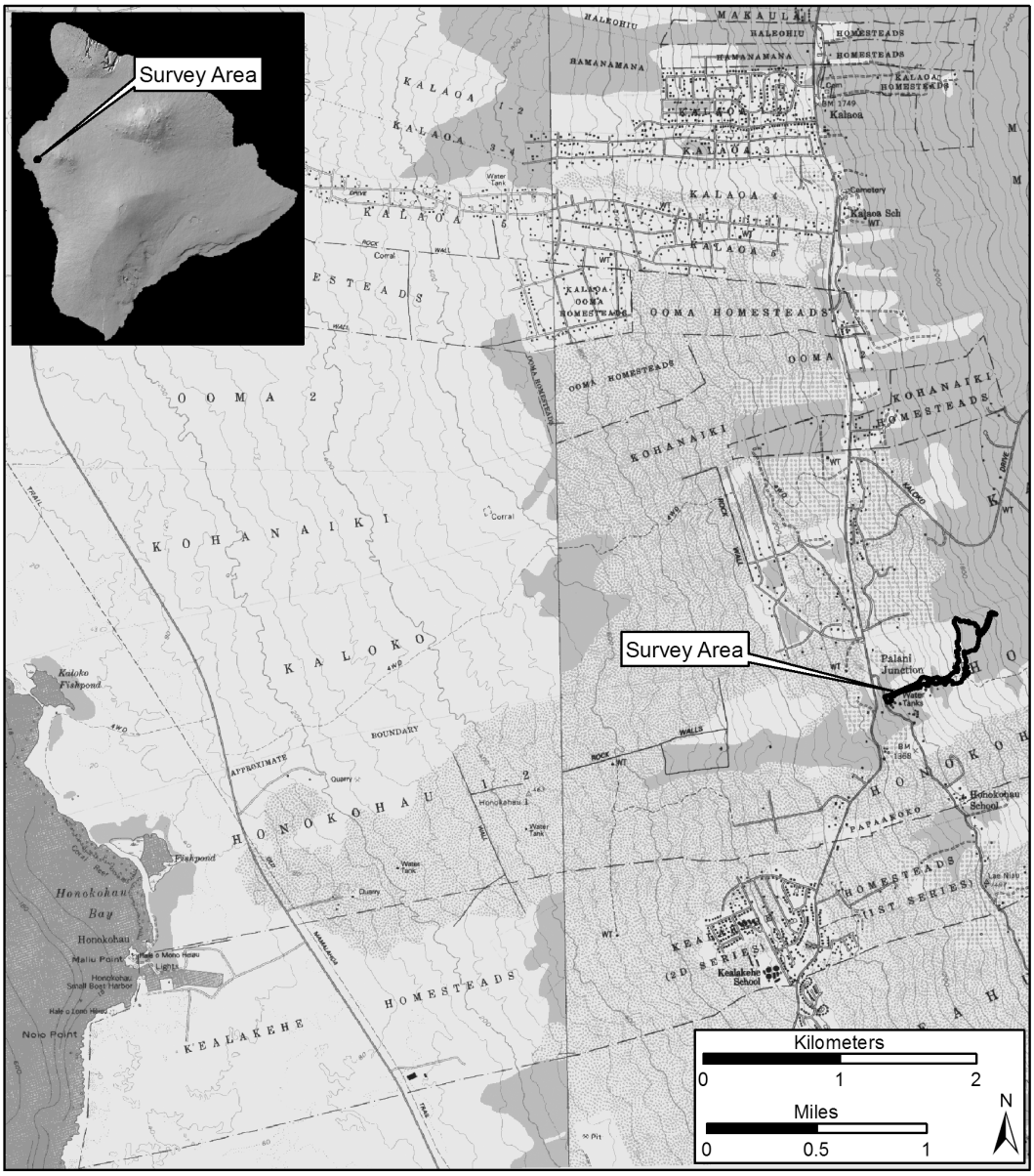

Figure 1. Location of project area. Shown on portions of U.S. Geological Survey (USGS) 7.5-minute series maps for Keahole Point and Kailua quandrangles.

RESEARCH PROCEDURES

The survey boundary was based on a three-meter corridor on either side of the existing road and tentative survey stakes in the project area, and the survey boundary was expanded at points where the existing road may be widened or diverted. The northeast portion of the survey area was enlarged to accommodate new potential engineering plans.

On 5 January and 1 and 2 May 2006, the survey area was examined by pedestrian survey at five-meter intervals for surface remains, mainly including stonework ruins but also accounting for any other artificial features. All feature locations and boundaries were recorded with a survey-grade Trimble Pro-XR global positioning system (GPS) with real-time differential correction for sub-meter accuracy. Feature dimensions, plan and section shapes, building materials, and other salient characteristics were recorded in the field. Digital photographs were taken of selected features.

Limited probing throughout the project area disclosed very rocky clay loam and loamy silt no more than 10 cm thick over basalt bedrock. Basalt bedrock exposures are in many locations. Subsurface cultural deposits were not encountered, and they are considered highly unlikely in the project area.

Nine formal excavations (TU-1 through -9) tested the interior of selected stonework features for the possibility of burial remains or preserved cultural deposits. These excavations involved dismantling dry-stacked stones and removing any sediment. The only material other than stonework and very thin loamy silt was a lone concentration of probable goat bones. These bones were examined and photographed in the field, and they were returned to their original context. All stonework features were re-constructed as nearly as possible to their original condition.

The mapping data were incorporated in a single geographic information system (GIS), using Universal Transverse Mercator (UTM) Zone 4 North with the North American Datum (NAD) of 1983. This information is consistent with the data in the Hawai‘i Statewide GIS, and it can be re-projected into other systems with appropriate re-projection protocol.

PROJECT CONTEXT

The project context is presented in terms of the physical setting, cultural and historic setting, and archaeological setting as relevant to the current work. This review suggests that the project area supported mixed cultivation of tree and root crops prehistorically and historically. Archaeological sites throughout Honokōhau have yielded evidence of land use mostly post-dating 1600, although some dates are potentially as early as the1400s. Cattle ranching became prevalent in the 1880s.

PHYSICAL SETTING

The project area is situated 5.5 to 6.4 km (3.4 to 4 miles) from the coast, between 396 and 549 m (1300 and 1800 ft) above sea level (see Fig. 1). The setting includes rocky ground, no permanent streams, a largely predictable rainfall pattern, and healthy plant growth.

The sloping landform is part of Hualālai Volcano, formed within the last 10,000 years (Rubin et al. 1987:214). The most recent eruption was in 1801. The lava flow in the project area may date within the range of 2120 to 1880 BC, based on a sample (W4376) collected beneath the lava flow about 500 m southwest of the project area (Rubin et al. 1987:217, 241).

The terrain is very rocky, and outcrop exposures are common. The general soil type is described as "Puna extremely stony muck," generally 5 to 15 cm thick over fragmented lava rock (Sato et al. 1973:48).

Rainfall generally occurs in afternoons, when an orographic effect creates moisture and rain clouds at higher elevations. Rainfall events are usually light in this leeward setting, and no permanent streams are present in the area. However, occasional heavy rains can cause massive sheet wash on the slopes. Mean annual rainfall is between 1000 and 1500 mm (39 and 59 inches) (Giambelluca 1986:99).

Despite the thin or non-existent soils, plant growth is rapid on the crumbling lava rock. Historically introduced grasses, few trees, and fewer shrubs are present in the project area. At present, ground visibility is very good, due to grazing by cattle and horses. The setting appears suitable for the growth of a variety of tropical plants.

The physical setting is favorable for general habitation and cultivation, and prehistoric and historic sites are expected. Given the rocky terrain, most site remnants are probably surface ruins, and subsurface deposits are unlikely.

CULTURAL AND HISTORIC SETTING

The project area is in a portion of a wider region of crop growth, habitation, and other activities. The setting is in Honokōhau in the Kona District of Hawai'i Island. Specifically, it is in the northern portion known as Honokōhau Nui (or Honokōhau 1), whereas Honokōhau Iki (or Honokōhau 2) is adjacent to the south. Kona is one of six traditional districts of the island known at the time of European contact in 1778.

Traditional settlement and land use patterns in Kona depended largely on areas of productive land for crop growth, and some form of cultivation took place almost everywhere at the time of European contact (Kelly 1983; Newman 1970). The extensive cultivated landscape is sometimes viewed as the Kona Field System. However, usage of this term is also sometimes restricted just to the areas of formally defined walled compounds in higher elevations with ample rainfall (Allen 2001, 2004).

Local variations in rainfall and soil conditions naturally affected what types of crops were most appropriate for different areas, and the Kona District generally is regarded as having four main cultivation zones. The zones are defined primarily by rainfall, which coincides more or less with elevation, distance from the coast, and other physiographic conditions (Kelly 1983; Newman 1970; Major 2001:25-28):

1) The *kula* zone nearest the coast was mostly for growing sweet potato, in lowland areas with less than 1000 mm (39 inches) mean annual rainfall.

2) The *kalu'ulu* zone was mostly for growing breadfruit, at elevations receiving between 1000 and 1400 mm (39 and 55 inches) mean annual rainfall.

3) The *'apa'a* zone was suited for dryland taro, where mean annual rainfall ranged 1400 to 2000 mm (55 to 79 inches).

4) The *'auma'u* zone involved cultivation of banana and probably other tree crops in upland forests, with mean annual rainfall in excess of 2000 mm (79 inches).

According to the generalized scheme above, the project area is in the *kalu'ulu* zone, but the situation in Honokōhau is somewhat different than in other parts of the Kona District (Fig. 2). Honokōhau is farther north of the high-rainfall sectors of Kona, so rainfall typical of the *'apa'a* and *'auma'u* zones is found not inland but rather to the southwest. A portion of *'apa'a* land is at a higher elevation in Honokōhau than it is elsewhere, and the *'auma'u* zone is absent.

Given the localized ecological composition in Honokōhau, the *kula* and *kalu'ulu* zones likely were used slightly differently than in other parts of Kona. In particular, the most favorable taro-growing lands are in short supply, and lowland sweet potato cultivation may have been more intensive. Tuggle (2006:12) notes that formalized walled agricultural fields are above 550 ft elevation, with a notable agricultural temple at 700 ft. Specifically for the project area at 1300 to

1680 ft above sea level, limited taro cultivation may have occurred among breadfruit plantings in the *kalu'ulu* zone.

In the middle to late 1800s, government land records indicate active use of Honokōhau for family residences and farming, mostly in elevations around and above the project area (Maly 2000). These records mention breadfruit and other trees. Subsistence crop growth is implied as the primary support of family compounds.

Table 1 lists the royal patents, land grants, and land commission awards for all of Honokōhau Nui and Honokōhau Iki, very little of which pertains to the project area. In the first and major partitioning of land in the middle 1800s, Honokōhau Nui (subsuming the project area) was given to high chiefess Miriam (or Mikahela) Kekauonohi as part of larger prizes. A few smaller family holdings were recognized later as Land Commission Awards, but none are within the project area. The closest of these are shown in Figure 3. In 1876, H. N. Greenwell acquired Honokōhau Nui (Maly 2000:79). The project area is part of Land Grant 8087 given to Frank R. Greenwell.

The project area has been used primarily for family residences, raising cattle and horses, and variable intensity of subsistence crop growth since the 1880s. A former wagon road (part of Site -24959) is around 1650 ft elevation. The wagon road was built some time in the late 1800s, and it was abandoned in favor of the more accommodating paved road in the early 1900s.

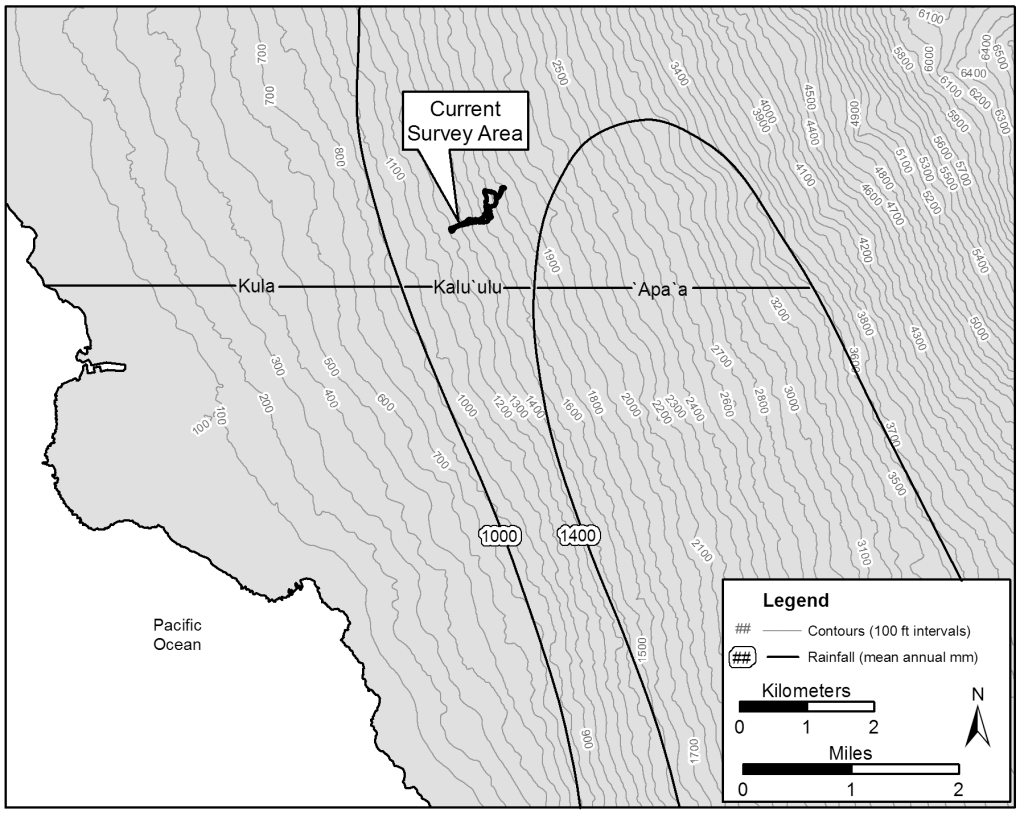

Figure 2. Project area in relation to major ecological zones.

Table 1. List of Royal Patent, Land Grant, and Land Commission Award records for Honokōhau. Data compiled from Waihona ‘Aina (2006).

Record Number	Claimant
Royal Patent	
3743	Ahu
4896	Nahina
5049	Kanae
5230	Kamohai
5231	Kekipi
5236	Apuni
5247	Polapola, Solomona
6855	Leliohoku, William Pitt
7587*	Kekauonohi, Mikahela
7766	Kukona
7785	Puhihale
Land Grant	
3022 (portion in Honokōhau)	Kalua
3456 (portion in Honokōhau)	McDougall, George
8087*	Greenwell, Frank R.
Land Commission Award	
06026 (portion in Honokōhau)	Lanai, Ikaaka
07396	Kekipi
07490	Polapola, Solomona
07870	Kamohai
07890	Kukona
08218	Ikiiki
08559 (portion in Honokōhau)	Lunalilo, William C.
09236	Kahaulewahine
09771 (portion in Honokōhau)	Leleiohoku, William P.
10319	Nahina
10521B	Puhihale
10762	Ahu
11064	Apuni
11216* (portion in Honokōhau)	Kekauonohi, Mikahela

* indicates land parcel pertaining to project area

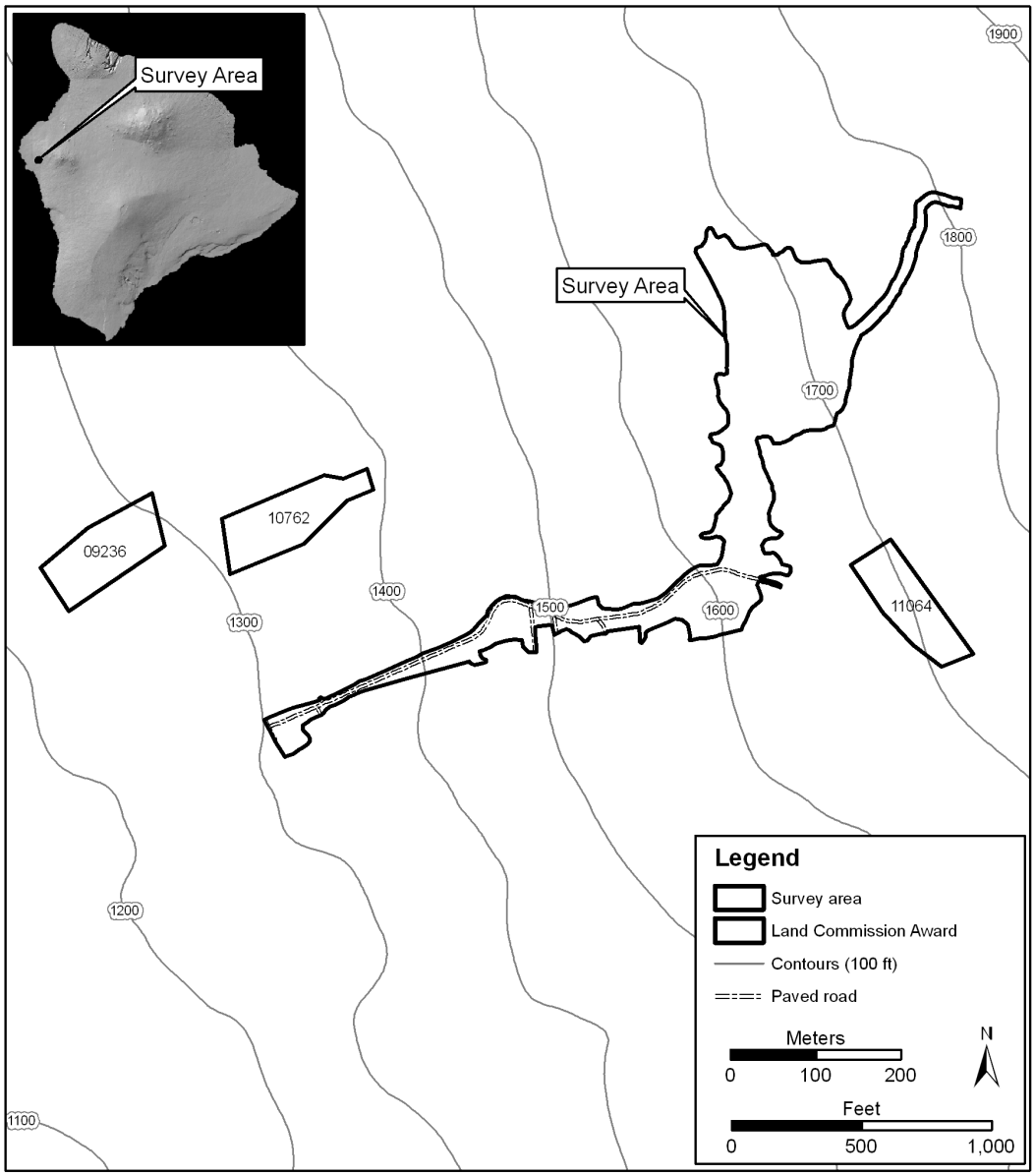

Figure 3. Project area in relation to nearest Land Commission Award parcels.

ARCHAEOLOGICAL SETTING

The present work is the first formal archaeological survey in the project area, but several prior investigations have occurred in other parts of Honokōhau (Fig. 4, Table 2). The prior work indicates mostly ruins of stonework features on the surface, and subsurface deposits are rare. Cave complexes are known in elevations lower than the project area. Earliest occupation is potentially around AD 1000 to 1200, but it is definite only after 1400 and most intense after 1600 (Tuggle 2006:10-11, 192-193, 253-256).

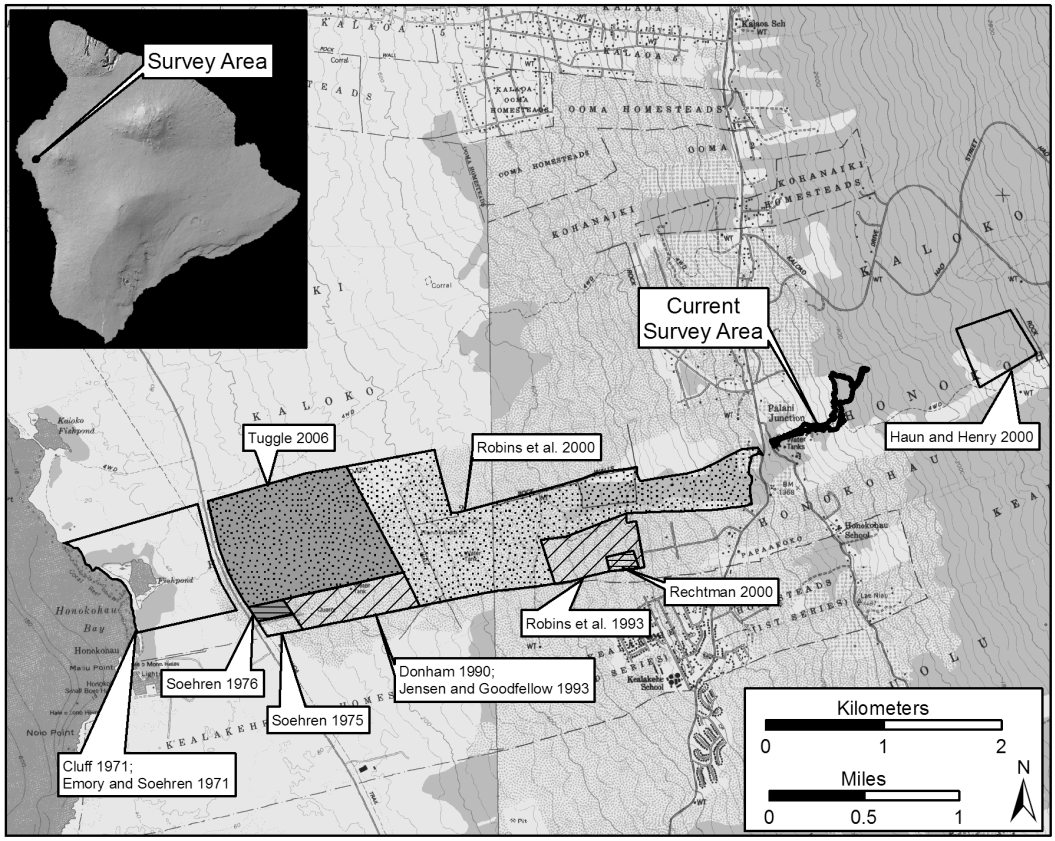

Figure 4. Prior archaeological survey areas in Honokōhau.

Table 2. Summary of prior archaeological investigations in Honokōhau.

Reference	Type of Investigation
Cluff 1971	Surface survey
Donham 1990	Inventory survey
Emory and Soehren 1971	Surface survey
Haun and Henry 2000	Inventory survey
Jensen and Goodfellow 1993	Data recovery
Rechtman 2000	Data recovery
Robins et al. 1993	Inventory survey
Robins et al. 2000	Inventory survey
Soehren 1975	Reconnaissance survey
Soehren 1976	Reconnaissance survey
Tuggle 2006	Data recovery

Documented prehistoric sites in Honokōhau were used for dryland agriculture, temporary camping, long-term residence, religious proceedings, burial interments, and other functions. Dryland agricultural sites typically include mounds and some walled parcels in lower elevations, whereas more formalized walled areas contain mounds and terraces above 550 ft elevation. Temporary campsites typically are scattered, isolated terraces, enclosures, or small caves or rockshelters. Most long-term residential sites consist of aggregated terraces and other features, sometimes in walled compounds. Religious sites usually are large terraces and platforms, and oral traditions often are associated with them. Burial interments are known in certain caves, but some could be inside platforms or other features. Caves also were used for temporary shelter, sometimes for workshops, occasionally for refuge, and at times for various other purposes.

Historic sites in Honokōhau include numerous cattle walls, but residential and cultivation areas are also present. The land use history in the project area suggests the presence of a number of sites of the cattle ranching era. Historic residential sites are often bounded by walls. Early historic cultivation areas include much the same arrangement of mounds, terraces, and walls of the prehistoric era.

An apparent expansion and intensification of land use after 1400 is consistent with an archipelago-wide pattern (Athens et al. 1991; Carson 2005, 2006; Cordy 2004:10; Dixon et al. 1999; Hommon 1976, 1986; Kirch 1990; McCoy 2005). Oral traditions suggest the 1400s for the rise of Kona as a political center, associated with powerful district-level or island-level chiefs (Cordy 2000:188, 216-218). These circumstances likely generated greater demand for agricultural production and other resources.

Prior to the 1400s, the Kona District as a whole was inhabited probably on a small scale. Few archaeological sites date within the range of 1200 to 1400, and they appear to pre-date formalization of complex agricultural systems (Allen 2001, 2004). A critical review of radiocarbon dates rejected all early dates from Kona (Spriggs and Anderson 1993), but more

recent work has contributed new evidence. The earliest confirmed date in Kona provided a 2 Sigma (95.4% confidence) calibrated range of AD 890 to 1160 for a firepit at a probable ceremonial or high-status site in Puapuaʻa Ahupuaʻa (Carson 1999:98).

Archaeological evidence of land use in Honokōhau appears to post-date AD 1400, but limited use occurred possibly as early as AD 1000 to 1200. Virtually all radiocarbon dates from Honokōhau sites are later than 1400 (Tuggle 2006:10-11, 192-193, 253-256), but one date has an error range of AD 980 to 1650 (Beta-34927, reported by Donham 1990). A few dates from nearby areas in Kohana Iki Ahupuaʻa are possibly early, but their error ranges include approximately four centuries from AD 1000 to 1400 (O'Hare and Goodfellow 1992). Other dates from neighboring Kaloko Ahupuaʻa suggest earliest settlement approximately AD 1000 to 1200 (Cordy et al. 1991).

SURVEY FINDINGS

The survey recorded 13 site areas (Fig. 5), comprised of 148 walls or alignments, 157 mounds, 12 mounded platforms, and one concrete pad (Table 3). Limited testing revealed little or no potential for subsurface cultural deposits.

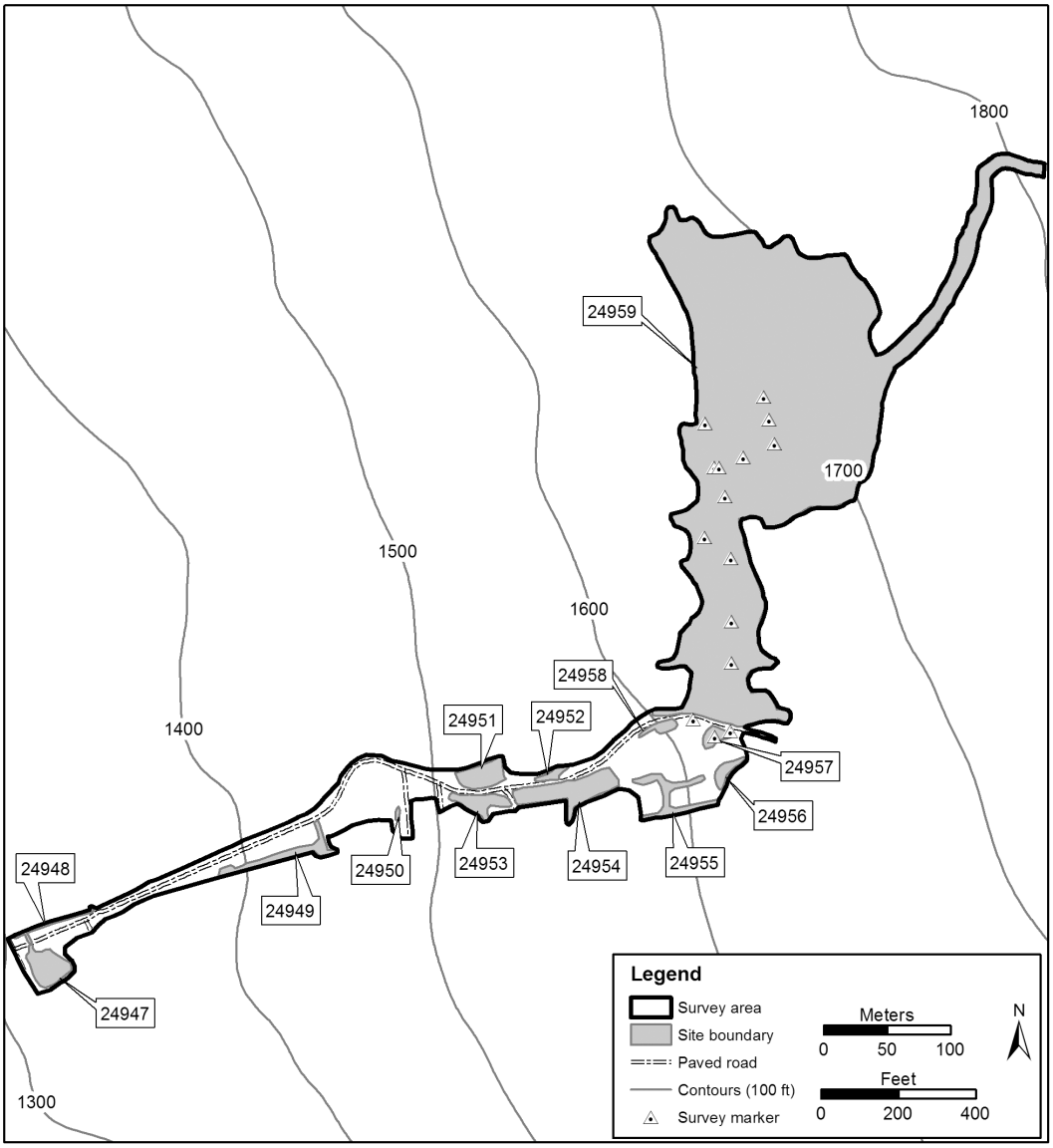

Figure 5. Location and boundaries of site areas.

Table 3. Summary of surface features.

Site 50-10-27-	Component Surface Features
24947	1 concrete pad, 5 walls or alignments
24948	2 walls or alignments
24949	3 walls or alignments
24950	1 wall or alignment
24951	5 walls or alignments, 6 mounds
24952	2 walls or alignments, 3 mounds
24953	7 walls or alignments, 1 mound
24954	5 walls or alignments
24955	3 walls or alignments
24956	5 mounds
24957	2 walls or alignments
24958	2 walls or alignments, 1 mound
24959	112 walls or alignments, 141 mounds, 12 mounded platforms

The 148 walls or alignments are of dry-stacked stone masonry, of variable dimensions and construction. Most lengths range 8 to 30 m, but many are shorter or longer. Width ranges 0.4 to 1.1 m for intact walls with recognizable multi-stacked or core-filled components, but most widths vary 0.2 to 1.4 m due to considerable disturbance and erosion. Heights range 0.2 to 1.1 m for intact walls and 0.2 to 0.6 m for disturbed remnants.

The 157 stone mounds are mostly oval in plan view, but some are irregular. Mounds are defined by their mounded section views, lacking defined vertical or nearly vertical edges. Dimensions vary 0.9 to 4 m in height, 0.5 to 3.5 m in width, and 0.2 to 0.8 m in height.

The 12 mounded platforms were identified only in Site -24959. They are oval but approaching roughly rectangular in plan view. In section view, they display nearly vertical edges near the base, but the upper portions are mounded. The perimeter edge stones are moderately to well fitted, but the internal fill stones and mounded top stones are loosely fitted.

A single concrete pad in Site -24947 measures 5.1 by 4.1 m in maximum plan view dimensions and a maximum 5 cm high. According to Mr. James Greenwell (present property owner and descendant of prior property owners since 1876), this concrete pad is situated in an area that was once a slaughter house in the early to middle 20th century.

The surface features are associated with historic ranching activities and cultivation practices. The ranching features are predominately walls of various forms, and they mostly post-date AD 1880. The cultivation features include stone mounds, walls, and alignments. Some of the cultivation features pre-date the ranching features, but many others were likely used in the historic ranching era. Some walls, alignments, terraces, and platforms are remnants of residential areas, associated with either ranching or cultivation activities.

Limited subsurface testing, informal probing of the rocky ground, and general surface observations revealed little or no possibly for subsurface archaeological deposits. Nearly the entire the project area terrain includes either exposed basalt outcrop or very thin (10 cm or less) rocky sediment over basalt bedrock.

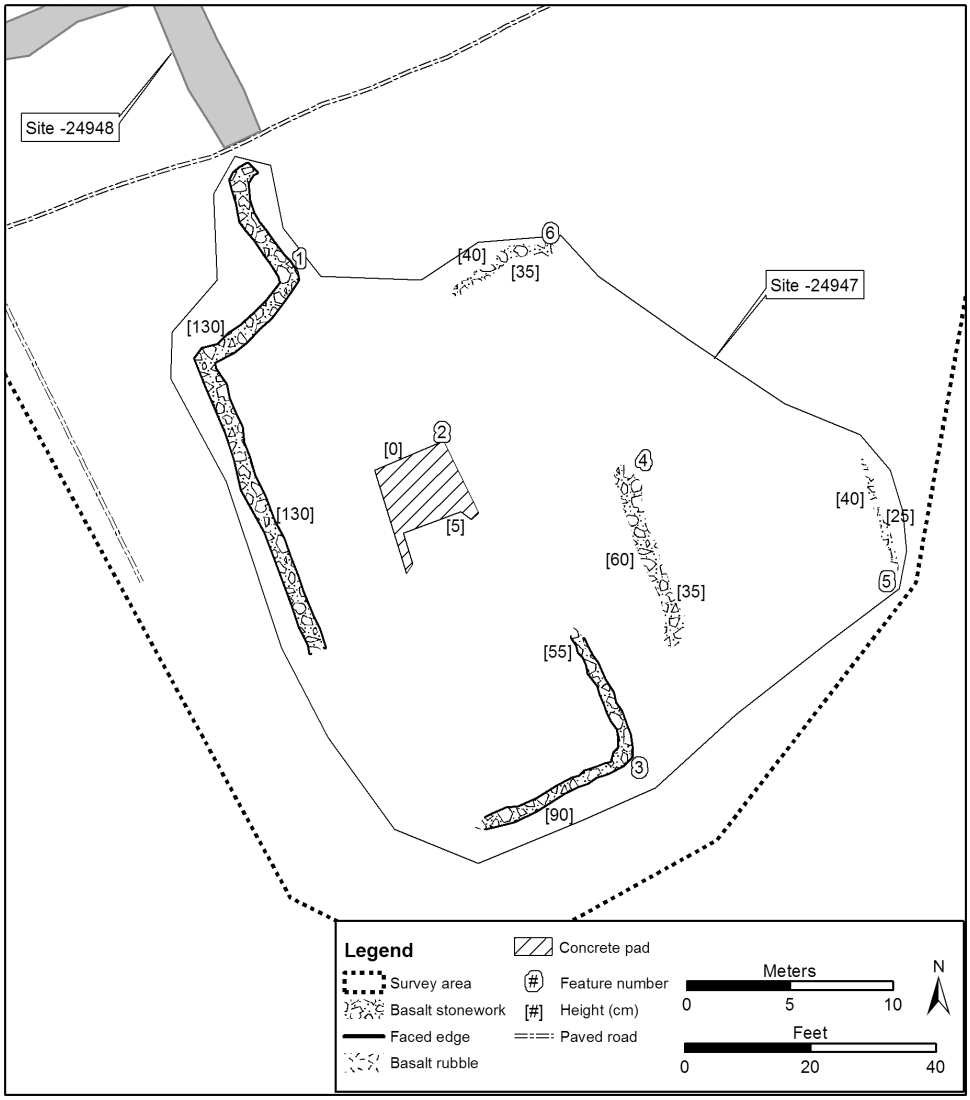

Figure 6. Map of Site 50-10-27-24947. Site location within project area is shown in Figure 5.

SITE 50-10-21-24947

Site -24947 includes five stone walls or alignments and one concrete pad, overall in good condition and retaining integrity as structural ruins (Fig. 6). This area is associated with a former slaughter house for cattle in the early to middle 20th century, according to Mr. James Greenwell (present property owner and descendant of prior owners since 1876) in January 2006. The Feature 1 wall is made of core-filled construction, bordering the downslope (west) side of the property where it meets a paved public road. Feature 2 is a concrete pad that was probably associated with the former slaughter house. The Feature 3 wall is multi-stacked in an L-shape around part of a modern water tank. Features 4 through 6 are disturbed remnants of walls. Some rusted metal is within the Feature 4 construction.

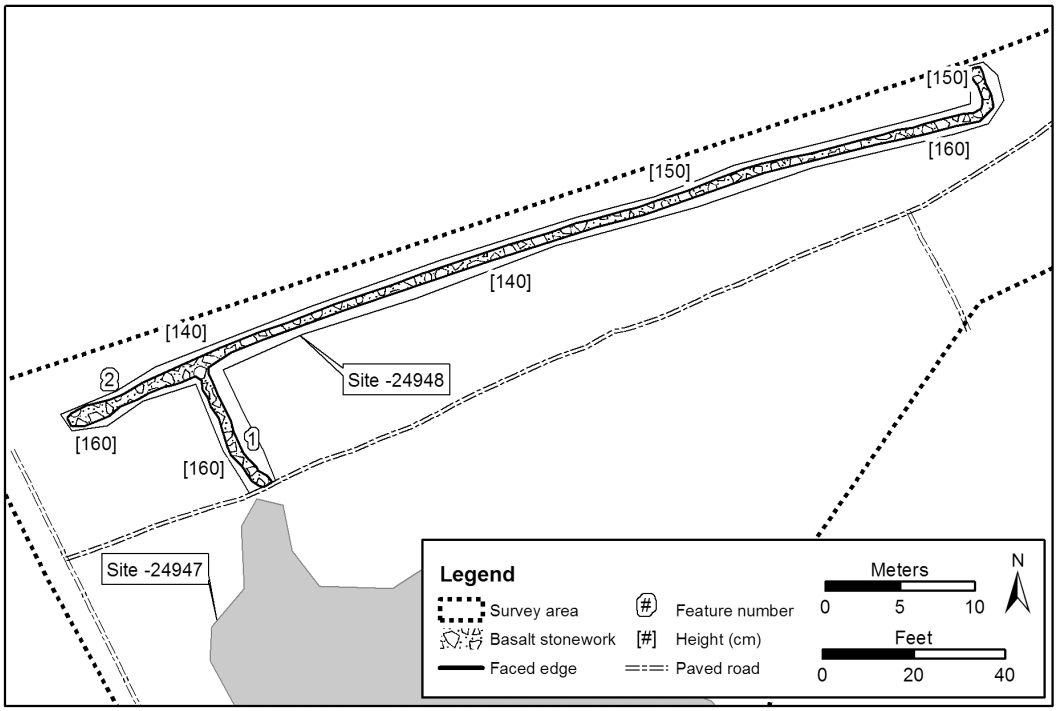

Figure 7. Map of Site 50-10-27-24948. Site location within project area is shown in Figure 5.

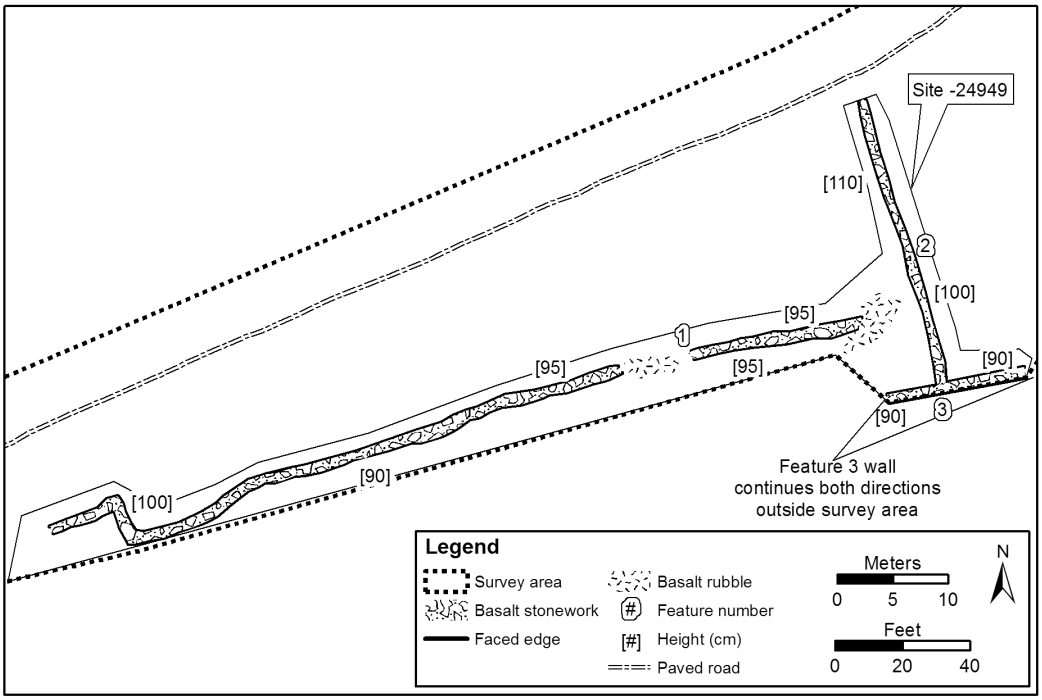

Figure 8. Map of Site 50-10-27-24949. Site location within project area is shown in Figure 5.

SITE 50-10-21-24948

Site -24948 includes two conjoined, core-filled stone walls in good condition and retaining integrity as structural ruins (Fig. 7). These walls may have related to former ranching activities in the historic and modern eras, but today they are property boundaries.

SITE 50-10-27-24949

Site Area -24949 consists of three core-filled stone walls, used formerly for cattle ranching in the historic and modern eras (Fig. 8). The features are in poor to fair condition, retaining integrity as ruins. Small sections of Feature 1 are disturbed. Features 2 and 3 are conjoined. Feature 3 continues upslope (east) and downslope (west) outside the survey area.

SITE 50-10-27-24950

Site -24950 is comprised of a single disturbed wall segment (Fig. 9). The wall varies poor to fair in condition, and it retains integrity as a structural ruin. The wall is built against the edge of a slope, so that its downslope (west) side appears taller than its upslope (east) side. The downslope (west) side is slanted. At one time, the wall may have retained a portion of the steep terrain on its upslope (east) side. The wall may have been constructed in the late historic or early modern era, possibly associated with a nearby paved road.

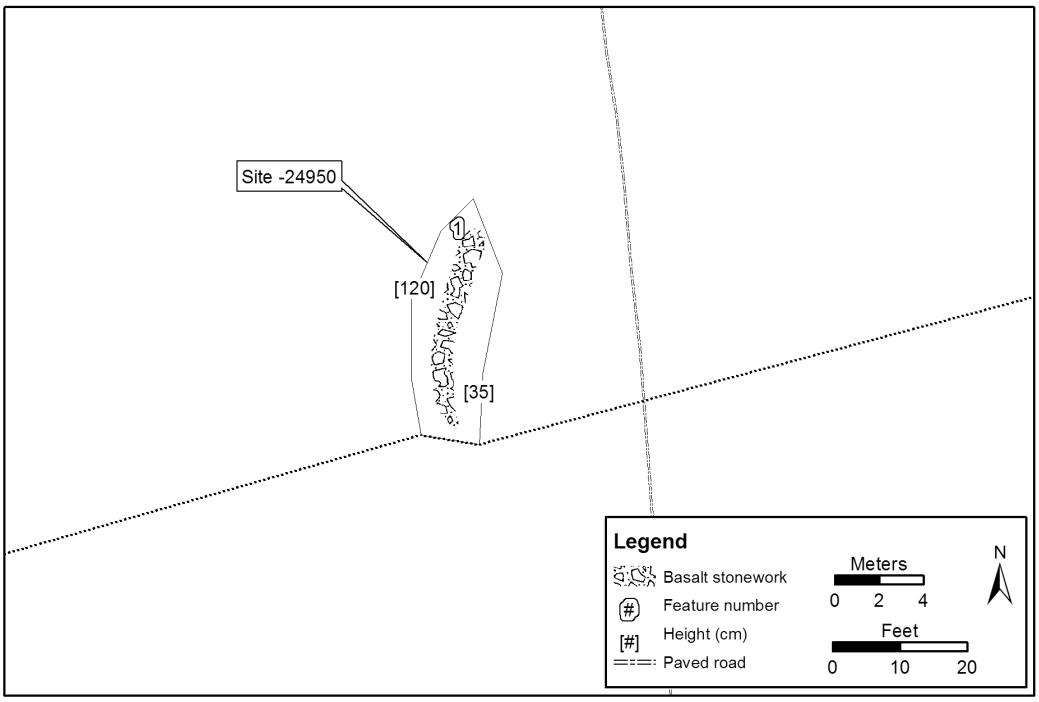

Figure 9. Map of Site 50-10-27-24950. Site location within project area is shown in Figure 5.

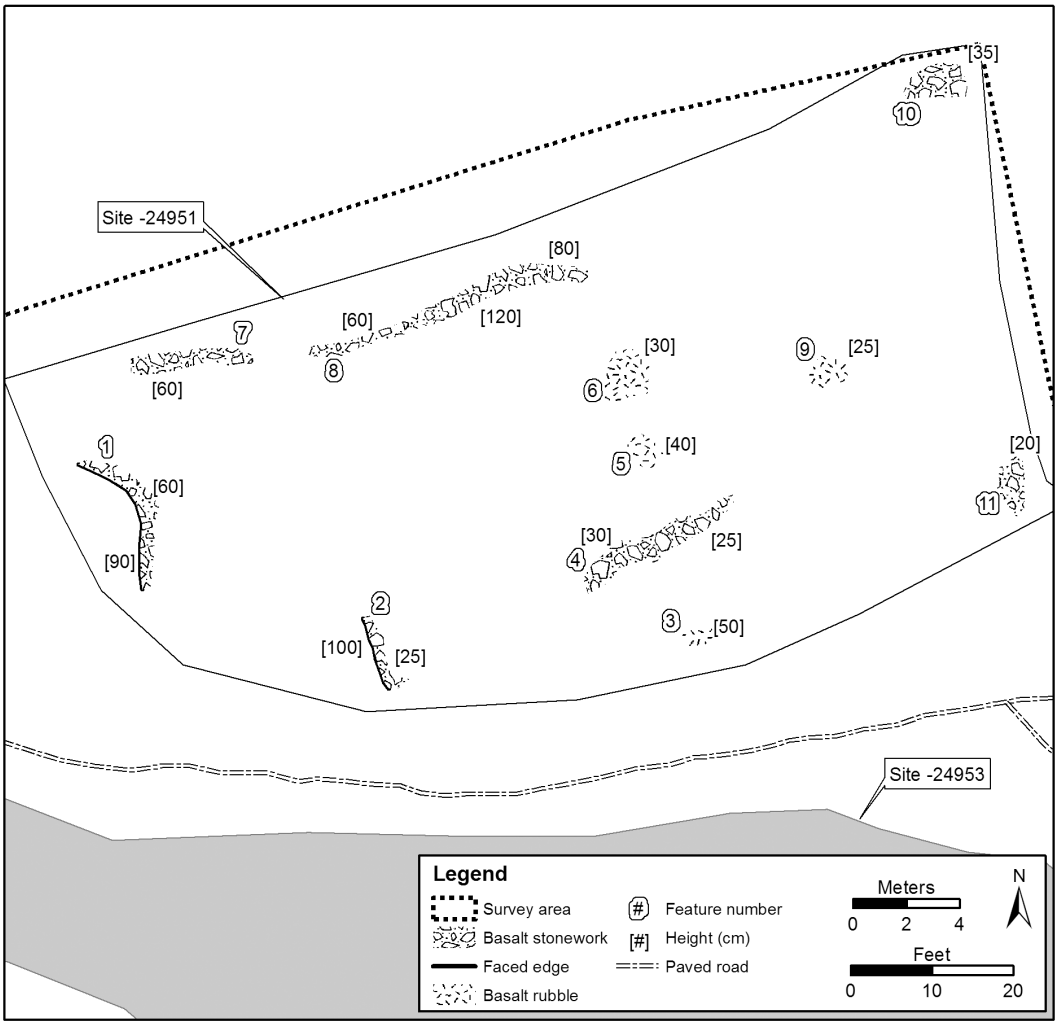

Figure 10. Map of Site 50-10-27-24951. Site location within project area is shown in Figure 5.

SITE 50-10-27-24951

Site -24951 consists of five walls or alignments and six mounds, ranging poor to fair in condition and retaining integrity as ruins (Fig. 10). The walls (Features 1, 2, 4, 7 ,and 8) may be remnants of a historic-era residential boundary, arranged around a roughly cleared and slightly sloped area. Features 1 and 2 are moderately faced walls, built against a naturally sloped edge. Features 4, 7, and 8 are disturbed walls or alignments, mounded in section view. The mounds (Features 2, 5, 6, and 9 through 11) resemble informal cultivation features. Features 3, 5, 6, and 9 are mounds of loose rubble. Features 10 and 11 are mounds of moderately fitted stones.

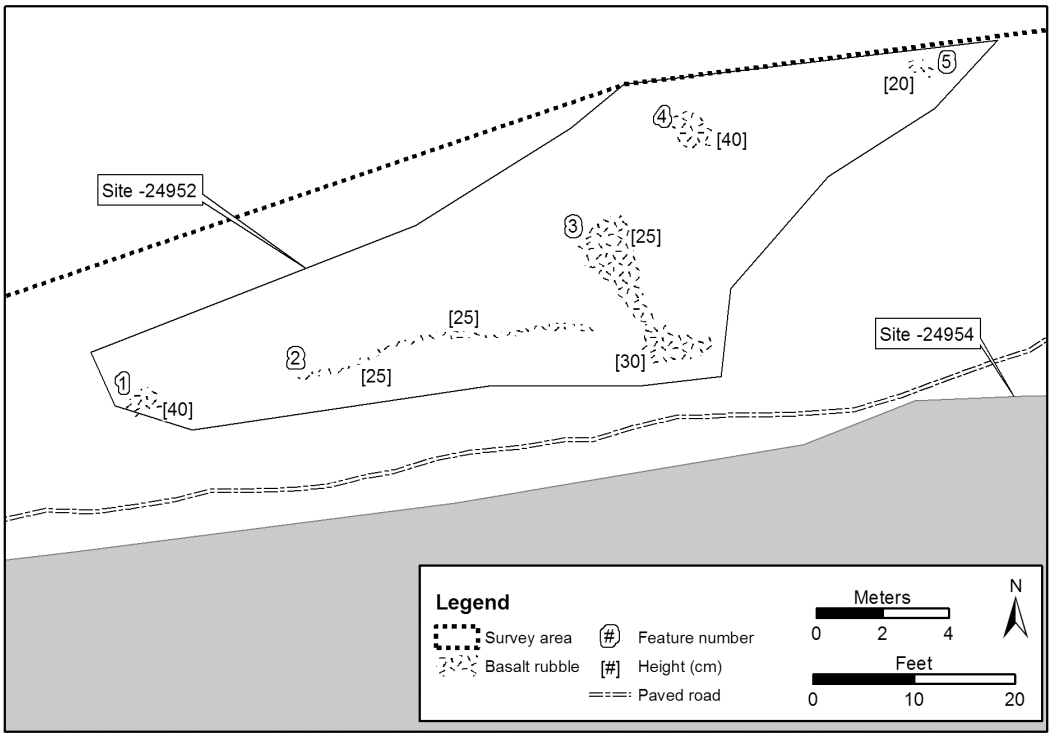

Figure 11. Map of Site 50-10-27-24952. Site location within project area is shown in Figure 5.

SITE 50-10-27-24952

Site -24952 includes two walls or alignments and three mounds (Fig. 11). The features vary poor to fair in condition, and they retain integrity as structural ruins. The walls may relate to former ranching activities in the historic era, but they may be remnants of cultivation area borders of approximately the same age. The mounds may be former cultivation features, but they also could be ruins of former walls or other structures. All features consist of loose basalt rubble, and they have been disturbed.

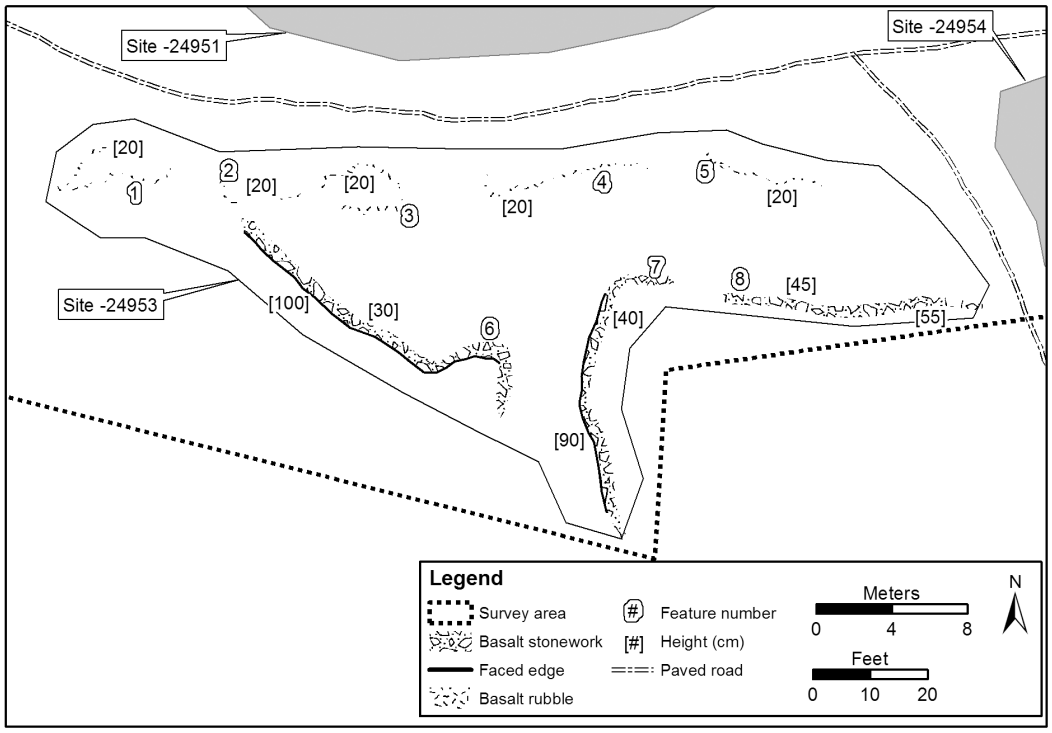

Figure 12. Map of Site 50-10-27-24953. Site location within project area is shown in Figure 5.

SITE 50-10-27-24953

Site -24953 is comprised of seven walls or alignments and one mound, varying poor to fair in condition and retaining integrity as structural ruins (Fig. 12). The single mound (Feature 2) may in fact represent the ruins of a former wall. Features 6 and 7 are built against the edge of a slope, and they likely retained small areas on their upslope (northeast and east) sides suitable for residential or other activities. The Feature 8 wall has been disturbed slightly. All other features are loose basalt rubble, and they have been disturbed intensively. Some may have related to a former residential boundary, and others they may represent ruins of cattle ranching walls in the historic era.

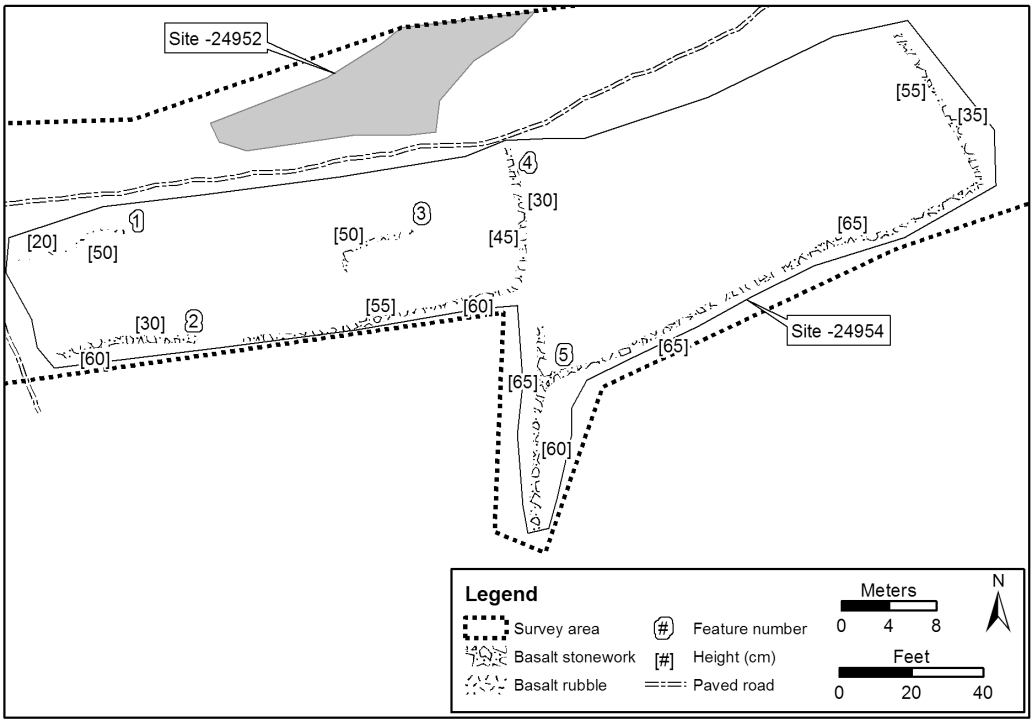

Figure 13. Map of Site 50-10-27-24954. Site location within project area is shown in Figure 5.

SITE 50-10-27-24954

Site -24954 includes five walls or alignments (Fig. 13) in an area of former historic-era ranching activities. The features range poor to fair in condition, and they retain integrity as structural ruins. Feature 1 is an alignment of loose rubble. All other features are disturbed walls, presently mounded in section view due to disturbance and erosion.

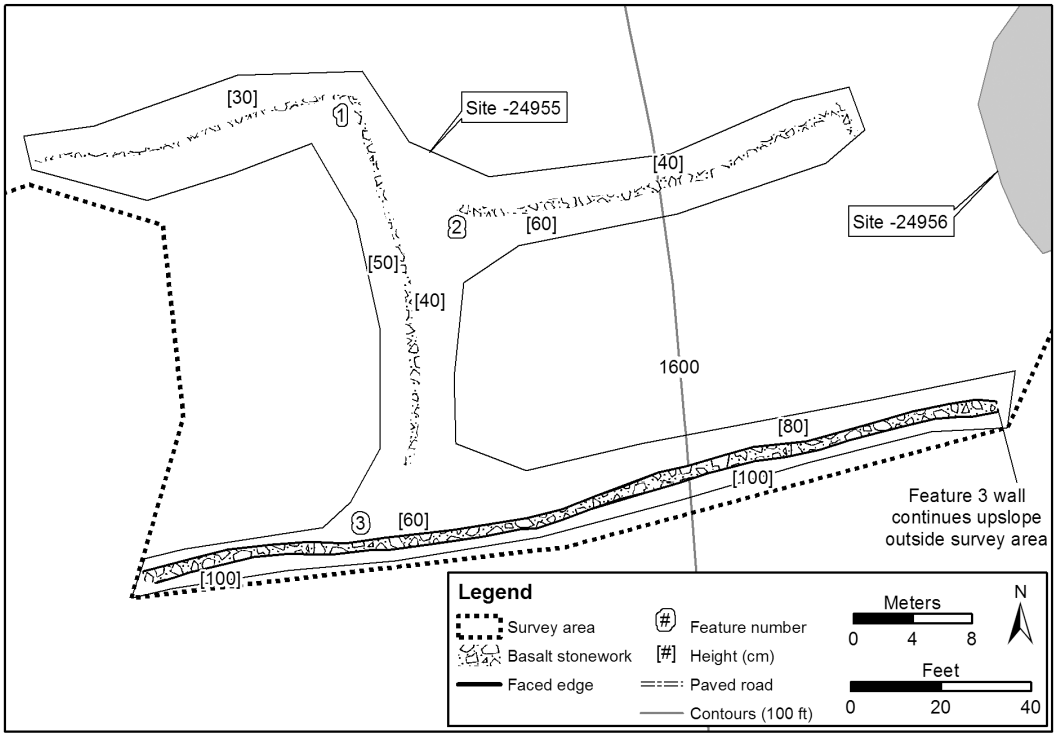

Figure 14. Map of Site 50-10-27-24955. Site location within project area is shown in Figure 5.

SITE 50-10-27-24955

Site -24955 consists of three walls (Fig. 14), used formerly for cattle ranching in the historic era. These walls vary poor to fair in condition, and they retain integrity as structural ruins. Features 1 and 2 are mounded in section view, due to disturbance and erosion. Feature 3 is an intact core-filled stone wall, and it continues upslope (east) and downslope (west) outside the survey area.

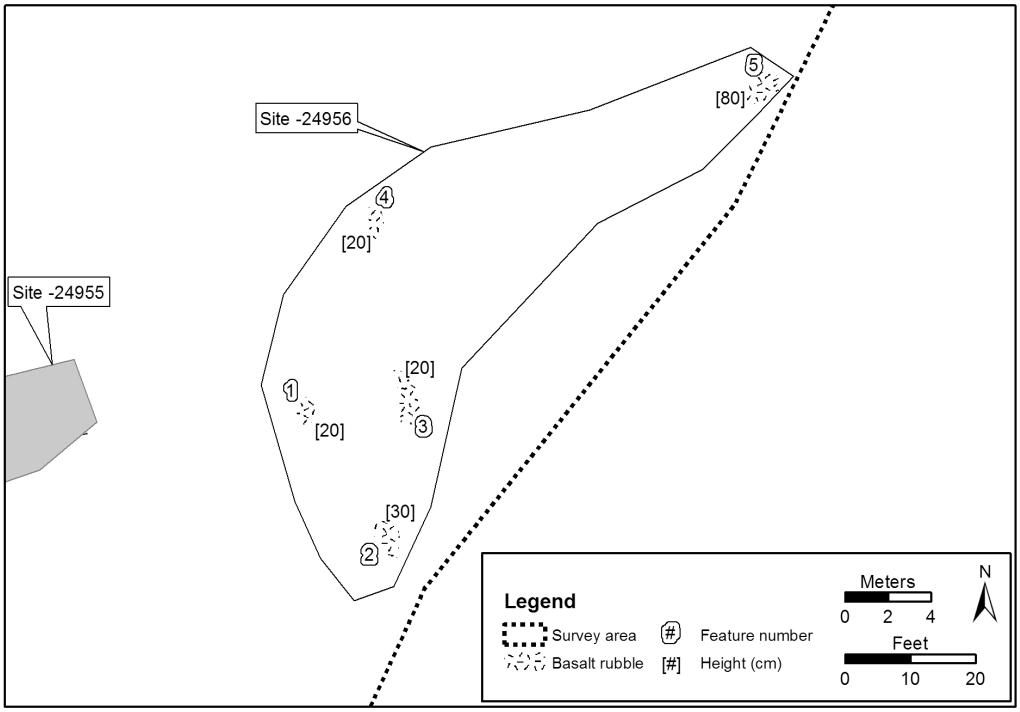

Figure 15. Map of Site 50-10-27-24956. Site location within project area is shown in Figure 5.

SITE 50-10-27-24956

Site -24956 consists of five mounds of loose basalt rubble (Fig. 15). All of these features are disturbed, ranging poor to fair in condition and retaining integrity as structural ruins. The mounds resemble remnants of cultivation features, probably of the historic era when land use was most intense in the general vicinity.

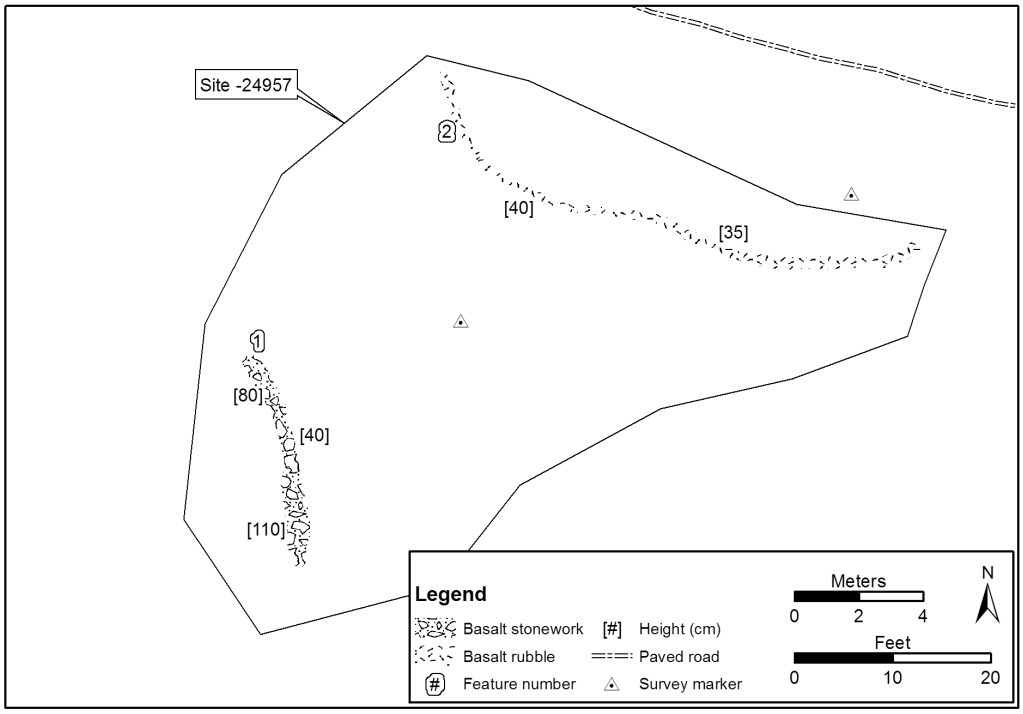

Figure 16. Map of Site 50-10-27-24957. Site location within project area is shown in Figure 5.

SITE 50-10-27-24957

Site -24957 includes one wall and one alignment, varying poor to fair in condition and retaining integrity as structural ruins (Fig. 16). The Feature 1 wall is built against the edge of a slope. The Feature 2 alignment is loose rubble. Both features may have been related to former ranching activities or to former cultivation areas in the historic era.

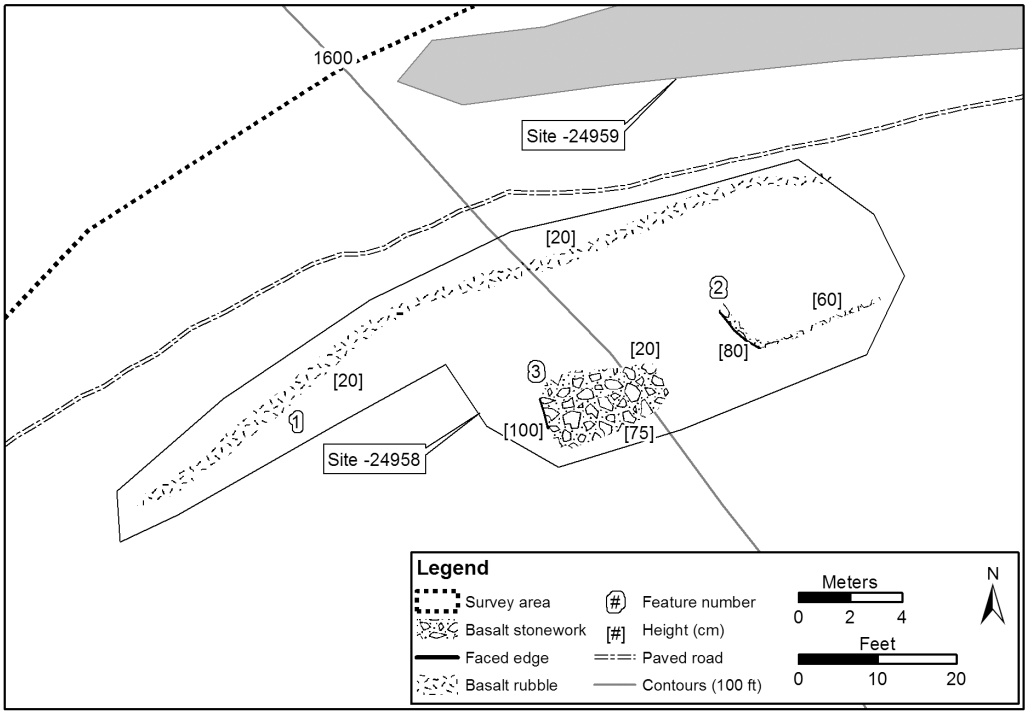

Figure 17. Map of Site 50-10-27-24958. Site location within project area is shown in Figure 5.

SITE 50-10-27-24958

Site -24958 is comprised of one alignment, one wall, and one mound (Fig. 17). These features range poor to fair in condition, and they retain integrity as structural ruins. The Feature 1 alignment is loose rubble, probably related to nearby road construction. The Feature 2 wall is L-shaped in plan view, and it may have related to a former residential area. The Feature 3 mound is somewhat disturbed, and it may represent the ruins of a former stone-filled terrace. The presumed former terrace was likely a residential feature. A few pieces of metal and glass in the vicinity suggest historic or modern use of the site area, probably associated with cattle ranching.

SITE 50-10-27-24959

Site -24959 includes 112 walls or alignments, 141 mounds, and 12 mounded platforms (Table 4). The features vary poor to good in condition, and they retain integrity as structural ruins. Figure 18 provides an overview of the site, and Figures 19 through 24 show detailed views of overlapping sections. Some of the walls continue outside the survey area.

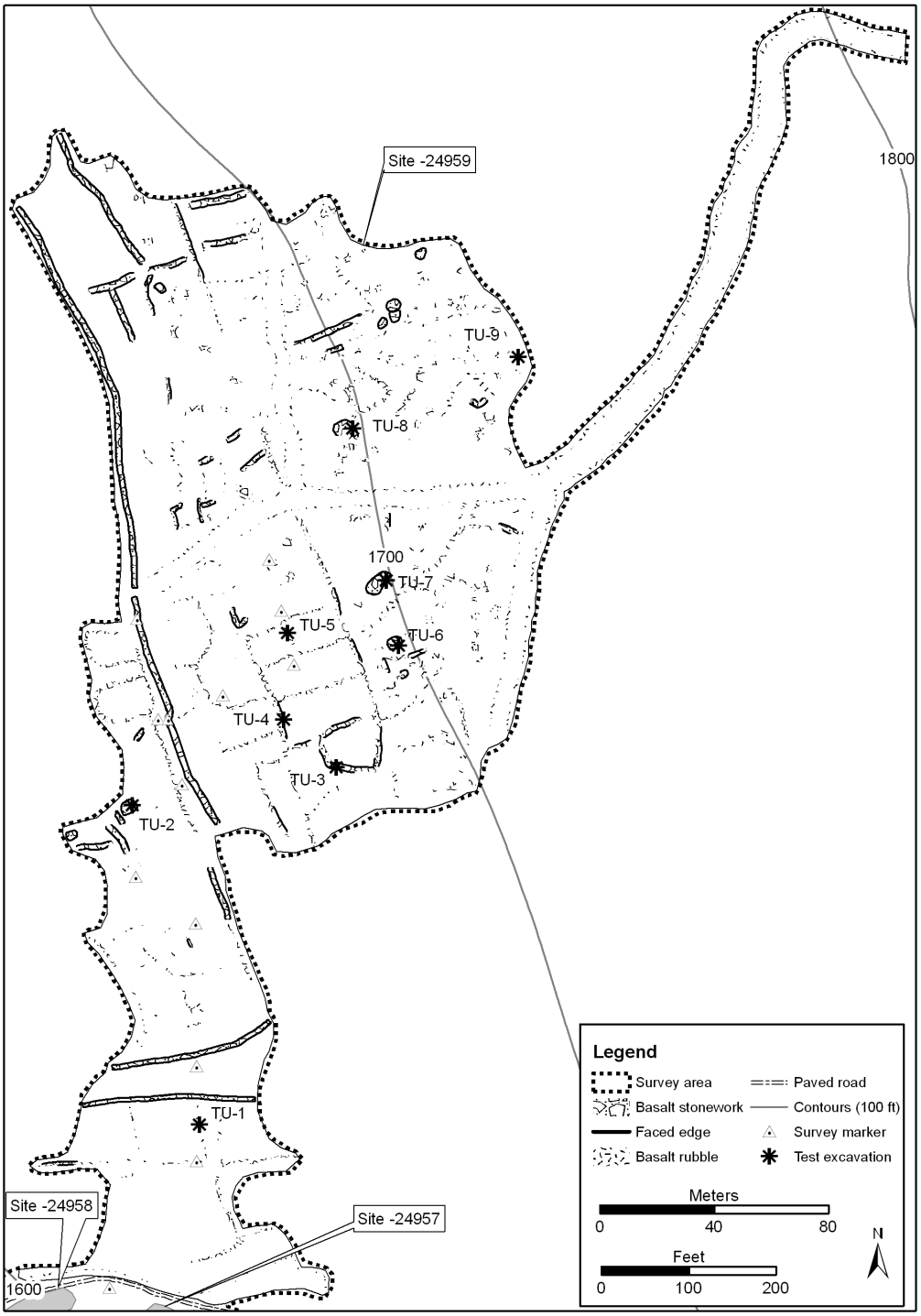

Figure 18. Overview map of Site 50-10-27-24959. Details are shown in Figures 19 through 24. Site location within project area is shown in Figure 5.

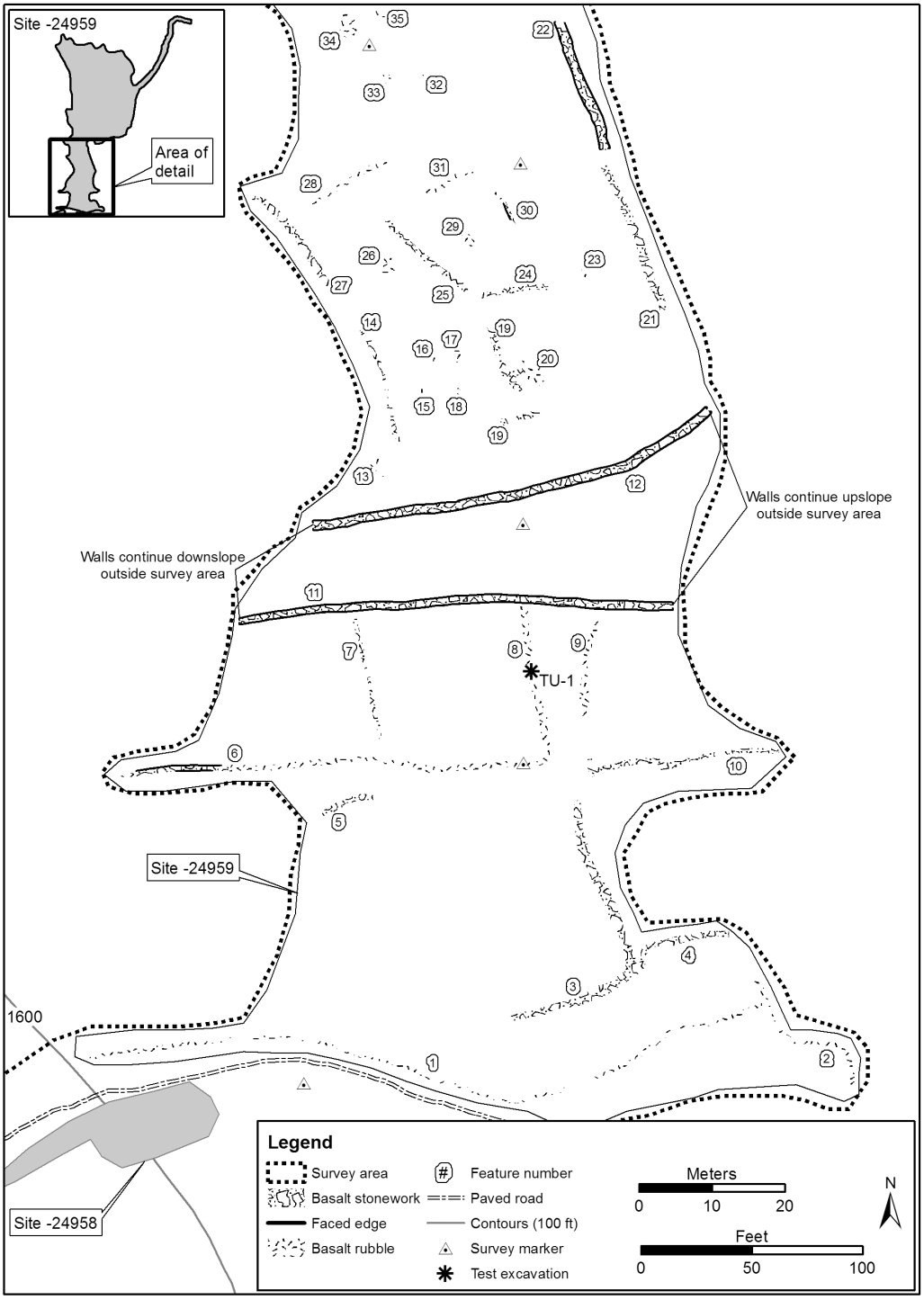

Figure 19. Map section one of six, Site 50-10-27-24959. Site overview is shown in Figure 18. Site location within project area is shown in Figure 5.

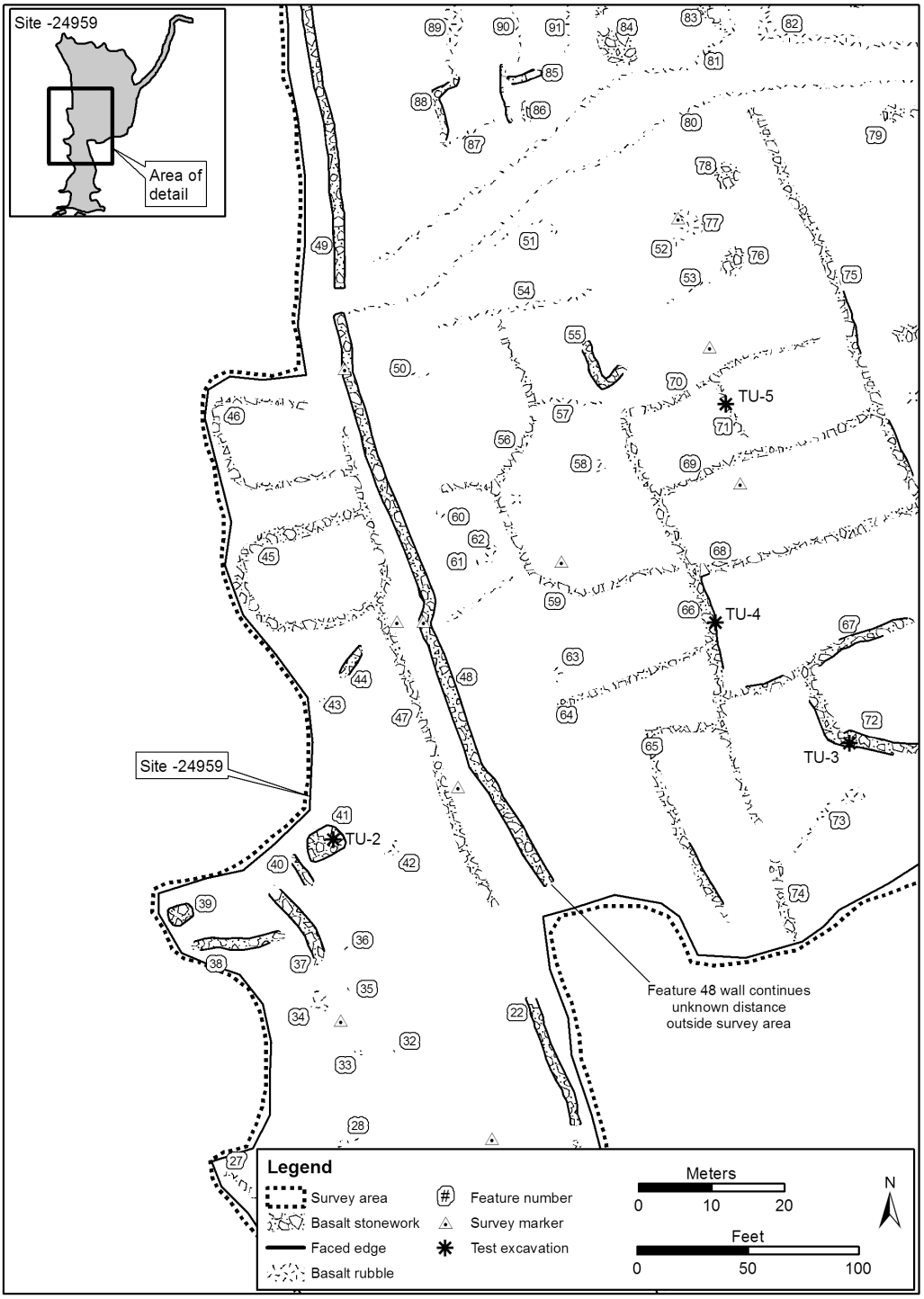

Figure 20. Map section two of six, Site 50-10-27-24959. Site overview is shown in Figure 18. Site location within project area is shown in Figure 5.

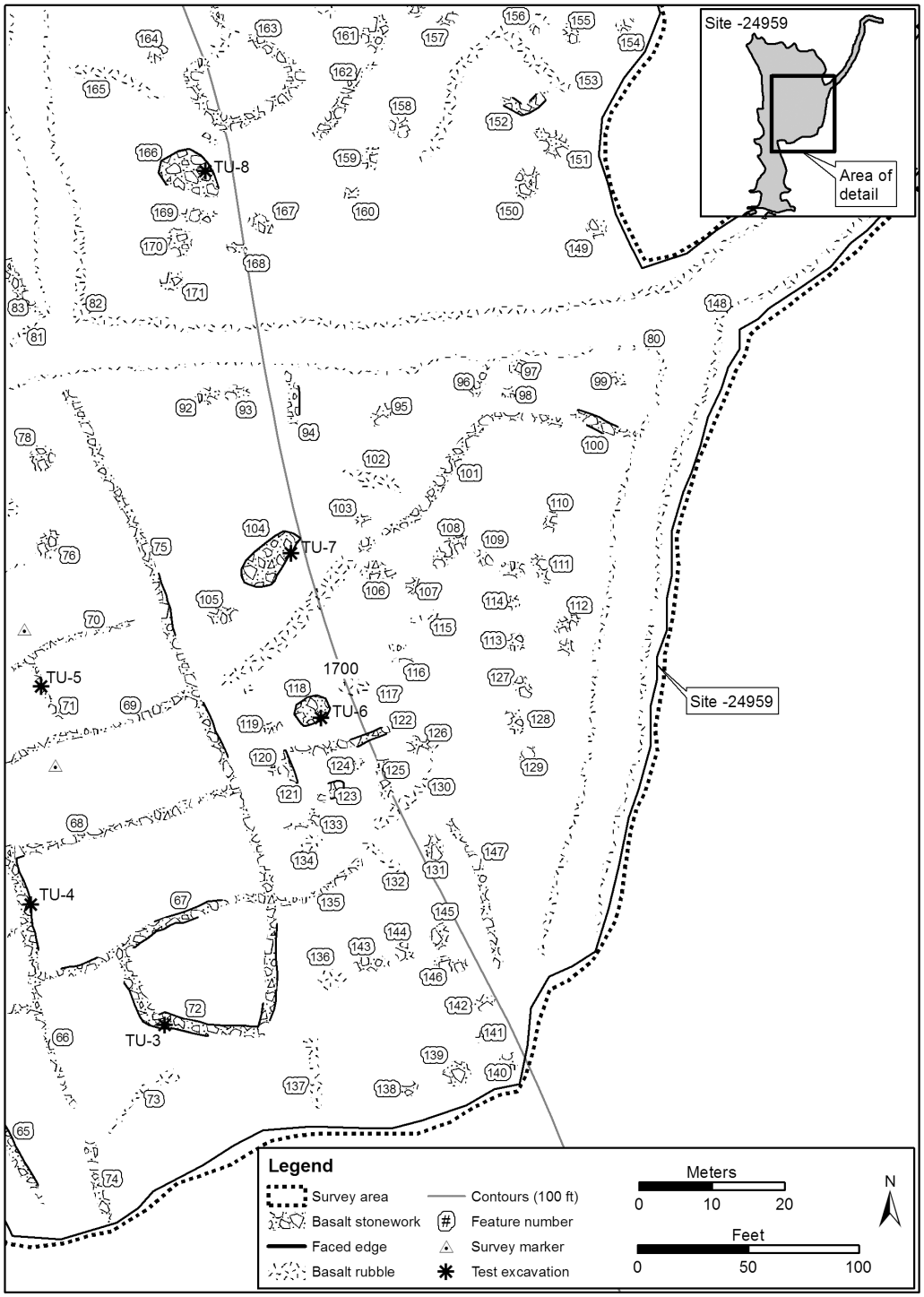

Figure 21. Map section three of six, Site 50-10-27-24959. Details are shown in Figures 18. Site location within project area is shown in Figure 5.

Figure 22. Map section four of six, Site 50-10-27-24959. Site overview is shown in Figure 18. Site location within project area is shown in Figure 5.

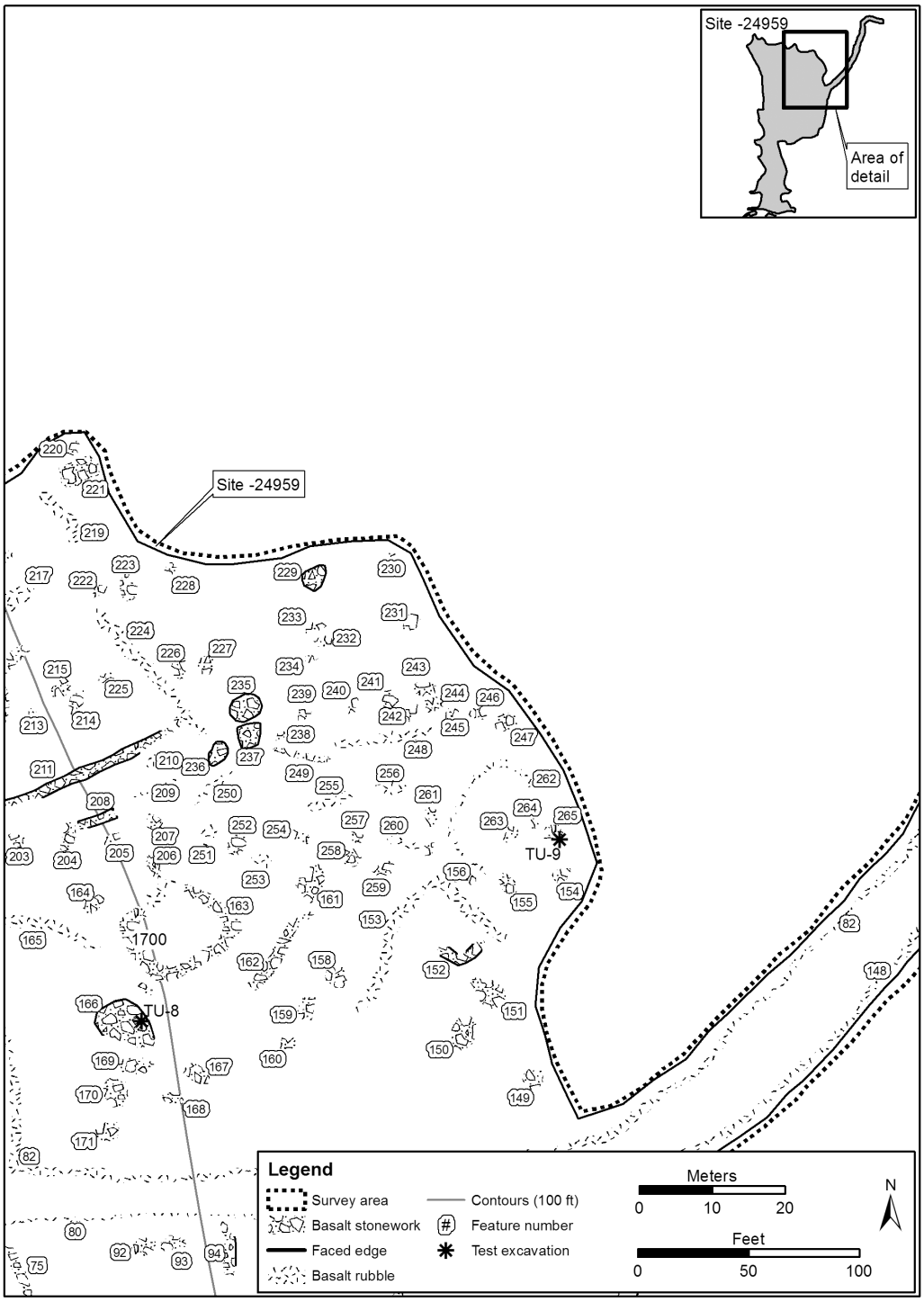

Figure 23. Map section five of six, Site 50-10-27-24959. Site overview is shown in Figure 18. Site location within project area is shown in Figure 5.

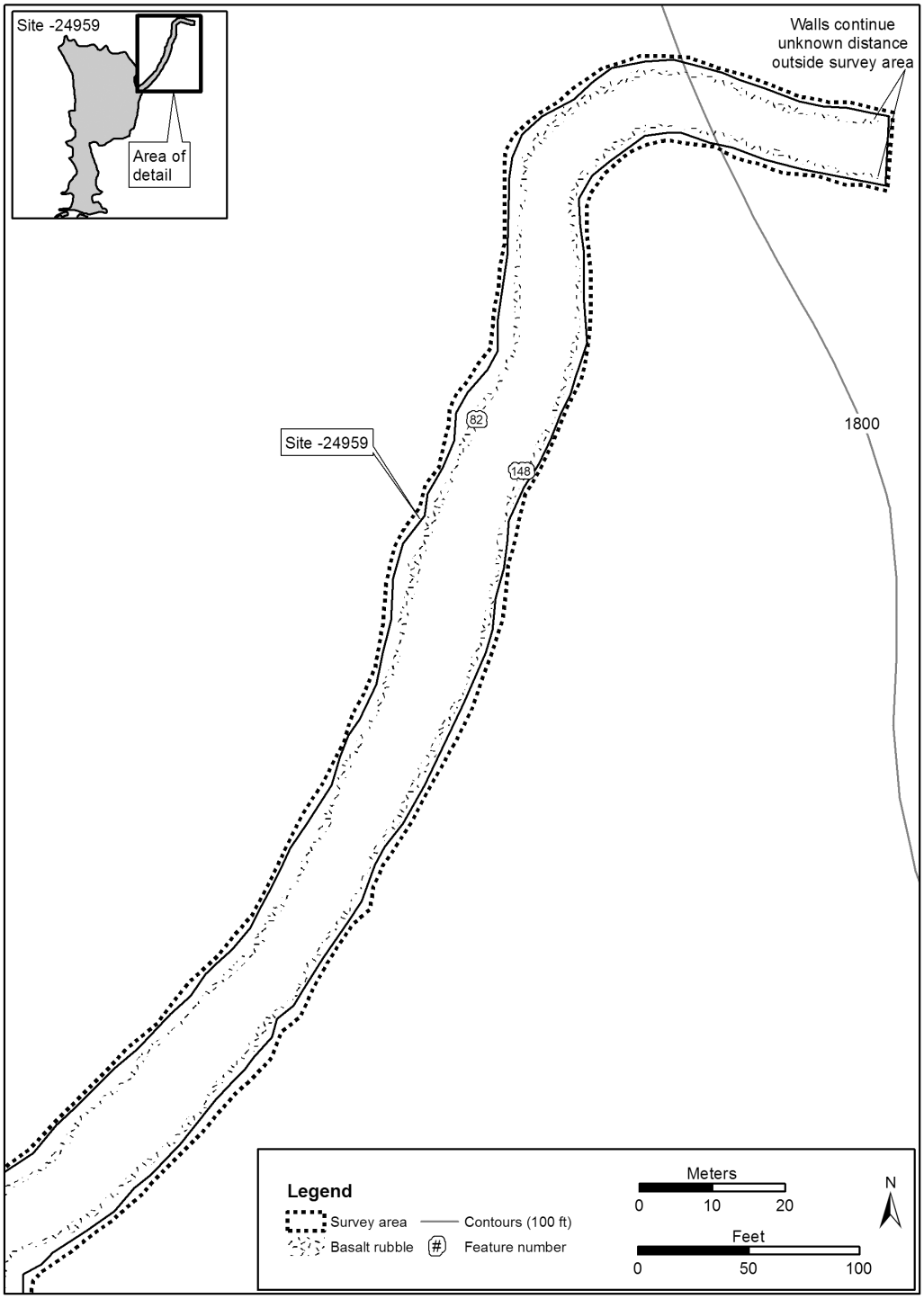

Figure 24. Map section six of six, Site 50-10-27-24959. Site overview is shown in Figure 18. Site location within project area is shown in Figure 5.

Table 4. Summary of surface features in Site 50-10-27-24959.

Morphological Type	Features
Core-filled wall	6, 11, 12, 21, 22, 30, 37, 38, 40, 44, 45, 46, 47, 48, 49, 55, 56, 57, 59, 65, 66, 67, 68, 69, 70, 72, 75, 85, 88, 94, 100, 101, 121, 122, 162,163, 172, 175, 176, 181, 190, 191, 192, 193, 197, 198, 199, 208, 211
Mounded wall	3, 4, 5, 7, 8, 9, 64, 71, 74, 83, 96, 125, 135, 147, 173, 182, 183, 212, 216
Rubble alignment	1, 2, 10, 14, 19, 20, 24, 25, 27, 28, 29, 31, 51, 73, 80, 81, 82, 87, 89, 90, 91, 102, 130, 132, 133, 137, 148, 153, 165, 179, 200, 201, 209, 217, 219, 224, 248, 249, 250, 254, 255, 260, 262
Mound	13, 15, 16, 17, 18, 23, 26, 32, 33, 34, 35, 36, 42, 43, 50, 52, 53, 58, 60, 61, 62, 63, 77, 78, 79, 84, 86, 92, 93, 95, 97, 98, 99, 103, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 119, 120, 124, 126, 127, 128, 129, 131, 134, 136, 138, 139, 140, 141, 142, 143, 144, 145, 146, 149, 150, 151, 154, 155, 156, 157, 158, 159, 160, 161, 164, 167, 168, 169, 170, 171, 174, 177, 178, 180, 184, 185, 186, 187, 188, 194, 195, 196, 202, 203, 204, 205, 206, 207, 210, 213, 214, 215, 218, 220, 221, 222, 223, 225, 226, 227, 228, 230, 231, 232, 233, 234, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 251, 252, 253, 256, 257, 258, 259, 261, 263, 264, 265
Mounded platform	39, 41, 104, 118, 123, 152, 166, 189, 229, 235, 236, 237

Nearly all of the walls and alignments are associated with former historic-era ranching activities, and most of these features have been disturbed and eroded. A few (Features 22, 47, 48, and 49) represent segments of a former historic wagon road. Some others (Features 7 through 9, 45, 46, 54 through 56, 59, 64 through 72, and 75) may have bordered former cultivation areas in the historic era or possibly earlier.

The historic wagon road (Features 22, 47, 48, and 49) is bounded by a core-filled wall on both upslope (east) and downslope (west) sides. Some portions have been disturbed and eroded, and they are mounded in section view. Other parts have been maintained or reconstructed with vertical or nearly vertical faces (Figs. 25 through 27). A number of sections have been disturbed by fallen trees or by small breaches for cattle ranching.

The historic wagon road continues both north and south outside the survey area, and at one time it probably extended at least a few kilometers. The entire length of the remaining wagon road was not surveyed, but an approximated position of the road indicates that it aligns with what are now paved Hawai‘i County roads at its north and south ends (Fig. 28).

According to Mr. James Greenwell (present property owner and descendant of prior owners since 1876), his family members remodeled most sections of the wagon road at different times, as part of ongoing maintenance of the land. A construction date for the road could not be specified, but Ms. Moana Rowland (personal communication, August 2006) in official capacity for the Hawai‘i Island office of Na Ala Hele noted:

> I have not found a map depicting a wagon trail in that area prior to 1892. I suspect it may have been one of Greenwell's ancestors who put in the wagon trail. The Greenwell family has owned Honokohau 1st and 2nd since 1876. The wagon trail was probably for their use.

Specifically is response to the Hawai‘i State Historic Preservation Office's inquiry about Na Ala Hele's potential interest in the wagon road as a native Hawaiian trail, Mr. Irving Kawashima (personal communication, August 2006) in official capacity for the Hawai‘i Island office of Na Ala Hele noted: "Hawai‘i Island Na Ala Hele has no interest in the Honokōhau wagon trail."

Figure 25. Photograph of Site 50-10-27-24959, Feature 48 portion of historic wagon road, view to north. Scale bar is in 20-cm increments.

Figure 26. Photograph of Site 50-10-27-24959, Feature 48 portion of historic wagon road, view to northeast. Scale bar is in 20-cm increments.

Figure 27. Photograph of Site 50-10-27-24959, Feature 48 portion of historic wagon road, view to east. Scale bar is in 20-cm increments.

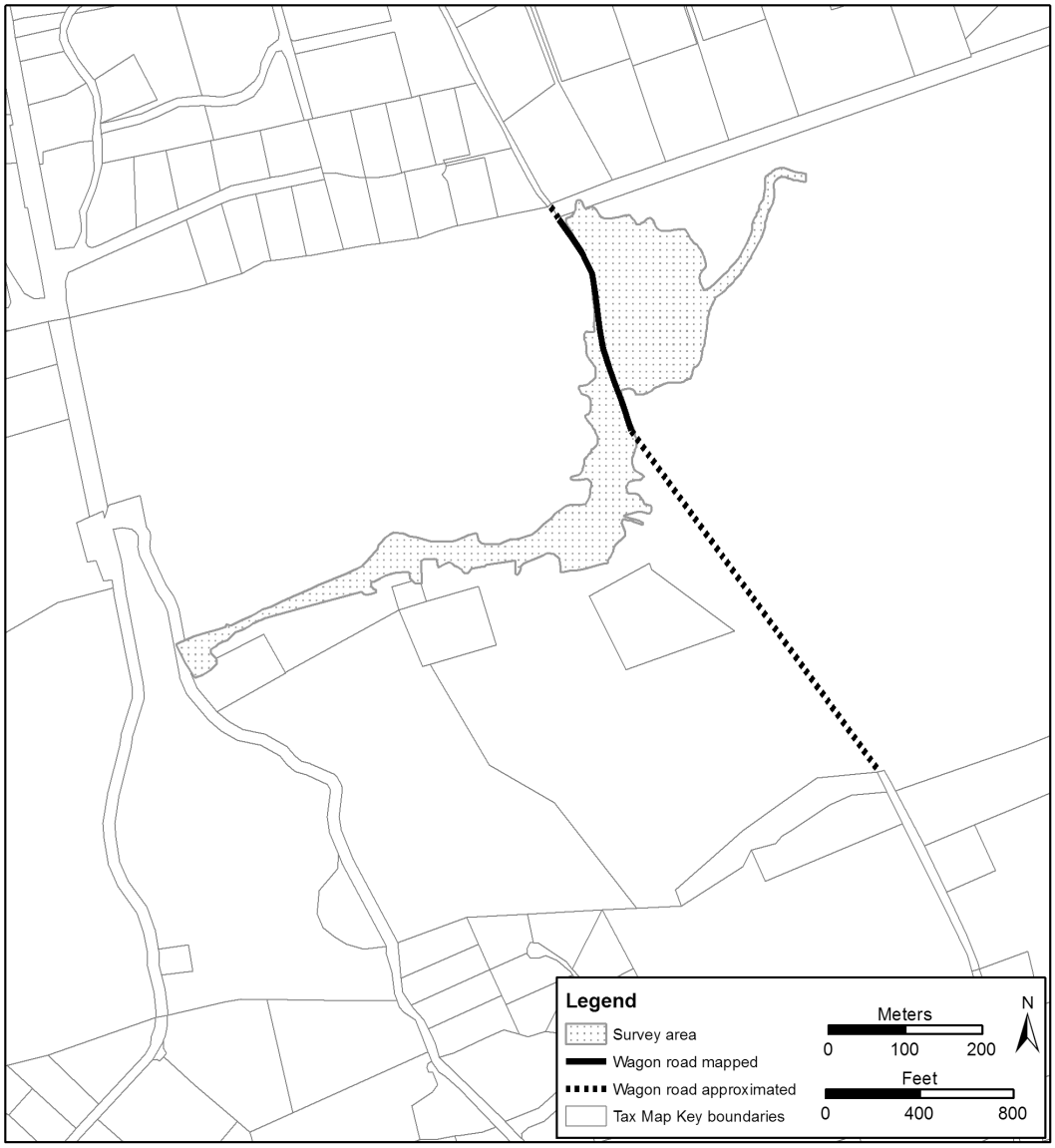

Figure 28. Mapped and approximated portions of historic wagon road in relation to modern Tax Map Key parcels, showing alignment with modern roads to north and south.

The core-filled walls resemble boundaries used for animal pens, and a few may relate to former residential areas and possibly cultivation plots. Many are known to have been for cattle ranching in recent decades, and others may date to the 1880s or possibly slightly earlier. Test excavations (described below) at Features 66 and 72 disclosed that these walls were built directly over basalt bedrock.

The mounded walls include two forms: 1) remnants of probable core-filled walls; and 2) stone piles mounded over natural breaks in the slope. The probable core-filled remnants (Features 3 through 5, 64, 74, 83, 135, 147, 182, 183, 212, and 216) may be former cattle ranching features. Features 7 through 9, 71, 96, 125, and 173 are built against natural breaks in the sloping terrain, and they may represent cultivation features. They may have retained planting areas, or the features themselves may have acted as hedgerows. Test excavations (described below) at Features 8 and 71 revealed that these two mounded walls were built directly over basalt bedrock with a shallow deposit of culturally sterile loamy silt.

The rubble alignments appear to be disturbed remnants of walls. No definite stacking or core-filling can be discerned. A few (Features 80, 81, 82,and 148) resemble push-piles from bulldozed roads, leaving clear spaces between parallel rubble alignments. These apparent push-piles may have displaced the remains of other stonework features.

Features 45, 46, and 163 are walled enclosures that may have enclosed former cultivation areas or other activity spaces. Features 45 and 46 are built against the downslope (west) side of the historic wagon trail segment Feature 47, suggesting construction and use during (or possibly after) the trail. Many other walls segments may be remnants of former larger enclosed areas.

Some other mounded walls (Features 54 through 56, 59, 64 through 72, and 75) form an inter-related complex. They may have bounded planting areas, and possibly they were used an animal pens at one time.

The 141 stone mounds vary from loosely piled rubble to moderately fitted stonework. Most have been disturbed and eroded. They resemble clearing piles commonly found in the region, associated with either cattle ranching or cultivation zones in the historic era. In either case, rock-clearance was an ongoing part of land use and maintenance. The known historic and modern cattle ranching in the project area represents the most likely context for most of the rock-clearance. Test excavation (described below) at Feature 265 revealed that this mound was built over basalt bedrock, and no cultural deposit was evident.

Twelve mounded platforms (Features 39, 41, 104, 118, 123, 152, 166, 189, 229, and 235 through 237) are roughly rectangular in plan view (Fig. 29). They exhibit nearly vertical edges of moderately to well fitted stones, with a mound of stones piled on top of each platform. The interiors consist of loosely fitted smaller stones. The mounded surfaces suggest continued piling due to rock-clearance of adjacent ground. The formalized edges indicate greater longevity of use than for the 141 mounds of the same site. Test excavations (described below) disclosed that Features 41, 104, 118, and 166 were built over bedrock with no sediment accumulation or cultural debris. These features likely are of similar association as the other mounds.

Figure 29. Photograph of Site 50-10-27-24959, Feature 118 mounded platform, view to west. Scale bar is in 20-cm increments.

SUBSURFACE TESTING

Subsurface testing included both overall assessment of the terrain and formal test excavation. The overall assessment involved inspection of landforms and sediment conditions to evaluate potential for subsurface deposits. Limited informal probing with a pick tested the depth of sediments in random locations. The formal test excavations tested a sample of stonework features for the possibility of burial remains or preserved cultural deposits.

The vast majority of the project area terrain includes either exposed basalt outcrop or very thin (10 cm or less) rocky sediment over basalt bedrock. Random probing with a pick disclosed little or no potential for subsurface cultural deposits.

The only visible sediment accumulation greater than 10 cm was a greatly disturbed deposit of loamy silt upslope (east) of the north end of Feature 75. The disturbance includes numerous large pits, typical of cattle wallowing. A cow was observed disturbing this ground on 4 January 2006, and others were observed in the vicinity on 1 and 2 May 2006. Numerous piles of bovine dung are visible on the surface. Informal probing of the disturbed pits disclosed 20 to 30 cm of loamy silt over basalt bedrock. No artifacts, food remains, or charcoal were observed.

Nine test units (TU-1 through -9) explored the possibility of burials or other cultural material within or beneath Features 8, 41, 66, 71, 72, 104, 118, 166, and 265 of Site -24959. Excavations involved dismantling of stonework, removal of any sediment, and documentation of exposed profiles. Following the excavations, all features were reconstructed.

Nearly all of the tested features had been constructed directly over basalt bedrock (Figs. 30 through 38). In only two cases (TU-1 at Feature 8 and TU-5 at Feature 71), a thin layer of rocky loamy silt was present over the bedrock.

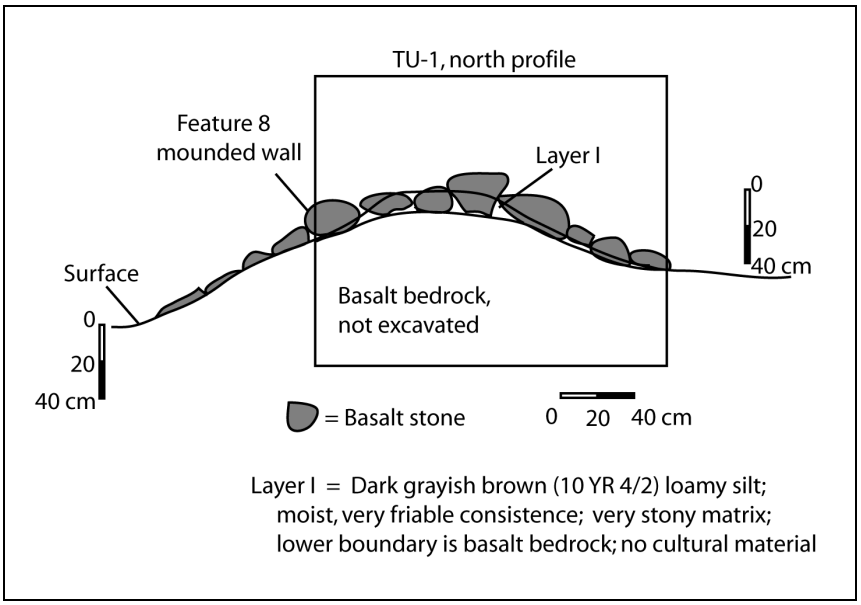

Figure 30. North profile of TU-1, Site 50-10-27-24959, Feature 8 mounded wall.

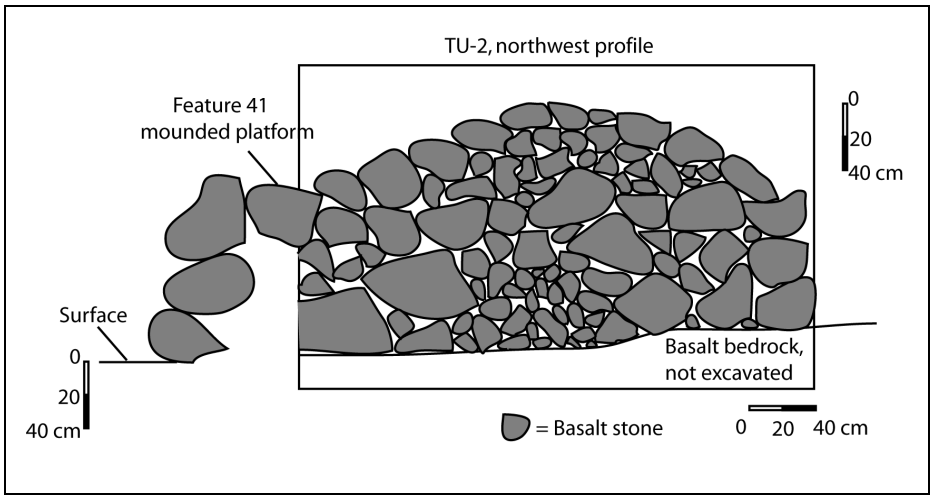

Figure 31. Northwest profile of TU-2, Site 50-10-27-24959, Feature 41 mounded platform.

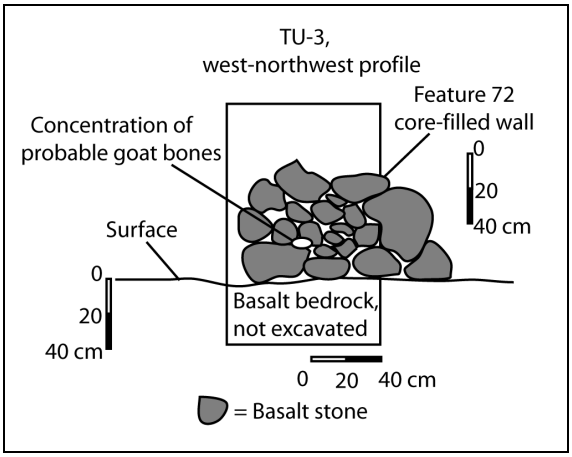

Figure 32. West-northwest profile of TU-3, Site 50-10-27-24959, Feature 72 core-filled wall.

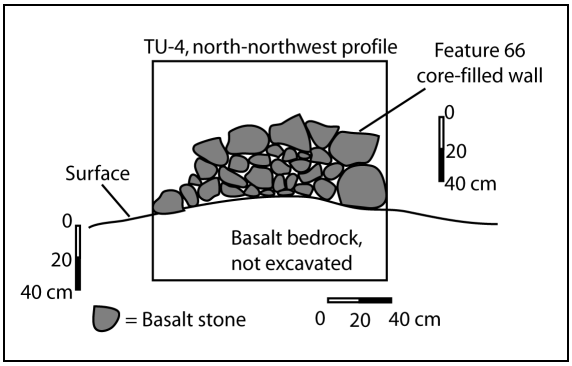

Figure 33. North-northwest profile of TU-4, Site 50-10-27-24959, Feature 66 core-filled wall.

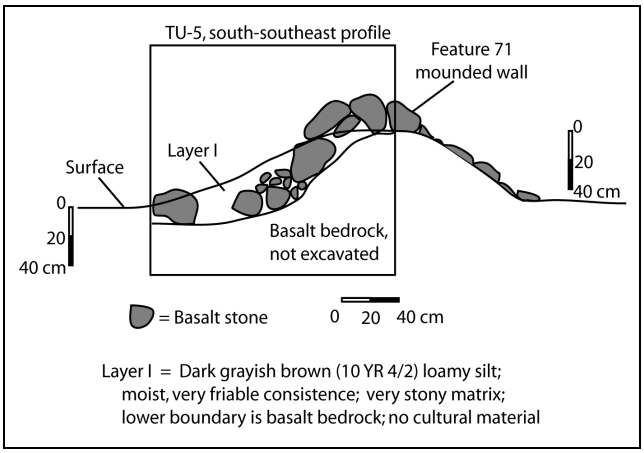

Figure 34. South-southeast profile of TU-5, Site 50-10-27-24959, Feature 71 mounded wall.

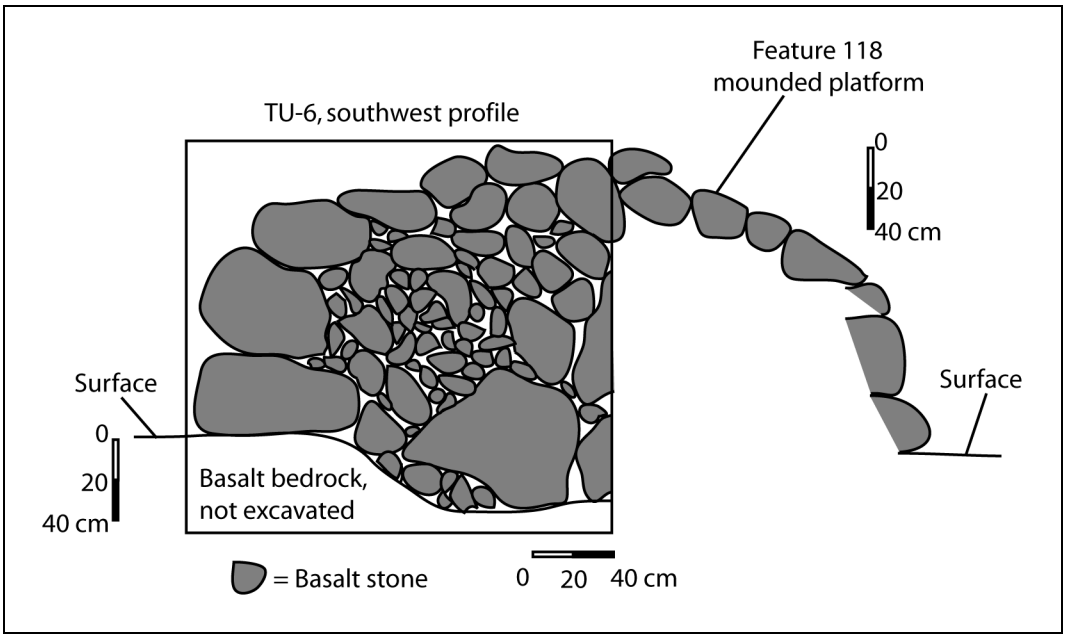

Figure 35. Southwest profile of TU-6, Site 50-10-27-24959, Feature 118 mounded platform.

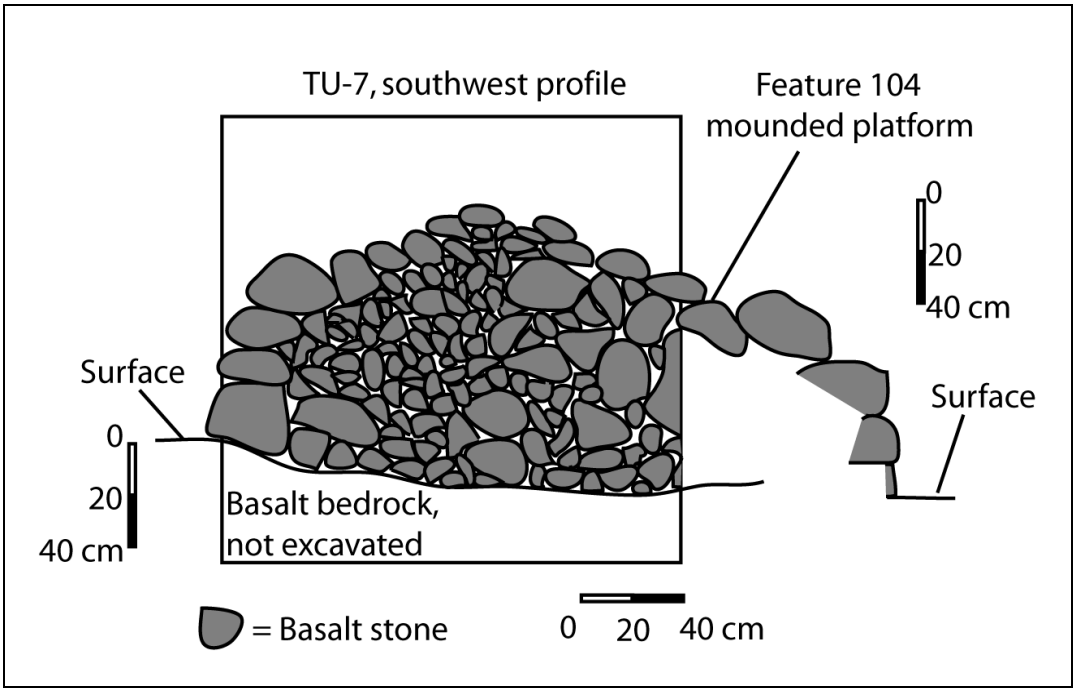

Figure 36. Southwest profile of TU-7, Site 50-10-27-24959, Feature 104 mounded platform.

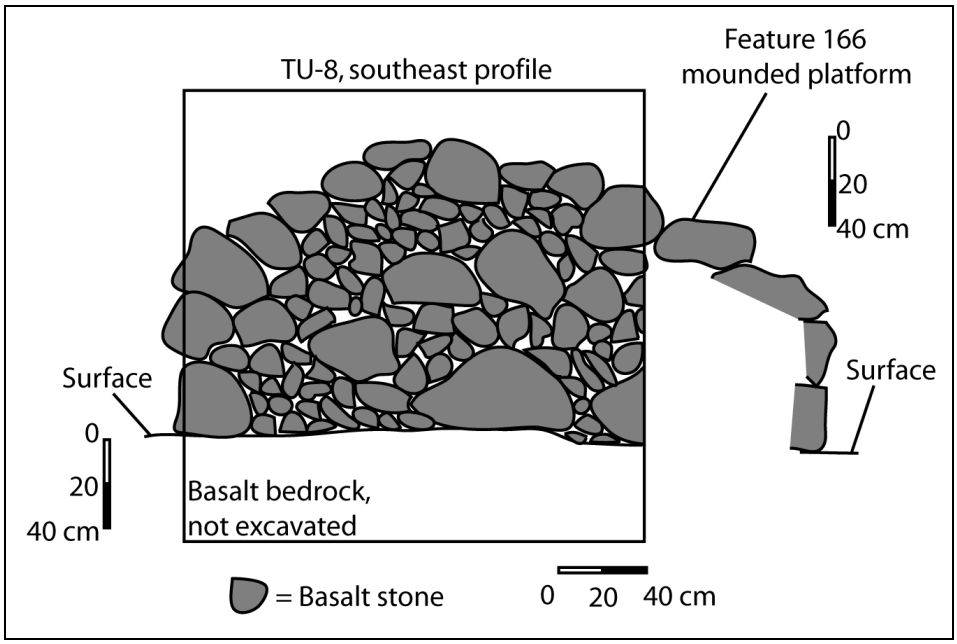

Figure 37. Southeast profile of TU-8. Site 50-10-27-24959, Feature 166 mounded platform.

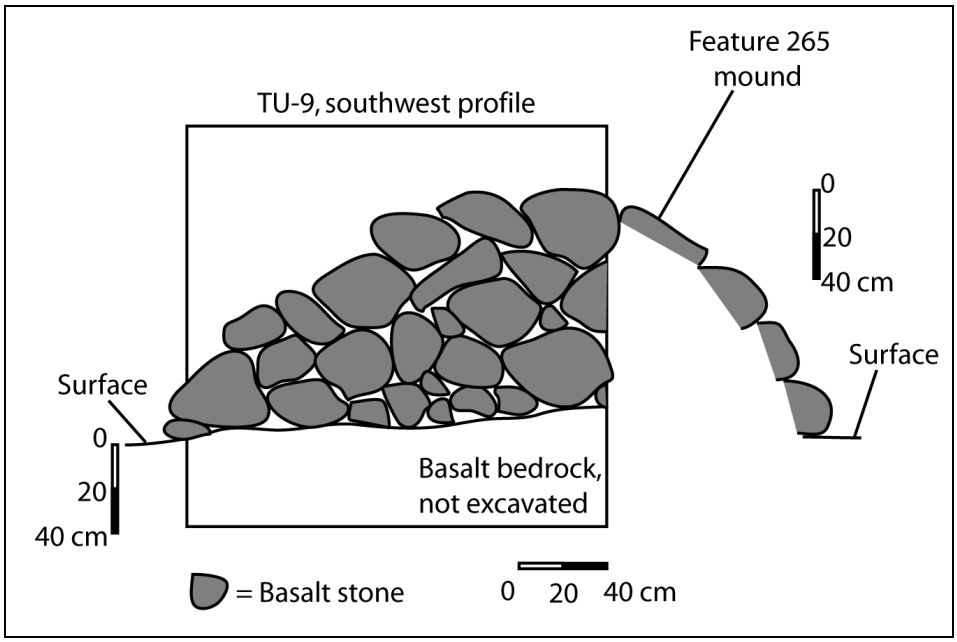

Figure 38. Southwest profile of TU-9, Site 50-10-27-24959, Feature 265 mound.

The only cultural material included a single concentration of probable goat bones inside the stonework of the Feature 72 core-filled wall (Fig. 39; see also Fig. 32). The bones are not of pig or dog, but they are of some other medium-sized mammal. Metal-sawed ends were visible on two bones. One of those bones also showed longitudinal slice marks at its metal-sawed end. Other slice marks were identified on an additional two bones. These findings suggest use of metal tools in the historic or modern era, consistent with the post-Contact introduction of goats to the region. After examination, the bones were returned to their original context, and the stone wall was reconstructed.

Figure 39. Photograph of probable goat bones from TU-3 at Site 50-10-27-24959, Feature 72 core-filled wall. Stratigraphic position is shown in Figure 31.

CONCLUSIONS

The current work was conducted to satisfy Hawai‘i State Historic Preservation Division (SHPD) requirements for an archaeological inventory survey. Table 5 summarizes the documented sites, their component features, probable functions, estimated time periods of use, integrity, condition, research significance, and recommended actions.

The survey recorded 318 surface features in 13 site areas (Sites 50-10-27-24947 through -24959), and no subsurface cultural deposits were identified. The surface features are associated mostly with historic ranching activities and cultivation practices probably since the 1870s or 1880s, and some residential features are also present. One set of walls represents a remnant segment of a historic wagon trail. Most of the features appear to be post-Contact in age, yet some may be earlier.

The boundaries of Sites -24949 through - 24955 and -24959 may be expanded on the basis of future survey outside the current project area. However, the component features within the project area have been recorded completely.

The current work was conducted to satisfy archaeological inventory survey requirements for the project area. All surface features were recorded in sufficient detail to document location, form, content, probable function, and estimate time period of use. No subsurface archaeological deposits were identified, nor are any expected in the project area. The physical environment, cultural and historic setting, and prior archaeological work have been reviewed to provide a context for the current findings.

The 13 site areas (Sites 50-10-27-24947 through -24959) retain their integrity of place, design, and association as archaeological ruins, and they have yielded important information about archaeology and history of land use in the project area. However, they are unlikely to yield additional information beyond what has been recorded in the present report, and no further archaeological work is recommended in the project area.

In terms of site significance evaluations according to Hawai‘i State Administrative Rules, the 13 site areas may be considered in terms of their ability to contribute to knowledge about certain categories of history, archaeology, and culture, including: a) relation to events significant in history; b) relation to persons significant in history; c) embodiment of a distinctive type or period; d) having contributed or being likely to contribute significant archaeological or historical information; or e) relation to traditional Hawaiian practices or values. According to these definitions, the 13 site areas may be considered significant for category (d), and the present documentation is sufficient for the salient characteristics of these sites.

Table 5. Summary of sites documented in the project area.

Site 50-10-27-	Central UTM Coordinates*	Component Surface Features	Probable Functions	Estimated Time Periods of Use	Integrity Retained	Condition	Research Significance	Recommended Action
24947	E 817229 N 2179616	1 concrete pad, 5 walls or alignments	property boundary, cattle slaughter house	historic to modern	yes	good	has yielded information about land use history; additional information unlikely	none
24948	E 81733 N 2179650	2 walls or alignments	property boundary	historic to modern	yes	good	has yielded information about land use history; additional information unlikely	none
24949	E 817409 N 2179702	3 walls or alignments	probable cattle ranching	historic to modern	yes	poor to fair	has yielded information about land use history; additional information unlikely	none
24950	E 817506 N 2179737	1 wall or alignment	unknown	probable historic	yes	poor to fair	has yielded information about land use history; additional information unlikely	none
24951	E 817572 N 2179766	5 walls or alignments, 6 mounds	cultivation and residential area	probable historic	yes	poor to fair	has yielded information about land use history; additional information unlikely	none
24952	E 817627 N 2179767	2 walls or alignments, 3 mounds	ranching and cultivation	probable historic	yes	poor to fair	has yielded information about land use history; additional information unlikely	none
24953	E 817568 N 2179744	7 walls or alignments, 1 mound	residential area or cattle ranching	probable historic	yes	poor to fair	has yielded information about land use history; additional information unlikely	none
24954	E 817637 N 2179753	5 walls or alignments	probable cattle ranching	probable historic	yes	poor to fair	has yielded information about land use history; additional information unlikely	none
24955	E 817718 N 2179752	3 walls or alignments	probable cattle ranching	probable historic	yes	poor to fair	has yielded information about land use history; additional information unlikely	none

Site 50-10-27-	Central UTM Coordinates*	Component Surface Features	Probable Functions	Estimated Time Periods of Use	Integrity Retained	Condition	Research Significance	Recommended Action
24956	E 817765 N 2179772	5 mounds	cultivation	probable historic	yes	poor to fair	has yielded information about land use history; additional information unlikely	none
24957	E 817757 N 2179799	2 walls or alignments	cattle ranching or cultivation	probable historic	yes	poor to fair	has yielded information about land use history; additional information unlikely	none
24958	E 817712 N 2179804	2 walls or alignments, 1 mound	residential area	probable historic	yes	poor to fair	has yielded information about land use history; additional information unlikely	none
24959	E 817799 N 2180009	112 walls or alignments, 141 mounds, 12 mounded platforms	cattle ranching, wagon road, cultivation	mostly historic, few features possibly pre-Contact	yes	poor to good	has yielded information about land use history; additional information unlikely	none

* Universal Transverse Mercator (UTM) coordinates are for the center of each site, recorded in UTM Zone 4 north with the North American Datum (NAD) of 1983.

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