4.7 ARCHAEOLOGICAL RESOURCES

An archaeological inventory survey (AIS) was completed in 1990 by Paul H. Rosendahl, Ph.D., Inc (PHRI) (Donham, 1990) for the larger 1,100-acre parcel in which the project site is located. The report was accepted by SHPD in 1993 and an archaeological monitoring plan was also approved in 1993 (Appendix D of the Final EIS for the Keahuolu Affordable Housing Project). Additional archaeological field work was done again in 2007 by PHRI for the proposed Keahuolu Affordable Housing Project EIS, in compliance with the current historic preservation requirements of SHPD (Appendix D of the Keahuolu Affordable Housing Project EIS). In November 2009, Haun & Associates prepared an Archaeological Mitigation Plan Update in consultation with SHPD, to determine appropriate archaeological mitigation tasks to be detailed in subsequently prepared plans for data recovery, burial treatment, site preservation, and monitoring that are tailored to the specific cultural resources present within the Kamakana Villages site (*Appendix B*).

2007 Archaeological Survey – PHRI

Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted archaeological inventory fieldwork from March 1, 2007 through July 9, 2007. The objectives of the archaeological survey were to (a) identify all potentially significant to re-identify and re-locate specific archaeological remains present within the study area; (b) to collect information sufficient to evaluate and document the potential significance of all identified remains; (c) to evaluate the potential impacts of any proposed development upon any identified significant remains; and (d) to recommend appropriate measures that would mitigate any adverse impacts upon identified significant remains.

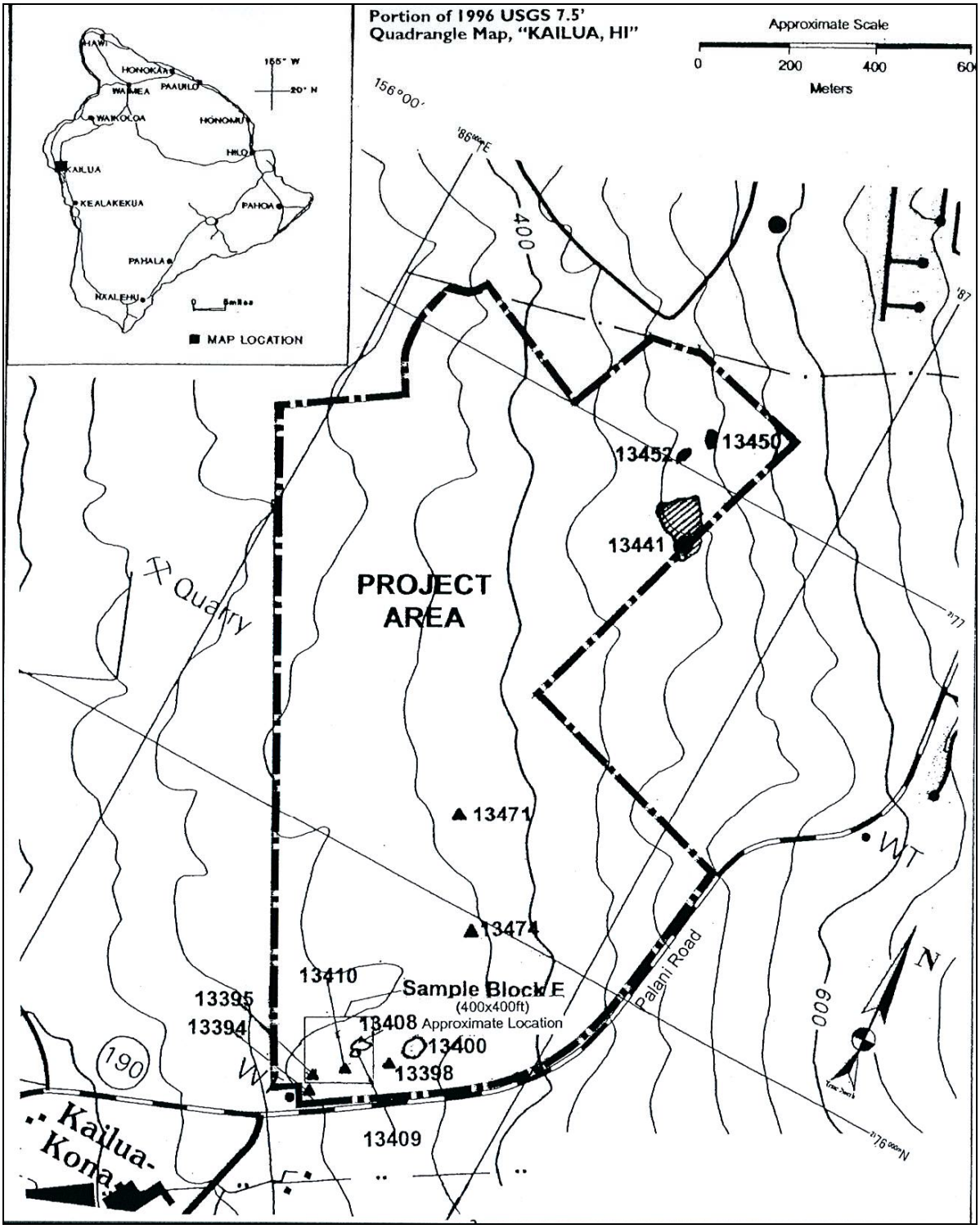
During the course of the survey, twelve archaeological sites previously identified during the archaeological survey conducted in 1990 by PHRI (Donham, 1990) were re-located and re-identified within the project area (*Figure 4-6*). During the 1990 archaeological survey, significance assessments and recommendations for the sites were presented (Donham, 1990). These assessments and recommendations were reiterated in an archaeological mitigation plan approved by the SHPD (Jensen et al. 1992) (SHPD approval letter of 12/21/93, Log 10361, Doc. 9312RC02; Appendix D - HHFDC, 2008). The archaeological mitigation plan was subsequently amended by PHRI Letter Report 1152-052493, outlining the sampling block methodology to be used during mitigation (dated June 10, 1993, PHRI Letter 1152-052493; SHPD approval letter dated 7/28/1993, Log 8976, Doc 9307RC40; Appendix D - HHFDC, 2008).

The final significance assessments and recommendations are summarized in *Table 4-1*. Site 13396, a platform originally located a short distance west of Sites 13394 and 13395, was slated for preservation; however it was not relocated during the survey because it was apparently destroyed by construction of a firebreak road corridor subsequent to the original Donham survey. Four sites (Sites 13395, 13408, 13409, and 13410) are located within Sample Block E shown on *Figure 4-6*. Sample Block E was established as a sample block of the QLT mitigation plan (HHFDC, 2008). Block E, which is 400 feet by 400 feet, was chosen so that data collected from it could be compared with similar sized sample blocks (Blocks A-D and F), which are not located on the proposed project site. The results would then be compared to similar sized sample blocks placed on the adjacent ahupua'a of Kealakehe. The blocks were selected to incorporate a wide variety of the site and feature types, and various soil and bedrock types at different elevation levels.

Table 4-1
Summary of General Significance Assessments and Recommended General Treatments – Project Site

SIHP Site Number	Formal Site Type	Functional Interpretation	Significance Category					General Recommendations			
			A	B	C	D	E	FDC	NFW	PID	PAI
13394	Alignment	Agriculture				D		FDC			PAI
13395	Platform	Habitation/possible burial			C	D	E *	FDC		PID	PAI *
13398	Platform, wall, cairn	Habitation/ agricultural			C	D		FDC		PID	
13400	Wall, enclosure	Agricultural/land division			C	D		FDC		PID	
13408	Platform, terrace, five walls, two enclosures,10+ pahoehoe excavations	Habitation/ agricultural/ possible burial			C	D	E *	FDC		PID	PAI *
13409	Three platforms, two walls, an enclosure, and three terraces	Habitation/ agricultural/ possible burial			C	D	E *	FDC		PID	PAI *
13410	Platform	Habitation			C	D		FDC		PID	
13441	Seven platforms, five terraces, wall remnant, wall, mound, cave, enclosure	Habitation/ agriculture			C	D		FDC	NFW	PID	
13450	Steppingstone trail	Transportation				D		FDC			
13452	Paved trail	Transportation				D		FDC			
13471	Upright, platform, cave	Habitation/ agricultural/ ceremonial				D		FDC			
13474	Cave	Habitation				D		FDC			

Source: PHRI, 2007 - HHFDC 2008, Belt Collins Notes:
General Significance Categories:
A = Important for historical contribution to significant events and/or broad patterns of history
B = Important for association with the lives of important individuals in history
C = Excellent example of site type at local, region, island, state, or national level
D = Important for information content
E – Culturally significant
Recommended General Treatments:
FDC = Further data collection necessary (detailed recording, surface collections, and limited excavations, and possibly subsequent data recovery/mitigation excavations)
NFW = No further work of any kind necessary, sufficient data collected, archaeological clearance recommended, no preservation potential
PID = Preservation with some level of interpretive development recommended (including appropriate related data recovery work)
PAI = Preservation "as is," with nor further work (and possible inclusion into landscaping), or possible minimal further data collection necessary
* = Provisional assessment; definite assessment pending completion of further data collection



PROJECT SITE ARCHAEOLOGICAL SITE LOCATIONS
KAMAKANA VILLAGES AT KEAHUOLU
(Source: PHRI, 2007 – HHFDC, 2008)

GROUP 70 INTERNATIONAL
Figure 4-6

2009 Archaeological Mitigation Plan Update – Haun & Associates, Inc.
The initial fieldwork was conducted between July 6 and September 16, 2009 by Haun & Associates, Inc (*Appendix B*). The Update included a 100% survey of three 50.0 meter wide transects and the objectives were to (a) evaluate the 1989 survey data, including site location accuracy, adequacy of original site documentation, and evaluation of original functional interpretations and recommended treatments; and (b) provide data recovery-level documentation of agricultural sites. The Archaeological Mitigation Plan Update has been submitted to SHPD for review.

The PHRI inventory survey report (Donham, 1990) provides a discussion of feature types and settlement patterning supported by the survey update results. The project area is characterized by numerous agricultural features and pahoehoe excavations. Temporary habitation sites are associated with these features. Burials are also present, but relatively few in number and widely dispersed. The current transect survey documented fifteen sites total of which thirteen sites that were either not identified during previous AIS of the parcel, or could not be correlated with sites that were previously documented. The two remaining site designations include agricultural features (Site 26909) and pahoehoe excavations (Site 26910) which are distributed throughout the project area and include newly and previously identified sites of similar functions (*Table 4-2*).

Table 4-2
Site Significance and Recommended Treatment

SIHP Number	Type	Function	Significance Criteria*	Recommended Treatment**
26896	Lava Tube	Temporary Habitation	D	DR
26897	Complex (2)	Temporary Habitation	D	DR
26898	Lava Tube	Temporary Habitation	D	DR
26899	Lava Tube	Temporary Habitation	D	DR
26900	Complex (2)	Temporary Habitation	D	DR
26901	Lava Tube	Temporary Habitation	D	DR
26902	Lava Tube	Temporary Habitation/Burial	D, E	PR
26903	Lava Tube	Temporary Habitation	D	DR
26904	Lava Tube	Temporary Habitation	D	DR
26905	Lava Tube	Temporary Habitation	D	DR
26906	Lava Tube	Burial	D, E	PR
26907	Lava Tube	Temporary Habitation	D	DR
26908	Lava Tube	Temporary Habitation	D	DR
26909***	Complex (98)	Agriculture	D	DR
26910***	Complex (8)	Resource Procurement	D	DR

Source: Haun & Associates, 2009
****Significance Criteria - D = Information Content, E = Cultural Value***
*****Recommended Treatments - DR=Data Recovery, PR=Preservation***
******Not new sites – Include newly and previously identified sites of similar function***

In addition to agricultural features and pahoehoe excavations (Resource Procurement), the newly identified sites consist of twelve temporary habitation sites and one burial site. Another burial was identified at one of the temporary habitation sites. Most of the newly identified sites (8) are situated in the inland portion of Transect 1. Three were found in Transect 3 and two in Transect 2. *Figure 4-7* illustrates previously and newly identified and sites recommended for preservation. *Section 6.2.8* provides a discussion on impacts and mitigation associated with these findings.

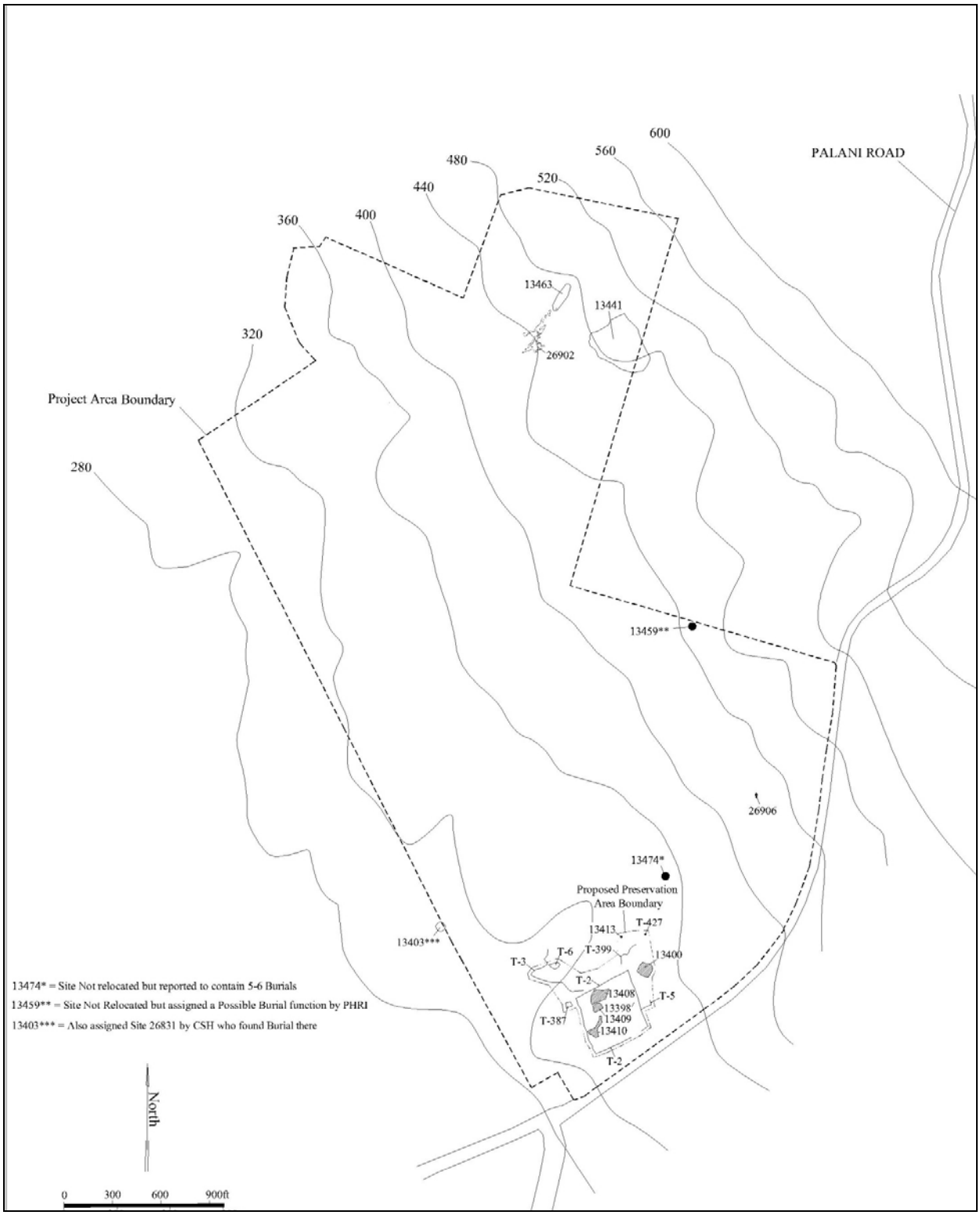
4.8 CULTURAL RESOURCES

A Cultural Impact Assessment (CIA) was completed for this project by PHRI in December 2007 (Appendix D of the Keahuolu Affordable Housing Project EIS) in compliance with Act 50 SLH 2000 and the State of Hawaii Office of Environmental Quality Control (OEQC) Guidelines for Environmental Impact Statements law (Chapter 343, HRS) which includes an ethnographic survey.

The specific purpose of the study is to assess the potential impacts of the proposed project upon the cultural resources – the practices, features and/or beliefs of Native Hawaiians or any other ethnic group that might be associated with the project area. Objectives were established to carry out this purpose:
1. Identify any Native Hawaiian or other ethnic group cultural practices currently being conducted by individual cultural practitioners or groups;
2. Collect sufficient information so as to define the general nature, location, and authenticity of any identified cultural practices;
3. Assess the potential impacts of the proposed project upon identified cultural practices; and
4. Recommend appropriate mitigation measures for any potentially adverse impacts upon identified cultural practices.

The methodology for the current project included several factors including: (a) the probable number and significance of known or suspected cultural properties, features, practices, or beliefs\ within or associated with the specific project area; (b) the potential number of individuals (potential informants) with cultural knowledge of the specific project area; (c) the availability of historical and cultural information on the specific project area or immediately adjacent lands; (d) the physical size, configuration, and natural and human modification history of the specific project area; and (e) the potential effects of the project on known or expected cultural properties, features, practices, or beliefs within or related to the specific project area.

PHRI contracted Cultural Resources Specialist Helen Wong-Smith, M.A. who has extensive experience in historical documentary and informant research, to conduct the CIA study. Informants known through past projects and through inquiries with departments and cultural specialists such as Kepa Maly, Ruby McDonald of the Office of Hawaiian Affairs (OHA), and Keola Lindsey, formerly of the island of Hawai'i SHPD office were contacted to participate in the study. One contact typically led to another contact until a list of over 30 potential informants was compiled (see Appendix D of the Keahuolu Affordable Housing Project EIS for the list). The potential informants were initially contacted by phone and e-mail. Those who were responsive were interviewed and asked to fill out written forms to answer some preliminary questions. These questions were followed up with phone conversations. Further interviews were also conducted with a few selected individuals who had potential to provide additional information on the proposed project area.



SITE SIGNIFICANCE & RECOMMENDED TREATMENTS
KAMAKANA VILLAGES AT KEAHUOLU
(Source: Haun & Associates, 2009)

GROUP 70 INTERNATIONAL
Figure 4-7

Overall, the study suggested limited cultural activity took place within the project area. Most of the events and documentary evidence were related to the seaward portion of Keahuolu. Texts indicate that the shoreline area was a rich marine resource which included springs and brackish water ponds from which people harvested. Heiau were located near the shore: Kawaluna, Pahiliholo, and Halepana. Inland areas were used primarily for agriculture. Planting was widespread and took place wherever there was a little soil. Rocky areas were also planted with crops that could thrive in small pockets of soil and mulch, such as sweet potatoes. The results of the informant study yielded limited information. Pili grass (*Heteropogon contortus*) was apparently harvested from the project area at some time in the past. Clarence Medeiros, Jr. states that he continues to gather pilo (*Capparis sandwichiana*) for medicinal uses in areas west of the project site. Mahealani Pai indicates that the project area contains plants such as alahe'e, kauila, and uhiuhi, which were important, useful plants in pre-contact times. Aside from cultural practices relating to the use of plants as mentioned above, informants had no other knowledge of cultural/traditional uses of the project area.

4.9 BIOLOGICAL RESOURCES

4.9.1 Flora

Two Botanical field surveys were conducted on the project site in 1989 and 2007. Both surveys found no threatened or endangered species and no sensitive types of vegetation, such as wetlands or dryland forest, within the 272-acre project site. The land is comprised of lava flows which are covered by alien dominated scrub vegetation which has been highly disturbed in the past. The 1989 botanical survey was conducted by Char and Associates for the QLT "Keahulou Lands of Kailua-Kona, Hawaii" 1990 EIS. The survey covered an area of 1,100-acres. The proposed project's 272-acre site is within the surveyed area. Art Whistler, Ph.D. conducted the 2007 botanical field survey from April 4 – 7, 2007. All plant species encountered during the survey were recorded and discussed in the *Botanical Survey of the Keahoulu Affordable Housing Project* (Appendix B of the Keahuolu Affordable Housing Project EIS).

The 2007 botanical survey of the proposed Kamakana Villages Project site, located four main types of vegetation incuding: (1) Managed Land Vegetation along Palani Road, dominated by alien species; (2) *Prosopis* Woodland dominated by kiawe (*Prosopis pallida*) and koa haole (*Leucaena leucocephala*) along the southern boundary of the property; (3) *Leucaena* Scrub dominated by koa haole (*Leucaena leucocephala*) in combination with alahe'e (*Psydrax odoratum*) and fountain grass (*Pennisetum setaceum*) in the lower part of the property and on soil on the upper part; and (4) *Schinus/Psydrax* scrub dominated by Christmas berry (*Schinus terebinthifolius*) and alahe'e (*Psydrax odoratum*) on or near lava flows.

Managed Land Vegetation. These areas are under periodic or frequent management, such as near the edges of roads. This is a relatively minor component of the overall vegetation on the site since Palani Road is the only roadsides currently being managed.

Prosopis Woodland. This type of vegetation is dominated by alien tree species kiawe (*Prosopis pallida*), which is found only in indistinct zones north of and paralleling Palani Road. There is an open woodland with other tree species besides the koa haole (*Lucaena leucocephala*). Two other trees, which are occasional here, are the Christmas berry (*Schinus terebinthifolius*) and the native alahe'e (*Psydrax odoratum*). The ground cover is typically dense, dominated by Guinea grass (*Panicum maximum*) and Philippine violet (*Barleria cristata*), two species otherwise uncommon at

the study site. Talinum (*Talinum triangulare*), a weed, is also often common in places. Due to the dominance of the kiawe tree, few native species are found in the project area, except for the alahe'e.

Leucaena Scrub. *Leucaena* scrub is classified as disturbed, since fires occasionally sweep through the area and goats are known to be present. These two factors account for the dominance of alien species, which adapt more easily to these disruptive conditions than do native species. The *Leucaena* scrub vegetation is found on areas of older lava flows dominated by the alien scrubby tree koa haole (*Leucaena leucocephala*). This type of vegetation is not homogeneous since with increasing elevation going eastward up the slope its density and the species associated with it change. On the lower portions of the site, koa haole is one to three meters in height, scattered in an open-to-dense matrix of *Pennisetum setaceum* (fountain grass). Also significant is the native shrub or small tree alahe'e (*Psydrax odoratum*), which in some places is co-dominant.

Several other trees and shrubs are found here, but are not as frequent. These species include the alien tree Christmas berry (*Schinus terebinthifolius*) and alien shrub klu (*Acacia farnesiana*). Fountain grass dominates most of the open areas having some soil, but a number of other herbaceous species are found in the shade of koa haole or on pahoehoe rocks free of fountain grass, particularly talinum (*Talinum triangulare*), air plant (*Kalanchoē pinnata*), lantana (*Lantana camara*), and carrion flower (*Stapelia gigantea*). Two indigenous vines found here are the huehue (*Cocculus trilobus*) and kowali-'awa (*Ipomoea indica*) and the native herb is 'ala'ala-wai-nui (*Peperomia leptostachya*). At higher elevations, koa haole is generally less dominant and is replaced with Christmas berry (*Schinus terebinthifolius*). On deeper soils, however, it extends up to higher elevations.

Schinus/Psydrax **Scrub.** This type of vegetation is found in a patchy distribution in areas comprised of lava flows of various ages, and stages of development into soil. This vegetation gradually increases in frequency with increasing elevation, particularly above the 400-foot elevation since it is dominated by species that do better in wetter conditions found upslope. The main species dominating this community is the alien tree Christmas berry (*Schinus terebinthifolius*) along with the indigenous tree alahe'e (*Psydrax odoratum*). These two species are also found at lower elevations mostly on or near 'a'a lava flows. At higher elevations on the project site these species are dominant rather than being of secondary importance to koa haole (*Leucaena leucocephala*). The third most prevalent tree is the koa haole, which, as noted above, sometimes forms nearly pure strands on some soil types. The fourth most prevalent tree is the introduced shrub or small tree klu (*Acacia farnesiana*).

Other tree species found include the endemic 'ohe (*Reynoldsia sandwicensis*), indigenous shrub pua pilo (*Capparis sandwichiana),* the endemic shrub or tree mamane (*Sophora chrysophylla*), the indigenous shrub 'a'ali'I (*Dodonaea viscosa*), and the introduced (by Polynesians) noni (*Morinda citrifolia*). In this type of vegetation, the ground cover is sparse consisting of scattered clumps of fountain grass (*Pennisetum setaceum*) found mostly in pockets of soil or pahoehoe. The ground cover is particularly sparse under the dense canopy of the Christmas berry trees. Second in prevalence is probably the air plant (*Kalanchoē pinnata*), which forms a dense undergrowth in some places but is entirely lacking in others. There are many patches of huehue (*Cocculus trilobus*) and a few patches of kowali-'awa (*Ipomoea indica*) and the native fern kupukupu (*Nephrolepis exaltata*), as well as the thorny alien shrub lantana (*Lantana camara*). In a few places at the highest elevations, the endemic subshrub *Bidens micrantha* ssp. *ctenophylla* occurs. This

species was a candidate for federal listing as endangered or threatened but was never classified as such.

Like *Leucaena* Scrub, the *Schinus/Psydrax* Scrub vegetation is classified as disturbed, since fires occasionally sweep through the area, and goats are known to be present. The description is similar to that of the "Lowland Dry Shrublands," which is described as occurring in leeward situations on most of the main islands at 330- to 2,000-foot elevation and as being open and not exceeding 10 feet in height.

A comprehensive list of the 83 plant species recorded within the 272-acre project site can be found in Appendix B of the Keahuolu Affordable Housing Project EIS. Of the 83 plant species, 17 are native, 6 are endemic and 11 indigenous. No species federally listed as threatened or endangered were found during either the 1989 or 2007 botanical field surveys.

4.9.2 Fauna

In May 2008, Phillip Bruner conducted a field survey for the Keahuolu Affordable Housing Project EIS (Appendix C of the Keahuolu Affordable Housing Project EIS). The goals of the field survey were to document the species of birds and mammals currently on the property, identify the natural resources available to wildlife in the region and document the presence and possible use of the project site by native and migratory species, particularly those listed as threatened or endangered. The field survey was conducted over two consecutive days (May 27-28, 2008), during the early morning and late in the day when the birds are most active.

The survey area is presently covered in dense, second growth forest composed of alien species of trees, brush, and grass. The land surrounding the project site contains residential, commercial, schools, and other undeveloped property. The survey found no threatened or endangered faunal species within the 272-acre project site.

Native Land Birds: No native land birds were observed during the field survey. The only species that may be seen in the area on occasion is the endangered Hawaiian Hawk (*Buteo solitarius*) and the Hawaiian Short-eared Owl (*Asio flammeus sanwichensis*). The Hawaiian Short-eared Owl is not listed as endangered or threatened on the island of Hawai'i. Aside from the Hawaiian Hawk, no other native land birds would be expected to occur on this property.

Native Waterbirds: No native waterbirds were recorded during the survey. Native waterbirds are not expected to occur on the project site, particularly since no wetland habitat was found.

Seabirds: No nesting seabirds were seen during the field survey. Due to the human disturbance of the area and the possibility of predators, seabirds are not expected to nest in this area.

Migratory Birds: No migratory shorebirds were observed. No habitat suitable for shorebirds exists on the project site.

Alien (Introduced) Birds: Nineteen alien species were observed during the field survey, of which none are listed as being threatened or endangered.

Mammals: During the field survey, the skeletal remains of a feral pig (*Sus scrofa*) and two live adult pigs were observed. While no rats (*Rattus spp.*), mice (*Mus musculus*), or cats (*Felis catus*)

were found it is likely they occur on and around the property. No endangered Hawaiian Hoary Bats (*Lasiurus cinereus semotus*) were detected during the night search of the property.

The survey did not detect avian species that are currently listed as endangered, threatened or proposed for listing under either State or federal endangered species for listing under either State or federal endangered species programs. The habitat is not conducive to supporting native avian species.

4.9.3 Invertebrates

SWCA Environmental Consultants conducted a biological survey of lava tube caves on the proposed project site (Appendix H of the Keahuolu Affordable Housing Project EIS). The study's objectives were to conduct a biological survey of caves within the project area, identify biologically significant caves, compile a list of faunal species found, particularly invertebrates, and provide management recommendations for the biologically significant caves. SWCA conducted surveys from June 18-20, 2008.

Eight cave openings were found at Keahuolu, of which three appeared to have a suitable habitat for troglobitic arthropods. A total of14 distinct species of arthropods were found within four caves. Of these 14 species, 13 species were collected and examined. Current State and Federal regulations provide no special (or specific) protection for any of these species.

Two possible native cave species are represented in survey's findings: the Rhagidiid mite, which belongs to a group with two known blind cave species and an eyed species known from fumaroles near Kilauea, and the cave moth (*Schrankia* species). The remaining eleven species are classified as alien invaders. The full list of species is provided in Appendix B of the Keahuolu Affordable Housing Project EIS and is also summarized below.

Acari (Mites): The only species of mite that was identified was the *Rhagidiidae* which is described as a pale predatory mite with conspicuous eyespots.

Araneae (Spiders): Six species of spiders were identified during the survey.

Collembola (Springtails): One species of Springtails was discovered (*Entomobryidae*: Genus species [unidentified]).

Insecta (Insects): Five species of insects were identified.

While the lava tubes and caves in the project site contain a variety of invertebrates, none of the identified species is listed as threatened or endangered.

4.10 VISUAL RESOURCES

The project site is presently undeveloped land overgrown with trees and dense undergrowth. The existing visual character of the project area from Queen Ka'ahumanu Highway looking mauka can be described as gently upward sloping land, lava fields with dense stands of kiawe, stands of various grasses, and a backdrop of Hualalai and residential uses bordering the site. The mauka and makai views across the project site from the upper elevations at Palani Road are similar with the exception that the Pacific Ocean and Kailua town form the backdrop of the views looking makai.

From neighboring properties, views of the project site are generally obscured by the existing vegetation making it difficult to see beyond the perimeter of the property to the interior.

4.11 TRAFFIC

The West Hawai'i roadway network near the project area consists of three principal roadways: Queen Ka'ahumanu Highway, Mamalahoa Highway, and Palani Road. A Traffic Study for the three alternative concept plans for the proposed Keahuolu Affordable Housing Project was prepared by Fehr & Peers/Kaku Associates in January 2008 (Appendix F of the Keahuolu Affordable Housing Project EIS). However, to support the land use applications for the development of Kamakana Villages at Keahuolu, Forest CIty had The Traffic Management Consultant (TMC) prepare a Traffic Impact Analysis Report (TIAR) consistent with the requirements of the Concurrency Ordinance in the Hawaii County Code. See TIAR dated December 2009 included as *Appendix D*. The TIAR evaluates potential impacts of the proposed project on existing roadways and traffic conditions.

The highway capacity analysis performed for the TIAR is based upon procedures presented in the Highway Capacity Manual (HCM) (2000), which is published by the Transportation Research Board. HCM defines Level of Service (LOS) as "a quality measure describing operational conditions within a traffic stream". Several factors may be included in determining LOS, such as: speed, travel time, freedom to maneuver, traffic interruptions, driver comfort, and convenience. LOS's "A", "B", and "C" are considered satisfactory Levels of Service. LOS "D" is generally considered a minimum "acceptable" operating level of service. LOS "E" is an undesirable condition, and LOS "F" is an unacceptable condition.

"Volume-to-capacity" (v/c) ratio is another measure of effectiveness (MOE) indicating the relative traffic demand to the roadway's capacity. HCM defines capacity as "the maximum number of vehicles that can pass a given point during a specified period under prevailing roadway, traffic flow, and traffic control conditions." A v/c ratio of 0.50 indicates that the traffic demand is utilizing 50 percent of the roadway's capacity.

The trip generation methodology is based upon generally accepted techniques developed by the Institute of Transportation Engineers (ITE) and published in Trip Generation, 8th Edition. ITE trip rates are developed by correlating the total vehicle trip generation data with various activity/land use characteristics, such as the vehicle trips per hour (vph) per dwelling unit (DU).

The TIAR reduced the trip generation rates for commercial activities at the project by a "capture rate" of 25 percent to account for the internal trips that do not leave the project site. The AM peak hour capture rate for a mixed-use "destination" trips is applied directly to the AM peak hour "origin" trip rates for apartments, since the AM peak hour traffic primarily involves the home to work trips. The PM peak hour capture rate for mixed-use trips is allocated over all the dwelling units in the project, which will be equivalent to a 7 percent reduction in residential trips. The elementary schools was assumed to generate trips from within the proposed project during the AM peak hour of traffic, i.e., parents dropping off children before going to work. The PM peak hour trips generated by the elementary school were assumed to be externally generated.

4.11.1 Existing Conditions

Area Roadway System

Queen Kaahumanu Highway is a two-way, two- to four-lane, high quality arterial highway between Kailua-Kona and Kawaihae. Queen Kaahumanu Highway is the primary arterial highway along the South Kohala and North Kona coasts. Queen Kaahumanu Highway is a four-lane divided highway between Henry Street and Kealakehe Parkway. The State Department of Transportation (DOT) is planning the second phase of the Queen Kaahumanu Highway widening from two lanes to four lanes between Kealakehe Parkway and the Kona International Airport Access Road.

Kealakehe Parkway is a two- to three-lane, two-way arterial highway between Honokohau Harbor and Keanalehu Drive. Kealakehe Parkway is signalized at its four-legged intersection with Queen Kaahumanu Highway.

Makala Boulevard is a two-way, two- to four-lane collector road between Kuakini Highway and Makalapua Center. Makala Boulevard intersects Queen Kaahumanu Highway at a four-legged signalized intersection.

Palani Road is a two-way, two- to four-lane roadway, between Kuakini Highway and Mamalahoa Highway. Palani Road is signalized at Henry Street, and at Queen Kaahumanu Highway.

Ane Keohokalole Highway is a two-lane, two-way roadway which extends from the future West Hawai`i Civic Center on Kealakehe Parkway to Puohulihuli Street. The County of Hawai'i will extend Ane Keohokalole Highway from Puohulihuli Street to Palani Road.

Henry Street is a two-way, four-lane divided roadway between Palani Road and Kuakini Highway. Henry Street is signalized at Palani Road and at Queen Kaahumanu Highway.

Existing Traffic Volumes and Operating Conditions

The TIAR analyzed the potential project-related traffic impacts under typical weekday A.M. and P.M. peak hour traffic conditions at six intersections near the proposed project.

1. Queen Kaahumanu Highway and Kealakehe Parkway
2. Kealakehe Parkway and Ane Keohokalole Highway
3. Queen Kaahumanu Highway and Makala Boulevard
4. Queen Kaahumanu Highway and Palani Road
5. Queen Kaahumanu Highway and Henry Street
6. Palani Road and Henry Street

Traffic counts were taken to evaluate the existing conditions near the proposed project site. The existing daily traffic volume data are available in *Appendix D.*

Existing AM Peak Hour Traffic

The existing AM peak hour of traffic occurred from 7:15 AM to 8:15 AM. Queen Kaahumanu Highway carried between 1,400 vehicles per hour (vph) and 2,000 vph, total for both directions, during the existing AM peak hour of traffic. Mauka of Henry Street, Palani Road carried about 1,700 vph, total for both directions.

The intersection of Queen Kaahumanu Highway and Kealakehe Parkway operated at LOS "C" and a v/c ratio of 0.86, during the existing AM peak hour of traffic. The shared left-turn/through movement on westbound (makai bound) Kealakehe Parkway operated at LOS "E". The other traffic movements at the intersection operated at a LOS of C or better.

The Queen Kaahumanu Highway and Makala Boulevard intersection operated at LOS "C" with a v/c ratio of 0.58. The left-turn movements in both directions on Queen Kaahumanu Highway and on makai bound Makala Boulevard operated at LOS "D". The other traffic movements at the intersection operated at satisfactory LOS during the existing AM peak hour of traffic.

The intersection of Queen Kaahumanu Highway and Palani Road operated at LOS "C" with a v/c ratio of 0.62, during the existing AM peak hour of traffic. The left-turn movement on all approaches to intersection operated at LOS "D". The other traffic movements at the intersection operated at satisfactory LOS. .

The intersection of Queen Kaahumanu Highway and Henry Street operated at LOS "C" with a v/c ratio of 0.72. The left-turn movements on all approaches to the intersection operated at LOS "D". The mauka bound through movement on Henry Street also operated at LOS "D". The other traffic movements at the intersection operated at satisfactory LOS during the existing AM peak hour of traffic.

The Palani Road and Henry Street intersection operate at capacity (v/c=1.00) and at LOS "C", during the existing AM peak hour of traffic. The dominant traffic movements were between Henry Street and the mauka leg of Palani Road. The left-turn movement from makai bound Palani Road onto Henry Street operated at LOS "D". The other traffic movements at the intersection operated at satisfactory LOS.

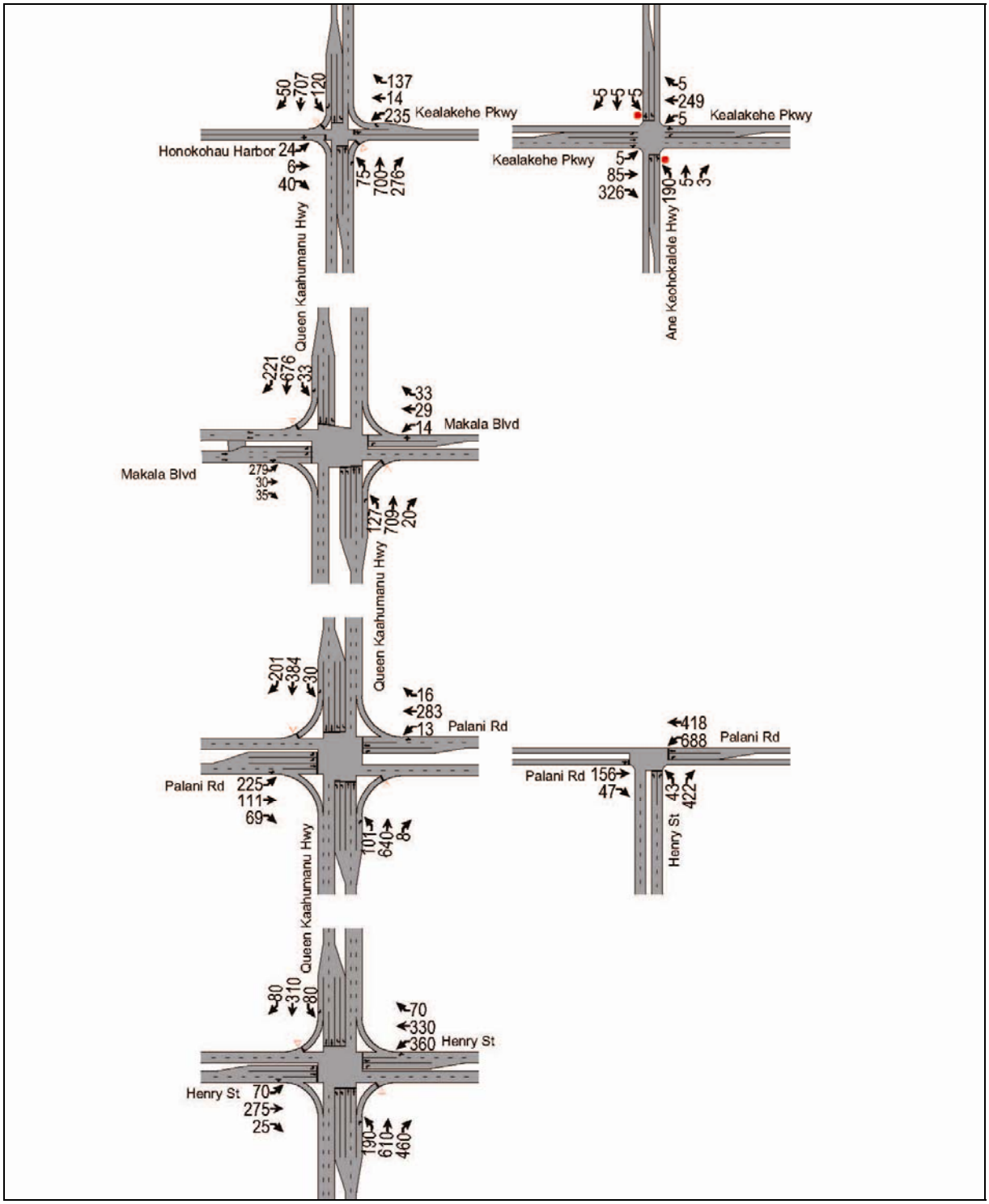
The intersection of Kealakehe Parkway and Ane Keohokalole Highway operated at satisfactory LOS. *Figure 4-8* depicts the existing AM peak hour traffic volumes.

Existing PM Peak Hour Traffic

The existing PM peak hour of traffic occurred between 3:30 PM and 4:30 PM. Queen Kaahumanu Highway carried between, 1,800 vph and 2,400 vph, total for both directions, during the existing PM peak hour of traffic. Mauka of Henry Street, Palani Road carried about 1,700 vph, total for both directions.

The Queen Kaahumanu Highway and Kealakehe Parkway intersection operated at capacity (v/c = 1.16) with a LOS "E", during the existing PM peak hour of traffic. The left-turn movement on northbound Queen Kaahumanu Highway and the shared left-turn/through movement on makai bound Kealakehe Parkway operated at LOS "F". The southbound through movement on Queen Kaahumanu Highway and the mauka bound approach of Kealakehe Parkway operated at LOS "E".

Queen Kaahumanu Highway and Makala Boulevard operated at LOS "D" with a v/c ratio of 0.89, during the existing PM peak hour of traffic. The left-turn movements on northbound Queen Kaahumanu Highway and on makai bound Makala Boulevard operated at LOS "E". The shared through/right-turn movements in both directions on Makala Boulevard at Queen Kaahumanu Highway also operated at LOS "E".



EXISTING AM PEAK HOUR TRAFFIC
KAMAKANA VILLAGES AT KEAHUOLU
(Source: Traffic Management Consultant, 2009)

GROUP 70 INTERNATIONAL
Figure 4-8

The intersection of Queen Kaahumanu Highway and Palani Road operated at LOS "C" with a v/c ratio of 0.84. The left-turn movements on northbound Queen Kaahumanu Highway and mauka bound Palani Road operated at LOS "E", during the existing PM peak hour of traffic.

During the existing PM peak hour of traffic, the intersection of Queen Kaahumanu Highway and Henry Street operated at LOS "D" with a v/c ratio of 0.80. The left-turn movements in both directions on Queen Kaahumanu Highway operated at LOS "E". The through movement on mauka bound Henry Street also operated at LOS "E".

The Palani Road and Henry Street intersection operated at LOS "C" with a v/c ratio of 0.93. Mauka bound Palani Road operated at LOS "D", during the existing PM peak hour of traffic. The other traffic movements at the intersection operated at satisfactory LOS.

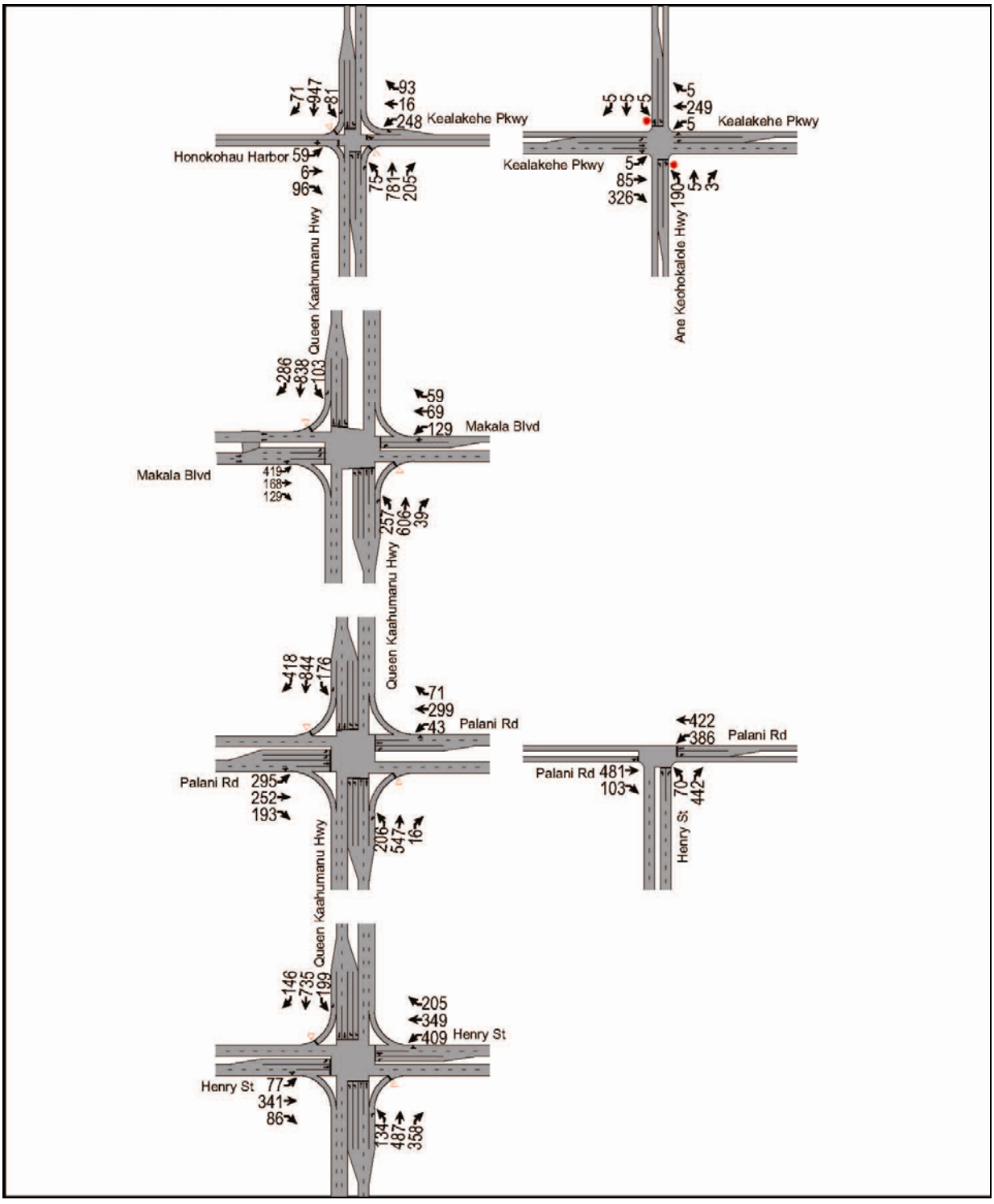
The Kealakehe Parkway and Ane Keohokalole Highway intersection operated at satisfactory LOS. The existing PM peak hour traffic volumes are depicted on *Figure 4-9.*

Public Transportation

The County of Hawai'i provides transportation services near the Kamakana Villages project site including the following:

Intra-Kona – This route provides regular bus service throughout the Kona region with the route extending from the Fujihara Store in Captain Cooke toward Kealakekua and Kona Hospital to the north along Alii Drive and to Keahole and Kona International Airport. The service operates six days a week (Monday through Saturday) from about 5:00am to 6:50pm heading northbound and from about 6:30am to 6:00pm heading southbound.

Kona-Hilo – This bus route provides service through Kona and into the Hilo area. The route extends from Fujihara Store in Captain Cooke to Alii Drive towards Waimea. Service then extends east to Laupaheohoe and south towards Hilo. The service operates six days a week (Monday through Saturday) from about 5:45am to 10:05am heading northbound and from about 1:10pm to 5:30pm heading southbound.



EXISTING PM PEAK HOUR TRAFFIC
KAMAKANA VILLAGES AT KEAHUOLU
(Source: Traffic Management Consultant, 2009)

GROUP 70 INTERNATIONAL
Figure 4-9

4.12 PUBLIC ACCESS

The existing project site is comprised of vacant and undeveloped land. There is no existing public access from within the proposed project site to and along shoreline and mountain areas. The project site is approximately one mile upslope and away from the coastline.

4.13 SOCIO-ECONOMIC CHARACTERISTICS

The Kamakana Villages Project is planned in response to the regional needs for housing and the desire to reduce congestion on regional highways due to residents traveling long distances between home and work. Future residents of Keahuolu are likely to come from West Hawai'i, ranging from Ocean View in Ka'u to North Kohala.

This section examines the socio-economic conditions and trends of Hawai'i County, the West Hawai'i region, and the proposed project area. The socio-economic conditions evaluated include the social settlement pattern (population, composition, and housing), socio-economic conditions and economic resources (economic characteristics and employment), and land values. In October 2009, The Hallstrom Group, Inc. performed a Market Study, Economic Impact Assessment, and Public Costs/Benefits Assessment to determine the strength of market demand for Kamakana Villages (*Appendix E*).

4.13.1 Social Settlement Pattern of the Area

North Kona

Prior to the 1970s, Kailua-Kona was a small coastal village with fewer than 5,000 residents, its economy oriented towards supporting the surrounding agricultural uses, with limited resort-oriented and commercial development. During that decade, the development of Keauhou Resort and Kona Village and revitalization of the town core, coupled with numerous condominium projects along Alii Drive, served to create a desirable visitor destination (*Appendix E*).

By the mid-1980s, it was becoming acknowledged that Greater Kailua-Kona would be the focus of urban uses in West Hawaii over the long-term; providing an appropriately sufficient mix of residential, commercial, industrial, resort and supporting inventory to allow the regional economy to achieve sustainability.

While the near-makai areas continued to be dominated by resort/transient-oriented and non-resident use and ownership, the inland areas of North Kona were being developed at a rapid pace for local resident households and their daily needs.

Within Hawai'i County, North Kona has seen one of the faster rates of increase than other areas in the island, except for in Puna and South Kohala. If population trends continue at the same rate, by the year 2020, the population of North Kona is expected to exceed 43,700 people (HHFDC, 2008). The resident population of West Hawai'i is forecast to increase by about 60% over the next two decades, reaching some 118,000 persons (*Appendix E*). The Greater Kailua-Kona area, which stretches from Keahole to Keauhou, the resident population is expected to grow from the current 23,000 to 40,000 persons by 2030. (*Appendix E*). These additional residents will primarily result from the natural growth of current Island resident families.

The overall population of North Kona and South Kohala includes a larger share of U.S. mainland in-migrants with the ethnic distribution having a larger share of Caucasians compared to island-wide statistics and other West Hawai'i districts. *Table 4-3* illustrates the historical and projected population by district and *Table 4-4* illustrates the demographic characteristics West Hawai'i districts.

Table 4-3
Historic and Projected Resident and De Facto Population
for General and Primary Study Areas 1980 to 2030

	Historic Figures				Projected Figures				
Year	1980	1990	2000	2005	2010	2015	2020	2025	2030
1. County of Hawaii									
Resident Population (1)	92,053	120,317	148,677	164,462	176,714	199,488	221,862	242,642	261,758
% Annual Average Change		3.1%	2.4%	2.1%	1.5%	2.6%	2.2%	1.9%	1.6%
Tourism Population	6,647	12,885	18,396	23,206	24,000	26,000	28,000	30,000	32,000
% Annual Average Change		9.4%	4.3%	5.2%	0.7%	1.7%	1.5%	1.4%	1.3%
Total De Facto Population	98,700	133,202	167,073	187,668	200,714	225,488	249,862	272,642	293,758
% Annual Average Change		3.5%	2.5%	2.5%	1.4%	2.5%	2.2%	1.8%	1.5%
% of State Total	12.4%	12.7%	13.6%	14.8%	15.4%	16.5%	17.4%	18.3%	19.0%
2. West Hawaii (2)									
Resident Population	27,518	43,373	56,301	62,160	74,000	85,000	97,000	108,000	118,000
% Annual Average Change		5.8%	3.0%	2.1%	3.8%	3.0%	2.8%	2.3%	1.9%
% of County Total	29.9%	36.0%	37.9%	37.8%	41.9%	42.6%	43.7%	44.5%	45.1%
Tourism Population	5,583	11,468	16,372	21,582	22,440	24,375	26,320	28,275	30,240
% Annual Average Change		10.5%	4.3%	6.4%	0.8%	1.7%	1.6%	1.5%	1.4%
Total De Facto Population	33,101	54,841	72,673	83,742	96,440	109,375	123,320	136,275	148,240
% Annual Average Change		6.6%	3.3%	3.0%	3.0%	2.7%	2.5%	2.1%	1.8%
% of County Total	33.5%	41.2%	43.5%	44.6%	48.0%	48.5%	49.4%	50.0%	50.5%
3. Greater Kailua-Kona (3)									
A. Based on State/County Figures									
Estimated Resident Population	11,382	15,606	19,078	21,800	24,000	27,000	31,000	35,000	39,000
% Annual Average Change		3.7%	2.2%	2.9%	2.0%	2.5%	3.0%	2.6%	2.3%
% of County Total	11.5%	11.7%	11.4%	11.6%	12.0%	12.0%	12.4%	12.8%	13.3%
B. Based on Market Trending									
Estimated Resident Population					24,200	28,000	32,500	37,000	41,500
% Annual Average Change						3.1%	3.2%	2.8%	2.4%

(1) From State of Hawaii DBEDT "Population and Economic Projections for the State of Hawaii to 2035 - DBEDT Series 2035", July 2009.
(2) Using DBEDT forecast for total county population, and distribution percentage to individual districts from County of Hawaii General Plan, Table 1-9, Scenario C. Includes the Districts of North Kohala, South Kohala, North Kona and South Kona.
(3) Includes area from Keahole to Keauhou.
(4) Based on past market trending, potential supply islandwide, regional economic vitality and other factors.

Source: State of Hawaii, County of Hawaii and The Hallstrom Group, Inc.

Table 4-4
Demographic Characteristics, Hawai'i County and West Hawai'i Districts, from 2000 Census

	North Kona District	Kalaoa CT 215.01	Kalaoa 215.01 BG 1	Kalaoa 215.01 BG 2	Kalaoa 215.01 BG 3	Hualalai CT 215.02	Kailua-Kona CT 216.01	Holualoa CT 216.02	Kahaluu-Keauhou CT 215.03
POPULATION									
Total Population (1)	28,543	9,505	3,087	3,307	3,111	3,688	5,987	5,268	4,095
Male	14,349	4,751	1,527	1,708	1,516	1,897	2,988	2,657	2,056
Female	14,194	4,754	1,560	1,599	1,595	1,791	2,999	2,611	2,039
Age Group									
Under 5 years	1,830	760	228	200	332	183	365	293	229
5 to 14 years	3,932	1,571	498	432	641	500	758	626	477
15 to 19 years	1,835	678	227	203	248	251	402	302	202
20 to 64 years	17,581	5,778	1,952	2,095	1,731	2,329	3,713	3,365	2,396
65 to 74 years	1,916	421	101	213	107	235	463	378	419
75 and over	1,449	297	81	164	52	190	286	304	372
Median Age	39.4	35.0	35.0	42.0	27.0	40.9	39.4	41.9	45.1
Race (Federal classification)									
White alone	47.1%	40.0%	46.6%	53.2%	19.5%	49.0%	45.5%	56.0%	52.9%
Black or Afr ican American alone	0.4%	0.3%	0.4%	0.5%	0.2%	0.2%	0.6%	0.6%	0.4%
American Indian and Alaska Native alone	0.5%	0.5%	0.5%	0.5%	0.5%	0.2%	0.5%	0.6%	0.5%
Asian alone	16.3%	14.8%	9.6%	16.0%	18.6%	15.2%	19.0%	16.4%	16.9%
Native Hawaiian and Other Pacific Islander alone	10.7%	14.0%	12.4%	7.5%	22.6%	11.3%	9.3%	7.3%	8.9%
Some other race alone	1.4%	0.9%	1.1%	0.6%	1.0%	1.0%	2.5%	1.7%	1.1%
Two or more races	23.5%	29.5%	29.5%	21.8%	37.6%	23.1%	22.7%	17.4%	19.2%

Source: (EIS TABLE 4-40) HHFDC, 2008; 2000 U.S Census

Hawai'i County's volume of new construction during boom times has been much larger than other islands such as Maui. As of 2006, the Hawai'i County had an estimated total of 77,577 single- and multi-family units. The approximately 23,000 full time residents in Greater Kailua-Kona are housed in an estimated 11,800 resident (i.e., non-resort) housing units (*Appendix E*). Long-range planning indicates that there will be a need for a 70% - 90% increase, with a midpoint of 8,861 units, in housing stock by 2030. (*Appendix E*). Housing costs are higher near job centers. Homeowners in the outlying districts typically do not spend a large part of their incomes on housing unlike homeowners in North Kona and South Kohala *Table 4-5 and Table 4-6*. As a result, approximately a quarter of the North Kona housing stock is vacant because they are for sale or rent or are reserved for use by non-residents as vacation rentals, second homes, or fractional ownership units.

Non-residents are disproportionately involved in the real estate market. From 2001 to 2005, out-of-state buyers accounted for approximately 35 percent of the county's single-family home sales and 75 percent of condominium sales (HHFDC, 2008). As a result, market prices reflect both local and non-local buying power, and the median home price is higher than the average household can afford.

Table 4-5
Housing Units and Cost, From 2000 Census, Hawai'i County and West Hawai'i Districts

	Hawaii County	Ka'u	South Kona	North Kona	South Kohala	North Kohala
HOUSING						
Housing Units (1)						
Occupied	52,985	2,209	3,113	10,522	4,648	1,751
Vacant	9,689	674	401	3,438	1,146	171
Vacant for seasonal use	5,101	292	218	2,753	847	58
Vacant share of all units	15.5%	23.4%	11.4%	24.6%	19.8%	8.9%
Tenure of occupied housing units						
Owner occupied	64.5%	74.2%	62.2%	58.5%	58.9%	70.4%
Renter occupied	35.5%	25.8%	37.8%	41.5%	41.1%	29.6%
Average household size	2.75	2.63	2.76	2.70	2.81	2.97
Housing Costs (2)						
Median contract rent	$553	$371	$506	$683	$724	$639
Median gross rent	$645	$431	$572	$745	$811	$739
Owner-occupant housing costs						
Median, for owners with a mortgage	$1,133	$749	$1,323	$1,423	$1,385	$1,245
Renters, paying 30% to 39% of income	2.9%	3.4%	3.1%	3.6%	2.2%	2.4%
Renters, paying > 40% of income	4.6%	9.5%	6.6%	2.3%	4.0%	4.0%
Owners, with mortgage, paying 30% to 39% of income	10.1%	7.5%	9.2%	13.3%	12.8%	11.2%
Owners, with mortgage, paying 40% + of income	13.6%	11.0%	14.9%	19.1%	21.3%	12.1%

Source/Notes: (EIS TABLE 4-41) HHFDC, 2008; (1) 2000 U.S. Census, SF1, from all households (2) 2000 U.S. Census, SF3, from a sample of households

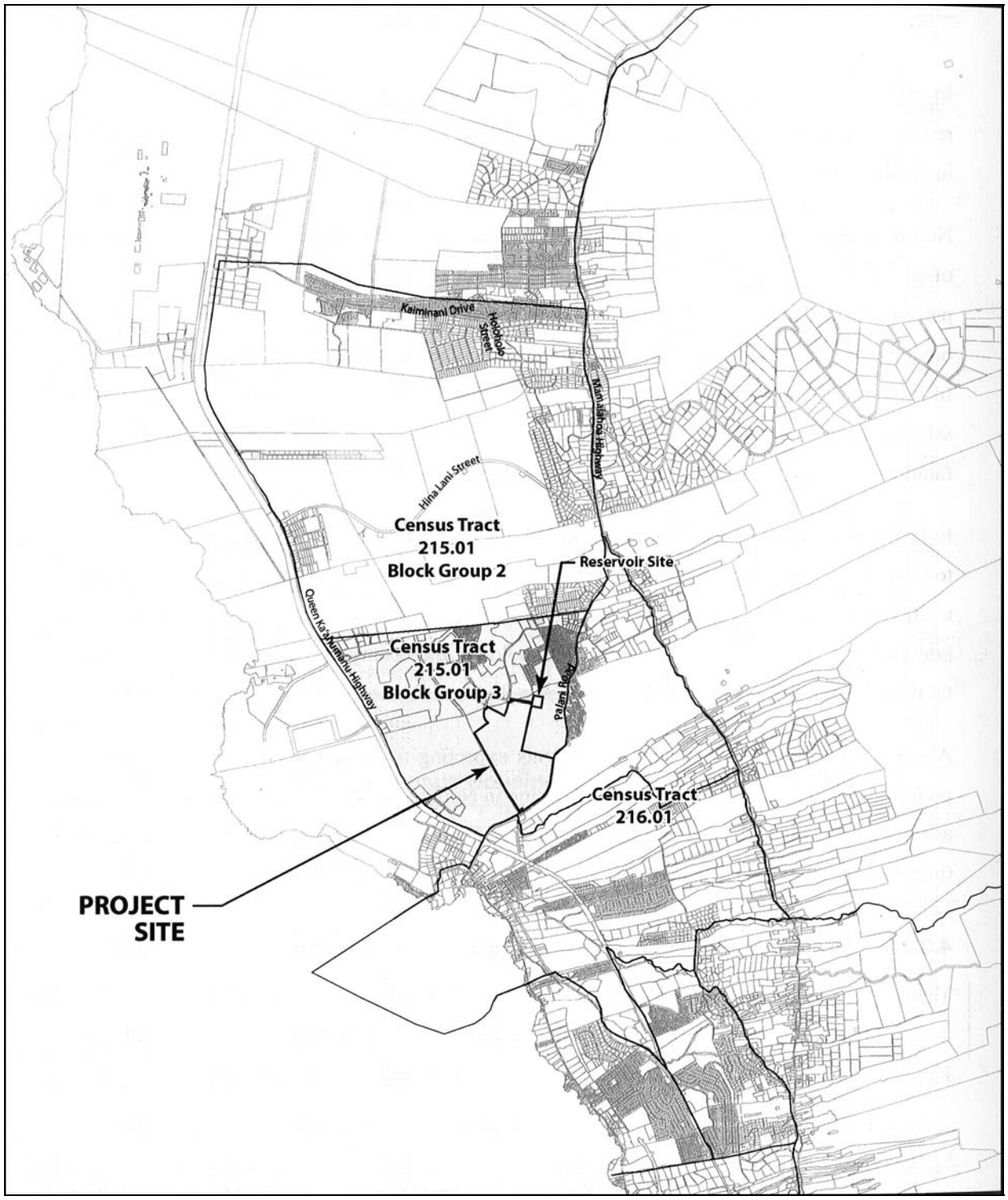
Table 4-6
2000 Census Housing Data, by Zip Code Area

Town	Zip Code	District	Population	Housing units	Renter-occupied units	Rental share of occupied units	Vacant units	Vacant share of total units
Ocean View	96737	Kau	2,112	1,273	207	23%	368	29%
Captain Cook	96704	South Kona	6,617	2,701	827	35%	344	13%
Kealakekua	96750	South Kona	2,629	1,049	498	51%	71	7%
Holualoa	96725	North Kona	2,956	1,293	483	44%	192	15%
Kailua-Kona	96740	North Kona	25,132	12,605	3,749	40%	3,319	26%
Waikoloa	96738	South Kohala	5,269	2,350	893	47%	444	19%
Kamuela	96743	South Kohala	8,546	3,748	1,093	37%	763	20%
Hawi	96719	North Kohala	2,615	671	176	29%	71	11%
Kapaau	96755	North Kohala	2,973	1,040	297	31%	74	7%

Source: (EIS TABLE 4-42) HHFDC, 2008; 2000 U.S. Census, as reported in American Factfinder, www.census.gov

Project Area

The Kamakana Villages project site lies within Census Tract 215.01, Block Group 3, as shown in *Figure 4-8*. In addition to the project site, that block group also includes two residential areas: Kealakehe Village on and near Kealaka'a Street, and Kaniohale, in the Villages of La'i 'Ōpua. In 2000, some 3,100 people lived in Census Tract 215.01, Block Group 3. The average household had 3.37 members, much more than the district average (2.7 persons per household). The median age was 27 years, far lower than for the district as a whole (39.4 years) and the other sub-areas studied. Block Group 3 includes more Native Hawaiian (22.6 percent of respondents) or of two or more races (37.6 percent) than residents of the other sub-areas.



CENSUS GEOGRAPHY, PROJECT AREA (HHFDC, 2008)
KAMAKANA VILLAGES AT KEAHUOLU

GROUP 70 INTERNATIONAL
Figure 4-10

The 2000 U.S. census indicated the average resident household size for the Big Island was 2.75 persons, and the census tracts within Greater Kailua-Kona ranged from about 2.6 to 3.0 persons per household. The average household size in the project area is estimated at 2.86 persons. The average household sizes in West Hawai'i are projected to trend downward over the study period, declining to circa 2.74 persons by 2030. Most Hawai'i-oriented sociologists contend the movement to smaller household sizes will continue into the future; forecasting longer life-spans, the influx of single persons attracted to the climate and employment opportunities, and the tendency towards fewer children.

In 2000, homeownership in the immediate area which includes, DHHL housing, La'ilani, Kealakehe, Kaimalino, and Jack Hall housing projects, was less common than in other sub-areas. While only 14 of a total of 994 housing units in the immediate area were listed as being vacant or held for seasonal use, only 51.2 percent were occupied by homeowners as compared to 58.5 percent for the district as a whole (HHFDC, 2008). Housing costs for both renters and owners were lower in the immediate area than in the surrounding sub-areas however, over half of the renters in the area paid 30 percent or more of their income for housing *Table 4-7*.

Analysis performed under both, the Gross Demand/Supply Comparison and the Residual Method, determined that even if all presently planned developments are built along probabe timelines and at maximum densities, a housing shortfall of 1,500 to 6,000, to 1,702 to 4,304 residential units is expected for the Greater Kailua-Kona area through 2028 (*Appendix E*).

Table 4-7
Housing Costs, From 2000 Census, North Kona District and Sub-Areas

	North Kona District	Kalaoa CT 215.01	Kalaoa 215.01 BG 1	Kalaoa 215.01 BG 2	Kalaoa 215.01 BG 3	Hualalai CT 215.02	Kailua-Kona CT 216.01	Holualoa CT 216.02	Kahaluu-Keauhou CT 215.03
Households (1)									
Number	10,522	3,142	1,063	1,159	920	1,419	2,331	2,040	1,590
Persons in households	28,410	9,488	3,087	3,301	3,100	3,688	5,974	5,268	3,992
Average household size	2.70	3.02	2.90	2.85	3.37	2.60	2.56	2.58	2.51
Housing Costs (2)									
Median Contract rent	$683	$740	$920	$998	$509	$577	$0	$745	$694
Median Gross rent	$745	$822	$959	$1,158	$583	$638	$727	$828	$746
Owner-occupant housing costs									
Median, for owners with a mortgage	$1,423	$1,392	$1,285	$1,630	$1,223	$1,602	$1,301	$1,532	$1,493
Share of households with high housing costs									
Renters paying 30% to 39% of income	13.9%	19.3%	13.1%	16.2%	26.9%	9.8%	16.8%	8.0%	8.7%
Renters paying > 40% of income	34.5%	35.0%	41.8%	37.8%	27.6%	40.2%	35.4%	22.6%	41.7%
Owners paying 30% to 39% of income	13.5%	10.4%	13.2%	10.6%	6.9%	5.2%	16.6%	25.6%	6.1%
Owners paying > 40% of income	24.9%	25.0%	23.9%	27.9%	22.2%	27.6%	21.2%	28.2%	22.3%

Source/Notes: (EIS TABLE 4-44) HHFDC, 2008; (1) 2000 U.S. Census, SF1, from all households (2) 2000 U.S. Census, SF3, from a sample of households

4.13.2 Socio-Economic Conditions and Economic Resources

North Kona

Historically, West Hawai'i was an agricultural area, with coffee, sugar, and cattle as its major commodities. Major public facilities for West Hawai'i, such as the hospital and the area's first high school, were located in Kealakekua in the South Kona district.

The visitor industry in North Kona grew after statehood, and the district received the majority of the island's visitor units. By 1990, coastal resorts became important destinations expanding the industry and making West Hawai'i more dependent on tourism. Today, Kailua-Kona is a regional center with commercial, industrial, and resort facilities. The daily tourist population in West Hawai'i averages about than 22,000 visitors, utilizing some 9,600 transient vacation units, and spending more than $1 billion annually (current dollars). The attractions of North Kona for residents and visitors are its exceptional climate, extensive shoreline, central location, significant business activity, and comprehensive supporting facilities.

As of 2002, Kailua-Kona had 165 retail establishments with gross sales of $410 million, which is 24 percent of the island total. The retail workforce in Kailua numbered 2,174. North Kona has seen continuing increases in population, visitor numbers, and commercial area. The ratio of visitors to residents in West Hawai'i, is about 1 to 3. In 2000, West Hawai'i had 56,301 residents and an average visitor census of 17,784. However, Greater Kailua-Kona has been among the most negatively impacted areas in the State during the recent downturn. There have been some business closures, many operations have cut back on staffing, and there are wide-spread concerns over viability should meaningful recovery not occur in 2010-11. As a result, the unemployment rate in Hawaii County, traditionally among the bottom half of the nation, has increased by more than 50% over the past year, now standing at 10.8% of the workforce, up from 6.6% in September 2008. Among the factors contributing to this unemployment rate are the decline in new construction and the 15 to 25% decline in tourism indicators.

Following past off-cycles, West Hawai'i has demonstrated the ability to rebound on par with most neighbor island sectors, a function of its large working-class resident population, economic prominence, and a significant and diverse tourism infrastructure. Regional recovery is anticipated to lag behind the mainland (and subsequently O'ahu) by several quarters, stabilizing over the coming year, and then moving upward in concert with statewide trends by 2011. The study area population and business activity is anticipated to continue growing over the coming two-plus decades (to 2030), although at a slightly slower rate than during the 1980s-90s. This growth will require additional lands be designated for residential, commercial, resort, recreational, park/open space and other uses in order to provide a sustainable, quality lifestyle for residents and visitors.

In 2000, approximately 10,000 people worked in Kailua-Kona. Of this number, 70 percent commuted from other places on the island (HHFDC, 2008). In the districts of West Hawai'i, incomes were typically above the county average in 1999. South Kohala had the highest average income. In both North Kona and South Kohala, there was a low share of population with incomes below poverty level (*Table 4-8*). While this data may indicate local prosperity, it also shows that local prosperity has generated such high housing costs that families with modest incomes can find homes only in outlying areas.

Table 4-8
Income and Poverty Characteristics, from 2000 Census, Hawai'i County and West Hawai'i Districts

	Hawaii County	Ka'u	South Kona	North Kona	South Kohala	North Kohala
INCOME AND POVERTY						
Household income in 1999	30.9%	43.7%	29.3%	22.2%	17.5%	25.3%
Under $25,000	29.8%	31.1%	28.3%	30.8%	30.7%	26.9%
$25,000 to $49,999	18.4%	14.2%	18.2%	20.0%	22.7%	24.1%
$50,000 to $74,999	10.4%	5.6%	12.8%	11.6%	15.1%	11.8%
$75,000 to $99,999	8.7%	5.2%	9.2%	12.2%	10.8%	10.2%
$100,000 to $199,999 $200,000 and above	1.8%	0.3%	2.2%	3.3%	3.2%	2.2%
Median Household income	$39,805	$29,466	$42,058	$47,610	$51,379	$47,733
Poverty Status						
Persons below poverty line	22,821	1,376	1,084	2,756	1,100	641
Share of total population below poverty line	15.7%	23.9%	12.7%	9.7%	8.5%	12.1%
Age distribution, persons below poverty line						
0 to 17 years	35.9%	34.4%	31.8%	32.7%	41.9%	27.3%
18 to 64 years	58.0%	56.9%	62.4%	60.9%	53.5%	61.9%
65 to 74 years	3.2%	4.0%	3.0%	3.6%	3.1%	3.0% 7.8%
75 years and over	2.9%	4.7%	2.9%	2.9%	1.5%	

Source: (EIS Table 4-37) HHFDC, 2008; 2000 U.S. Census, SF3 data from a sample of households

Project Area

Block Group 3 stands out as an area with large undeveloped sections, between the commercial and industrial areas of Kailua to the west and single-family residential areas to the north and east. To the south are single-family areas, along with concentrations of multi-family housing serving vacation and upscale markets toward the shore.

The region's visitor areas extend along the coast, from Keauhou to the Mauna Kea Resort. Retail activity is centered on the intersection of Queen Ka'ahumanu Highway with Palani Road. Other new and proposed retail areas within a few miles of that intersection include Lowe's on Henry Street, Costco in the Kaloko Industrial Park, and the planned Kona Commons, next to the existing QLT industrial area makai of the Queen Ka'ahumanu Highway.

In 2000, most residents of the immediate project area worked in hotel and food services (18 percent). Transportation and warehousing (9.7 percent) and construction (9.5 percent) were the next most common industries. Residents surrounding the project site, have lower incomes than households in the other block groups of tract 215.01. The incidence of poverty is high in the immediate project area (see *Table 4-9*).

Table 4-9
Income and Poverty Characteristics, from 2000 Census, North Kona District and Sub-Areas

	North Kona District	Kalaoa CT 215.01	Kalaoa 215.01 BG 1	Kalaoa 215.01 BG 2	Kalaoa 215.01 BG 3	Hualalai CT 215.02	Kailua-Kona CT 216.01	Holualoa CT 216.02	Kahaluu-Keauhou CT 215.03
INCOME AND POVERTY									
Household income in 1999									
Under $25,000	22.2%	18.6%	16.9%	11.9%	28.2%	25.4%	24.7%	18.1%	28.2%
$25,000 to $49,999	30.8%	31.8%	36.6%	26.3%	33.4%	27.9%	36.2%	29.0%	25.4%
$50,000 to $74,999	20.0%	21.4%	18.1%	24.3%	21.5%	16.9%	20.6%	19.1%	20.0%
$75,000 to $99,999	11.6%	13.8%	12.8%	17.3%	10.9%	9.8%	9.3%	13.1%	10.4%
$100,000 to $199,999	12.2%	11.0%	11.7%	17.3%	2.4%	16.2%	7.4%	17.7%	10.7%
$200,000 and above	3.3%	3.3%	3.8%	3.0%	3.0%	3.9%	1.8%	3.0%	5.3%
Median Household income	$47,610	$49,772	$48,415	$61,181	$41,086	$46,100	$40,765	$51,590	$45,076
Share of total population below poverty line	9.7%	8.5%	7.8%	3.6%	14.4%	9.5%	8.7%	7.5%	17.1%
Age distribution, persons below poverty line									
0 to 17 years	32.7%	34.9%	37.5%	18.5%	37.9%	33.3%	27.7%	17.7%	42.0%
18 to 64 years	60.9%	60.3%	53.0%	81.5%	58.5%	56.6%	67.8%	69.4%	53.7%
65 to 74 years	3.6%	2.0%	4.7%	0.0%	1.1%	8.9%	0.0%	6.1%	3.9%
75 years and over	2.9%	2.8%	4.7%	0.0%	2.5%	1.1%	4.4%	6.8%	0.4%

Source: (EIS Table 4-43) HHFDC, 2008; 2000 U.S. Census, SF3 data from a sample of households

4.13.3 Land Values

The County Real Property Tax Office valued the 272.063 acre subject property at $3,060,700 based on the current Agricultural (A-5a) zoning. In this part of North Kona, there is a mix of residential uses. The average estimated sales price for a home in the District, and thus open to upward skewing due to the impact of a relative few ultra high-end resort sales, peaked in 2007 at $870,460, before falling by nearly 40 percent in 2008, and stabilizing at $820,000 through the first three quarters of 2009. Despite the sharp decline from the record high level, current average prices are still more than double those of 2002. Multifamily indicators, have followed the same general trending as in the single family sector. Currently, the average price in the sector is at $401,000, which is off 15 percent from the peak of $453,000 achieved during 2006, but a gain of 13 percent from last year. More importantly, the number of sales has plummeted by more than three-quarters, falling from 665 in 2005 to an expected 157 for all of 2009.

4.14 SURROUNDING LANDS

The expansion of residential housing is imminent in North Kona and particularly the areas surrounding the project site. The site is bordered by DHHL Villages of La'i 'Ōpua to the north, future DHHL Housing to the east (mauka), some light commercial and industrial uses to the south, and QLT to the west (makai). These areas surrounding the project site are designated as low density urban, high density urban, and urban expansion by the County's LUPAG map (*Figure 1-4*). Kamakana Villages supports the County's plan for growth and fits with the surrounding developments of the region.

4.14.1 Land Use

- DHHL Villages of La'i 'Ōpua (north) – Agricultural District and Urban District,
- DHHL Housing (east) – Agricultural and Urban District
- Commercial and Industrial uses (south) – Urban District
- Queen Lili'uokalani Trust (QLT) (west) – Urban District

4.14.2 Zoning

- DHHL Villages of Laʻi ʻŌpua (north) – A-5a
- DHHL Housing (east) – A-5a and RS-15
- Commercial uses (south) – CG-10, CG-20, RCX-2, A-5a
- Queen Liliʻuokalani Trust (QLT) (west) – A-5a, CG-10 and Open

4.14.3 Relationship to Centers of Trading and Employment

Kamakana Villages is located approximately one mile of Kailua-Kona, West Hawaiʻi's commercial, industrial and economic center. West Hawaiʻi is a high growth visitor destination, however, the area needs affordable housing opportunities to support employees of the visitor industry and service sectors. Kamakana Villages will have a beneficial impact on tourist industry workers by providing affordable housing in reasonable proximity to job centers, thereby reducing commute times which is important to workers' overall well being.

The project site has been designated by the State and the County for future urban growth and expansion. The proposed reclassification from the Agricultural District to the Urban District will contribute to the government's desire to direct population growth to areas with the greatest economic benefit and to provide housing near employment centers. The reclassification would also support current State Land Use classifications of the surrounding areas, which are almost entirely designated within the State Urban District.

5.0 PUBLIC FACILITIES AND SERVICES

5.0 PUBLIC FACILITIES AND SERVICES

The Kamakana Villages site is currently vacant and undeveloped. There are no existing public facilities and services within the project area. Public facilities and services are available in the region and surrounding communities. While the proposed project will result in an increase in population in the North Kona, public facilities and services in the surrounding area are available to support the needs of new residents. As construction of Kamakana Villages and other projects planned for the North Kona area are developed in the future, additional public facilities and services may be needed to accommodate the regions overall growth.

The project will require cooperation and coordination with both public agencies and private organizations in the overall development of project site. The proposed project will meet standards and requirements set by each Federal, State, and County agencies. Coordination efforts will be made directly with public agencies to mitigate potential impacts of the proposed development.

Below is a discussion of the project's probable impact on public facilities and services of the project site and surrounding area.

5.1 PUBLIC SAFETY

Police
Serving as the local station and main office for West Hawai'i bureaus, the County Police Department's Kona station is located at Kealakehe, about 1.5 miles from the proposed project site. As of 2005, approximately 78 positions were authorized for the Kona district.

Fire Protection
Primary fire protection is provided by the County's North Kona fire station located in Kailua-Kona approximately 0.75 miles from the project site. The Makalei Fire Station, to be located approximately 6 miles north of the project site, is scheduled to be constructed in the near future.

Civil Defense
The County's Civil Defense Agency directs and coordinates the development and administration of the County's total emergency preparedness and response program. Emergency preparedness and response ensures that prompt and effective action is carried out when natural or man-caused disaster threatens or occurs anywhere in the County of Hawai'i.

5.1.1 Potential Impacts and Mitigation Measures

Police
While population in Keahulou will increase as a result of the proposed project, the impact of Kamakana Villages is likely to be small and will unlikely create an additional demand for police services. Since the proposed project is expected to draw residents from outlying areas to a central planned community, it will improve delivery of public safety services, since the time needed to respond to calls will be reduced. No significant impacts to police services are anticipated.

The Public Facilities and Programs working group of the Kona Community Development Plan identified the need for Police and fire protection improvements for the area. These improvements

were to be accomplished by increased citizen patrols and higher wages for police officers, and are highlighted in the "Final Actions" report issued in 2006.

Fire Protection
While the project will increase the Fire Department's responsibility for additional structures impacts on the Fire Department's operations or ability to provide fire protection service to the project and surrounding areas are expected to be minimal. To the extent that the project allows residents to congregate in a planned community, rather than being dispersed throughout the region, it will help the Fire Department to improve its response times. Kamakana Villages will be designed to meet fire and building code requirements. This will include providing necessary hydrants and meeting fire flow requirements for water systems. Additionally, public roadways within the project will be wide enough to permit access by fire trucks.

Civil Defense
The proposed project may include the installation of one outdoor warning siren (minimum size 121 DBC solar powered with omni-directional sound properties) at a central location within the development to assist with emergency preparedness and response program of the County's Civil Defense Agency. No impacts with regard to civil defense are anticipated.

5.2 MEDICAL EMERGENCIES

The primary medical facility for the Kona region is Kona Community Hospital in Kealakekua, South Kona. Located about 10 miles from the proposed project, this 94-bed hospital is part of the Hawaii Health Care System supported by the State. The Kona Community Hospital has 24-hour emergency services, an intensive care unit, maternity, oncology, and other units.

The North Hawaii Community Hospital located in Waimea, approximately 39 miles from the project site is the second closest hospital to the proposed project site. The North Hawaii Community Hospital is a privately owned non-profit facility with 40 beds, a 24-hour emergency room, and acute care services.

5.2.1 Potential Impacts and Mitigation Measures

Since the population in North Kona will increase as a result of the proposed project, the demand for medical services will also grow. The proposed project is expected to draw residents from outlying areas to a central planned community; therefore, the potential impact of the project involves redistribution of existing and anticipated demand, rather than new demand. When the question of the location of medical facilities for West Hawai'i is discussed again in the future, the project will help to increase demand for new medical facilities being located in or near the Kailua-Kona area.

5.3 SCHOOLS

The Kamakana Villages project site is within the Kealakehe school catchment area and is served by:

- Kealakehe Elementary School - Located on Kealaka'a Street, this school serves nearly 990 students from kindergarten through grade five. It has 60 full-time equivalent teaching positions, including regular education, special education, and supplemental instructors.

- Kealakehe Intermediate School - Located on Kealakaʻa Street, this school has approximately 900 students in grades six through eight, and a teaching staff of 58 positions.
- Kealakehe High School - Opened in 1997 in the Villages of Laʻi ʻŌpua, this school serves students from Hualalai to Waikoloa Village. In the 2007-2008 school year, 1,638 students were enrolled and 76.5 teaching positions are allocated to the school.

Private schools in North Kona include:

- Hualalai Academy, with 160 students in grades K through 12, located on Kealakaʻa Street;
- The Kona campus of the Hawaiʻi Montessori School (serving grades K through six); and
- Makua Lani Christian School in Holualoa, and the Kona Christian Academy.

In addition, Hawaiʻi Preparatory School, located in Waimea, is a K-12 school with approximately 585 students. It regularly enrolls students from North Kona, South Kohala and boarders. The Keaʻau campus of the Kamehameha Schools enrolls more than 1,100 Native Hawaiian students from the County with some students commuting from West HawaiʻI (HHFDC, 2008).

5.3.1 Potential Impacts and Mitigation Measures

Two sites are being reserved for education facilities. The first site is an approximately 8-acre area and the second site is approximately 4-acres. Both sites will be located near parks and are accessible from bike and pedestrian paths. Including school sites within the design of Kamakana Villages is alignment with LEED principles for "Neighborhood Schools" which "promote community interaction and engagement by integrating schools into the neighborhood fabric, and support student health by encouraging walking and bicycling to school" (LEED for Neighborhood Development Rating System, NPD Credit 15: Neighborhood Schools).

These facilities may provide education alternatives to families in the immediate area, and may also allow for collaboration with Kealakehe High School and the Kamehameha pre-school at Laʻi ʻŌpua, as well as support additional learning opportunities within the Department of Education's (DOE) Kealakehe complex. While all of the schools in the Kealakehe complex are large (compared to DOE standards) existing schools will likely experience crowding until new schools are built as planned. The DOE, developers, and community leaders will cooperate and coordinate with one another to manage anticipated period of growth in the area, and to advocate timely construction of new schools.

Under the DOE's former student generation rates, at full build out the number of school age children at Kamakana Villages was expected to be approximately 1,131 (*Appendix E*). However, in December 2009 the DOE issued new student generation rate numbers that more accurately reflect the number of new students anticipated from the development of new projects. Under the current DOE student generation rates, the number of school age children expected from Kamakana Villages is 599.

5.4 PARKS

Major recreation facilities and parks in North Kona include:

- Kailua Park Complex (also known as Old Airport Park) - This site includes a gym, swimming pool, and fields for active recreation as well as an extensive beach area. It lies on the shore, directly west of the Kealakehe/Keahuolu area.
- Hale Halawai. This recreation center, located on Ali'i Drive on the south side of Kailua-Kona, offers sports and crafts programs.
- Honokohau Boat Harbor, approximately 2.6 miles from Keahuolu project, provides ocean access and services to boaters.
- Newer subdivisions such as Pualani Estates and Lokahi Makai include a sports field for resident use.

5.4.1 Potential Impacts and Mitigation Measures

Kamakana Villages will include approximately 18-acres of open space and 30-acres for parks throughout the mixed use community to support the recreational needs of the residents. With increased population in the Kailua-Kona area as a result of existing and future developments such as Kamakana Villages, the demand for active recreation space will increase. However, many residents of the proposed project are expected to move to North Kona from South Kona, Ka'u, or South Kohala, therefore, the potential impacts of the project involves redistribution of existing and anticipated demand, rather than new demand. While an increased need in parks and recreational spaces are anticipated in the future, the Kamakana Villages and other recreational projects such as the Kailua Park Master Plan will be developed to meet the needs of area residents and other surrounding communities.

5.5 DESCRIPTION OF ACCESS AND ROADWAYS

The existing project site is vacant and undeveloped. There are currently no paved roadways within the immediate project area. Palani Road borders the project along the southern boundary. The proposed Ane Keohokalole Highway, which will be under construction in late 2009/early 2010, will border the project along the makai boundary and the newly constructed Keanalehu Drive borders a short portion of the project along the mauka boundary. Keanalehu Drive and Manawalea Street meet at the northern-mauka tip of the project and were completed in late 2008.

5.5.1 Proposed Roadway System

Off-Site Roadway System

Ane Keohokalole Highway is a key roadway to facilitate full build out of the Kamakana Villages Project. Without Ane Keohokalole Highway, vehicular access to the site would be limited to Keanalehu Drive and connections to Palani Road during later phases of the development. The Ane Keohokalole Highway design has been completed and construction is set to begin late 2009/early 2010. The right-of-way is set to be 120-feet wide and will have a posted speed limit of 30 miles per hour. The initial phase of construction includes sections that have one and two lanes in each direction but the entire Highway is planned to be upgraded to two lanes in each direction. There is a portion with two lanes in each direction and a portion with only one lane in each direction but future construction on the highway will upgrade the entire highway to a 4-lane highway. The initial phase also includes improvements to Palani Road from the Ane Keohokalole Highway down

to Queen Ka'ahumanu Highway. The County plans to designate the highway as a bus transit corridor. The final plans indicate regional bus transit stops at the Ane Keohokalole Highway/Makala Boulevard intersection and at the Ane Keohokalole Highway/Manawalea Street intersection with both bus stops fronting the Kamakana Villages. Bus stops are also proposed on Ane Keohokalole Highway for local circulators serving the mauka and makai neighborhoods.

Construction costs for the Ane Keohokalole Highway will be covered by Federal Stimulus funds. However, to date no Federal funds have been made available for the installation of major utility transmission lines within the Highway.

One standard intersection and two right-in/right-out intersections are proposed along Palani Road. To minimize impacts on traffic along Palani Road, the intersections would likely include deceleration and acceleration lanes and the right-in/right-out intersections would include a raised median to prevent vehicles from attempting to make left turn movements. Traffic impacts and mitigation measures for the project area and along Palani Road are provided in *Section 6.2.12* and the TIAR (*Appendix D*).

Internal Road System

The internal roadways of the Kamakana Village Project would accommodate cars, bicycles, and pedestrians. The internal roadways will be designated in consultation with the County Department of Public Works for dedication to the County. The preliminary layout of the internal roads has been designed to comply with the Village Design Guidelines of the Kona CDP. An order-of-magnitude cost for the internal roadways, including water, sewer, drainage, electric, telephone and cable television utilities, based on this preliminary plan is $129,915,378. A more detailed breakdown of the onsite phasing construction costs is provided in *Appendix C*.

5.5.2 Potential Impacts and Mitigation Measures

Potential Short-Term and Long-Term Impacts and Mitigative Measures

The development of roadway infrastructure will be coordinated directly with State and County agencies. Construction of the roadway system will be carried out in compliance with applicable rules and regulations. Best management practices will be implemented to minimize potential impacts. The traffic impacts associated with Kamakana Villages are assessed in *Section 6.2.12* and the TIAR provided in *Appendix D*. No significant short-term environmental impacts are anticipated from the development of the roadways associated with this project. Long-term impacts of the proposed roads would not be significant.

5.6 AVAILABILITY OF WATER

Although there are no existing water commitment for the project, planned improvements to existing DWS systems will support development of the project. A PER for Kamakana Villages was prepared by Lyon Associates in December 2009 (*Appendix C).*

There is existing water system infrastructure around the project area, which connects to well sites above Mamalahoa Highway (see *Figure 5-1*). An existing 16-inch water line in Manawale'a Street from the 595-foot elevation Kealakehe High School reservoir stubs out to the Project site and services the 495 to 225-foot elevation water service pressure zone. There is also a 12-inch water line in Manawale'a Street providing water service above the 495-foot elevation. There is an existing 16-inch water line in Palani Road along the project site and a new water line will be

installed with the new Ane Keohokalole Highway construction later this year. The line will be a 16-inch main from Palani Road to Makala Boulevard and will be installed as a 12-inch line from. Makala Boulevard to Manawalea Street.

A 1.0 million gallon (MG) reservoir exists at the 595-foot elevation Kealakehe High School reservoir site. The site is designed for a second reservoir to be constructed in the future.

5.6.1 Proposed Water System

Proposed Water System Design

The proposed water system would be developed in accordance with the 2002 State of Hawai'i Water System Standards, Rules and Regulations. For details of the project's water supply requirements, see the attached *Appendix C*. The design and construction of the proposed offsite and onsite water systems within the road right-of-way would meet County Standards for dedication to the DWS.

The projected average and maximum day demand of the proposed development are summarized in *Table 5-1*. Full water system calculations are provided in the PER (*Appendix C*).

Table 5-1
Water Requirements

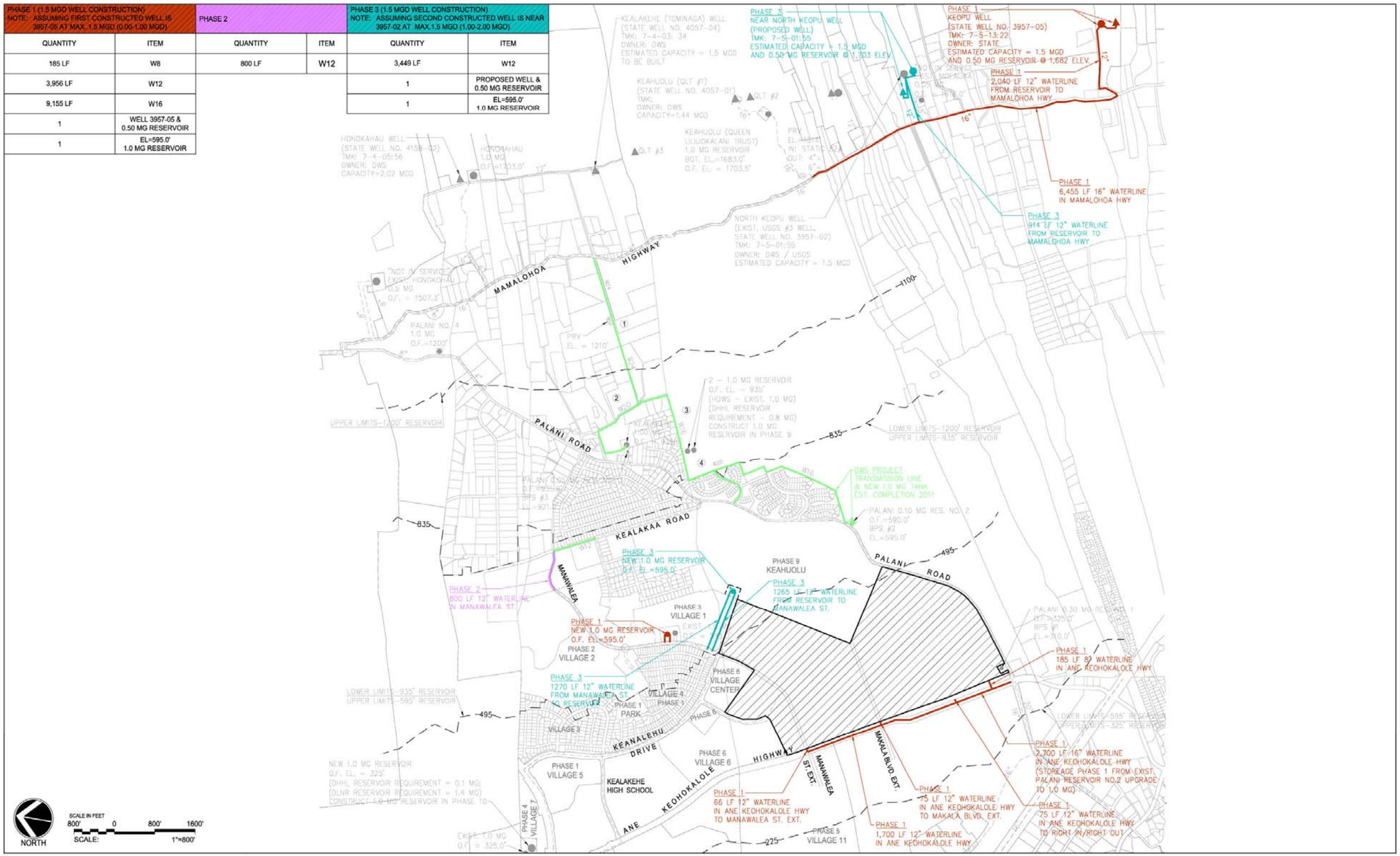
Water Master Plan	Cumulative By Phase Average Daily Demand (gallons per day)	Cumulative By Phase Max. Daily Demand (gallons per day)
Phase 1	182,760	274,140
Phases 1 & 2	451,320	676,980
Phases 1-3	644,170	966,255
Phases 1-4	793,770	1,190,653
Phases 1-5	961,690	1,442,535
Phases 1-6 (Full Development)	1,116,040	1,674,060

Proposed Sources of Supply

Proposed Initial Well Development

The Keopu-HFDC well, identified as State No. 3957-05, will be the project's initial source of supply. The location of this well is shown on *Figure 5-1*. It is above Mamalahoa Highway at elevation 1600 feet on TMK 7-5-13:22, a parcel of land owned by the State. It was completed and pump tested in 2003. As documented in Appendix C of the PER, final pump testing in April 2003 was run for four days at an average of 1648 GPM. Drawdown stabilized at 9.8 feet and the pumped water salinity was very low (chlorides of less than 10 mg/l). The well taps high level groundwater with a static level about 56 feet above sea level.

PHASE 1 (1.5 MGD WELL CONSTRUCTION) NOTE: ASSUMING FIRST CONSTRUCTED WELL IS 3957-05 AT MAX. 1.5 MGD (0.00-1.00 MGD)		PHASE 2		PHASE 3 (1.5 MGD WELL CONSTRUCTION) NOTE: ASSUMING SECOND CONSTRUCTED WELL IS NEAR 3957-02 AT MAX.1.5 MGD (1.00-2.00 MGD)	
QUANTITY	ITEM	QUANTITY	ITEM	QUANTITY	ITEM
185 LF	W8	800 LF	W12	3,449 LF	W12
3,956 LF	W12			1	PROPOSED WELL & 0.50 MG RESERVOIR
9,155 LF	W16			1	EL=595.0' 1.0 MG RESERVOIR
1	WELL 3957-05 & 0.50 MG RESERVOIR				
1	EL=595.0' 1.0 MG RESERVOIR				



OFFSITE WATER MASTER PLAN
KAMAKANA VILLAGES AT KEAHUOLU
(Source: Lyon Associates, 2009)

GROUP 70 INTERNATIONAL

Figure 5-1

To put Well 3957-05 into the production, the following improvements must be completed: (1) installation of a 1050 GPM pump and motor, providing a nominal capacity of 1.5 MGD; (2) control building and other site improvements as required by DWS; (3) a 12-inch transmission main to a new upgradient storage tank; (4) the upgradient storage tank with a 1703-foot spillway and tentatively sized at 0.5 MG; and (5) a 16-inch main from the tank down to Mamalahoa Highway and north along Mamalahoa Highway to DWS' existing 16-inch main at its point of connection to the QLT 1703-foot tank. Ongoing field studies are being undertaken to confirm or revise the storage tank size so that the number of well pump cycles are limited to one or two a day.

The 1.5 MGD supply capacity will be allocated 2/3 to the project and 1/3 to DWS. As shown on *Table 5-1*, the 1.0 MGD supply allocation from Well 3957-05 for the project will be sufficient to supply its maximum day demand through Phase 3.

Development of the Second Well

As shown on *Figure 5-1*, the project's second well will be developed on or upgradient of DWS' Moeauoa Tank site (TMK 7-5-01:55). The 0.05 MG tank is now out of service as its lower, 1616-foot spillway elevation does not match the 1703-foot elevation of more recently constructed storage reservoirs. In 1991, the USGS completed the Komo Monitor Well at this site. It was drilled from 1600-foot ground level to about 22 feet below sea level and then completed with four-inch casing for monitoring purposes. This well taps high level groundwater which stands about 40 feet above sea level. Details of its construction and water levels can be found in Appendix D of the PER. The results of this well establish that a production well located on or upgradient of this parcel will tap high level groundwater and, if properly developed, will be very likely to be able to provide a supply of 1.5 MGD or more.

Development of this well, which is necessary to supply the project's Phases 4 through 6, which have a combined projected maximum day demand of 0.7078 MGD (*Table 5-1*), will require the following improvements: (1) drilling, casing, and pump testing the well; (2) installing a pump and motor, tentatively selected to have 1.5 MGD capacity to be confirmed during pump testing; (3) control building and other site improvements as required by DWS; (4) a 12-inch transmission main to a new upgradient storage tank; (5) the upgradient storage tank with a 1703-foot spillway and tentatively sized at 0.5 MG pending results of field studies; and (6) a 16-inch main from the tank down to Mamalahoa Highway.

The new well would have 20-inch casing to accommodate a four-pole submersible motor. The casing and annulus would be configured so that the solid portion of the casing would function as a shroud for the motor to ensure its proper cooling. The well would be drilled to at least 200 feet below sea level to maximize its hydraulic capacity. Based on the project's maximum day supply projection and the 2/3 and 1/3 supply allocation of the well capacity for the project and DWS, a capacity of 1.06 MGD (740 GPM) would suffice to complete the project's Phases 4 to 6. However, the objective would be to achieve a full 1.5 MGD capacity to match other high elevation well capacities to the north and south.

Proposed Reservoir Storage

Based on the maximum day criterion, two new 1.0 MG reservoirs will be required for the project to accommodate water storage. The first 1.0 MG reservoir will be installed at the existing Kealakehe High School reservoir site. Based on discussions between HHFDC and DHHL, the second reservoir will be located at a new 595-foot elevation site on the DHHL Keahuolu property

on TMK 7-4-21: portion of 21. The site would be off the future extension of Keanalehu Drive. A temporary access road with two 12-inch water lines extending about 1,270 linear feet would be required off of Manawalea up to the reservoir site. The access road would be over TMK 7-4-21: portions of 20 and 21.

Construction of the second reservoir site would require a grading permit, an NPDES general permit, and building permits for the reservoir structure. If dry wells are constructed at the reservoir site, an Underground Injection Control permit may also be required depending on well depth.

Proposed Off-Site Water Lines

The *Villages of La'i 'Ōpua Water Master Plan* identified transmission deficiencies in the offsite water system. Approximately 3,200 linear feet of 8-inch water line in Kealaka'a Street, from Palani Road to Manawalea Street, are being upsized to a 12-inch water line. Approximately 800 linear feet of new 12-inch water line may be required in the existing Manawale'a Street to connect to the extension in Kealaka'a Road. As previously discussed, 4,400 total linear feet of 12-inch and 16-inch water line will be installed within Ane Keohokalole Highway, between Palani Road and Manawale'a Street. Upon finalization of the development concept, DWS requested that the developer update the *Villages of La'i 'Ōpua Water Master Plan* to determine whether there are any other system deficiencies and required improvements. The proposed preliminary Offsite Water Master Plan can be seen in *Figure 5-1*.

Off-Site Water System Costs

Order-of-magnitude costs for the off-site water system improvements are shown in *Table 5-2*. For details on the water system costs, see the PER (*Appendix C*).

Table 5-2
Water System Costs

Off-site Wells and Appurtenances (Well Site No. 3957-05 will be required from Phase 1 through Phase 3 and the second well for Phase 4 onward).	
Well Site No. 3957-05	$3,985,650
Second Well	$5,182,970
Reservoirs (TWO (2) total will be required)	
1) DHHL Keahuolu property:1.00 MG Reservoir	$2,620,000
2) Kealakehe High School Reservoir Site:1.00 MG Reservoir	$2,620,000
- Phase A - Off-site transmission	$2,128,875
- Phase B - Off-site transmission	$ 161,500
- Phase C - Off-site transmission	$ 668,880

Proposed On-Site Distribution System

The on-site water system would consist of main water lines within the roadway network. The system would be connected to the existing water system at Keanalehu Drive and Manawale'a Street and at Palani Road and Ane Keohokalole Highway, forming a looped water system. The Kamakana Villages water system network would have a minimum pipe size of 6-inches in diameter and a maximum pipe size of 12 inches in diameter, based on the proposed roadway layout and development layout and densities. The water lines would be sized to meet the

maximum daily demand plus fire flow with a residual pressure of 20 pounds per square inch (psi) at the critical fire hydrant or the peak hour demand with residual pressure of 40 psi.

5.6.2 Potential Impacts and Mitigation Measures

The projected average water daily demand generated by the proposed project is 1,116,040 gpd (*Appendix C*). The Kamakana Villages will require new water system infrastructure and connections to existing systems around the project area. Two source wells will be required to supplement the existing DWS system and support the full development of Kamakana Villages. Development of the project's water system infrastructure will be in accordance with the County and State water system standards and coordinated with respective agencies. No adverse impacts are anticipated.

Potential Short-Term Impacts to Surface Waters
There are no surface water bodies on or near the project site. The development of the proposed project will meet State NPDES permit requirements and County Erosion and Sedimentation Control during construction to prevent the discharge of sediment from the site. As areas of the site are developed, drainage systems would collect runoff and discharge it to the subsurface. Drainage systems will collect runoff that would discharge to the subsurface as the site is developed. The project design will comply with the County's Storm Drainage Standards. The project would have no significant short-term effects on surface waters because there would be no increase of runoff from the site.

Potential Short-Term Impacts to Groundwater
During and after site development, precipitation will continue to percolate to the underlying groundwater. Materials will be managed to prevent the discharge of pollutants to the ground as required by the NPDES permit. Landscape management practices and community association covenants would be applied in public and private areas to minimize the use of fertilizers, pesticides and herbicides that could potentially enter the groundwater. The project will implement best management practices such as the use of storm drainage filtration devices to mitigate pollutants from entering the groundwater. Significant short-term impacts upon the local groundwater quality are not anticipated with the use of these measures. However, one potential short-term impact of the project's development would be the lowering of available water levels in the vicinity of the project's wells.

Potential Short-Term Impacts to Water Supply
No significant short-term impacts on the existing water supply system are anticipated as a result of the proposed project. The project will require the development of water supply infrastructure, including source wells, storage reservoirs, and distribution lines which will be constructed in accordance with County and State standards and requirements. During construction, short-term localized water system shut-downs and road closures may be required since the new water infrastructure will be connected to the existing water system.

Potential Long-Term Impacts to Surface Waters
The project would have no significant long-term effects on surface waters. Once developed, rainfall runoff from the site would be collected in the drainage systems and percolated into the ground in the on-site seepage areas, seepage wells, and dry wells. The development of the project will comply with County's Storm Drainage Standards and will not result in an increase in runoff volumes and rates.

Potential Long-Term Impacts to Groundwater
Significant long-term impacts upon the local groundwater quality are not anticipated. Rainfall runoff from the developed site would collect in the drainage systems and percolate into the ground in the on-site seepage areas, seepage wells, and dry wells. To help prevent pollutants from entering the groundwater, educational materials and programs to will be provided to residents to establish landscape management and vehicular maintenance controls. Best management practices including the use of vegetative swales, bioretention areas, storm drain filtration devices, ground stabilization with landscape and hardscape, educational warning signs on the drainage systems and coordinating environmental educational programs will also be incorporated into the proposed project.

Kamakana Villages will be designed to meet USGBC LEED ND standards and will include water conserving strategies. Some of these design strategies may include the use of low flow fixtures, plant drought tolerant native landscaping and providing residents with information on the importance of water conservation.

Potential Long-Term Impacts to Water Supply
No significant long-term impacts on the existing water supply system are anticipated as a result of the project. The long-term impacts of the project on the County water source, storage, and transmission system would be positive, as the project would improve the existing system. The additional source wells required for the project would increase the water available to the region, since the County allocates only a portion of the well yield to the project. The project would add storage reservoirs and improve the area water transmission system, required to provide water service from the source wells down to the site.

5.7 SEWAGE COLLECTION, TREATMENT AND DISPOSAL

No sewage disposal services are available in the immediate project area since the property is currently vacant. Hawai'i County's Kealakehe STP is located makai of Queen Ka'ahumanu Highway. Regional sewer in the area connects to an existing 30-inch sewer line that crosses Queen Ka'ahumanu Highway near the police station. The Keahuolu Affordable Housing Project EIS indicated that the County had reserved 431,360 gpd capacity at the Kealakehe STP for Kamakana Villages. A PER was prepared for the Kamakana Villages by Lyon Associates in December 2009 and is included in *Appendix C.*

5.7.1 Proposed Wastewater System

Proposed Wastewater System Design
The proposed sewer system would be developed in accordance with the Hawaii County Department of Environmental Management (DEM) criteria. For details of the sewer system criteria, see the PER (*Appendix C*). The design and construction of the proposed offsite sewer system and onsite sewer system would meet County Standards for dedication to the County DEM.

The projected sewer flows are summarized in *Table 5-3*. Sewer system calculations are provided in the PER (*Appendix C*).

Table 5-3
Sewer Requirements

Sewer Master Plan	Cumulative By Phase Design Average Flow (gallons per day)	Design Peak Flow (gallons per day)
Phase 1	110,420	548,856
Phases 1 & 2	265,980	1,141,556
Phases 1-3	392,946	1,658,142
Phases 1-4	491,750	1,975,284
Phases 1-5	582,040	2,270,165
Phases 1-6 (Full Development)	673,778	2,555,477

The Keahuolu Affordable Housing Project EIS indicated that the County had reserved 431,360 gpd capacity at the Kealakehe STP for Kamakana Villages. The project will result in an average daily flow of 673,778 gpd and peak daily flows of 2,555,477 gpd to the STP. Increased capacity at the Kealakehe STP would be required to accommodate the full development of the site. The DEM would have to expand the STP and are currently undertaking a master plan to review options to upgrade the STP. Two improvement projects to the STP are planned which include 1) sludge removal: $8,600,000, of which $600,000 has been allotted for design work and 2) aeration upgrade: $8,250,000 of which $750,000 has been allotted for design work (County of Hawaii FY 07-08 budget). The two improvement projects will allow the STP to continue to operate at the present capacity and allow for future capacity upgrades.

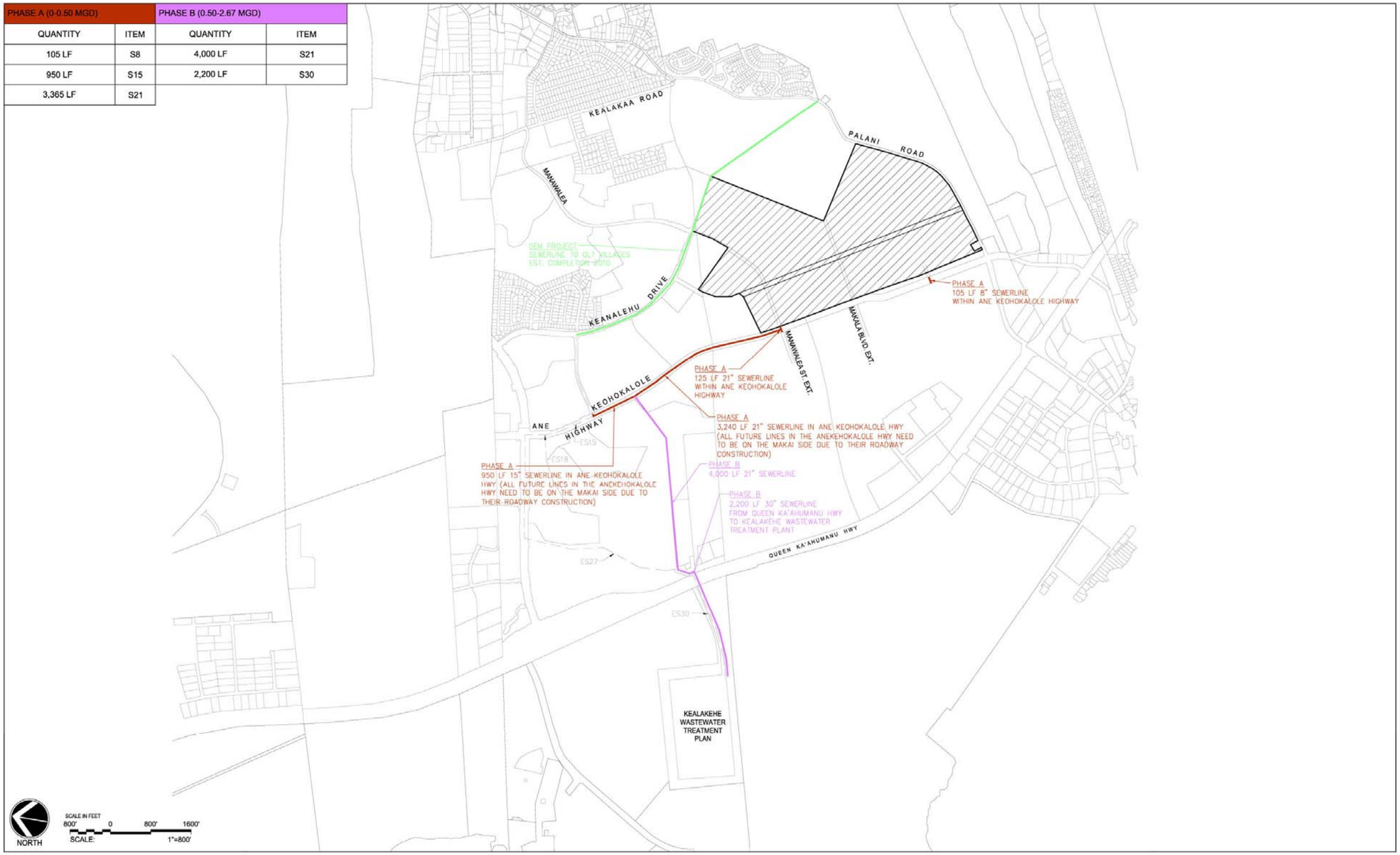
R-3 Water (undisinfected secondary recycled water) from the Kealakehe STP is discharged in the lava fields *mauka* of Queen Kaahumanu Highway in the DHHL/Villages of La'i 'Ōpua. R-3 Water is not suitable for irrigation use for the project. The County would have to further treat the effluent to R-1 Water (significant reduction in viral and bacterial pathogens) before the effluent would be suitable for irrigation use at Kamakana Villages. The County has plans to upgrade the STP to produce R-1 Water in FY 10-11. In addition, a pump system, storage and transmission lines for the recycled effluent system would be required.

Proposed Off-Site Wastewater System

Sewer lines from the project site to the STP would be routed along Ane Keohokalole toward Kealakehe Parkway. In the first phase of the project, the proposed sewer line will connect to the existing main at the intersection of Puohulihuli Street and Ane Keohokalole. Based on discussions with the DEM there is sufficient capacity in this line running down to the sewage treatment plant to serve the early stages of the project.

The second phase of the offsite Sewer Master Plan suggests installation of a line through the DHHL/Villages of La'i 'Ōpua lands. Based on the design flows, this is necessary because the existing line does not have the sufficient capacity to serve the entire project. This proposed line includes a new 30-inch line that crosses Queen Ka'ahumanu Highway en route to the treatment plant. The proposed preliminary Offsite Sewer Master Plan can be seen in *Figure 5-2*.

PHASE A (0-0.50 MGD)		PHASE B (0.50-2.67 MGD)	
QUANTITY	ITEM	QUANTITY	ITEM
105 LF	S8	4,000 LF	S21
950 LF	S15	2,200 LF	S30
3,365 LF	S21		



OFFSITE SEWER MASTER PLAN
KAMAKANA VILLAGES AT KEAHUOLU
(Source: Lyon Associates, 2009)

GROUP 70 INTERNATIONAL

Figure 5-2

The following order-of-magnitude costs for offsite sewer system construction assume that the low area within the project site would be developed with sewage-pumping facilities (*Table 5-4*). For details on the sewer system costs, see the PER (*Appendix C*).

Table 5-4
Wastewater System Costs

Off-Site Water System	Estimated Cost
Phase A	$930,550
Phase B	$1,888,400
Total	$2,818,950

Proposed On-Site Wastewater System
The onsite sewer system would consist of sewer lines within the roadway network. The system would connect to the offsite sewer lines. The sewer system would have a minimum pipe size of 6-inches in diameter and a maximum pipe size of 15-inches. Because of the natural slope of the project site, a lift station and force main will be required to pump sewage to where it can gravity flow and exit the site. There is one proposed outflow connection to the offsite sewer system at Ane Keohokalole Highway and Manawalea Street.

5.7.2 Potential Impacts and Mitigation Measures

The project will require sewage disposal throughout the entire site. The project will result in an increase in average daily flows to the STP of 673,778 gpd and would require the County to upgrade the STP to accommodate additional sewage flows.

Potential Short-Term Impacts
Extension of the sewer system to serve the proposed development would not have significant short-term impacts on the environment. Construction activities would conform to the applicable requirements relating to storm water and mitigation of potential noise and dust impacts.

Potential Long-Term Impacts
The long-term impacts of the project on the sewer system would be the construction of new sewer lines through the DHHL/Villages of La'i 'Ōpua lands to the Kealakehe STP. The impact would be an increase in average daily flows to the STP of 673,778 gpd which would require the County to upgrade the Kealakehe STP to accommodate the final phases of the project. The new sewer lines makai of the project would allow the potential development of the DHHL/Villages of La'i 'Ōpua lands adjacent to the new sewer line. The construction of new sewer lines through the proposed project would also provide sewer service to lands mauka of the project site. The County is currently assessing the appropriate system upgrades to increase the STP capacity; however, the type and costs of the STP upgrades are not known yet. No significant long-term impacts on the existing sewer lines are anticipated as a result of the project.

5.8 SOLID WASTE MANAGEMENT

No solid waste service is currently required as the site is vacant.

5.8.1 Potential Impacts and Mitigation Measures

The project will require solid waste management services. All solid waste will be removed from all buildings and premises and disposed of at an approved solid waste disposal facility. All solid waste generated from the project would be taken to the West Hawai'i Landfill in Pu'uanahulu, a County transfer station, or recycled.

A preliminary solid waste management plan was prepared for the Keauholu Affordable Housing EIS and is provided in Appendix G of the Keahuolu Affordable Housing Project EIS. Quantities of solid waste were estimated for both construction and occupancy phases of the Keahuolu project. The occupancy phase of development refers to the time at which the facilities have been constructed and are open for use. The construction and occupancy phases are expected to overlap, as construction of later portions of Kamakana Villages would continue while earlier portions are completed and occupied. The project is estimated to be completed and occupied in 2028. The average amount of solid waste generated by construction activities and occupancy are summarized in *Table 5-5 (*Appendix G of the Keahuolu Affordable Housing Project EIS*)*.

Table 5-5
Solid Waste Generated by Construction Activities and Occupancy

Year	Construction Waste (tons/year)		Occupancy Waste (tons/year)
	Low	High	
2012	638	1,222	0
2013	900	1,560	250
2014	438	751	834
2015	438	751	1,417
2016	438	751	2,001
2017	438	751	2,584
2018	438	751	3,168
2019	438	751	3,752
2020	438	751	4,252
2021	375	644	4,752
2022	375	644	5,252
2023	375	644	5,753
2024	375	644	6,253
2025	375	644	6,753
2026	375	644	7,253
2027	375	644	8,337
2028	375	644	8,337
2029	0	0	8,337
2030	0	0	8,337
TOTAL	**7,608**	**13,186**	

Potential Short-Term Impacts

Emphasis for the management of solid wastes generated by the project would be on waste diversion and recycling. Solid wastes management will conform to State DOH and County requirements. Since the County of Hawai'i does not provide waste collection services, recycle and disposal of construction and occupancy waste would be hauled by private contractors or individuals. Specific arrangements for construction and occupancy wastes would be made closer to the beginning phases of the project. Recyclables and wastes would be managed in either a centralized system or by private individuals, and hauled directly to recycling centers, transfer stations, and the landfill. The average amount of solid waste diverted through minimization and recycling is summarized in *Table 5-6 (*Appendix G of the Keahuolu Affordable Housing Project EIS).

Table 5-6
Total Solid Waste Quantities Diverted and Landfilled

Year	Diverted Waste (tons/year)		Landfilled Waste (tons/year)	
	Low	**High**	**Low**	**High**
2012	319	611	319	611
2013	450	780	450	780
2014	434	591	838	994
2015	585	741	1,271	1,427
2016	735	892	1,704	1,860
2017	886	1,042	2,137	2,293
2018	1,036	1,193	2,570	2,726
2019	1,187	1,343	3,003	3,159
2020	1,316	1,472	3,374	3,530
2021	1,414	1,548	3,714	3,848
2022	1,543	1,677	4,085	4,219
2023	1,672	1,806	4,456	4,590
2024	1,801	1,935	4,827	4,961
2025	1,930	2,064	5,198	5,332
2026	2,059	2,193	5,570	5,704
2027	2,339	2,473	6,374	6,508
2028	2,339	2,473	6,374	6,508
2029	2,151	2,151	6,186	6,186
2030	2,151	2,151	6,186	6,186

Potential Long-Term Impacts

Emphasis for the management of solid wastes generated by Kamakana Villages would be placed on waste diversion and recycling. Educational materials and information on recycling programs will also be provided to encourage residents to minimize and divert wastes. The 2002 Updated Integrated Solid Waste Management Plan for the County estimates that 12 million cubic yards of air space at the Pu'uanahulu Landfill, is which is enough to accommodate the waste generated by

West Hawai'i for approximately the next 40 years The plan also notes that the County is looking into waste reduction facilities for the island, using either a waste-to-energy incinerator, a thermal gasification plant (produces heat from waste), or an anaerobic digestion plant (breaks refuse into its molecular components).

The project's full- build out annual occupancy landfill waste percentage of the annual West Hawaii Landfill waste would be estimated to be 7.40% and the project's waste stream is a small fraction of the waste that would go to the landfill. No significant short- or long-term impacts on are anticipated as a result of the proposed development.

5.9 OTHER UTILITIES AND SERVICES

The project site currently does not require utilities and services because the area is vacant. Utilities services for other developments in the area are provided by HELCo, HTCo and Oceanic.

5.9.1 Electrical and Communications Systems

The proposed electric and communications systems would be developed in accordance with the standards of HELCo, HTCo, and Oceanic. HELCo and HTCo are responsible for the development of off-site facilities that meet island-wide needs. Presently, the existing off-site facilities that would serve this development are HELCo's Palani Substation located at the intersection of Henry Street and Palani Road and HTCo's Kailua-Kona central office located near the intersection of Queen Kaahumanu Highway and Palani Road. Oceanic is the sole land-line provider of cable television service to Hawai'i Island. Oceanic's off-site facility construction policy is to provide such facilities where the anticipated revenue from the prospective service connections warrants the expenditure. Both HTCo and Oceanic offer broadband and telephone services. The design and construction of the proposed onsite electric and communications systems would meet the respective utility company's standards. The projected electrical demand and telephone line requirements are summarized in *Table 5-7*.

Table 5- 7
Electrical Demand and Telephone Line Requirements

Electric and Comm. Master Plan	Electric Demand (kiloVolt-Amperes kVA)	Telephone Lines
Phase 1	2,446	734
Phases 1 & 2	5,264	1,579
Phases 1 through 3	7,371	2,211
Phases 1 through 4	9,241	2,772
Phases 1 through 5	10,936	3,280
Phases 1-6 (Full Development)	13,048	3,914

Proposed Off-Site Electric
Electric ductlines to the project site will be constructed as part of the Ane Keohokalole Highway Federal Aid project although funding for the ductlines will be provided, in part, by this project. The ductlines will extend from HELCo's Palani Substation located on the South side of Palani Road across the County DWS' 310 Reservoir and will consist of concrete encased, PVC conduits and manholes. Presently, HELCo has installed one 10 MVA transformer in Palani Substation and has

sufficient land area to install three additional 10 MVA transformers. HELCo's main regional substation, located along Kaiwi Street has reached its capacity and under an agreement with QLT for dedication of the Palani Substation site, HELCo has dedicated a certain amount substation capacity to the Makalapua Development. As a State PUC regulated company, HELCo will require large developments such as Kamakana Villages to advance the cost for construction of additional facilities within the Palani Substation site to support the residential and commercial development. For a 5-year period after the facilities are energized and begin paying for their electricity usage, HELCo will, on a yearly basis, issue a refund, based on the electricity revenues, of a portion or all these advanced costs to the project developer.

As noted in the HHFDC La'i 'Ōpua Utility Assessment, HELCo considers Palani Substation to be a regional facility, therefore the substation capacity is not dedicated to any particular development. Hence, as development around the Kailua-Kona area continues, HELCo would continue to place transformers within the Palani Substation to meet the increased demands. Depending upon the length of time for the full build-out of Kamakana Villages, if the Palani Substation has reached its capacity, the need for another substation site may arise.

Proposed Off-Site Communications

HTCo and Oceanic ductlines to the project site will be constructed as part of the Ane Keohokalole Highway Federal Aid project although funding for the ductlines will be provided by this project. The ductlines will extend from the existing overhead and underground facilities presently located on Palani Road and Henry Street. HTCo's ductline will consist of concrete encased, PVC conduits and manholes. Oceanic's ductline will consist of a concrete encased PVC conduit and handholes. Based on its PUC tariff, HTCo would not normally require an off-site facility development charge unless the telephone provisioning requested was deemed to be in excess of HTCo's standard installation for this type of Development. Similarly, Oceanic would not normally request an off-site facility development payment.

The following order-of-magnitude costs are for offsite electric and communication duct systems construction.

Table 5-8
Offsite Electric and Communication System Costs

Ane Keohokalole Duct System	$1,726,000
Anticipated HELCo. Charges	$ 550,000
Anticipated Palani Substation Development Charge	$2,000,000
Total	$4,276,00

Proposed On-Site Communications

The onsite electric and communications systems would consist of concrete encased, PVC conduits, typically installed within a common trench and located, where feasible, under the roadway sidewalk between the curb and the road right-of-way line. Manholes and handholes would be place periodically to serve as pulling points for the utilities and as parcel service points. These ductlines would connect to the Ane Keohokalole Highway ductline at the various intersections. The anticipated duct complement for the major roadways would consist of 4-5" and 2-4" conduits for HELCo, 4-4" conduits for HTCo and 1-4" conduit for Oceanic. The number and size of conduits would vary based on the adjacent land usage with the typical minimum conduit

complement being 2-2" conduits for HELCo, 1-4" conduit for HTCo and 1-4" conduit for Oceanic on local residential roadways.

Proposed Street Lighting

Pending the acceptance by the County for use of the proposed roadway luminaire selected by the developer, the street lighting system would consist of low pressure sodium, cut-off luminaires, aluminum poles, bracket arms and breakaway aluminum transformer base mounted on a cast-in-place reinforced concrete foundation. The typical street light spacing for County dedicable roadways would be at 130 feet to 160 feet on center. To retain dedicability, proposed changes to this spacing should be submitted to the County for review and approval pursuant to the exemptions from County standards permitted under HRS Section 201H-38. The street lighting system would be energized through unmetered electrical connections to HELCo secondary power sources situated along the internal roadways.

5.9.2 Potential Impacts and Mitigation Measures

Kamakana Villages will require electrical and communication services for the site. Utility services for the project will likely come from the existing HELCo's Palani Substation, which has capacity to support the proposed project. As electrical services are required to support developments in the Kailua-Kona area, HELCo will place transformers within the Palani Substation. Electric ductlines to the project site will be constructed as part of the the Ane Keohokalole Highway Federal project. No adverse impacts are anticipated.

Oceanic has sufficient capacity to serve the project through existing facilities in the Kona Acres area which could be extended to project. The installation of HTCo and Oceanic ductlines to the project will be constructed as part of the Ane Keohokalole Highway Federal project which will not create adverse impacts and conditions. Ductlines will extend to existing overhead and underground facilities. No significant impacts related to utilities and other services are anticipated.

5.10 DRAINAGE

There are currently no existing drainage facilities and no defined natural drainage ways onsite. Since there are no natural storm water channels within the Project area it is likely that there is high permeability of the existing soils. Proposed drainage facilities will be constructed in the Ane Keohokalole Highway at intersections which feed the project.

5.10.1 Proposed Drainage System

The project will require the development of drainage infrastructure. Storm water runoff from the site would be collected through swales, ditches, gutters, inlets and/or catch basins, and transported through pipes to dry wells, seepage wells or infiltration areas for disposal. Where practical, infiltration areas, seepage wells and dry wells would be located in open spaces and parking lots. Dry wells would also be located within the roadway right-of-way as needed. The drainage system will comply with the County's Storm Drainage Standards and coordination will be carried out with appropriate public agencies. All applicable permits will be obtained for the project including the UIC permit which is required by the State DOH to construct and operate the dry wells. Best management practices, such as vegetated swales, bioretention areas, and storm drain filtration devices to capture sediments and prevent pollutants from entering the groundwater may be included in the design of the drainage system.

5.10.2 Potential Impacts and Mitigation Measures

Storm drainage filtration devices and other measures will be used to reduce potential impacts to groundwater. Runoff volumes will not increase as a result of the project's development. No significant drainage impacts are anticipated.

Potential Short-Term Impacts and Mitigation Measures

Although there will be no major grading required at Kamakana Villages, portions of the site will be disturbed during grading thereby increasing the potential for site erosion to occur. During all phases of construction, the project will conform to Erosion and Sedimentation Control requirements, Storm Drainage Standards, and NPDES permit requirements. Through the use of best management practices and the project's adherence to County and State requirements relating to drainage, the short-term environmental impacts from grading activities will be insignificant. Once the project area is developed, ground surfaces will be covered with landscaped and hardscaped areas. The stabilization of the area through these methods will minimize the potential for erosion to occur on site.

Potential Long-Term Impacts and Mitigation Measures

While the increase of impermeable surfaces as a result of site development would have the effect of increasing storm water runoff quantities, long-term impacts of the project on drainage and erosion are not anticipated to be significant. The proposed project will comply with the County's Storm Drainage Standards and will not result in an increase in runoff flow rates and volumes from the site. Site drainage would be collected through swales, ditches, gutters, inlets and/or catch basins, and transported through pipes to dry wells, seepage wells or infiltration areas for disposal. The drainage systems will include storm drain filtration devices such vegetated swales, bio-retention areas, and storm drain filtration devices to mitigate potential impacts from pollutants.

Other mitigation measures such as educational outreach for the residents of Kamakana Villages, landscape management and vehicle maintenance controls within the project site may also be implemented for the proposed project. Educational outreach would include information related to control and prevention of non-point source pollution, such as vehicular maintenance and proper disposal of vehicle fluids. Landscape management controls would include information related to the proper use of fertilizers, pesticides and herbicides, and vehicle maintenance controls would include proper vehicle washing and maintenance.

6.0 ENVIRONMENTAL ASSESSMENT AND ANALYSIS

6.0 ENVIRONMENTAL ASSESSMENT AND ANALYSIS

6.1 RELATIONSHIP BETWEEN SHORT TERM USES OF THE ENVIRONMENT AND LONG TERM PRODUCTIVITY

Most of the proposed project site is classified as State Agricultural and zoned agricultural (A-5) with a small portion classified as State Urban and zoned residential (RS-15). The current use of the project site is generally limited to agricultural uses. However, the site is not considered to be a valued agricultural resource due to the poor quality of the soil, consequently, it has remained unutilized and vacant. The project site is proposed for reclassification from the State Agricultural District to the State Urban District, and subsequent rezoning to allow its development as a mixed-use residential master planned community. With these actions and the development of the project infrastructure would also be required in the form of new roadways; potable water wells, reservoirs, and a water transmission system; a wastewater collection system; and electrical and telecommunications utilities.

Development of the property as a residential community represents a permanent commitment that would remove the property from the inventory of available agricultural land. Reclassification of the property to the Urban District is consistent with the State and County plans for the area which designates areas between Keahole and Kailua-Kona as the residential and commercial center for West Hawai'i. Demand for homes in North Kona is strong and expected to exceed planned production, particularly of housing for middle-income families. The housing market continues to be active, even though prices have reached levels that many families cannot afford. About a third of Hawai'i County respondents expecting to move named North Kona as their preferred destination. The Kamakana Villages Project is planned as a response to the regional needs for housing and the desire to reduce congestion on regional highways due to residents' traveling long distances between home and work.

Potential short-term and long-term impacts are offset by mitigation measures to address such impacts as described in this section. The short-term and long-term gains as a result of the proposed Kamakana Villages Project outweigh short-term or long-term losses that may be caused by the development of the project. Short-term uses of the environment and long-term productivity relate to the short-term construction impacts and the long-term socioeconomic benefits for the State and the County in the form of affordable housing near employment centers and added revenue resulting from economic activity that would otherwise not occur on the property. While the project will remove the existing open space and natural environment of the site, it has been sited in an area designated for Urban Expansion by the County of Hawai'i.

6.2 CONSEQUENCES OF THE PROPOSED ACTION AND MITIGATIVE MEASURES

6.2.1 Climate

Impacts on climate are not anticipated to occur as a result of the proposed Kamakana Villages Project. No mitigation measures are required.

6.2.2 Geology and Topography

The existing topography of the project site will be altered to the extent necessary for construction of the proposed project. Cut and fill quantities are anticipated to generally balance as construction progresses. During all phases of construction, erosion control practices will comply with county, state and federal regulations. Best management practices (BMP) will be implemented pursuant to the required Grading Permit to mitigate any potential impacts of soil erosion and fugitive dust during any grading or excavation. The State DOH NPDES permit will be obtained for the project from the State Prior to construction.

Potential Short-Term Impacts:
During grading activities, portions of the site would be disturbed and the potential for site erosion would increase. The contractor will comply with Erosion and Sedimentation Control, Storm Drainage Standards, and NPDES permit requirements. Best management practices will be used to contain site erosion and prevent sediment discharge from occurring in the site. Short-term environmental impacts from grading activities are anticipated to insignificant with the use of mitigation measures and compliance with County and State requirements.

Potential Long-Term Impacts:
Significant long-term impacts on drainage and erosion are not anticipated to occur as a result of the project's development. The increase of impermeable surfaces from site development may increase storm water runoff quantities on the site. The runoff will be collected and discharged to on-site seepage areas, seepage wells, and drywells for percolation into the ground. On the site precipitation will discharge into the ground as it does under pre-development conditions. An underground injection control (UIC) permit will be required by the State DOH to construct and operate the dry wells. To the extent feasible, drainage systems may include storm drain filtration such as vegetated swales, bio-retention areas, sand or organic filtering systems, catch basin inserts and hydrodynamic devices, to mitigate potential impacts from pollutants.

To comply with the County's Storm Drainage Standard, runoff flow rates and volume from the site will ultimately not increase.

6.2.3 Soils and Agriculture

As shown in *Figure 4-4*, the project site are comprised of poor, low-quality, and extremely rocky soils which are predominately bare 'a'a Lava Flows and bare Pahoehoe Lava Flows. The land is unfavorable for commercial crop production. The project area is currently not used for agricultural activities, therefore, the development of Kamakana Villages will not have any impact on existing agricultural activities. No mitigation measures are required.

6.2.4 Natural Hazards

Because the project area is located well away from the coastal area and the stream courses, the project area is secure from stream flooding, as well as coastal inundation. To prevent ponding or localized flooding resulting from storm run-off, existing drainage structures surrounding the project site will be maintained, while new infrastructure within the project site will be designed and constructed to meet applicable standards.

All construction of structures within the project site will meet the Uniform Building Code (UBC) standards for Seismic Zone 4 (the highest on the code's range from 0 to 4) to mitigate the risk of wind and seismic damage.

The site is within lava flow hazard Zone 3, indicating moderate hazard (*Figure 4-5*). No mitigation is proposed.

6.2.5 Ground Water, Hydrology, Surface Water and Drainage

Potential Short-Term Impacts:
On-site precipitation currently percolates to the underlying groundwater. This would continue to be the case during and after site development. The project will require the development of drainage infrastructure. Storm water runoff from the site would be collected through swales, ditches, gutters, inlets and/or catch basins, and transported through pipes to dry wells, seepage wells or infiltration areas for disposal. The NPDES permit requirements, will require contractors to manage materials to prevent the discharge of pollutants into the ground during construction. Landscape management practices will be applied to minimize the use of fertilizers and pesticides that could potentially enter the groundwater. The use of best management practices, such as storm drainage filtration devices, is recommended to prevent pollutants from entering the groundwater. Significant short-term impacts upon the local groundwater quality are not anticipated.

There are no surface water bodies on or near the project site. The project will to comply with NPDES permit requirements, including Erosion and Sedimentation Control to prevent the discharge of sediment from the site. Drainage systems will collect runoff that would discharge to the subsurface as the site is developed. The project design will comply with the County's Storm Drainage Standards. Significant short-term effects on surface waters are not anticipated since there would be no increase of runoff from the site.

Potential Long-Term Impacts:
The development of the proposed project will require the developer to implement best management practices and other measures such as ground stabilization with landscape and hardscape, educational warning signs, and coordinating educational programs for the project area residents. Storm water runoff from the site would be collected through swales, ditches, gutters, inlets and/or catch basins, and transported through pipes to dry wells, seepage wells or infiltration areas for disposal. The project will meet the County's Storm Drainage Standards and will not result in increases in runoff volumes and rates. No significant long-term effects on surface waters are anticipated.

6.2.6 Air Quality

Construction Activities
There will be two types of short-term air quality impacts that will result from the proposed construction project: 1) fugitive dust generation dust from vehicle movement and soil excavation and 2) on-site/off-site emissions from moving construction equipment and commuting construction workers. Air quality monitoring will implemented to ensure compliance with State Ambient Air Quality Standards.

State of Hawai'i Air Pollution Control regulations prohibit visible emissions of fugitive dust from construction activities at the property line. A dust control program will be implemented to control dust from construction activities. Fugitive dust emission will be controlled through the mitigation measures such as watering active work areas, using wind screens, keeping adjacent paved roads clean, and covering open-bodied trucks. Other measures include limiting the area to be disturbed at any given time, mulching or chemically stabilizing inactive areas, or paving and landscaping areas early in the construction schedule.

Roadway Traffic
Once construction is completed, motor vehicle traffic would result in a long-term increase in vehicular emissions. However, due to a combination of Hawai'i's weather patterns and tradewinds and the national standards imposed on lowering vehicles' emissions, concentrations are expected to remain well within state and federal Ambient Air Quality Standards. No mitigation is required.

Electrical Demand
The project may also result in long-term air quality impacts due to electrical generation required to support the proposed project. However, the Keahole plant is required to obtain State DOH permits and meet state and federal air quality standards. Therefore, no significant long-term impacts to air quality due to electrical generation are anticipated and no mitigation is required.

6.2.7 Ambient Noise

Construction Activities
The construction of Kamakana Villages is not likely to result in an increase in ambient noise levels. While significant amounts of noise will be generated during the construction period, the project is not expected to impact neighboring areas. Construction activities will be monitored by the State to comply with the provisions of the regulation for community noise control. The dominant noise sources during construction will be earth moving equipment such as bulldozers and trucks. Construction activities will involve grubbing and grading of the site and construction of infrastructure and buildings. Noise levels associated with construction equipment typically range from 80 to 95 dBA at 50 feet from the source. Some area residences may be temporarily impacted by construction noise depending on their proximity to the project site. However, mitigation measures such as limiting work to daytime hours, reducing truck/equipment idling when not in use, using manually adjustable or self-adjusting backup alarms, and fitting generators and equipment with manufacturer-approved exhaust mufflers, will be implemented to minimize noise impacts.

Roadway Traffic Noise
The increase in traffic-related noise associated with the Kamakana Villages Project is not anticipated to be significant. To buffer the project from the Ane Keohokalole Highway, project design provides for commercial uses along the highway and a wide landscaped greenway between the highway and the project site. Residential and commercial uses within the project site will be required to conform to DOH rules and regulations for noise.

6.2.8 Archaeological Resources

SHPD has approved the 1990 archaeological inventory survey and the 1993 archaeological mitigation plan for the project area (Appendix D of Keahuolu Affordable Housing Project EIS - approval letters).

2007 Archaeological Survey – PHRI
During the course of the 2007 archaeological survey, twelve archaeological sites previously identified during the archaeological survey conducted in 1990 by PHRI (Donham, 1990) were re-located and re-identified within the project area (*Figure 4-6*). Significance assessments and recommendations were reiterated in an archaeological mitigation plan approved by the SHPD in1993. The 1993 archeological mitigation plan outlines the data recovery work that remains to be done within the project area. Eleven of the twelve sites within the project boundary require data recovery work and the entire Sample Block E needs to be recorded in detail (*Figure 4-6*) (*Table 4-1*). Sites 13395, 13408, and 13409 also require burial testing. If human remains are found at these sites, a burial treatment plan would need to be prepared in consultation with the SHPD and the Hawaii Island Burial Council (HIBC).

Seven of the twelve sites previously identified during the archaeological survey conducted in 1990 are recommended for "preservation with some level of interpretive development recommended" and four of the twelve sites are recommended for "preservation as is." A preservation plan detailing treatments for the preservation of all sites needs to be prepared and approved by the SHPD.

2009 Archaeological Mitigation Plan Update – Haun & Associates, Inc.
The Archaeological Mitigation Plan Update was prepared to determine appropriate archaeological mitigation tasks to be detailed in subsequently prepared plans for data recovery, burial treatment, site preservation, and monitoring tailored to the specific cultural resources present within the Kamakana Villages site. As part of the data recovery mitigation for the project, systematic, pedestrian survey coverage should be conducted to encompass the areas where five sites (13477, 13451, 13459, 13449, and 13474) could not be relocated. All previously identified sites and newly identified sites that include non-agricultural and non-resource exploitation features should be documented and test excavations should also be conducted to determine site or feature function. As part of the monitoring phase of the project, previously undisturbed areas not included within the surveyed transects and areas surveyed to relocate sites, should be inspected. Newly discovered sites should be properly documented and SHPD should be consulted regarding site significance and proposed treatment.

Figure 4-7 illustrates previously and newly identified and sites recommended for preservation. The two sites containing human remains (Sites 26902 and 26906) are recommended for preservation (see *Table 4-2*). The 13 remaining sites are recommended for data recovery mitigation which should be detailed in a Data Recovery Plan for approval by SHPD. The plans for preservation and maintenance of the burial features should be detailed in a Burial Treatment Plan prepared for SHPD and HIBC approval. The plans for non-burial preservation sites would be detailed in a Site Preservation Plan for approval by SHPD. In addition, a monitoring plan should be prepared for SHPD review and approval.

6.2.9 Cultural Resources

Reviewing the information presented in CIA – historical documentation, archaeological surveys and research, and oral reminiscences – reveals limited cultural activities in the project area. Background research and community consultation indicates that the proposed project will have minimal to no impacts to Hawaiian culture, cultural beliefs, practices, resources (historic and cultural properties) sites, and traditions. For Keahuolu, contemporary or continuing cultural practices include gathering of ocean resources and specific plants from the 300-foot elevation seaward. One cultural practitioner has spoken of the availability and the gathering of pili, and in the literature are general references to features such as the wind. Halepaoʻo, an *ʻopelu koʻa*, is referenced at Pawai.

Based on the findings of this assessment, the development of the Kamakana Villages Project would have limited impact on Hawaiian cultural resources, beliefs, and practices. Care will be taken to preserve the habitat of endemic plants, in addition to preserving access for gathering activities. Project personnel will be alerted as to the potential for inadvertent cultural finds. If iwi or cultural resources are found during the ground disturbance and construction phases of this proposed project, cultural and lineal descendants of the area and appropriate agencies (e.g., Office of Hawaiian Affairs (OHA), OIBC) will be notified and consulted in regard to preparation of appropriate mitigation plans, including a burial treatment plan.

6.2.10 Biological Resources

6.2.10.1 Flora

There are no botanical impediments to the proposed project. The development and operation of the proposed project are not expected to result in adverse impacts to plant species. The project landscaping may include future placement of indigenous vegetation and could incorporate non-invasive, drought-tolerant species to minimize irrigation requirements and water needs. Because no species are federally listed as threatened or endangered, no mitigation is needed.

6.2.10.2 Fauna

There are no avifaunal or feral mammal impediments to the proposed project. All habitats on the property were surveyed and the potential impacts were evaluated. The birds and mammals found were those to be expected in this region. The endangered Hawaiian Hawk and non endangered Hawaiian Short-eared Owl occur in man-altered as well as native habitats throughout the island of Hawaiʻi. While a change in the land use at this site may produce small, local increases and decreases in the populations of alien birds, there are no anticipated adverse impacts to the area's wildlife or habitat. No mitigation is required.

6.2.10.3 Invertebrates

The lava tubes and caves in the project site contain a variety of invertebrates, none of which are identified as threatened or endangered. An invertebrate survey was conducted and potential impacts were evaluated by SWCA Environmental Consultants (Appendix H of the Keahuolu Affordable Housing Project EIS), which concluded that the biological resources within the project site do not present a regulatory obstacle to development. Ultimately, the disposition of the surveyed caves will depend upon whether they contain significant archaeological or cultural

material. Mitigation measures are recommended for those caves and/or lava tubes identified for preservation by the SHPD. It is likely that caves and/or lava tubes containing no significant archaeological or cultural resources will be destroyed since the invertebrates inventoried do not warrant preservation. A determination as to the preservation of caves and/or lava tubes containing no archaeological or cultural resources will be made by the developer.

The following recommendations to minimize impacts on caves, particularly those known to contain cultural resources are provided below:

- Minimize adding topsoil or impermeable material to the surface directly above known caves and preserves.
- Control invasive plant species within the preserves. Utilize native plants for landscaping and avoid aggressive, fire-prone, non-native grasses.
- Exercise care to minimize surface disturbance during construction within the general vicinity of known caves.
- Prevent wildfires and develop a rapid response plan to fires within the proposed project area.
- If unsurveyed caves are encountered during construction and the caves are accessible, allow a biological survey if appropriate.

6.2.11 Visual Resources

Development of the project site will replace vegetated land with homes and landscaping, commercial development, and related infrastructure such as internal roadways. Kamakana Villages will become visible from Palani Road and existing neighboring developments. From vantage points located mauka and makai of the site, the property will appear as a continuation of the development in the Kailua- Kona area. The project design will maintain visual resources of the area by meeting county height requirements and including open space and landscaped areas throughout the development. The project will blend with the surrounding developments while preserving the natural beauty of the North Kona area.

6.2.12 Traffic

Kamakana Villages will provide pedestrian, bicycle, and bus facilities, as well as provide connectivity to the surrounding street network. Kamakana Villages will provide affordable housing that will be located in proximity to schools, shopping centers, and employment centers.

Kamakana Villages will provide more than twice the number of affordable housing credits required under Chapter 11, Hawai'i County Code. Therefore, under Hawai'i County Code Section 25-2-46(h)(1), HHFDC/Forest City Hawai`i Kona, LLC shall not be required to perform any area mitigation traffic improvements, as discussed herein.

Kamakana Villages at Keahuolu is expected to generate a total of 1,478 vph during the AM peak hour of traffic - 415 vph entering the site and 1,063 vph exiting the site. During the PM peak hour of traffic, the proposed project is expected to generate a total of 2,094 vph - 1,251 vph entering the site and 843 vph exiting the site. The trip generation characteristics for the proposed project are summarized in *Table 6-1*.

Table 6-1
Master Plan Trip Generation Characteristics

Year	Land Use (ITE Code)	Units	AM Peak Hour (vph)			PM Peak Hour (vph)		
			Enter	Exit	Total	Enter	Exit	Total
2014	Single-Family Housing (210)	76 DU	14	43	57	45	26	71
	Residential Condominiums (230)	191 DU	14	70	84	67	33	100
	Apartments (220)	149 DU	11	46	57	56	30	86
	Shopping Center (820)	41,833 SFGFA	20	13	33	56	61	117
	Totals		59	172	231	224	150	374
2019	Single-Family Housing (210)	153 DU	29	86	115	90	53	143
	Residential Condominiums (230)	324 DU	24	119	143	105	51	156
	Apartments (220)	180 DU	14	56	70	67	37	104
	Shopping Center (820)	57,167 SFGFA	27	17	44	34	41	75
	Totals		94	278	372	296	182	478
2029	Single-Family Housing (210)	432 DU	79	236	315	246	144	390
	Residential Condominiums (230)	733 DU	46	225	271	199	97	296
	Apartments (220)	92 DU	15	60	75	73	39	112
	Shopping Center (820)	98,000 SFGFA	46	30	76	132	143	275
2029	Elementary School (220)	550 Students	N/A	N/A	N/A	40	42	82
	Elementary School (820)	150 Students	76	62	138	41	46	87
	Totals		262	613	875	731	511	1,242
Project Totals			415	1,063	1,478	1,251	843	2,094

A portion of the PM peak hour traffic, generated from the retail component of Kamakana Villages at Keahuolu, can be expected to be "pass-by" trips, i.e., traffic already on the road, stopping at a "secondary" destination. The percentages of pass-by trips vary by size of the shopping center. The retail components of Phases 1 and 2 will total 66,333 Square Feet Gross Floor Area (SFGFA) and generate 31.9 percent pass-by traffic. The Phase 3 retail component will total 32,667 SFGFA and generate 53.9 percent pass-by traffic. The Phase 6 retail component will total 98,000 SFGFA and generate 39.1 percent pass-by traffic. Therefore, of the total 2,094 vph generated during the PM peak hour of traffic, 246 vph are expected to be passby trips.

6.2.12.1 Future Traffic Conditions and Mitigation - *With and* Without the Project

2014 Traffic Conditions

The widening of Queen Kaahumanu Highway, from two lanes to four lanes between Kealakehe Parkway and the Kona International Airport Access Road, is expected to be completed by the Year 2014 by the State Department of Transportation. Furthermore, the initial phase of the two-way, two- to four-lane Ane Keohokalole Highway from Puohulihuli Street to Palani Road and the widening of Palani Road from Ane Keohokalole Highway/Henry Street to Kamakaeha Avenue are expected to be completed by the County of Hawai'i. The baseline roadway conditions for the Year 2014 without the proposed project include the following improvements on Ane Keohokalole Highway/Henry Street, which are part of the County of Hawai'i's initial phase of the Ane Keohokalole Highway project:

- Mauka bound Palani Road will be widened to provide an exclusive left-turn lane to Ane Keohokalole Highway.
- Mauka bound Palani Road will be widened to provide an exclusive right-turn lane to Henry Street.
- The southbound approach of Ane Keohokalole Highway at Palani Road will provide an exclusive left-turn lane, a through-only lane, and a shared through/right-turn lane.
- The north leg of Ane Keohokalole Highway at Palani Road will provide two northbound lanes up to the future Makala Boulevard Extension.
- Henry Street will be restriped to provide a shared left-turn/through lane and a shared right-turn/through lane at Palani Road.
- The traffic signal phasing will be modified to provide protected-permissive left-turn phases on all approaches to the intersection of Palani Road and Ane Keohokalole Highway/Henry Street.
- A median lane for left-turn lanes on Ane Keohokalole Highway at the future extensions Makala Boulevard and Manawalea Street will be provided.

Table 6-2 provides a summary of the 2014 AM and PM peak hour traffic conditions with and without the project. The table also includes the improved traffic conditions through the implementation of proposed improvements described below. See *Appendix D* for additional details and diagrams.

Table 6-2
2014 Traffic Conditions at Key Intersections With / Without the Project

Intersection	Scenario	Morning Peak Hour		Afternoon Peak Hour	
		V/C	LOS	VC	LOS
Queen Kaahumanu Highway and Kealakehe Parkway	No Project	0.85	C	1.29	F
	-Improved	0.88	C	0.95	D
	Project	0.86	C	1.35	F
	- Improved	0.80	B	0.95	D
Kealakehe Parkway and Ane Keohokalole Highway	No Project	1.73	F	0.63	A
	- Improved	0.53	A	0.33	A
	Project	2.09	F	0.71	A
	- Improved	0.60	B	0.36	A
Queen Kaahumanu Highway and Makala Boulevard	No Project	0.86	C	1.04	D
	- Improved	0.76	C	0.93	D
	Project	0.86	C	1.04	D
	- Improved	0.86	C	0.93	D
Queen Kaahumanu Highway and Palani Road	No Project	0.85	C	.99	D
	- Improved	n/a	n/a	n/a	n/a
	Project	0.85	C	1.04	D
	- Improved	0.85	C	0.98	D
Queen Kaahumanu Highway and Henry Street	No Project	0.86	D	0.97	D
	- Improved	0.81	C	0.93	D
	Project	0.89	D	1.00	D
	- Improved	0.85	C	0.95	D
Palani Road and Henry Street/Ane Keohokalole Highway	No Project	0.88	C	0.99	D
	- Improved	0.78	B	0.90	D
	Project	0.92	C	1.02	D
	- Improved	0.88	C	0.91	D
V/C = Ratio of the traffic volume to the theoretical capacity of the intersection. LOS = Level of service.					

2014 Proposed Traffic Improvements Without Project

The following improvements are proposed to mitigate highway deficiencies expected by the Year 2014 without the proposed project:

- Kealakehe Parkway and Queen Kaahumanu Highway

- Widen makai bound Kealakehe Parkway to provide double left-turn lanes onto southbound Queen Kaahumanu, in addition to existing through lane and right-turn lane.
- Widen mauka bound Kealakehe Parkway to provide a left-turn lane onto northbound Queen Kaahumanu, in addition to existing shared through/right-turn lane.
- Modify the traffic signal phasing to provide protected left-turn phases on both approaches on Kealakehe Parkway.

- Makala Boulevard and Queen Kaahumanu Highway

- Restripe the right-turn only lane on mauka bound Makala Boulevard at Queen Kaahumanu Highway to a shared through/right-turn lane to provide two through lanes across the intersection.

- Restripe/widen makai bound Makala Boulevard at Queen Kaahumanu Highway to provide double left-turn lanes, a through only lane, in addition to the existing shared through/right-turn lane.
- Modify the traffic signal phasing to provide an eight-phase operation with protected left-turn phases on all approaches.

- Henry Street and Queen Kaahumanu Highway

- Widen makai bound Henry Street to provide double left-turn lanes in addition to a through-only lane and a shared through/right-turn lane.
- Modify the traffic signal phasing to provide an eight-phase operation with protected left-turn phases on all approaches.

- Palani Road and Henry Street/ Ane Keohokalole Highway

- Widen makai bound Palani Road to provide double left-turn lanes onto Henry Street.
- Modify the traffic signal phasing to include protected left-turn phases in both directions on Palani Road.

- Ane Keohokalole Highway and Kealakehe Parkway

- Signalize the intersection, when warranted.

Project Mitigation for 2014

Local Mitigation Traffic Improvement With Project

Manawalea Street will be constructed with separate left-turn and right-turn lanes to intersect Ane Keohokalole Highway at a stop-controlled Tee-intersection to provide access to the project.

Area Mitigation Traffic Improvements With Project

In addition to proposed improvements recommended for the Year 2014 without the proposed project, the following improvements are proposed to maintain minimum LOS "D" conditions up to the Year 2014 with the proposed project:

- Palani Road and Queen Kaahumanu Highway

- Widen makai bound Palani Road at Queen Kaahumanu Highway to provide an exclusive right-turn lane.

- Henry Street and Queen Kaahumanu Highway

- Widen northbound Queen Kaahumanu Highway to provide double right-turn lanes at Henry Street.

- Palani Road and Henry Street/Ane Keohokalole Highway

- Widen northbound Henry Street at Palani Road to provide exclusive left-turn lane.

2019 Traffic Conditions

The traffic improvements proposed in the previous section are assumed to be implemented by 2019 without the proposed project. *Table 6-3* provides a summary of AM and PM peak traffic conditions both with, and without, the project, and the improved traffic conditions through implementation of proposed improvements described below. See *Appendix D* for additional details and diagrams.

Table 6-3
2019 Traffic Conditions at Key Intersections With / Without the Project

Intersection	Scenario	Morning Peak Hour		Afternoon Peak Hour	
		V/C	LOS	VC	LOS
Queen Kaahumanu Highway and Kealakehe Parkway	No Project	0.93	C	1.07	D
	- Improved	0.92	C	0.98	D
	Project	0.89	C	1.10	E
	- Improved	0.85	C	0.94	C
Kealakehe Parkway and Ane Keohokalole Highway	No Project	0.59	B	0.47	A
	- Improved	n/a	n/a	n/a	n/a
	Project	0.77	B	0.54	A
	- Improved	n/a	n/a	n/a	n/a
Queen Kaahumanu Highway and Makala Boulevard	No Project	0.92	C	1.03	E
	- Improved	0.79	C	1.01	D
	Project	0.92	C	1.03	E
	- Improved	0.80	C	0.99	D
Queen Kaahumanu Highway and Palani Road	No Project	0.89	C	1.08	E
	- Improved	0.78	C	0.99	D
	Project	0.94	D	1.07	E
	- Improved	0.82	C	0.93	D
Queen Kaahumanu Highway and Henry Street	No Project	0.89	D	1.02	D
	- Improved	0.83	C	0.95	D
	Project	0.95	D	1.07	D
	- Improved	0.85	C	0.95	D
Palani Road and Henry Street/Ane Keohokalole Highway	No Project	0.81	C	1.05	E
	- Improved	0.83	C	0.87	C
	Project	0.89	C	1.08	E
	- Improved	0.86	B	0.90	C

V/C = Ratio of the traffic volume to the theoretical capacity of the intersection.
LOS = Level of service.

2019 Proposed Traffic Improvements Without Project

The following improvements are proposed to mitigate highway deficiencies expected by 2019 without the proposed project:

- Queen Kaahumanu Highway

- Widen Queen Kaahumanu Highway from four lanes to six lanes from Kealakehe Parkway to Henry Street.

- Palani Road and Henry Street/Ane Keohokalole Highway

- Widen northbound Henry Street to provide an exclusive left-turn lane onto makai bound Palani Road.
- Restripe the exclusive right-turn lane on mauka bound Palani Road to a shared through/right-turn land to provide two mauka bound lanes.
- Widen the mauka leg of Palani Road to provide two lanes in the mauka bound direction.

Project Mitigation for 2019

Local Mitigation Traffic Improvements With Project
The traffic improvements proposed in the previous section are assumed to be implemented by 2019. The following traffic local mitigation improvements are recommended at the intersection of Ane Keohokalole Highway and Makala Boulevard to provide access to the proposed project:

- Makala Boulevard and Ane Keohokalole Highway
- Construct the east leg of Makala Boulevard with separate left-turn and right-turn lanes, intersecting Ane Keohokalole Highway at a stop-controlled Tee-intersection.
- Restripe the median to provide a shelter lane on southbound Ane Keohokalole Highway at Makala Boulevard.

- Manawalea Street and Ane Keohokalole Highway
- Restripe southbound Ane Keohokalole Highway to provide a median shelter lane at Manawalea Street.

Area Mitigation Traffic Improvements With Project
In addition to proposed improvements described above, the following area mitigation traffic improvements are proposed to accommodate the 2019 traffic demands with the proposed project:

- Kealakehe Parkway and Queen Kaahumanu Highway
- Widen mauka bound Kealakehe Parkway at Queen Kaahumanu Highway to provide an exclusive right-turn lane.

- Palani Road and Queen Kaahumanu Highway
- Widen makai bound Palani Road to provide double left-turn lanes onto Queen Kaahumanu Highway.
- Widen southbound Queen Kaahumanu Highway to provide double right-turn lanes to Palani Road.

- Henry Street and Queen Kaahumanu Highway
- Widen mauka bound Henry Street to provide an exclusive right-turn lane to Queen Kaahumanu Highway.
- Widen makai bound Henry Street to provide an exclusive right-turn lane to Queen Kaahumanu Highway.

- Palani Road and Henry Street/ Ane Keohokalole Highway
- Widen and restripe approaches on Palani Road to provide two through lanes in each direction at Ane Keohokalole Highway/Henry Street, as recommended in the Final Environmental Assessment for the Ane Keohokalole Mid-Level Highway Project:
- Widen northbound Henry Street to provide exclusive left-turn lane.

2029 Traffic Conditions
Table 6-4 provides a summary of morning and afternoon peak traffic conditions with and without the project. The table also includes the improved traffic conditions through the implementation of proposed improvements described below. See *Appendix D* for additional details and diagrams.

Table 6-4
2029 Traffic Conditions at Key Intersections With / Without the Project

Intersection	Scenario	Morning Peak Hour		Afternoon Peak Hour	
		V/C	LOS	VC	LOS
Queen Kaahumanu Highway and Kealakehe Parkway	No Project	0.95	C	0.96	D
	- Improved	n/a	n/a	n/a	n/a
	Project	0.89	C	0.90	D
	- Improved	n/a	n/a	n/a	n/a
Kealakehe Parkway and Ane Keohokalole Highway	No Project	n/a	n/a	n/a	n/a
	- Improved	0.90	C	0.77	B
	Project	0.91	C	0.81	C
	- Improved	n/a	n/a	n/a	n/a
Queen Kaahumanu Highway and Makala Boulevard	No Project	0.91	C	1.16	D
	- Improved	n/a	n/a	n/a	n/a
	Project	0.98	D	1.08	E
	- Improved	0.93	D	0.99	D
Queen Kaahumanu Highway and Palani Road	No Project	0.89	D	1.09	E
	- Improved	n/a	n/a	n/a	n/a
	Project	0.93	D	0.99	E
	- Improved	n/a	n/a	n/a	n/a
Queen Kaahumanu Highway and Henry Street	No Project	1.14	E	1.23	F
	- Improved	n/a	n/a	n/a	n/a
	Project	0.89	D	1.06	E
	- Improved	n/a	n/a	n/a	n/a
Palani Road and Henry Street/Ane Keohokalole Highway	No Project	n/a	n/a	n/a	n/a
	- Improved	0.86	C	0.97	D
	Project	0.92	C	1.00	E
	- Improved	0.87	C	0.97	D
V/C = Ratio of the traffic volume to the theoretical capacity of the intersection. LOS = Level of service.					

2029 Proposed Traffic Improvements Without Project

In addition to the traffic improvements proposed in the previous sections, the following roadway improvements are assumed to be implemented by 2029 without the proposed project, as recommended in the Final Environmental Assessment for the Ane Keohokalole Mid-Level Highway Project:

- Ane Keohokalole Highway

- Widen Ane Keohokalole Highway to a four-lane divided highway from Palani Road to Kealakehe Parkway.
- Provide separate left-turn and right-turn lanes in both directions on Ane Keohokalole Highway at Kealakehe Parkway.
- Extend the four-lane divided Ane Keohokalole Highway to Hina Lani Street.

- Makala Boulevard

- Extend Makala Boulevard from Makalapa Shopping Center to Ane Keohokalole Highway.
- Provide a separate left-turn lane on Ane Keohokalole Highway to Makala Boulevard.

- Palani Road and Ane Keoholalole Highway/Henry Street

- Provide an exclusive right-turn lane on Ane Keohokalole Highway at Palani Road.
- Widen makai bound Palani Road to provide two through lanes at Ane Keohokalole Highway/Henry Street.

Mitigation for 2029 With Project

Local Mitigation Traffic Improvements With Project
The following local mitigation traffic improvements are recommended by 2029.

- Ane Keohokalole Highway and Manawalea Street
- Signalize the intersection when warranted.

- Ane Keohokalole Highway and Makala Boulevard
- Signalize the intersection when warranted.

- Ane Keohokalole Highway and South Street
- South Street will be constructed to intersect Ane Keohokalole Highway at a stop-controlled Tee-intersection, which will be restricted to right-turn-in and right-turn-out movements only.

- Palani Road and School Street
- Construct South Street with separate left-turn and right-turn lanes, which will intersect Palani Road at a Tee-intersection.
- Widen mauka bound Palani Road to provide an exclusive left-turn lane at School Street.
- Widen makai bound Palani Road to provide an exclusive right-turn lane at School Street.
- Signalize the intersection of School Street and Palani Road when warranted.

- Palani Road and D Street
- Construct D Street, which will intersect Palani Road at a stop-controlled Tee-intersection, which will be restricted to right-turn-in and right-turn-out movements only.
- Widen makai bound Palani Road to provide a right-turn deceleration lane to D Street.

- Palani Road and C Street
- Construct C Street to intersect Palani Road at a stop-controlled Tee-intersection, which will be restricted to right-turn-in and right-turn-out movements only.
- Widen makai bound Palani Road to provide a right-turn deceleration lane to C Street.

Area Mitigation Traffic Improvements With Project
The proposed improvements recommended above are assumed to be implemented by 2029. In addition, the following area mitigation traffic improvements are proposed to accommodate 2029 traffic demands with the proposed project.

- Makala Boulevard and Queen Kaahumanu Highway
- Widen south bound Queen Kaahumanu Highway to provide a double left-turn lane to mauka bound Makala Boulevard.
- Widen makai bound Makala Boulevard to provide an exclusive right-turn lane to northbound Queen Kaahumanu Highway.
- Widen mauka bound Makala Boulevard to provide an exclusive right-turn lane to southbound Queen Kaahumanu Highway.

- Palani Road and Ane Keohokalole Highway/Henry Street
- Widen mauka bound Palani Road to provide double left-turn lanes at Ane Keohokalole Highway/Henry Street.

- Widen mauka bound Palani Road to provide an exclusive right-turn lane, in addition to the two through lanes at Ane Keohokalole Highway/Henry Street.
- Widen makai bound Palani Road to provide an exclusive right-turn lane at Ane Keohokalole Highway/Henry Street.

Public Transportation
Kamakana Villages is located along the Intra-Kona bus route and is easily accessible to public transportation options. Bus service will be needed at 60 trips per weekday and 40 trips per weekend, including Sundays, per LEED ND. New transit stops are planned to be located along the project boundary on the proposed extension of Ane Keohokalole Highway/Mid Level Road. A new transit line will be established to provide service to this area. Transit services will be carried out in coordination with the County of Hawai'i's Mass Transit Agency.

6.2.12.2 Conclusions

The Phase 1 improvements on Queen Kaahumanu Highway improved traffic operations up to Kealakehe Parkway. It is expected that the second Phase of the Queen Kaahumanu Highway widening project will likewise improve traffic flow up to the Kona International Airport Access Road. Further improvements will be required on the cross streets on Queen Kaahumanu Highway to minimize delays and optimize intersection operations. Without the proposed project, Queen Kaahumanu Highway will require additional widening, from four lanes to six lanes, from south of Henry Street to north of Kealakehe Parkway.

The Year 2029 PM peak hour traffic demands at the Queen Kaahumanu Highway intersections at Palani Road, and at Henry Street are expected to reach the limits of capacity for an at-grade intersection. Ane Keohokalole Highway is expected to provide some relief to Queen Kaahumanu Highway. Additional capacity on the north-south highway corridor can be provided by the planned extension of Kuakini Highway from Makala Boulevard to Kealakehe Parkway. However, the extension of Kuakini Highway was not included in the TIAR.

Palani Road is expected to require an additional mauka bound lane by the Year 2019 without the proposed project, and an additional makai bound lane by the Year 2019 with the proposed project. Additional capacity in the mauka-makai directions can be provided by the extension of Kealakehe Parkway to Mamalahoa Highway/Palani Road. However, the extension of Kealakehe Parkway was not included in the TIAR. Together with the extension of Kuakini Highway to Kealakehe Parkway, this second access route to and from Kailua Town would relieve the heavily traveled Palani Road.

Kamakana Villages will provide pedestrian, bicycle, and bus facilities, as well as provide connectivity to the surrounding street network. Kamakana Villages will provide affordable housing that will be located in proximity to schools, shopping centers, and employment centers. Table 4 of the TIAR summarizes the capacity analysis used therein. Kamakana Villages will provide more than twice the number of affordable housing credits required under Chapter 11, Hawai'i County Code. Therefore, under Hawai'i County Code Section 25-2-46(h)(1), HHFDC/Forest City Hawai`i Kona, LLC shall not be required to perform any area mitigation traffic improvements, as discussed herein.

6.2.13 Public Access

Impacts on public access are not anticipated to occur as a result of the proposed Kamakana Villages Project. There is no existing public access from within the proposed project site to and along shoreline and mountain areas. Access to parks and recreational areas developed within the project site will be provided. No mitigation measures are required.

6.2.14 Recreation

Future residents of the proposed project are expected to move to North Kona from South Kona, Ka'u, or South Kohala, areas with even fewer resources for active recreation than North Kona. The Kamakana Villages Project will provide new recreation areas throughout the project site. These areas which consist of parks and open spaces will be accessible to the public, in accordance with County park requirements. Nearby recreational facilities, such as the Kailua Park would also be available for public use.

6.2.15 Socio-Economic Conditions

As a workforce housing development, the Kamakana Villages Project is planned to have beneficial socio-economic impacts. The project will increase the housing supply in the area, and have a positive impact on housing prices and the overall quality of life. The development of the project will increase the workforce population within the Kailua urban area, and encourage higher labor force participation. It will result in increased revenues for the State and County, which will likely offset increased costs associated with new development.

6.2.15.1 Housing Needs

At build-out the de facto population of Kamakana Villages will be some 5,302 persons. With more than half of the units being dedicated to workforce housing/affordable units for local families, along with a variety of moderate market product types, full-time Big Island residents will comprise a primary target demographic for the project. Non-resident purchasers are anticipated to comprise only a minor group.

The resident population of West Hawai'i is forecast to increase by about 60 percent over the next two decades, reaching some 118,000 persons. In Greater Kailua-Kona (stretching from Keahole to Keauhou), the resident population is projected to grow from a current level of just over 23,000 to circa 40,000 persons by 2030 (*Appendix E*).

These additional residents will primarily result from the natural growth of existing Big Island families, with secondary contributors being intra-state migration from other islands, and in-migration of mainland and foreign persons. Non-resident purchasers will also be active in the market. Combined, this should create demand for some 7,560 to 10,162 new housing units in Greater Kailua-Kona during the 2010 through 2030 projection period. About 44 percent of this demand will be for resident/workforce housing units meeting affordable pricing guidelines. Non-resort multifamily units will comprise an increasing percentage of the housing stock (*Appendix E*).

Currently there are interested buyers in the lower to middle income segments but, despite declining prices, the available inventory remains beyond their reach. As the economy stabilizes and credit becomes more readily available, this demand will again be expressed.
The 2006 *Hawaii Housing Policy Study* suggests that there is demand for resident units in North Kona in the next few years. The first of six phases of development is expected to provide between 100 - 118 housing units annually. Later Phases will range from 105 to 165 units annually. Presales are anticipated to start in 2011, occupancy in 2012, and all for sale and rental units should be absorbed by 2028. Along with other projects such as the DHHL increments in La'i 'Ōpua, affordable and market housing produced in Palamanui, new housing in Waikoloa Village, and smaller projects, the cumulative impact of planned housing developments are likely to provide a significant reduction in demand. A wide range of prices and housing types (including apartments, condominiums, town homes, homes, self-help housing, and properties in leased-land as well as fee-simple communities) will be available to West Hawai'i residents, with the prices of moderate homes becoming stabilized as a result of the increase in available housing (*Appendix E*).

6.2.15.2 Employment

Construction
The proposed project will require infrastructure, residential and commercial construction over a period of approximately 17 - 18 years. Development of the project will include off-site infrastructure development, on-site infrastructure development, and housing construction. Development of Kamakana Villages will create both direct and indirect employment within the County.

From 2011 to 2030 the number of worker-years created on- and off-site, directly and indirectly, by the development varies from 103 to 1,173 positions annually, totaling 11,131 worker-years over the entire timeframe. Of this total 3,189 worker-years (an annual average of 168 positions) are direct construction-oriented, 5,180 (or 273 per year) are on-going, on-site business operating and maintenance positions; and 2,762 are off-site/indirect worker-year requirements.

On a stabilized basis, after the completion of construction (year 20 and beyond), the project will generate some 933 permanent full-time equivalent employment opportunities, 654 directly related to on-site activities, and 279 indirect positions throughout the island.

In the first year of development, the "Total Annual Wages Generated" by the subject development effort would be $6.5 million, increasing to as high as $48.3 million in year 19. After completion of all construction, the stabilized on-going commercial operations, maintenance/common element, off-site and indirect employment would result in total annual wages of $34.8 million thereafter in uninflated 2009 dollars. This is equates to an average wage of $37,306 per worker-year. During the development period, on- and off-site, direct and indirect worker wages would total $505 million.

Refer to *Appendix E* for additional details and information.

Operations
Typically, residential projects do not result in the creation of many permanent jobs. Most residential projects require only managers and a few landscape, maintenance, and security workers on a permanent basis. Once the commercial component of Kamakana Villages is completed and the project is fully built out, it is anticipated to generate 933 permanent, full time

equivalent jobs, 654 of which will be directly related to on-site activities, and 279 of which will be indirect positions throughout the County.
Direct jobs associated with operations at the project site are a socio-economic impact that affects residents and their neighbors. Indirect jobs associated with operations on the project site does not impact residents and neighbors since those operations, funded by resident spending, would occur somewhere in the County with or without the project. Accordingly, indirect and induced jobs associated with operations are not calculated here.

Application of these ratios to the proposed subject master plan is shown on the top half of *Table 6-5*.

Table 6-5
Employee Job Count and Wage Estimates

Development Year	Infrastructure and Initial Product Built 1	2	Occupancy & Use Begins 3	4	5	6	7	8	9	10
Worker Requirements (1)										
Infrastructure Construction (2)	77	77			46				46	
Commercial Construction (3)				17				0		
Unit/Home Construction (3)		102	124	120	120	143	136	136	136	119
Commercial Businesses Workers (4)				75	105	138	168	168	168	208
Maint. & Common Element Staff (5)			22	29	37	46	55	64	73	80
Off-Site Employees (6)	26	59	48	80	102	108	118	121	139	134
TOTAL EMPLOYMENT CREATED	**103**	**238**	**194**	**322**	**410**	**435**	**477**	**488**	**562**	**541**
Worker Wages										
Infrastructure (7)	$5,486,816	$5,486,816	$0	$0	$3,292,090	$0	$0	$0	$3,292,090	$0
Commercial Construction (7)	$0	$0	$0	$1,230,075	$0	$0	$0	$0	$0	$0
Unit/Home Construction (7)	$0	$7,226,025	$8,814,739	$8,539,969	$8,539,969	$10,171,815	$9,622,275	$9,622,275	$9,622,275	$8,476,335
Commercial Businesses Workers (8)	$0	$0	$0	$2,550,000	$3,570,000	$4,675,000	$5,695,000	$5,695,000	$5,695,000	$7,055,000
Maint. & Common Element Staff (9)	$0	$0	$882,867	$1,197,200	$1,511,533	$1,896,933	$2,265,933	$2,634,933	$3,003,933	$3,288,200
Off-Site Employees (9)	$1,045,586	$2,422,602	$1,971,112	$3,271,639	$4,174,213	$4,424,738	$4,847,686	$4,969,456	$5,718,578	$5,507,860
TOTAL ANNUAL WAGES PAID	**$6,532,402**	**$15,135,443**	**$11,668,718**	**$16,788,882**	**$21,087,805**	**$21,168,487**	**$22,430,895**	**$22,921,665**	**$27,331,876**	**$24,327,395**

(1) All job counts expressed as "full-time" equivalent positions.
(2) Based on one worker year for every $400,000 in construction costs.
(3) Based on one worker year for every $200,000 in construction costs.
(4) Ratio of one FTE worker for each 400 SF of GLA.
(5) Includes common element administration and maintenance staff of 7 jobs, and ratio of one full-time-equivalent landscaping/maintenance/repair worker for every 15 units.
(6) Off-site employees at 33% of on-site workers.
(7) Based on average annual wages of $71,000.
(8) Based on average annual wage of $34,000.
(9) Based on average annual wage of $41,000.

Source: Various, and The Hallstrom Group, Inc.

Table 6-5 Continued

Development Year	11	12	13	14	15	16	17	18	19	Total for Yrs 1 Through 19	Stabilized Annually Thereafter
Worker Requirements (1)											
Infrastructure Construction (2)		46			46		46			386	
Commercial Construction (3)	22						89	45		174	
Unit/Home Construction (3)	128	138	146	156	156	186	191	202	189	2,629	
Commercial Businesses Workers (4)	248	248	248	248	248	248	248	410	493	3,663	493
Maint. & Common Element Staff (5)	87	95	103	112	121	132	143	153	162	1,517	162
Off-Site Employees (6)	160	174	164	170	188	187	237	268	279	2,762	279
TOTAL EMPLOYMENT CREATED	**645**	**701**	**660**	**686**	**759**	**753**	**955**	**1,079**	**1,123**	**11,131**	**933**
Worker Wages											
Infrastructure (7)										$17,557,812	
Commercial Construction (7)										$1,230,075	
Unit/Home Construction (7)	$9,100,425	$9,833,145	$10,331,831	$11,056,031	$11,056,031	$13,228,898	$13,586,738	$14,373,240	$13,435,241	$186,637,256	
Commercial Businesses Workers (8)	$8,415,000	$8,415,000	$8,415,000	$8,415,000	$8,415,000	$8,415,000	$8,415,000	$13,940,000	$16,745,000	$124,525,000	$16,745,000
Maint. & Common Element Staff (9)	$3,575,200	$3,884,067	$4,239,400	$4,608,400	$4,977,400	$5,425,667	$5,876,667	$6,289,400	$6,655,667	$62,213,400	$6,655,667
Off-Site Employees (9)	$6,560,359	$7,131,606	$6,716,546	$6,976,322	$7,725,443	$7,660,088	$9,713,705	$10,975,739	$11,420,160	$113,233,439	$11,420,160
TOTAL ANNUAL WAGES PAID	**$27,650,984**	**$29,263,818**	**$29,702,777**	**$31,055,753**	**$32,173,875**	**$34,729,653**	**$37,592,109**	**$45,578,379**	**$48,256,068**	**$505,396,983**	**$34,820,827**

(1) All job counts expressed as "full-time" equivalent positions.
(2) Based on one worker year for every $400,000 in construction costs.
(3) Based on one worker year for every $200,000 in construction costs.
(4) Ratio of one FTE worker for each 400 SF of GLA.
(5) Includes common element administration and maintenance staff of 7 jobs, and ratio of one full-time-equivalent landscaping/maintenance/repair worker for every 15 units.
(6) Off-site employees at 33% of on-site workers.
(7) Based on average annual wages of $71,000.
(8) Based on average annual wage of $34,000.
(9) Based on average annual wage of $41,000.

Source: Various, and The Hallstrom Group, Inc.

Labor Force Impacts

While the proposed Kamakana Villages Project will affect the regional labor force by creating jobs, the project will also provide housing opportunities for service, retail, managerial, and professional workers. As housing units are built in the area, fewer workers will face unacceptable housing choices and/or difficult daily commutes. By shortening the commute time for workers, the project is likely to increase labor force participation with some joining the labor force and others changing from part-time to full-time employment. With jobs being more accessible to area residents, the high-school student participation in the labor force may also increase. Finally, by having fewer obstacles to work, residents living near job centers are more likely to keep their jobs than others with long commutes resulting in lower job turnovers.

6.2.15.3 Agricultural Production

Although the site lies within the Agricultural District, the proposed project site is not considered to be a valued agricultural resource. State and County objectives and policies related to agriculture are typically not applicable to the proposed project because the property has soils with poor agricultural viability. No potentially productive agricultural land is being removed from the inventory with the development of this project. The Kamakana Villages Project will utilize largely marginal or non-essential agricultural lands as shown in *Figure 4-4*.

6.2.15.4 Fiscal Impacts

Government Revenues

The development of Kamakana Villages will result in revenues for both the State and County. The State will generate revenues through construction of the project and sale of property and the County will gain revenues from taxes on homes and residential land.

Real Property Taxes – Anticipated property taxes to be paid by landowners within Kamakana Villages were calculated using the 2009 tax rates for both land and buildings, improved and unimproved. The basis for the calculations is presented in *Appendix E*.

The total assessments and resulting taxes for the finished units and commercial components are added to the tax rolls as they are completed and absorbed. Conversely, the assessed value and taxes attributable to the underlying land diminishes as it is built-out and sold.

The total real property taxes to be paid to the County of Hawai'i in 2009 dollars ranges from $220,401 in year 1 of development, to a stabilized level of $6.8 million at build-out in year 19 and beyond. The aggregate taxes paid over the development modeling time-frame will be $62.1 million.

State Income Tax -- The state will receive income taxes from three sources:

- The wages of the workers associated with the construction, maintenance, and operation of the Kamakana Villages components;

- The profits from contractors and suppliers serving the construction and maintenance phases of the development, and as generated by on-going commercial operations; and

- The income of full-time residents of the development.

According to DBEDT data, individual State of Hawai'i income tax liability as a ratio to gross income has averaged ranged from about 5.6 to just over 5.80 percent during the past two decades, with the more current figures tending toward the mid to upper-end of the range. We have employed an effective tax rate of 5.80 percent of gross personal income for individual workers and full-time residents (*see Appendix E*).

The effective tax rate for the corporate income is estimated at 2.00 percent of gross operating profits, based on available DBEDT statistics.

The total income tax revenues to be received by the state are projected at $386,916 in the first year of construction increasing to a maximum level at year 19 of $16.6 million. On a stabilized basis, after build-out, the permanent worker incomes, building maintenance and off-site workers, and operating businesses, would pay an annual state income tax of about $15.8 million.

Over the 19-year projection period, the cumulative income taxes paid are estimated at $154.1 million. This figure does not include any corporate income or other taxes that may be paid by Forest City on its profits from undertaking the development, or from the secondary jobs created by the discretionary spending of owners, workers and businesses. Such items have the potential to be substantial contributions to the state coffers.

State Gross Excise Tax -- This 4.166 percent of expenditures tax was applied against:

- The total estimated construction contract costs;

- Discretionary spending of wage income by workers associated with the project's construction and operation;

- Expenditures of Kamakana Villages unit owners and their guests on and off-site; and

- Non-resident patronage expenditures in the subject community businesses.

The anticipated state excise tax receipts arising from the subject development range from an estimated $1.5 million in the first year of development to a peak of $12.5 million. Over the 19-year study period, the receipts total $89.5 million and stabilize at circa $10.4 million per year. This figure does not include any excise tax revenues associated with the direct, local "multiplier effect" expenditures on the Big Island, or those created in the secondary market by the suppliers to the operating businesses or secondary worker expenditures.

Total Public Benefits (Revenues) -- In constant 2009 dollars, the rounded aggregate annual tax revenues flowing from the subject development during the construction and at full project build-out range from:

- $220,401 to $6.8 million per year for the County of Hawaii, stabilizing over time at $6.8 million annually and totaling $62.1 million over the 19-year development projection time-frame;

- $1.8 million to $29.1 million annually for the State of Hawaii, stabilizing at $26.2 million per year, and cumulatively at $279.8 million over the modeling period; and

- $2.1 million to $35.9 million annually in total to the combined County and State public purse, stabilizing at about $33 million per year, and cumulatively at $341.9 million over the modeling period.

The public cost/benefit (fiscal impact) assessment model for Kamakana Villages is complied on *Table 6-6* with the correlation of per capita public service fair contribution "costs" and the specifically anticipated tax revenue "benefits" shown on the bottom line. As construction activity (which generates tax revenues) is completed and the full de facto population is established (which results in increasing public costs), the net returns to governmental entities decrease.

Table 6-6
Public Costs/Benefits Summary Table

Development Year	1	2	3	4	5	6	7	8	9	10	11
PUBLIC BENEFITS (Revenues)											
1. REAL PROPERTY TAXES											
Total Assessed Value	$27,210,000	$27,210,000	$150,069,452	$200,004,552	$249,899,777	$308,742,416	$359,640,856	$410,539,296	$461,437,736	$512,401,112	$567,077,792
TOTAL REAL PROPERTY TAXES (1)	$220,401	$220,401	$1,021,064	$1,321,288	$1,621,153	$1,971,672	$2,260,906	$2,550,139	$2,839,372	$3,150,977	$3,486,272
2. STATE INCOME TAXES											
Taxable Personal Income	$6,532,402	$15,135,443	$33,802,718	$50,543,232	$66,462,505	$80,930,287	$95,915,775	$110,129,625	$128,262,916	$135,550,745	$149,055,974
Taxable Corporate Profits	$401,851	$686,821	$481,814	$2,531,948	$3,637,423	$4,395,417	$5,195,420	$5,223,420	$5,492,531	$6,415,828	$7,585,140
Personal Taxes Paid	$378,879	$877,856	$1,960,558	$2,931,507	$3,854,825	$4,693,957	$5,563,115	$6,387,518	$7,439,249	$7,861,943	$8,645,246
Corporate Taxes Paid	$8,037	$13,736	$9,636	$50,639	$72,748	$87,908	$103,908	$104,468	$109,851	$128,317	$151,703
TOTAL STATE INCOME TAXES	$386,916	$891,592	$1,970,194	$2,982,146	$3,927,574	$4,781,865	$5,667,023	$6,491,987	$7,549,100	$7,990,260	$8,796,949
3. STATE GROSS EXCISE TAX											
Taxable Transactions											
Construction Contracts	$30,911,641	$51,266,641	$32,915,250	$27,521,250	$46,040,734	$32,090,500	$27,105,000	$27,105,000	$45,651,984	$28,277,000	$30,035,000
Worker Disposable Income Purchases	$3,919,441	$9,081,266	$7,001,231	$10,073,329	$12,652,683	$12,701,092	$13,458,537	$13,752,999	$16,399,126	$14,596,437	$27,650,984
Unit Owner/Guest Expenditures (on/off site)			$14,430,150	$22,041,110	$29,652,070	$38,986,955	$47,923,428	$56,859,901	$65,796,374	$72,674,385	$79,613,744
Non-Resident Patronage Expenditures					$12,936,000	$16,940,000	$20,636,000	$20,636,000	$20,636,000	$25,564,000	$30,492,000
Total Taxable Transactions	$34,831,082	$60,347,907	$54,346,631	$59,635,689	$101,281,487	$100,718,547	$109,122,965	$118,353,900	$148,483,484	$141,111,822	$167,791,728
TOTAL STATE EXCISE TAX	$1,451,063	$2,514,094	$2,264,081	$2,484,423	$4,219,387	$4,195,935	$4,546,063	$4,930,623	$6,185,822	$5,878,719	$6,990,203
TOTAL GROSS PUBLIC REVENUES											
To County of Hawaii (Item #1)	$220,401	$220,401	$1,021,064	$1,321,288	$1,621,153	$1,971,672	$2,260,906	$2,550,139	$2,839,372	$3,150,977	$3,486,272
To State (Items #2 & #3)	$1,837,979	$3,405,686	$4,234,275	$5,466,569	$8,146,961	$8,977,800	$10,213,086	$11,422,610	$13,734,922	$13,868,978	$15,787,153
AGGREGATE TAX REVENUES	$2,058,380	$3,626,087	$5,255,339	$6,787,857	$9,768,113	$10,949,472	$12,473,992	$13,972,749	$16,574,294	$17,019,955	$19,273,425
PUBLIC COSTS (Expenses)											
By County of Hawaii			$854,616	$1,303,944	$1,753,272	$2,307,939	$2,837,611	$3,367,282	$3,896,954	$4,297,481	$4,696,222
By State of Hawaii			$2,686,794	$4,099,419	$5,512,044	$7,255,840	$8,921,054	$10,586,267	$12,251,481	$13,510,681	$14,764,269
TOTAL PUBLIC COSTS			$3,541,410	$5,403,363	$7,265,316	$9,563,780	$11,758,664	$13,953,549	$16,148,434	$17,808,162	$19,460,491
TOTAL NET PUBLIC BENEFITS											
By County of Hawaii	$220,401	$220,401	$166,448	$17,344	($132,119)	($336,267)	($576,705)	($817,143)	($1,057,581)	($1,146,504)	($1,209,950)
To State of Hawaii	$1,837,979	$3,405,686	$1,547,481	$1,367,150	$2,634,917	$1,721,959	$1,292,032	$836,343	$1,483,441	$358,297	$1,022,884
AGGREGATE NET BENEFITS	$2,058,380	$3,626,087	$1,713,929	$1,384,494	$2,502,797	$1,385,692	$715,327	$19,200	$425,860	($787,207)	($187,066)

(1) Real property taxes include tax rates of $5.55 per $1,000 for homeowners/residents, $8.10 for non-resident multifamily and $7.44 for non-resident single family. Underlying unsold land at rate of $8.10 per $1,000, with a value of $200,000 per acre upon entitlement.

Source: The Hallstrom Group, Inc.

Table 6-6 Continued

Development Year	12	13	14	15	16	17	18	19	Total Years 1 Through 19	Stabilized Operations
PUBLIC BENEFITS (Revenues)										
1. REAL PROPERTY TAXES										
Total Assessed Value	$619,320,904	$674,339,334	$733,434,284	$792,529,234	$863,661,510	$962,815,840	$1,053,866,934	$1,126,597,940		$1,126,597,940
TOTAL REAL PROPERTY TAXES (1)	$3,786,050	$4,101,231	$4,440,578	$4,779,925	$5,188,617	$5,843,791	$6,414,594	$6,837,724	$62,056,155	$6,837,724
2. STATE INCOME TAXES										
Taxable Personal Income	$161,735,808	$175,123,157	$189,867,203	$204,376,395	$223,311,333	$242,552,949	$265,036,989	$280,397,460	$2,614,722,915	$266,962,219
Taxable Corporate Profits	$10,556,547	$10,363,503	$7,684,813	$7,957,673	$7,834,003	$8,377,676	$12,633,382	$14,820,141	$122,275,349	$14,290,300
Personal Taxes Paid	$9,380,677	$10,157,143	$11,012,298	$11,853,831	$12,952,057	$14,068,071	$15,372,145	$16,263,053	$151,653,929	$15,483,809
Corporate Taxes Paid	$211,131	$207,270	$153,696	$159,153	$156,680	$167,554	$252,668	$296,403	$2,445,507	$285,806
TOTAL STATE INCOME TAXES	$9,591,808	$10,364,413	$11,165,994	$12,012,984	$13,108,737	$14,235,625	$15,624,813	$16,559,455	$154,099,436	$15,769,615
3. STATE GROSS EXCISE TAX										
Taxable Transactions										
Construction Contracts	$46,245,984	$29,103,750	$31,143,750	$49,690,734	$37,264,500	$74,694,484	$49,563,000	$37,845,750	$734,471,953	
Worker Disposable Income Purchases	$29,263,818	$29,702,777	$31,055,753	$32,173,875	$34,729,653	$37,592,109	$45,578,379	$48,256,068	$429,639,555	$34,820,827
Unit Owner/Guest Expenditures (on/off site)	$87,084,319	$95,683,728	$104,612,620	$113,541,512	$124,391,008	$135,304,379	$145,280,541	$154,129,385	$1,388,005,609	$154,129,385
Non-Resident Patronage Expenditures	$42,534,800	$42,534,800	$30,492,000	$30,492,000	$30,492,000	$30,492,000	$50,512,000	$60,676,000	$466,065,600	$60,676,000
Total Taxable Transactions	$205,128,921	$197,025,055	$197,304,123	$225,898,121	$226,877,161	$278,082,973	$290,933,920	$300,907,203	$3,018,182,718	$249,626,212
TOTAL STATE EXCISE TAX	$8,545,671	$8,208,064	$8,219,690	$9,410,916	$9,451,703	$11,584,937	$12,120,307	$12,535,794	$89,496,454	$10,399,428
TOTAL GROSS PUBLIC REVENUES										
To County of Hawaii (Item #1)	$3,786,050	$4,101,231	$4,440,578	$4,779,925	$5,188,617	$5,843,791	$6,414,594	$6,837,724	$62,056,155	$6,837,724
To State (Items #2 & 3))	$18,137,479	$18,572,477	$19,385,684	$21,423,900	$22,560,440	$25,820,561	$27,745,120	$29,095,250	$279,836,928	$26,169,043
AGGREGATE TAX REVENUES	$21,923,529	$22,673,708	$23,826,262	$26,203,825	$27,749,056	$31,664,352	$34,159,714	$35,932,973	$341,893,083	$33,006,766
PUBLIC COSTS (Expenses)										
By County of Hawaii	$5,128,291	$5,631,181	$6,151,926	$6,672,670	$7,308,276	$7,945,072	$8,514,618	$9,015,127	$81,682,483	$9,015,127
By State of Hawaii	$16,122,634	$17,703,652	$19,340,800	$20,977,948	$22,976,204	$24,978,202	$26,768,774	$28,342,307	$256,798,369	$28,342,307
TOTAL PUBLIC COSTS	$21,250,925	$23,334,833	$25,492,725	$27,650,618	$30,284,480	$32,923,274	$35,283,392	$37,357,435	$338,480,852	$37,357,435
TOTAL NET PUBLIC BENEFITS										
To County of Hawaii	($1,342,241)	($1,529,950)	($1,711,348)	($1,892,745)	($2,119,660)	($2,101,281)	($2,100,024)	($2,177,404)	($19,626,328)	($2,177,404)
To State of Hawaii	$2,014,844	$868,825	$44,894	$445,952	($415,764)	$842,359	$976,346	$752,942	$23,038,559	($2,173,265)
AGGREGATE NET BENEFITS	$672,604	($661,125)	($1,666,463)	($1,446,793)	($2,535,423)	($1,258,922)	($1,123,678)	($1,424,462)	$3,412,231	($4,350,669)

(1) Real property taxes include tax rates of $5.55 per $1,000 for homeowners/residents, $8.10 for non-resident multifamily and $7.44 for non-resident single family. Underlying unsold land at rate of $8.10 per $1,000, with a value of $200,000 per acre upon entitlement.

Source: The Hallstrom Group, Inc.

The summarized indicators are as follows:

- The net fiscal benefit (revenue contributions less per capita costs) to Hawaii County from the development of the subject ranges from an annualized "gain" of $220,400 to a "loss" of $2.2 million per year, with stabilization at the latter figure and an aggregate "loss" of $19.6 million during the study period.

- The net fiscal benefit to the State of Hawai'i ranges from a low of a $417,764 loss to a maximum net annual gain of $3.4 million, totaling $23 million during the modeling period. On a stabilized basis following build-out, the net loss to the State will also be $2.2 million annually.

- The overall yearly net benefit to local governmental agencies (state and county) varies from a $2.5 million loss to a peak gain of $3.6 million during development, with a cumulative "profit" figure of $3.4 million during construction. Annually, after stabilization is reached, the net combined governmental losses are $4.4 million.

A stabilized "operating" net annual loss is not unexpected. The large residential component with significant affordably-priced units, coupled with the limited amount of on-site business activity, serves to maximize governmental costs while minimizing the direct tax contributions of the community (the old adage applies "residences use services, businesses generate taxes").

If secondary taxes and fees were included, and the secondary/indirect economic and taxation activities were incorporated, it is likely the overall fiscal impact of Kamakana Villages would result in no loss or gain.

Government Costs

The Kamakana Villages Project is designed as a smart growth community which includes compact and infill growth, particularly in existing urban zones. The project will serve existing West Hawai'i residents and does not create a new demand for government services, but rather relocates that demand to a site near the urban center. The costs of government service delivery to residents of Kamakana Villages are likely to be less than they would be without the project.

The delivery of some services such as police and fire control are more efficient and at lower cost if homes are concentrated near police and fire stations. While traffic congestion may continue in Kailua-Kona with concentrated development, it is likely to be less severe than the impact over the many miles that commuters from Ka'u, South Kona and North Kohala now travel to and from work. Infrastructure such as wastewater facilities typically exist in urban and not rural areas. The Kamakana Villages will include onsite and offsite infrastructure that will be dedicated to the County. The County will thereby acquire assets and will be responsible for operations and maintenance.

According to their Financial Services/Budgeting database, the state expects to spend a total of $10.8 billion on services, salaries, infrastructure, and financing in the coming 2009-10 fiscal year. Of this figure, approximately $7.5 billion will be raised from taxation of persons in-state; the remainder from federal funds and other sources. The total de facto population in the state on an average daily basis at present is about 1,400,000 persons, including residents, tourists, and military personnel.

The per capita contributions by the Hawai'i population towards expenditures by the state will thus be about $5,346 for this year ($7,484,000,000 divided by 1,400,000).

The average de facto population (residents, non-residents and their guests) at Kamakana Villages at build-out will be 5,302 persons, a figure reached in year 19 of the development process. The annual total "per capita fair contribution" to the State's public purse from the subject at stabilization would be $28.3 million in constant year 2009 dollars.

Analyzed on a similar basis, the County of Hawai'i's budget for the island government in year 2009, calls for the County's population to contribute $328.2 million towards local services (the remainder coming from federal, state and other sources). The current de facto population on the Big Island is some 193,000 persons. The resulting de facto per capita contribution towards county expenditures for this year is therefore anticipated to be $1,700.

Application of this County-based per person fair contribution figure to the total on-site de facto population at subject build out would be $9.0 million annually in costs to the county government on a stabilized basis (5,302 population x $1,700).

Total Public Costs -- On a per capita fair contribution basis, at build-out the total governmental costs to the state and county would be $37.3 million annually.

6.2.15.5 Social Impacts

Impacts on West Hawai'i

The Kamakana Villages will house a large number of working residents in Kailua-Kona, thereby increasing demand for commercial and public services. With increased housing available near the employment centers of West Hawai'i, it is likely that young working families will concentrate in or near Kailua-Kona. While retirees and some workers may still be willing to commute long distances, outlying areas will typically consist of older populations and lower labor force participation. This urban area will be more densely settled, while other areas will have a more country type character. While the impact of the project may intensify the existing trends in West Hawai'i, it is not a qualitative change.

Community involvement is likely to increase as a result of the increased housing and community developments in the urban area. Having shorter commutes tend to make it easier for adults to participate in the life of their home communities, whether as volunteers, coaches, or parents involved with schools or teams. On the other hand, residents moving from outlying areas where they grew up may find a new community to lack social networks, family occasions, and places in which they have enjoyed community life in the past. The project's design as an interwoven and walkable community with parks and schools will help to encourage overall resident participation and contribution to community life.

Traffic congestion on Palani Road has long been a source of resident dissatisfaction in Kona. The proposed project, along with adjacent residential developments, will likely worsen existing congestion near Palani Road during the early stages of development. However, as the project progresses, planned highway improvements and the construction of new roads, will help to alleviate congestion throughout the region, particularly with a smaller share of workers commuting long distances.

Impacts on the Project Site and Surrounding Area
With the development of the proposed Kamakana Villages Project, and developments in QLT and DHHL lands, the immediate area will change into a densely settled urban area. The County of Hawai'i has prepared for this change to occur as most of the sites are already designated as Urban or Urban Expansion. As new residential areas are developed, new infrastructure and roadways will also be provided creating internal circulation of the project area and adjoining sites. The new neighborhood community will be characterized by smart growth and sustainable design elements intended to promote walking, bicycling, and public transit use. Homes, schools, and community facilities, such as neighborhood parks and recreation areas will be located within close proximity to one another. The commercial and public facilities within the project will help to encourage residents of the project and adjoining areas to limit trips outside the immediate area.

6.2.16 Surrounding Lands

The proposed Kamakana Villages project will not impact surrounding lands. The site is bordered by DHHL Villages of La'i 'Ōpua to the north, future DHHL Housing to the east (mauka), some light commercial and industrial uses to the south, and QLT to the west (makai). The project will fit with the existing residential community environment and will conform to the County's General Plan LUPAG which designates the majority of the subject property for Urban Expansion, and the remainder of the property as Low Density Urban.

Kamakana Villages will enhance the existing economy and employment of the Kaiula-Kona area. By providing additional housing opportunities to support employees of the visitor industry and service sectors, the proposed project will ultimately support job growth in West Hawai'i's visitor industry.

6.3 ADVERSE ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED

Adverse impacts are divided into short term and long term effects. Short-term effects are generally last for the duration of the construction period. Long term effects generally follow the completion of the construction and improvements, and relate to their existence or to the operation of the new facilities, and are permanent. The adverse and environmental effects of the project are discussed below.

6.3.1 Short Term Effects

Construction impacts to air quality are short term and temporary in nature. If mitigation measures are not provided, significant airborne emissions could include fugitive dust. Fugitive dust emissions are expected to result from earth-moving, cement mixing activities, and vehicular travel in construction areas. HAR Section 11-60.1-33 prohibits the generation of fugitive dust without taking reasonable precautions to limit these emissions. As a result, significant fugitive dust generating activities will be minimized through mitigation measures identified in *Section 6.26.*

Besides emissions resulting from combustion of fossil fuels from the use of construction equipment, vehicular emissions will also occur from commuting construction workers.

Noise impacts generated by the proposed action will come from the operation of equipment

during the construction phase. These impacts will also be minimized through mitigation measures identified in *Section 6.27.*

6.3.2 Long Term Effects

After the proposed Kamakana Villages Project is completed, long-term impacts on air quality in the project area due to emissions from project-related motor vehicle traffic should be small and insignificant. Concentrations of carbon monoxide will remain within the State and National ambient air quality standards. The urbanization of the area will result in a loss of open and natural space. Additionally, there will be an increase in overall density as a result of the proposed project and neighboring developments.

6.4 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF NATURAL RESOURCES

The construction and operation of the proposed project will result in the irreversible and irretrievable commitment of certain natural and fiscal resources. Development of the site as a mixed use community will permanently alter the character and use of the land. Grubbing and grading will remove existing flora and change the topography of the land. However, residential properties will eventually be landscaped with new plant material, including, where practicable, drought-tolerant species. The project will require aggregate rock for the development of roads and building foundations and the production of concrete and asphalt. During construction, fauna and avifauna will be temporarily displaced from the land. With the exception of rats and pigs, most displaced species of fauna and avifauna will likely return once the property has been re-landscaped. Significant archaeological cultural resources will be analyzed, recorded and preserved within the project area, in accordance with the requirements of the Department of Land and Natural Resources (DLNR), SHPD.

The proposed Kamakana Villages project will also require the expenditure of energy of fuel for construction vehicles and equipment, and the consumption construction materials and resources. The development of the project will also require the consumption of potable water, some of which will be used for dust control which will percolate back into the soil while the remainder evaporates.

Finally, the development of the proposed project will require the investment of human labor that may otherwise be employed elsewhere. Once the project is fully built, the operational phase of the project will require an ongoing commitment of potable water, electrical energy, and fuel for privately owned vehicles and motorized equipment.

6.5 CUMULATIVE AND SECONDARY IMPACTS

The Kamakana Villages Project will significantly contribute to the availability of affordable housing units for the city of Kailua-Kona which has grown from a small community to a regional growth center in the past 10 years. With the development of several visitor destination areas along the North Kona/South Kohala coastline in the 1970's came a demand for additional resort employees. This led the State and the County to designate North Kona, between Kailua-Kona and Keahole, as the primary growth area for residential and commercial development in West Hawai'i.

Over the years, North Kona has seen an expansion of commercial centers, such as the Kona Coast Shopping Center and Makalapua Center which demonstrate a demand for new goods and services generated by an expanding residential population. However, the pace of commercial and residential growth has now exceeded the area's overall ability to support this increased growth. The development of transportation infrastructure is not adequate to accommodate the area, leaving traffic conditions along the principal arterials (Queen Ka'ahumanu Highway and Mamalahoa Highway) to deteriorate.

The need for improvements to support future growth is clear to both residents and community leaders. Kailua-Kona is on a path of growth fueled by an abundance of developable land, lack of existing housing stock, a highly desirable climate, and a continuous supply of visitors to West Hawai'i. The commercial and population expansion around Kailua-Kona is a direct result of the success of the visitor industry. While the changes of economic cycles are inevitable, improvements are needed to sustain Kailua-Kona and its surrounding areas as a primary center for economic development and urban growth in the County of Hawaii.

As a mixed-use affordable housing community, the cumulative impact of the project is the long-term support it will provide for the resident population of Kailua-Kona. Kamakana Villages and other proposed housing developments will help the County of Hawai'i to achieve a strong and healthy West Hawai'i economy and while providing affordable housing in close proximity to employment centers. The primary impacts from Kamakana Villages Project is an increase in the supply of affordable housing, an increase in commercial floor area in the Kailua-Kona region, population growth, increased traffic, and the demand for potable water and energy. The project's secondary impacts, which occur from primary impacts, will result in additional jobs created in the economy, and the effects resulting from the project residents' demand for goods and services.

6.6 ALTERNATIVES TO THE PROPOSED PROJECT

6.6.1 No Action Alternative

This alternative will result in keeping the site vacant and undeveloped, with no immediate change to the property. Construction of the Kamakana Villages mixed use development would not occur and the mission of HHFDC to develop low- and moderate-income housing projects would not be accomplished. While the selection of this alternative would mean that State lands and funds would not be expended on the project, and neither would the significant private investment, it would also mean that the need to provide affordable housing in West Hawai'i would not be met, and would not be consistent with State and County polices to provide affordable housing near the job centers of the region.

Under the No Action Alternative, the site would remain vacant in an area that is currently being developed with housing and is designated mostly for Urban Expansion on the County's General Plan LUPAG map. The project site is in a key location to provide housing opportunities located in close proximity to Kailua-Kona. If left vacant, the site would be significantly underutilized in terms of meeting the demand for long-term affordable housing in West Hawai'I, and substantial physical, social and economic benefits expected to accrue from the project would not be realized since the project would not be implemented.

The No Action Alternative would not meet the project's objectives to:

- Respond to the demand for affordable homes for working families in North Kona, helping to reduce traffic on regional highways caused by Island residents traveling long distances between home and work.

- Provide the needed affordable units in the most livable community within the shortest feasible duration.

- Use design principles that will create a walkable, bikable, active-lifestyle community.

- Promote a walkable community that offers multiple modes of transportation options.

- Integrate the project site with the area's current and future transportation network.

- Accommodate the potential for future feasible roadway connections to development on adjacent lands.

- Provide transit-oriented, high density development within easy walking distance (1/4 mile) of future bus transit stops along Ane Keohokalole Highway and the future extension of Makala Boulevard, and near Manawalea Street.

- Provide mixed-use centers in multi-block areas that contain multifamily housing with a mixture of ground-floor residential and non-residential space, such as commercial or other uses, and civic open space.

- Provide neighborhood parks.
- Provide approximately 12-acres for school facilities.

- Retain the approximately 7-acre archeological preserve area located in the southern, makai portion of the Kamakana Villages site and develop an approximately 2.6 acre archeological preserve area in the northern, mauka portion of the site.

- Develop required infrastructure for the project.

6.3.1 Alternative Locations

The primary objective for the Kamakana Villages Project is to provide affordable and for-sale housing units in West Hawai'i. The proposed project site the State's HHFDC's only non-ceded property located on the island of Hawai'i. The site has been determined to have poor soil for agricultural production, and is therefore appropriate for the development of affordable for-sale housing in fee simple ownership. The mission of HHFDC is to develop and finance low- and moderate income housing projects throughout the State of Hawaii, and the objective of the current project is to provide affordable housing in response to demand in West Hawai'i. Therefore, locating the Kamakana Villages Project in another location or on another island is not a viable alternative. No other locations on the island of Hawai'i would meet the project's objectives like the current project site in Keahuolu.

7.0 PARTIES CONSULTED AND COMMENTS RECEIVED

7.0 PARTIES CONSULTED AND COMMENTS RECEIVED

7.1 ENVIRONMENTAL IMPACT STATEMENT

In accordance with Chapter 343, HRS, an EIS (Keahuolu Affordable Housing Project EIS) was prepared for the project and accepted by the Office of the Governor, c/o the Hawaii Housing Finance and Development Corporation, in September 2008 for the proposed project. Public comments were received and addressed throughout the EIS planning process (see Section 7.5).

7.2 COMMUNITY OUTREACH

Forest City places a high value on meaningful community relations. Community consultation has been an ongoing process for the proposed project. HHFDC maintained a dialogue with the community throughout the EIS process and continued this dialogue with the support of Forest City into the conceptual design and development phases of the project.

Two planning workshop meetings or charrettes were held in Kona in 2009. The first meeting held on July 7 gathered input from the community to build the vision and set the foundation for the mixed-use community of Kamakana Village at Keahuolu. Over 70 community members were present at the meeting, many who were members or representatives of groups who have been active in Kona's planning and development. The team led workshop participants in a discussion on the planning and design of Kamakana Village including the site description, land use, sense of place and its connection to surrounding neighborhoods.

The second meeting held on October 19 was an opportunity for Forest City to provide the community with an update on the Kamakana Village Project. Conceptual designs that incorporate the major themes discussed in the previous public workshop were presented to participants.

7.3 AGENCY COMMENTS

Federal, State, and County agencies were contacted and consulted throughout the planning and development of the proposed Kamakana Villages Project. As required by Chapter 343, HRS, agencies were provided with copies of the EIS for their review and comment. Those comments received were addressed and included in the each stage of the EIS process (see Chapter 10 of the Keahuolu Affordable Housing EIS). Additionally, agencies were consulted with on the project planning and development during the preparation of the ER for the Project District Application and SLUBA (refer to S*ection 7.5*).

7.4 CONSULTATION WITH DESIGN CENTER (TOD)

In October 2009, follow-up meetings were held with the Kona CDP Working Group to discuss the conceptual plan elements and project features. Agency consultations were also conducted during this period to address planning issues and infrastructure requirements.

7.5 LIST OF AGENCIES, ORGANIZATIONS, AND INDIVIDUALS CONSULTED

This section provides a list of agencies, organization, and individuals who were consulted during the EIS planning process and throughout the SLUBA. Copies of comments received during the EIS can be found in the Chapter 10 of the Keahuolu Affordable Housing Project EIS. Copies of comments received in response to consultation during the preparation of the SLUBA and Project District Rezoning Applications are included with this section.

Respondents and Distribution	Received EIS (EISPN/DEIS/FES)	Provided Comments on EIS (EISPN/DEIS)	Consulted During LUC/Project District Application Process	Provided Comments During Consultation
Federal Agencies				
Department of Housing and Urban Development (HUD)	X			
Federal Highway Administration	X			
US Army Corps of Engineer	X			
US Department of the Interior -Fish and Wildlife Service (USFWS)	X	X		
US Department of the Interior -National Park Service, Pacific West Region	X			
US Department of the Interior -National Park Service, Koloko-Honokohua National Historic Park	X	X		
State Agencies				
Department of Accounting and General Services	X	X		
Department of Agriculture	X			
Department of Business, Economic Development and Tourism (DBEDT)	X			
DBEDT, Land Use Commission (LUC)	X	X	X 8/7/09 & 9/10/09	
DBEDT, Office of Planning	X	X	X 7/30/09 & 9/22/09	
DBEDT, Strategic Industries Division	X	X		
Department of Defense (DOD)	X	X	X 8/31/09	
Department of Education (DOE)	X	X	X 8/6/09, 8/10/09 & 8/31/09	
Department of Hawaiian Home Lands (DHHL)	X			
DHHL, Land Development Division	X		X 2/5/09, 2/10/09 & 7/28/09	
Department of Health (DOH)	X			
DOH, Environmental Planning Office	X	X		
DOH, Office of Environmental Quality Control	X	X		
Department of Human Services (DHS)				
DHS, Hawai'i Public Housing Authority	X	X		
Department of Land & Natural Resources (DLNR)	X			
DLNR, Aquatic Resources Division	X			
DLNR, Commission on Water Resource Management		X		
DLNR, Engineering Division	X	X		
DLNR, State Historic Preservation Division	X	X		
DLNR, -Land Division, Honolulu	X	X		

Respondents and Distribution	Received EIS (EISPN/DEIS/FES)	Provided Comments on EIS (EISPN/DEIS)	Consulted During LUC/Project District Application Process	Provided Comments During Consultation
Department of Transportation (DOT)	X	X	X 8/7/09 &10/16/09	
DOT, Highways Division	X	X		
Hawai'i Housing Finance Development Corporation	X		X 1/6/09, 2/10/09, 5/27/09, 7/17/09, 9/10/09, & 10/1/09	
Office of Hawaiian Affairs	X	X		
Office of the Governor	X		X 4/23/09	
Office of the Governor – Kona/West Hawai'i	X			
University of Hawai'i – Environmental Center	X	X		
Univesity of Hawai'i at Mānoa – Water Resources Research Center	X			
County of Hawai'i				
Civil Defense Agency	X			
Department of Environmental Management (DEM)	X	X		
DEM, Solid Waste Division	X			
DEM, Wastewater Division	X			
DEM, Technical Services	X			
Department of Parks and Recreation	X			
Department of Public Works (DPW)	X		X 8/26/09, 8/28/09, 9/1/09, 10/5/09, & 11/13/09	
DPW, Building Division	X			
DPW, Engineering Division	X			
DPW, Highway Maintenance Division	X			
DPW, Traffic Division	X			
Department of Research and Development	X	X		
Department of Water Supply (DWS)	X	X	X 11/4/09 & 11/12/09	
DWS, Water Round Table			X 7/22/09	
Finance Department	X			
Fire Department	X	X	X 10/14/09	
Mass Transit Agency	X			
Office of Housing and Community Development	X		X 7/27/09 &10/21/09	
Office of the Mayor	X		X 1/14/09, 2/10/09, 2/17/09, 3/17/09, 3/20/09, 3/24/09, 5/12/09, 6/17/09, 6/23/09, & 8/19/09	
Planning Department	X	X	X 4/13/09, 7/29/09, 10/5/09 & 10/19/09	
Planning Department, Kona CDP Design Center			X 1/14/09, 5/28/09, 6/2/09,10/5/09 & 11/2/09	
Planning Department, Placemakers			X 10/26/09	
Police Department	X	X		

Respondents and Distribution	Received EIS (EISPN/DEIS/FES)	Provided Comments on EIS (EISPN/DEIS)	Consulted During LUC/Project District Application Process	Provided Comments During Consultation
Elected Officials				
Senator Daniel K. Akaka	X		X 7/23/09	
Senator Daniel K. Inouye	X			
Rep. Neil Abercrombie	X			
Rep. Mazie Hirono	X			
State Senator Paul Whalen	X			
State Rep. Denny Coffman			X 02/03/09	
State Rep. Josh Green M.D.	X			
County Council	X		X 1/14/09, 1/19/09 & 10/14/09	
News Media				
Hawai'i Tribune Herald	X			
Honolulu Advertiser	X			
Honolulu Star Bulletin	X			
West Hawa'i Today	X			
Public Libraries and Depositories				
Bond Memorial Public Library	X			
DBEDT Library	X			
Hawai'i State Main Library	X			
Hilo Regional Library	X			
Holualoa Public Library	X			
Kailua-Kona Public Library	X			
Kealakekua Public Library	X			
Legislative Reference Bureau Library	X			
Thelma Parker Memorial Public/School Library	X			
University of Hawai'i – Hamilton Library	X			
University of Hawai'i – Edwin H. Mookini Library at Hilo	X			
Local Utilities				
Hawai'i Electric Light Co., Inc.	X		X 8/12/09	
Hawaiian Telcom – Hilo	X			
Hawaiian Telcom – Honolulu	X			
Hawaiian Telcom – Kailua-Kona	X			
HECO - Honolulu	X		X 4/4/09 & 5/13/09	
Oceanic Time Warner Cable – Kailua-Kona	X			
The Gas Company – Kailua-Kona	X			
Community Organizations, Associations, and Other Groups				
A & B Properties, Inc.	X			
Akinaka and Associates, Ltd.	X			
Carpenter's Union			X 4/27/09	
Stanford S. Carr Development Corporation	X			
Castle & Cooke Homes Hawaii, Inc.	X			
Community Planning and Engineering, Inc.	X			

Respondents and Distribution	Received EIS (EISPN/DEIS/FES)	Provided Comments on EIS (EISPN/DEIS)	Consulted During LUC/Project District Application Process	Provided Comments During Consultation
Concerned Citizens of Kona	X			
D.R. Horton, Schuler Division	X			
General Contractors Association of Hawaii	X			
Hawai'i Developers Council			X 08/25/09	
Hawai'i Island Economic Development Board	X			
Hawai'i Island Board of Realtors	X			
Hawai'i Island Chamber of Commerce	X			
Hawai'i Island Community Development Corporation	X			
Hawai'i Leeward Planning Conference (HLPC)	X		X 2/27/09 & 3/27/09	
Kailua Park Master Plan Meeting			X 8/25/09	
Kamehameha Schools	X			
Kona Board of Realtors	X			
Kona Community Charrette			X 7/7/09 & 10/19/09	
Kona CDP Action Committee			X 8/26/09	
Kona Community Plan Steering Committee	X			
Kona-Kohala Chamber of Commerce	X			
Kona Traffic Safety Committee	X			
Kuakini Hawaiian Civic Club	X			
La'i' ōpuā 2020			X 1/5/09, 1/21/09, 5/15/09, 9/4/09 & 9/10/09	
Maryl Development	X			
Neighborhood Place of Kona	X			
Pacific Kona Landscaping	X			
Peoples Advocacy for Trails, Hawai'i (PATH)			X 1/15/09 & 7/21/09	
Queen Lili'uokalani Trust (QLT)	X		X 7/28/09 & 10/8/09	
Steelhead Capital	X		X 4/3/09	
Sustainable Kealakehe Alliance				
UniDev Hawaii, LLC	X			
Urban Land Institute (ULI) Transit Oriented Development (TOD) Committee			X 1/23/09	
Individuals				
Mr. Fritz Harris-Glade			X 10/20/09	
Ms. Elaine Watai	X			
Mr. Robert Ward, Hawai'i County Transportation Commission	X	X		
Mr. Aaron Stene	X	X		

8.0 List of References

8.0 LIST OF REFERENCES

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APPENDIX A 2009 INCOME, SALES AND RENT GUIDELINES (HHFDC FOR HAWAI'I COUNTY)

HAWAII COUNTY INCOME SCHEDULE BY FAMILY SIZE 2009

THE FOLLOWING TABLE PRESENTS INCOME LIMITS BY FAMILY SIZE AND BY PERCENTAGES OF THE MEDIAN INCOME ESTABLISHED BY HUD. THESE INCOME LIMITS SERVE AS GUIDELINES TO ESTABLISH SALES/RENTAL PREFERENCES.

	LIMITS BY FAMILY SIZE							
MEDIAN	1 PERSON	2 PERSON	3 PERSON	4 PERSON	5 PERSON	6 PERSON	7 PERSON	8 PERSON
Adjustments for family size	0.7000	0.8000	0.9000	1.0000	1.0800	1.1600	1.2400	1.3200
10%	$4,730	$5,400	$6,080	$6,750	$7,290	$7,830	$8,370	$8,910
20%	$9,460	$10,800	$12,160	$13,500	$14,580	$15,660	$16,740	$17,820
30%	$14,200	$16,200	$18,250	$20,250	$21,850	$23,500	$25,100	$26,750
40%	$18,920	$21,600	$24,320	$27,000	$29,160	$31,320	$33,480	$35,640
50%	$23,650	$27,000	$30,400	$33,750	$36,450	$39,150	$41,850	$44,550
60%	$28,380	$32,400	$36,480	$40,500	$43,740	$46,980	$50,220	$53,460
70%	$33,110	$37,800	$42,560	$47,250	$51,030	$54,810	$58,590	$62,370
80%	$37,800	$43,200	$48,600	$54,000	$58,300	$62,650	$66,950	$71,300
90%	$42,570	$48,600	$54,720	$60,750	$65,610	$70,470	$75,330	$80,190
100%	$45,570	$52,080	$58,590	$65,100	$70,310	$75,520	$80,720	$85,930
110%	$50,130	$57,290	$64,450	$71,610	$77,340	$83,070	$88,800	$94,530
120%	$54,680	$62,500	$70,310	$78,120	$84,370	$90,620	$96,870	$103,120
130%	$59,240	$67,700	$76,170	$84,630	$91,400	$98,170	$104,940	$111,710
140%	$63,800	$72,910	$82,030	$91,140	$98,430	$105,720	$113,010	$120,300

% of Income

HUD determines the median, very low (50%), and low (80%) income limits. Adjustments are made by HUD for areas with unusually high or low family income or housing cost to income relationships. Pursuant to rules for the Low Income Housing Tax Credit Program, the 60% income limit is calculated as 120% (60/50) of the very low income limit for each family size. The income limits for other income groups of less than 80% are calculated in the same way. The remaining income limits are calculated as a percentage of the median income for a family of four (the base) with adjustments for family size (i.e., income for a 3-person family is 90% of the base, income for a 2-person family is 80% of the base, etc.).

AFFORDABLE RENT GUIDELINES* 2009

Affordable rents are based on 30% of income (including utilities)**

Area	$ 65,100	Studio	1 Bedroom	2 Bedroom	3 Bedroom	4 Bedroom
HAWAII						
30% of Median		$355	$380	$456	$526	$587
50% of Median		$591	$633	$760	$877	$978
60% of Median		$709	$759	$912	$1,053	$1,174
80% of Median		$945	$1,012	$1,215	$1,403	$1,566
100% of Median		$1,139	$1,220	$1,464	$1,692	$1,888
120% of Median		$1,367	$1,464	$1,757	$2,031	$2,265
140% of Median		$1,595	$1,708	$2,050	$2,369	$2,643

*Please note that are market rents may be lower than these rent guidelines.

**Monthly rent levels would include the cost of the following utilities: water, sanitary sewage services, electricity and gas (where applicable). Please refer to the Utility Allowance Schedule for each island.

Based on 2009 median income established by HUD.

AFFORDABLE SALES GUIDELINES* 2009

COUNTY: HAWAII FAMILY SIZE: 1 PERSON

% of Median:	50%	60%	70%	80%	90%	100%	110%	120%	130%	140%
$ Income:	$23,650	$28,380	$33,110	$37,800	$42,570	$45,570	$50,130	$54,680	$59,240	$63,800
0.00%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4.00%	$121,700	$146,000	$170,300	$194,500	$219,000	$234,400	$257,900	$281,300	$304,800	$328,200
4.25%	$118,100	$141,700	$165,300	$188,700	$212,500	$227,500	$250,300	$273,000	$295,800	$318,500
4.50%	$114,600	$137,600	$160,500	$183,200	$206,400	$220,900	$243,000	$265,100	$287,200	$309,300
4.75%	$111,400	$133,600	$155,900	$178,000	$200,400	$214,600	$236,000	$257,500	$278,900	$300,400
5.00%	$108,200	$129,800	$151,500	$172,900	$194,800	$208,500	$229,400	$250,200	$271,000	$291,900
5.25%	$105,200	$126,200	$147,300	$168,100	$189,300	$202,700	$223,000	$243,200	$263,500	$283,800
5.50%	$102,300	$122,800	$143,200	$163,500	$184,100	$197,100	$216,900	$236,500	$256,300	$276,000
5.75%	$99,500	$119,400	$139,400	$159,100	$179,200	$191,800	$211,000	$230,100	$249,300	$268,500
6.00%	$96,900	$116,300	$135,600	$154,900	$174,400	$186,700	$205,400	$224,000	$242,700	$261,400
6.25%	$94,300	$113,200	$132,100	$150,800	$169,800	$181,800	$200,000	$218,100	$236,300	$254,500
6.50%	$91,900	$110,300	$128,700	$146,900	$165,400	$177,100	$194,800	$212,500	$230,200	$247,900
6.75%	$89,600	$107,500	$125,400	$143,100	$161,200	$172,600	$189,800	$207,100	$224,300	$241,600
7.00%	$87,300	$104,800	$122,200	$139,500	$157,200	$168,200	$185,100	$201,900	$218,700	$235,500
7.25%	$85,200	$102,200	$119,200	$136,100	$153,300	$164,100	$180,500	$196,900	$213,300	$229,700
7.50%	$83,100	$99,700	$116,300	$132,800	$149,500	$160,100	$176,100	$192,100	$208,100	$224,100
7.75%	$81,100	$97,300	$113,500	$129,600	$145,900	$156,200	$171,900	$187,500	$203,100	$218,700

1. Based on **2009** medium income established by HUD for various family sizes. Adjustments to the very low- (50%) and low-income (80%) limits are made by HUD for areas with unusually high or low family income or housing cost. Most income limits are proportionately based on very low-income limits. Thus, the four-person income limit is 120% (60/50ths) of the four-person very low-income limit.

2. Mortgage term: **30 years**

3. Principal and Interest: **28.00%**

4. Down Payment of: **5.00%** for those earning at or below HUD 140% median income.

(Please note: Aside from Studios (Studios = Family Size of 1), Unit Size is determined by Family Size plus 1 (i.e., 1-Bedroom Unit = 2 Person Family Size).

AFFORDABLE SALES GUIDELINES* 2009

COUNTY: HAWAII FAMILY SIZE: 2 PERSON

% of Median:	50%	60%	70%	80%	90%	100%	110%	120%	130%	140%
$ Income:	$27,000	$32,400	$37,800	$43,200	$48,600	$52,080	$57,290	$62,500	$67,700	$72,910
0.00%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4.00%	$138,900	$166,700	$194,500	$222,200	$250,000	$267,900	$294,700	$321,500	$348,300	$375,100
4.25%	$134,800	$161,800	$188,700	$215,700	$242,600	$260,000	$286,000	$312,000	$338,000	$364,000
4.50%	$130,900	$157,100	$183,200	$209,400	$235,600	$252,500	$277,700	$303,000	$328,200	$353,400
4.75%	$127,100	$152,600	$178,000	$203,400	$228,800	$245,200	$269,700	$294,300	$318,800	$343,300
5.00%	$123,500	$148,200	$172,900	$197,700	$222,400	$238,300	$262,100	$286,000	$309,800	$333,600
5.25%	$120,100	$144,100	$168,100	$192,100	$216,200	$231,600	$254,800	$278,000	$301,100	$324,300
5.50%	$116,800	$140,200	$163,500	$186,900	$210,200	$225,300	$247,800	$270,400	$292,900	$315,400
5.75%	$113,600	$136,400	$159,100	$181,800	$204,500	$219,200	$241,100	$263,000	$284,900	$306,900
6.00%	$110,600	$132,700	$154,900	$177,000	$199,100	$213,400	$234,700	$256,000	$277,300	$298,700
6.25%	$107,700	$129,200	$150,800	$172,300	$193,900	$207,800	$228,500	$249,300	$270,100	$290,800
6.50%	$104,900	$125,900	$146,900	$167,900	$188,900	$202,400	$222,600	$242,900	$263,100	$283,300
6.75%	$102,200	$122,700	$143,100	$163,600	$184,000	$197,200	$216,900	$236,700	$256,400	$276,100
7.00%	$99,700	$119,600	$139,500	$159,500	$179,400	$192,300	$211,500	$230,700	$249,900	$269,200
7.25%	$97,200	$116,700	$136,100	$155,500	$175,000	$187,500	$206,300	$225,000	$243,800	$262,500
7.50%	$94,800	$113,800	$132,800	$151,700	$170,700	$182,900	$201,200	$219,500	$237,800	$256,100
7.75%	$92,600	$111,100	$129,600	$148,100	$166,600	$178,600	$196,400	$214,300	$232,100	$250,000

1. Based on **2009** medium income established by HUD for various family sizes. Adjustments to the very low- (50%) and low-income (80%) limits are made by HUD for areas with unusually high or low family income or housing cost. Most income limits are proportionately based on very low-income limits. Thus, the four-person income limit is 120% (60/50ths) of the four-person very low-income limit.

2. Mortgage term: **30 years**

3. Principal and Interest: **28.00%**

4. Down Payment of: **5.00%** for those earning at or below HUD 140% median income.

(Please note: Aside from Studios (Studios = Family Size of 1), Unit Size is determined by Family Size plus 1 (i.e., 1-Bedroom Unit = 2 Person Family Size).

AFFORDABLE SALES GUIDELINES* 2009

COUNTY: HAWAII FAMILY SIZE: 3 PERSON

% of Median:	50%	60%	70%	80%	90%	100%	110%	120%	130%	140%
$ Income:	$30,400	$36,480	$42,560	$48,600	$54,720	$58,590	$64,450	$70,310	$76,170	$82,030
0.00%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4.00%	$156,400	$187,700	$219,000	$250,000	$281,500	$301,400	$331,600	$361,700	$391,900	$422,000
4.25%	$151,800	$182,100	$212,500	$242,600	$273,200	$292,500	$321,800	$351,000	$380,300	$409,600
4.50%	$147,400	$176,800	$206,300	$235,600	$265,300	$284,000	$312,400	$340,800	$369,200	$397,600
4.75%	$143,100	$171,800	$200,400	$228,800	$257,600	$275,900	$303,500	$331,000	$358,600	$386,200
5.00%	$139,100	$166,900	$194,700	$222,400	$250,400	$268,100	$294,900	$321,700	$348,500	$375,300
5.25%	$135,200	$162,300	$189,300	$216,200	$243,400	$260,600	$286,700	$312,700	$338,800	$364,900
5.50%	$131,500	$157,800	$184,100	$210,200	$236,700	$253,400	$278,800	$304,100	$329,500	$354,800
5.75%	$127,900	$153,500	$179,100	$204,500	$230,300	$246,600	$271,300	$295,900	$320,600	$345,200
6.00%	$124,500	$149,400	$174,400	$199,100	$224,200	$240,000	$264,000	$288,000	$312,000	$336,000
6.25%	$121,300	$145,500	$169,800	$193,900	$218,300	$233,700	$257,100	$280,500	$303,800	$327,200
6.50%	$118,100	$141,800	$165,400	$188,900	$212,600	$227,700	$250,400	$273,200	$296,000	$318,800
6.75%	$115,100	$138,100	$161,200	$184,000	$207,200	$221,900	$244,100	$266,300	$288,400	$310,600
7.00%	$112,200	$134,700	$157,100	$179,400	$202,000	$216,300	$237,900	$259,600	$281,200	$302,800
7.25%	$109,500	$131,300	$153,200	$175,000	$197,000	$211,000	$232,000	$253,100	$274,200	$295,300
7.50%	$106,800	$128,100	$149,500	$170,700	$192,200	$205,800	$226,400	$247,000	$267,600	$288,100
7.75%	$104,200	$125,100	$145,900	$166,600	$187,600	$200,900	$221,000	$241,100	$261,100	$281,200

1. Based on **2009** medium income established by HUD for various family sizes. Adjustments to the very low- (50%) and low-income (80%) limits are made by HUD for areas with unusually high or low family income or housing cost. Most income limits are proportionately based on very low-income limits. Thus, the four-person income limit is 120% (60/50ths) of the four-person very low-income limit.

2. Mortgage term: **30 years**

3. Principal and Interest: **28.00%**

4. Down Payment of: **5.00%** for those earning at or below HUD 140% median income.

(Please note: Aside from Studios (Studios = Family Size of 1), Unit Size is determined by Family Size plus 1 (i.e., 1-Bedroom Unit = 2 Person Family Size).

AFFORDABLE SALES GUIDELINES* 2009

COUNTY: HAWAII FAMILY SIZE: 4 PERSON

% of Median:	50%	60%	70%	80%	90%	100%	110%	120%	130%	140%
$ Income:	$33,750	$40,500	$47,250	$54,000	$60,750	$65,100	$71,610	$78,120	$84,630	$91,140
0.00%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4.00%	$173,600	$208,400	$243,100	$277,800	$312,500	$334,900	$368,400	$401,900	$435,400	$468,900
4.25%	$168,500	$202,200	$235,900	$269,600	$303,300	$325,000	$357,500	$390,000	$422,500	$455,000
4.50%	$163,600	$196,300	$229,000	$261,800	$294,500	$315,600	$347,100	$378,700	$410,200	$441,800
4.75%	$158,900	$190,700	$222,500	$254,300	$286,000	$306,500	$337,200	$367,800	$398,500	$429,100
5.00%	$154,400	$185,300	$216,200	$247,100	$278,000	$297,900	$327,600	$357,400	$387,200	$417,000
5.25%	$150,100	$180,100	$210,200	$240,200	$270,200	$289,600	$318,500	$347,500	$376,400	$405,400
5.50%	$146,000	$175,200	$204,400	$233,600	$262,800	$281,600	$309,800	$337,900	$366,100	$394,300
5.75%	$142,000	$170,500	$198,900	$227,300	$255,700	$274,000	$301,400	$328,800	$356,200	$383,600
6.00%	$138,300	$165,900	$193,600	$221,200	$248,900	$266,700	$293,400	$320,000	$346,700	$373,400
6.25%	$134,600	$161,600	$188,500	$215,400	$242,300	$259,700	$285,700	$311,600	$337,600	$363,600
6.50%	$131,100	$157,400	$183,600	$209,800	$236,100	$253,000	$278,300	$303,600	$328,900	$354,200
6.75%	$127,800	$153,400	$178,900	$204,500	$230,100	$246,500	$271,200	$295,800	$320,500	$345,100
7.00%	$124,600	$149,500	$174,400	$199,400	$224,300	$240,300	$264,400	$288,400	$312,400	$336,500
7.25%	$121,500	$145,800	$170,100	$194,400	$218,700	$234,400	$257,800	$281,300	$304,700	$328,100
7.50%	$118,600	$142,300	$166,000	$189,700	$213,400	$228,700	$251,500	$274,400	$297,300	$320,100
7.75%	$115,700	$138,800	$162,000	$185,100	$208,300	$223,200	$245,500	$267,800	$290,100	$312,500

1. Based on **2009** medium income established by HUD for various family sizes. Adjustments to the very low- (50%) and low-income (80%) limits are made by HUD for areas with unusually high or low family income or housing cost. Most income limits are proportionately based on very low-income limits. Thus, the four-person income limit is 120% (60/50ths) of the four-person very low-income limit.

2. Mortgage term: **30 years**

3. Principal and Interest: **28.00%**

4. Down Payment of: **5.00%** for those earning at or below HUD 140% median income.

(Please note: Aside from Studios (Studios = Family Size of 1), Unit Size is determined by Family Size plus 1 (i.e., 1-Bedroom Unit = 2 Person Family Size).

AFFORDABLE SALES GUIDELINES* 2009

COUNTY: HAWAII FAMILY SIZE: 5 PERSON

% of Median:	50%	60%	70%	80%	90%	100%	110%	120%	130%	140%
$ Income:	$36,450	$43,740	$51,030	$58,300	$65,610	$70,310	$77,340	$84,370	$91,400	$98,430
0.00%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4.00%	$187,500	$225,000	$262,500	$299,900	$337,500	$361,700	$397,900	$434,100	$470,200	$506,400
4.25%	$182,000	$218,400	$254,800	$291,100	$327,600	$351,000	$386,100	$421,200	$456,300	$491,400
4.50%	$176,700	$212,000	$247,400	$282,600	$318,000	$340,800	$374,900	$409,000	$443,100	$477,100
4.75%	$171,600	$205,900	$240,300	$274,500	$308,900	$331,000	$364,200	$397,300	$430,400	$463,500
5.00%	$166,800	$200,100	$233,500	$266,700	$300,200	$321,700	$353,900	$386,000	$418,200	$450,400
5.25%	$162,100	$194,600	$227,000	$259,300	$291,800	$312,700	$344,000	$375,300	$406,500	$437,800
5.50%	$157,700	$189,200	$220,700	$252,200	$283,800	$304,100	$334,600	$365,000	$395,400	$425,800
5.75%	$153,400	$184,100	$214,800	$245,400	$276,100	$295,900	$325,500	$355,100	$384,700	$414,300
6.00%	$149,300	$179,200	$209,100	$238,800	$268,800	$288,000	$316,800	$345,600	$374,400	$403,200
6.25%	$145,400	$174,500	$203,600	$232,600	$261,700	$280,500	$308,500	$336,600	$364,600	$392,600
6.50%	$141,600	$170,000	$198,300	$226,500	$255,000	$273,200	$300,500	$327,900	$355,200	$382,500
6.75%	$138,000	$165,600	$193,200	$220,800	$248,500	$266,300	$292,900	$319,500	$346,100	$372,700
7.00%	$134,600	$161,500	$188,400	$215,200	$242,200	$259,600	$285,500	$311,500	$337,400	$363,400
7.25%	$131,200	$157,500	$183,700	$209,900	$236,200	$253,100	$278,500	$303,800	$329,100	$354,400
7.50%	$128,000	$153,600	$179,300	$204,800	$230,500	$247,000	$271,700	$296,400	$321,100	$345,800
7.75%	$125,000	$150,000	$175,000	$199,900	$224,900	$241,100	$265,200	$289,300	$313,400	$337,500

1. Based on **2009** medium income established by HUD for various family sizes. Adjustments to the very low- (50%) and low-income (80%) limits are made by HUD for areas with unusually high or low family income or housing cost. Most income limits are proportionately based on very low-income limits. Thus, the four-person income limit is 120% (60/50ths) of the four-person very low-income limit.

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AFFORDABLE SALES GUIDELINES* 2009

COUNTY: HAWAII FAMILY SIZE: 6 PERSON

% of Median:	50%	60%	70%	80%	90%	100%	110%	120%	130%	140%
$ Income:	$39,150	$46,980	$54,810	$62,650	$70,470	$75,520	$83,070	$90,620	$98,170	$105,720
0.00%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4.00%	$201,400	$241,700	$282,000	$322,300	$362,500	$388,500	$427,400	$466,200	$505,100	$543,900
4.25%	$195,500	$234,600	$273,700	$312,800	$351,800	$377,100	$414,700	$452,400	$490,100	$527,800
4.50%	$189,800	$227,700	$265,700	$303,700	$341,600	$366,100	$402,700	$439,300	$475,900	$512,500
4.75%	$184,300	$221,200	$258,100	$295,000	$331,800	$355,600	$391,100	$426,700	$462,200	$497,800
5.00%	$179,100	$214,900	$250,800	$286,600	$322,400	$345,500	$380,100	$414,600	$449,200	$483,700
5.25%	$174,100	$209,000	$243,800	$278,700	$313,400	$335,900	$369,500	$403,100	$436,600	$470,200
5.50%	$169,400	$203,200	$237,100	$271,000	$304,800	$326,700	$359,300	$392,000	$424,700	$457,300
5.75%	$164,800	$197,700	$230,700	$263,700	$296,600	$317,800	$349,600	$381,400	$413,200	$445,000
6.00%	$160,400	$192,500	$224,500	$256,700	$288,700	$309,400	$340,300	$371,200	$402,200	$433,100
6.25%	$156,200	$187,400	$218,600	$249,900	$281,100	$301,300	$331,400	$361,500	$391,600	$421,700
6.50%	$152,100	$182,600	$213,000	$243,500	$273,800	$293,500	$322,800	$352,100	$381,500	$410,800
6.75%	$148,300	$177,900	$207,600	$237,200	$266,900	$286,000	$314,600	$343,200	$371,800	$400,300
7.00%	$144,500	$173,400	$202,300	$231,300	$260,200	$278,800	$306,700	$334,500	$362,400	$390,300
7.25%	$141,000	$169,100	$197,300	$225,600	$253,700	$271,900	$299,100	$326,300	$353,500	$380,600
7.50%	$137,500	$165,000	$192,500	$220,100	$247,500	$265,300	$291,800	$318,300	$344,800	$371,400
7.75%	$134,200	$161,100	$187,900	$214,800	$241,600	$258,900	$284,800	$310,700	$336,600	$362,400

1. Based on **2009** medium income established by HUD for various family sizes. Adjustments to the very low- (50%) and low-income (80%) limits are made by HUD for areas with unusually high or low family income or housing cost. Most income limits are proportionately based on very low-income limits. Thus, the four-person income limit is 120% (60/50ths) of the four-person very low-income limit.

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APPENDIX B ARCHAEOLOGICAL MITIGATION PLAN UPDATE

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Report 655-101909

ARCHAEOLOGICAL MITIGATION PLAN UPDATE
KAMAKANA VILLAGES AT KEAHUOLU PROJECT
LAND OF KEAHUOLU, NORTH KONA DISTRICT
ISLAND OF HAWAI'I
TMK: (3) 7-4-21:20

Haun & Associates

Archaeological, Cultural, and Historical Resource Management Services
73-1168 Kahuna A'o Road, Kailua-Kona, Hawai'i 96740 Phone: 982-7755 Fax: 325-1520

ARCHAEOLOGICAL MITIGATION PLAN UPDATE
KAMAKANA VILLAGES AT KEAHUOLU PROJECT
LAND OF KEAHUOLU, NORTH KONA DISTRICT
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TMK: (3) 7-4-21:20

By:

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November 2009

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SUMMARY

On behalf of Forest City Hawaii Kona, LLC, the developer of the Hawaii Housing Finance & Development Corporation's (HHFDC) Kamakana Villages at Keahuolu Project, Haun & Associates conducted a study to update an archaeological mitigation plan for the project, a c. 272-acre parcel located in the Land of Keahuolu, North Kona District, Island of Hawai'i (TMK: [3] 7-4-21:20). Paul H. Rosendahl, Ph.D., Inc (PHRI) previously prepared a mitigation plan (Jensen et al. 1992) for an 1,100 acre parcel, which includes the Kamakana Villages project area, that was accepted by Department of Land and Natural Resources-State Historic Preservation Division (DLNR-SHPD). The plan was based on an archaeological inventory survey conducted by PHRI (Donham 1990) and accepted by DLNR-SHPD. The present update effort is a preliminary step designed to determine appropriate archaeological mitigation tasks to be detailed in subsequently prepared plans for data recovery, burial treatment, site preservation, and monitoring that are tailored to the specific cultural resources present within the Kamakana Villages project area.

The examination of the project area consisted of a 100% surface survey of three transects that extended through the parcel, and a site relocation phase undertaken to relocate previously identified sites that had been recommended for preservation and data recovery. The transect survey identified 15 sites with 121 features and 36 non-cultural caves. The 13 new sites were either not identified during a previous archaeological inventory survey of the parcel, or could not be correlated with sites that were previously documented. Two site designations include agricultural features (Site 26909) and pahoehoe excavations (Site 26910) that are distributed throughout the project area including newly and previously identified sites of similar function.

The identified features consist of 62 modified outcrops, 36 mounds, 8 pahoehoe excavations, 12 lava tubes, 2 lava blisters and a terrace. Functionally the features are comprised of agriculture (n=98), resource procurement (8), temporary habitation (13), temporary habitation/burial (1) and burial (1).

It is recommended that as part of the data recovery mitigation for the project systematic, pedestrian survey coverage be conducted that broadly encompasses the areas where five sites (13477, 13451, 13459, 13449, and 13474) could not be relocated. These areas are situated in the inland half of the project area where the vegetation tends to be dense.

All previously identified sites that include non-agricultural and non-resource exploitation features should be documented with scaled plan maps, photographs, and written descriptions. Any newly identified sites encountered should be similarly documented. Test excavations should be conducted at previously identified and newly identified sites, where necessary to determine site or feature function.

It is further recommended that as part of the monitoring phase of the project, any previously undisturbed areas not included within the surveyed transects and areas systematically surveyed to relocate sites, be systematically inspected. Any newly discovered sites should be properly documented and SHPD consulted regarding site significance and proposed treatment.

The newly identified sites are all assessed as significant for their information content. All of the sites have yielded information important for understanding prehistoric to historic land use in the project area. Two sites are additionally assessed as significant for their cultural value due to the presence of human remains. The two sites containing human remains (Sites 26902 and 26906) are recommended for preservation. The 13 remaining sites retain the potential to yield information important for understanding prehistoric and early historic land use. These sites are recommended for data recovery mitigation. The plans for data recovery would be detailed in a Data Recovery Plan prepared for DLNR-SHPD review and approval. The specific plans for preservation and maintenance of the burial features would be detailed in a Burial Treatment Plan prepared for DLNR-SHPD and the Hawaii Island Burial Council (HIBC) review and approval. The plans for non-burial preservation sites would be detailed in a Site Preservation Plan prepared for DLNR-SHPD review and approval. In addition, it is recommended that a monitoring plan be prepared for DLNR-SHPD review and approval.

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ILLUSTRATIONS

TABLES

INTRODUCTION

This report presents the results of a study to update an archaeological mitigation plan for the Kamakana Villages at Keahuolu Project (TMK: [3] 7-4-21:20), a c. 272-acre parcel located in the Land of Keahuolu, North Kona District, Island of Hawai'i (*Figures 1* and *2*). Paul H. Rosendahl, Ph.D., Inc (PHRI) previously prepared a mitigation plan (Jensen et al. 1992) for an 1,100 acre parcel, which includes the Kamakana Villages project area, that was accepted by Department of Land and Natural Resources-State Historic Preservation Division (DLNR-SHPD). The plan was based on an archaeological inventory survey conducted by PHRI (Donham 1990) and accepted by DLNR-SHPD. The present update effort is a preliminary step designed to determine appropriate archaeological mitigation tasks to be detailed in subsequently prepared plans for data recovery, burial treatment, site preservation, and monitoring that are tailored to the specific cultural resources present within the Kamakana Villages project area.

The initial fieldwork was conducted between July 6, 2009 and September 16, 2009 under the direction of Dr. Alan Haun. Described in this report are the project scope of work, field methods, and survey findings. Also included is background information relevant to the project area, site significance assessments, and recommended site treatments.

Scope of Work

Based on consultation with the DLNR-SHPD staff, the following tasks were determined to constitute an appropriate scope of work for the project:

1. Conduct 100% survey of three 50.0 m wide sample transects to: (a) evaluate the earlier survey data, including site location accuracy, adequacy of original site documentation, and evaluation of original functional interpretations and recommended treatments and (b) generate data recovery-level documentation of agricultural sites; and

2. Relocate all previously identified sites recommended for data recovery and/or preservation, excluding all sites exclusively assigned an agricultural function, to determine the accuracy of site location, documentation and functional interpretation; and

3. Analyze field data and previous site documentation and prepare a report describing the study's findings and make recommendations for any additional archaeological work.

Project Area Description

The project area is comprised of an irregularly-shaped c. 272-acre parcel located in the Land of Keahuolu on the leeward slopes of Hualalai volcano. The parcel is bordered by Palani Road and a water tank site to the southeast and by undeveloped land along the remaining sides. Keanalehu Drive terminates at the northern corner of the parcel. The terrain within the area slopes slightly to moderately to the southwest. The rainfall in the vicinity of the project area ranges from 10 to 20 inches per year (Juvik and Juvik 1998:66). Elevation in the project area ranges from c. 280 to 565 ft.

There are four soil types are present within the project area. These consist of Pahoehoe lava, A'a lava, Kaimu extremely stony peat and Punalu'u extremely rocky peat. The soil throughout the majority of the parcel is pahoehoe lava, covering 156.9-acres or 57.68% of the total area. According to Sato et al. (1973:34) the pahoehoe flow is dominated by a smooth surface with periodic hummocks and pressure domes.

A'a lava comprises 62.9-acres or 23.13% of the total project area. The a'a lava is characterized as rough land comprised of "a mass of clinkery, hard, glassy, sharp pieces piled in tumbled heaps" (*ibid.* 1973:34). The Kaimu extremely stony peat occupies 26.9-acres or 9.89% of the total area. This soil is characterized as a shallow, well-drained organic soil over a'a lava (*ibid.* 1973:22). This soil rapidly permeable, and presents slow runoff and a slight erosional hazard. The majority of this soil is not suitable for cultivation and is in native woodlands, though small areas are utilized for pasture, and nut and fruit trees.

Figure 2. Tax Map Key 7-4-21 showing Project Area

Figure 1. Portion of USGS Kailua Quadrangle showing Project Area, Sample Transects and Southwest Preserve Study Area

Punaluu extremely rock peat occurs on 6-20% (Sato et al. 1973:48). This soil occupies and is characterized by shallow (4") black peat overlying pahoehoe bedrock, with rock outcrops occupying 40-50% of the surface. This soil type occupies 25.3 acres, which is 9.3% of the project area. This soil is rapidly permeable, and presents slow runoff a slight erosion hazard, suitable for pasturelands. Wolfe and Morris (2001) indicate that the lava flows within the project area originated from Hualalai Volcano deposited from 1,500 to 3,000 years ago. Since the Kaimu soil developed over a'a lava and the Punalu'u soil developed over pahoehoe, the areas overlain by soils are geologically older than the bare pahoehoe and a'a lava flows.

Vegetation within the project area consists of *koa haole* (*Leucaena glauca*), Christmas berry (*Schinus terebinthifolius*), purslane (*Portulaca oleracea),* lantana (*Lantana camara*), fountain grass (*pennisetum setaceum* (Forsk.) Chiov.), airplant (*Bryophyllum pinnatum* [Lam.] Kurz.), autograph tree (*Closia rosea),* Christmas berry (*Schinus terebinthifolius* Raddi) and noni (*Morinda citrifolia).*

Methods

Field methods employed during the recent fieldwork consisted of transect survey and site relocation. First, three 50.0 m wide transects were established, designed to traverse a representative sample of the project area's soil types and elevation. The transects were subjected to a 100% surface examination with archaeologists spaced at a maximum of 10.0 m intervals. Ground surface visibility during the survey was obscured in some areas due to the relatively dense vegetation. Sites and features were flagged with pink and blue flagging tape and the locations were plotted on a scaled project area map with the aid of a Magellan MobileMapper CX global positioning device (GPS) using the World Geodetic Survey (WGS) 1984 datum. This device has sub-meter real-time accuracy and represents technology not available during the earlier PHRI inventory.

Numerous agricultural and resource procurement features were identified during the examination of the sample transects. These features consisted of clearing piles (mounds and modified outcrops), and pahoehoe excavations. Documentation of the agricultural features consisted of recording individual feature length, width, height, and shape. Representative feature types were photographed. The non-agricultural sites were documented in greater detail, including preparing scaled plan maps, completing standardized site and feature forms, and photographs. A metal tag identifying the site was placed at each site and the tag's location was plotted on the site plan map.

Subsurface testing during the project consisted of excavating three test units at three sites. A total of 2.5 sq m of excavation was undertaken. The tested features consisted of a temporary habitation terrace and two agricultural modified outcrops. The units were excavated in arbitrary 10-cm levels within stratigraphic layers and were terminated on bedrock. Standardized excavation records were prepared after the completion of each stratigraphic layer. The soil removed during excavation was screened through ¼-inch mesh screen. Portable remains collected were placed in paper bags labeled with the appropriate provenience information. Recovered charcoal samples were carefully removed from either *in situ* locations or collected during the screening process. The charcoal samples were deposited in aluminum foil pouches and placed in labeled paper bags. Following the excavation, a section drawing depicting the stratigraphy was prepared and post-excavation photographs were taken. Recovered cultural remains were transported to Haun & Associates' office for analysis.

The site relocation effort began with review of the limited data presented in the original inventory survey report and generation of estimated GPS coordinates for the sites. In the field, Haun & Associates' staff inspected the GPS-estimated site location. If the site was not relocated, then the surrounding area was surveyed in a circular pattern around the location extending out in spiral fashion to distance of at least 50 m. When a site was relocated the available data was reviewed for accuracy and the previous site interpretations were evaluated. After the original PHRI field records were obtained in late August 2009, additional attempts were made to relocate sites using landmarks visible on the original black and white aerial photographs and topographic maps used in the field by PHRI personnel.

BACKGROUND

The project area is a c. 272-acre portion of a larger c. 1,100-acre parcel surveyed by PHRI in 1990 (Donham 1990). A total of 239 sites were documented within the overall survey area. The report was accepted by the State Historic Preservation Division (SHPD) in 1993. SHPD's approval letter was provided in Appendix A to Exhibit D of the Final Environmental Impact Statement for the Keahuolu Affordable Housing Project, accepted by the Office of the Governor in 2008, notice of which was published in the October 8, 2008 edition of The Environmental Notice.

The current 272-acre project area contains 56 of the original 239 sites documented by PHRI (Donham 1990). The site locations are depicted in *Figure 3* and are listed in *Tables 1* and *2*. A total of 477 features were documented at the 56 sites (see *Table 2*). Twenty-six sites composed only of agricultural features were recommended for further data collection (data recovery; "1990 Treatment" column in *Table 1*). Of the thirty remaining sites, fourteen were recommended for data recovery, most of which included habitation features. Nine sites were recommended for further data collection, preservation and interpretive development. One site (13463) was recommended for further data collection and conservation preservation. Preservation and interpretive development, but no further work was recommended for one site (13394). No further work and no preservation was recommended for five sites (13406, 13453, 13469, 13470, and 13475).

The PHRI inventory survey report explicitly noted difficulties with agricultural site boundary definition resulting from dense vegetation in the vicinity of the current project area: "For example, it is suspected that several complexes in the upper elevations are currently delineated on the basis of no visibility, rather than the absence of features" (Donham 1990:34). The PHRI survey report recommended the following strategy for mitigating impacts to agricultural sites:

> "In order to obtain reliable data for continued analysis of the agricultural complexes, it is recommended that a systematic sampling approach be adopted, whereby sample blocks or transects are cleared of vegetation and all features within the designated area are plotted and recorded. These sample transects or blocks should be located independently of the existing sites in order to control for those features not located between survey sweeps in areas of dense vegetation.
>
> The use of sampling blocks will provide a reliable basis for the analyses of feature density and relative frequency of types, and will provide a more realistic framework for comparing elevation variation. A sampling scheme will also help determine the best means for identifying site boundaries (or the absence of such) in areas where this is problematic...A systematic sampling approach should provide sufficient data for the mitigation of adverse effects on a large proportion of the agricultural complexes recommended for further data collection."

PHRI subsequently prepared a mitigation plan for the overall 1,100-acre project area (Jensen et al. 1992) that subsequently was amended by PHRI Letter Report 1152-110593 (Walker 1993). The latter document presented a sampling strategy for data recovery that employed a series of 400 ft square sample blocks within which all archaeological features were to be documented in detail. While the sampling strategy focused on a study of numerous, mostly undocumented agricultural features, it had implications for earlier recommended treatments of other non-agricultural sites. The planned sampling strategy was designed to mitigate impacts to the twenty-six sites that consist exclusively of agricultural features. The sampling strategy was used to justify a change in treatment from further data collection to no further work or preservation for nine sites (13402, 13403, 13404, 13449, 13451, 13459, 13462, 13465 and 13477; "1992 Treatment" column in *Table 1*). Two other sites were removed from the further data collection category, but retained recommendations for preservation: one with interpretive development (13413) and other for conservation (13463). *Table 2* lists twenty-five PHRI sites with non-agricultural features and their recommended treatments. The sampling strategy reduced the population of sites requiring further work to from twenty-five to sixteen.

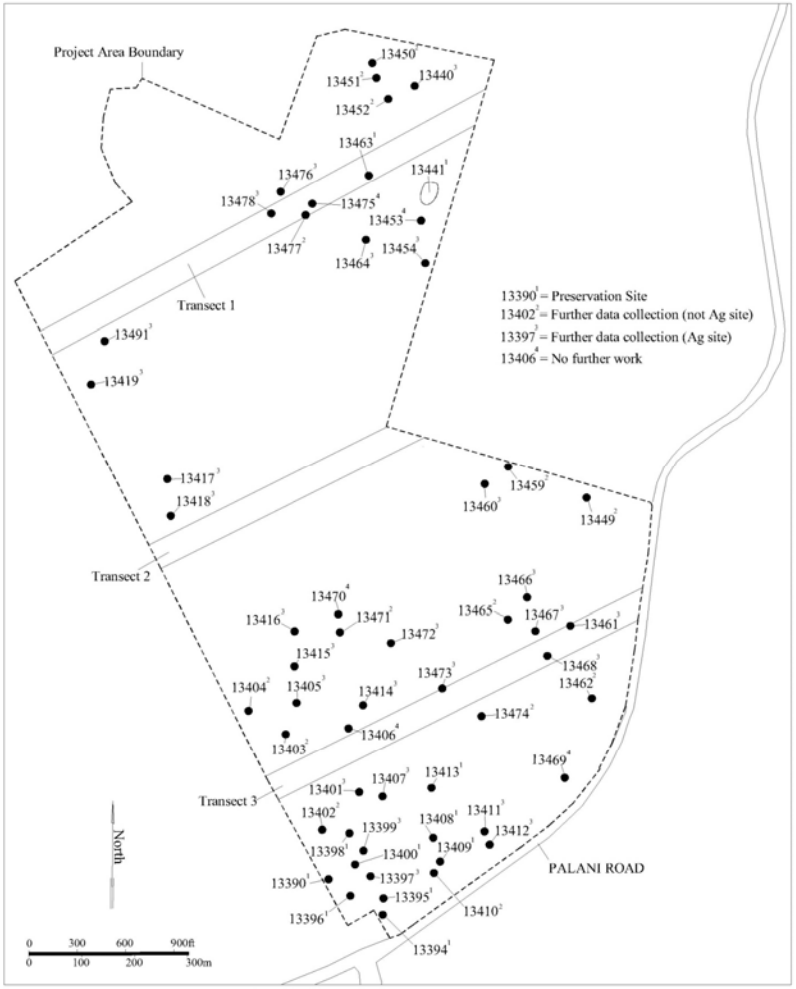

Figure 3. Reported Location of PHRI Sites

Table 1. PHRI Sites in Project Area

SIHP Site	Type	1990 Treatment*	1992 Treatment
13390	Habitation/Agriculture Complex	FDC, PID	FDC, PID
13394	Indeterminate Alignment	PID	PID
13395	Possible Burial	FDC, PID	FDC, PID
13396	Habitation Platform	FDC, PID	NFW
13397	Agriculture Complex	FDC	FDC
13398	Habitation/Agriculture/Poss. Burial Complex	FDC, PID	FDC, PID
13399	Agriculture Terrace	FDC	FDC
13400	Agriculture/Boundary Complex	FDC, PID	FDC, PID
13401	Agriculture/Boundary Complex	FDC	FDC
13402	Boundary Complex	FDC	NFW
13403	Habitation Cave	FDC	NFW
13404	Encl (Agriculture/Habitation?)	FDC	NFW
13405	Agriculture (Pahoehoe Excavations) Complex	FDC	FDC
13406	Agriculture Pahoehoe Excavation	NFW	NFW
13407	Agriculture Complex	FDC	FDC
13408	Agriculture/Habitation/Poss. Ceremonial Complex	FDC, PID	FDC, PID
13409	Habitation/Agriculture/Poss. Burial complex	FDC, PID	FDC, PID
13410	Habitation Platform	FDC	FDC
13411	Agriculture/Boundary Complex	FDC	FDC
13412	Agriculture Complex	FDC	FDC
13413	Habitation Platform	FDC, PID	PID
13414	Agriculture Complex	FDC	FDC
13415	Agriculture Terrace	FDC	FDC
13416	Agriculture Complex	FDC	FDC
13417	Pahoehoe Excavation	FDC	FDC
13418	Pahoehoe Excavation	FDC	FDC
13419	Pahoehoe Excavation	FDC	FDC
13440	Agriculture Complex	FDC	FDC
13441	Habitation/Agriculture Complex	FDC, PID	FDC, PID
13449	Habitation/Trans/P Ceremonial Complex	FDC	NFW
13450	Stepping Stone Trail	FDC	FDC
13451	Habitation Cave	FDC	NFW
13452	Paved Trail	FDC	FDC
13453	Agriculture pavement	NFW	NFW
13454	Agriculture Complex	FDC	FDC
13459	Habitation/Poss. Burial Complex	FDC	NFW
13460	Agriculture Faced Mound	FDC	FDC
13461	Agriculture Terrace	FDC	FDC
13462	Agriculture/Habitation Complex	FDC	NFW
13463	Ceremonial/Burial /Habitation Complex	FDC, PAI	PAI
13464	Agriculture Complex	FDC	FDC
13465	Habitation/Agriculture/Ceremonial Complex	FDC	NFW
13466	Agriculture Complex	FDC	FDC
13467	Agriculture Complex	FDC	FDC
13468	Agriculture Enclosure	FDC	FDC
13469	Cairn Complex	NFW	NFW

Table 1. PHRI Sites in Project Area (cont.)

SIHP Site	Type	1990 Treatment	1992 Treatment
13470	Petroglyph	NFW	NFW
13471	Agriculture/Habitation Complex	FDC	FDC
13472	Agriculture Complex	FDC	FDC
13473	Agriculture Complex	FDC	FDC
13474	Habitation Cave	FDC	FDC
13475	Agriculture Blister	NFW	NFW
13476	Agriculture Complex	FDC	FDC
13477	Agriculture/Habitation Complex	FDC	NFW
13478	Agriculture Complex	FDC	FDC
13491	Agriculture Complex	FDC	FDC

*Treatments: NFW=No Further Work, FDC=Further Data Collection, PID=Preservation with Interpretative Development, PAI=Preserve As Is

Table 2. PHRI Sites and Features in Project Area

SIHP Site/Feature	Type	No Features	Function*
13390	**Habitation/Agriculture complex**	**15**	
A	Platform		H
B	Enclosure		A
C	Wall		A
D	Terrace		H/A
E	Terrace		A
F	Terrace		H/A
G	Mound (4)		A
H	Terrace		H/A
I	Platform		H/A
J	Linear Mound (3)		A
13394	**Indeterminate Alignment**	**1**	**I**
13395	**Possible Burial Platform**	**1**	**PB**
13396	**Habitation Platform**	**1**	**H**
13397	**Agriculture Complex**	**5**	
A	Terrace		A
B	Terrace		A
C	Terrace		A
D	Terrace		A
E	Terrace		A
13398	**Habitation/Agriculture/Poss. Burial complex**	**4**	
A	Platform		H/A/PB
B	Wall		
C	Cairn		I
D	Cairn		
13399	**Agriculture Terrace**	**1**	**A**
13400	**Agriculture/Boundary Complex**	**2**	
A	Wall		A
B	Enclosure		A

Table 2. PHRI Sites and Features in Project Area (cont.)

SIHP Site	Type	No Features	Function*
13401	**Agriculture/Boundary Complex**	**2**	
A	Wall		A/LD
B	Terrace		A
13402	**Boundary Complex**	**1**	LD
13403	**Habitation Cave**	**1**	H
13404	**Agriculture/Possible Habitation Enclosure**	**1**	H/PH
13405	**Agriculture (Pahoehoe Excavations) Complex**	**15**	
	Pahoehoe Excavations (15)		A
13406	**Agriculture Pahoehoe Excavation**	**1**	
13407	**Agriculture Complex**	**2**	
A	Mound		A
B	Pahoehoe Excavation		
13408	**Agriculture/Habitation/Poss. Ceremonial Complex**	**19**	
A	Platform		ND
B	Terrace		ND
C	Wall		ND
D	Wall		ND
E	Wall		ND
F	Enclosure		ND
G	Enclosure		ND
H	Wall		ND
I	Wall		ND
J	Pahoehoe Excavation (10+)		ND
13409	**Habitation/Agriculture/Poss. Burial Complex**	**9**	
A	Platform		A/H
B	Wall		ND
C	Enclosure		ND
D	Terrace		ND
E	Terrace		ND
F	Terrace		ND
G	Platform		A/PB
H	Platform		A/PB
I	Wall		ND
13410	**Habitation Platform**	**1**	H
13411	**Agriculture/Boundary Complex**	**4**	
A	Wall		ND
B	Wall		ND
C	Mound		ND
D	Wall		ND
13412	**Agriculture Complex**	**2**	
A	Enclosure		A
B	Terrace		A
13413	**Habitation Platform**	**1**	**H**
13414	**Agriculture Complex**	**20**	
	Pahoehoe Excavations (20+)		

Table 2. PHRI Sites and Features in Project Area (cont.)

SIHP Site	Type	No Features	Function*
13415	**Agriculture Terrace**	**1**	**A**
13416	**Agriculture Complex**	**2**	
	Rubble wall with terrace		A
	Wall		A
13417	**Pahoehoe Excavation**	**1**	**A**
13418	**Pahoehoe Excavation**	**1**	**A**
13419	**Pahoehoe Excavation**	**1**	**A**
13440	**Agriculture Complex**	**3**	
A	Terrace		A
B	Filled Crevice		A
C	Pahoehoe Excavation		A
13441	**Habitation/Agriculture complex**	**21**	
A	Platform		H/A
B	Terrace		A
C	Platform		A
D	Platform		H
E	Terraces (4) and pavement		
	Pavement		A
	1st terrace		A
	2nd Terrace		A
	3rd terrace		A
	4th Terrace		A
F	Terrace		A
G	Terrace		A
H	Terrace		A
I	Wall Remnant		I
J	Platform		H/A
K	Platform		H/A
L	Wall		I
M	Mound		A
N	Platform		H/A
O	Platform		A
P	Cave		H/A
Q	Enclosure		H/A
13449	**Habitation/Trans/Poss. Ceremonial Complex**	**3**	
A	Cave		H
B	Cairn		PA
C	Stepping Stone Trail		T
13450	**Stepping Stone Trail**	**1**	**T**
13451	**Habitation Cave**	**1**	**H**
13452	**Paved Trail**	**1**	**H**
13453	**Agriculture pavement**	**1**	**A**
13454	**Agriculture Complex**	**14**	
	Pahoehoe Excavations (11)		A
	Mound		A

Table 2. PHRI Sites and Features in Project Area (cont.)

SIHP Site	Type	No Features	Function*
13459	**Habitation/Poss. Burial Complex**	**2**	
A	Cave		H
B	Modified Outcrop		H
13460	**Agriculture Faced Mound**	**1**	**A**
13461	**Agriculture Terrace**	**1**	**A**
13462	**Agriculture/Habitation Complex**	**4**	
A	Modified Outcrop		A
B	Alignment		A
C	C-Shape		A
D	Enclosure		A
13463	**Ceremonial/Burial/Habitation Complex**	5	
A	Enclosed Platform		H/PC
B	Cave		H
C	Cave		B
D	Trail		T
E	Pavement		I
13464	**Agriculture Complex**	**8**	
A	Alignment/wall		A
B	Enclosure (2)		A
C	Cairn		I
D	Pahoehoe Excavations (3)		A
E	Mound		A
13465	**Habitation/Agriculture/Ceremonial Complex**	**8**	
A	Platform		A/PH
B	Terrace with upright		H/C
C	Wall remnant		H/A
D	Wall remnant		H/A
E	Pavement with Upright		H/C
F	Pahoehoe Excavation w/ lava tube		H/A
G	Pavement		I
13466	**Agricultural Terrace**	**1**	**A**
13467	**Agriculture Complex**	**9**	
A	Pahoehoe Excavations (6+)		A
B	Terrace		A
C	Terrace		A
D	Mound		A
13468	**Agriculture Enclosure**	**1**	**A**
13469	**Cairn Complex**	**6**	
A	Cairn		IM
B	Cairn		IM
C	Cairn		IM
D	Cairn		IM
E	Cairn		IM
F	Cairn		IM
13470	**Petroglyph**	**1**	**RA**

Table 2. PHRI Sites and Features in Project Area (cont.)

SIHP Site	Type	No Features	Function*
13471	**Agriculture/Habitation Complex**	**3**	
A	Upright		PC
B	Platform		A
C	Cave		H
13472	**Agriculture Complex**	**164**	
	Pahoehoe Excavations (6+)		A
	Modified Blister (16)		A
	Mound (3)		A
	Alignment		A
13473	**Agriculture Complex**	**73**	
	Pahoehoe Excavations (68)		
	Linear Mounds (2)		A
	Terrace		A
	Filled Blister		A
	Upright		A
13474	**Habitation Cave**	**1**	**H**
13475	**Agriculture Blister**	**1**	**A**
13476	**Agriculture Complex**	**10**	
	Pahoehoe Excavations (10)		A
13477	**Agriculture/Habitation Complex**	**4**	A
A	Enclosure (2)		A/H
B	C-Shape		I
C	Mound		I
13478	**Agriculture Complex**	**6**	
A	Platform		A
B	Terrace		A
C	Enclosure w/ mound		A
D	Filled Pahoehoe Excavation		A
E	Wall		B
13491	**Agriculture Complex**	**8**	
	Pahoehoe Excavations (8)		
56 Sites	**Total**	**477**	**Features**

* Feature Function: A=Agriculture, H=Habitation, PB=Possible Burial, I=Indeterminate, M=Marker, RA=Rock Art, B=Boundary, LD=Land Division, I=Indeterminate, C=Ceremonial, ND=No Data

A subsequent study by PHRI (Corbin and Wong-Smith 2007) included an effort to relocate sites within the current 272-acre project area. The survey relocated twelve sites (*Table 3*).

In preparation for the present project, SHPD staff was consulted to determine the scope of work. The proposed transect survey design for the current project had a two-fold objective developed in consultation with the SHPD staff. The primary objective was to provide data to evaluate the original survey results. The secondary objective was to systematically document a representative sample of agricultural features for potential data recovery mitigation. It also was agreed that the update scope of work include relocation of all sites that were recommended for further data collection and/or preservation, excluding those sites exclusively composed of agricultural features. The relocation effort focused on all of the sites listed in *Table 3*.

After the majority of the update fieldwork was completed, Haun & Associates staff gained access to the original PHRI field records for the project. The records include the original hand-written site forms for 30 of the 56 sites in the current project area. Plan maps for two sites (13463 and 13474) in addition to the maps for four sites presented in the report (13441, 13462, 13465, and 13471), were included in the PHRI field records. The original aerial photograph and a topographic map used by PHRI staff to plot the locations of sites were also obtained. Dates on the forms and maps indicate that the PHRI fieldwork spanned the month of September, 1989. Several subsequent attempts were made to relocate sites using data from the original records, but these were met with limited success.

Table 3. PHRI Sites with Non-Agricultural Features in Project Area

SIHP Site	Type	1990 Treatment*	1992 Treatment
13390	Habitation/Agriculture Complex	FDC, PID	FDC, PID
13394	Indeterminate Alignment	PID	PID
13395	Possible Burial	FDC, PID	FDC, PID
13396	Habitation Platform	FDC, PID	NFW
13398	Habitation/Agriculture/Poss. Burial Complex	FDC, PID	FDC, PID
13400	Agriculture/Boundary Complex	FDC, PID	FDC, PID
13402	Boundary Complex	FDC	NFW
13403	Habitation Cave	FDC	NFW
13404	Agriculture/Poss. Habitation Enclosure	FDC	NFW
13408	Agriculture/Habitation/Poss. Ceremonial Complex	FDC, PID	FDC, PID
13409	Habitation/Agriculture/Poss. Burial complex	FDC, PID	FDC, PID
13410	Habitation Platform	FDC	FDC
13413	Habitation Platform	FDC, PID	PID
13441	Habitation/Agriculture Complex	FDC, PID	FDC, PID
13449	Habitation/Trans/P Ceremonial Complex	FDC	NFW
13450	Stepping Stone Trail	FDC	FDC
13451	Habitation Cave	FDC	NFW
13452	Paved Trail	FDC	FDC
13459	Habitation/Poss. Burial Complex	FDC	NFW
13462	Agriculture/Habitation Complex	FDC	NFW
13463	Ceremonial/Burial/Habitation Complex	FDC, PAI	PAI
13465	Habitation/Agriculture/Ceremonial Complex	FDC	NFW
13471	Agriculture/Habitation Complex	FDC	FDC
13474	Habitation Cave	FDC	FDC
13477	Agriculture/Habitation Complex	FDC	FDC

Shaded entries are sites relocated by Corbin and Wong-Smith (2007)

*Treatments: NFW=No Further Work, FDC=Further Data Collection, PID=Preservation with Interpretative Development, PAI=Preserve As Is

FINDINGS

Archaeological Survey of Transects

A primary element of the present project was the archaeological survey of three 50.0 m wide transects that extend through the project area. The transects ranged in length from 503.0 m to 961.0 m and comprise 27.4-acres or c. 10% of the overall 272-acre project area (*Figure 4*). The transects are oriented east to west and inland to seaward and are located where main roadway corridors are planned. *Tables 4* and 5 show that the transect are generally representative of the overall project area with respect to elevation and soils as reflected in the relative percentage composition for the three transects combined ("Total Transects" column) compared to the percentage values for the overall project area.

Table 4. Distribution of Elevation by Transect

	Project Area		Total Transects		Transect 1		Transect 2		Transect 3	
Elevation	Ac	%	Ac	%	Ac	%	Ac	%	Ac	%
>320 ft	27.2	**10.00**	2.94	**10.70**	1.54	13.39	0.36	5.51	1.04	11.02
320-360	93.7	**34.45**	10.74	**39.10**	3.05	26.52	2.99	45.79	4.7	49.79
360-400	61.1	**22.46**	4.99	**18.17**	1.34	11.65	2.27	2.45	1.38	14.62
400-440	45.1	**16.58**	4.75	**17.29**	2.12	18.43	0.91	13.94	1.72	18.22
440-480	26.2	**9.63**	1.96	**7.14**	1.36	11.83	0	0.00	0.6	6.36
480-520	13.9	**5.11**	1.29	**4.70**	1.29	11.22	0	0.00	0	0.00
<520	4.8	**1.76**	0.8	**2.91**	0.8	6.96	0	0.00	0	0.00
Total	**272**	**100**	**27.47**	**100**	**11.5**	**100**	**6.53**	**68**	**9.44**	**100**

Table 5. Distribution of Soil Type by Transect

	Project Area		Total 3Transects		Transect 1		Transect 2		Transect 3	
Soil Type	Ac	%	Ac	%	Ac	%	Ac	%	Ac	%
Pahoehoe (rLW)	156.9	**57.68**	13.05	**47.50**	7.1	61.74	0.487	7.46	5.46	57.84
A'a (rLV)	62.9	**23.13**	7.01	**25.52**	0.97	8.43	6.04	92.54	0	0.00
Kaimu ESP-(rKED)	26.9	**9.89**	3.43	**12.49**	3.43	29.83	0	0.00	0	0.00
Punaluu ERP (rPYD)	25.3	**9.30**	3.98	**14.49**	0	0.00	0	0.00	3.98	42.16
Total	**272**	**100**	**27.47**	**100**	**11.5**	**100**	**6.53**	**100**	**9.44**	**100**

The archaeological survey of transects identified 15 previously undocumented sites with 121 features and 36 non-cultural caves (*Table 6*). A total of 928 linear meters of subterranean lava tubes and blisters were mapped. Two of the new site designations are for two functional site types that span the entire project area. All of the agricultural features are categorized as features of Site 26909 and all pahoehoe

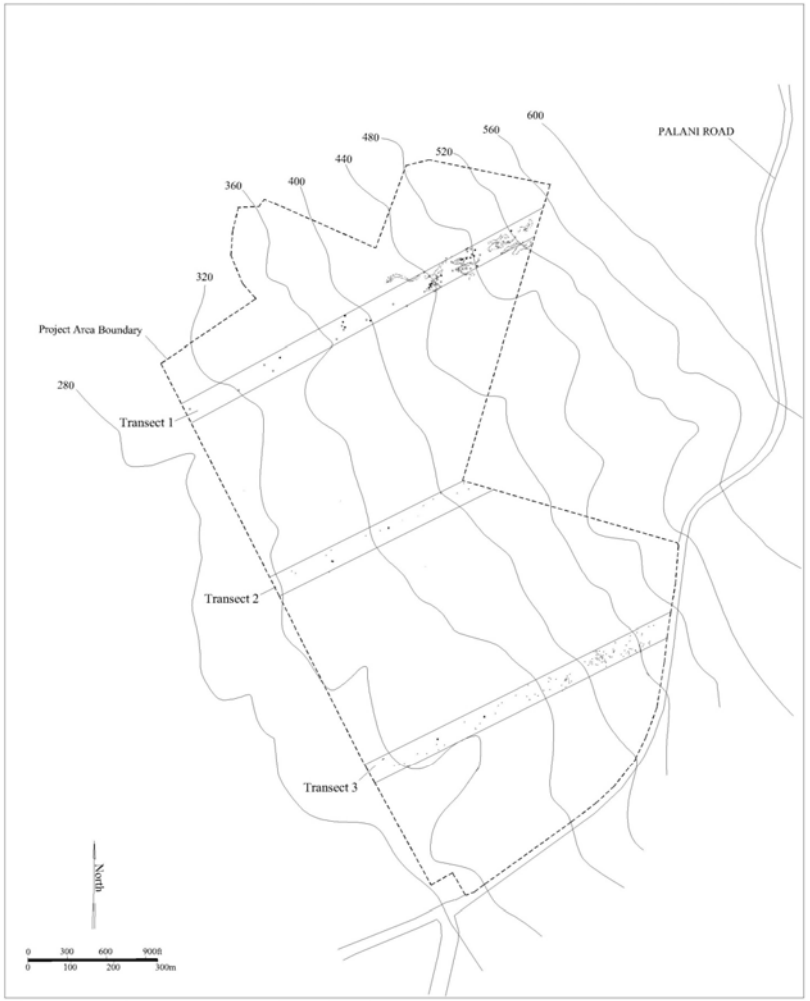

Figure 4. Location of Transects within Project Area

Table 6. Summary of Sites Identified in Transects 1-3

SIHP Site No.	H & A Temp. Site No.	Formal Type	Function	Formal Type						Function					Easting	Northing
				Modified Outcrop	Mound	Pahoehoe Excavation	Lava Tube	Lava Blister	Terrace	Agriculture	Resource Procurement	Temporary Habitation	Temporary Habitation/ Burial	Burial		
Transect 1																
-	26896	Lava Tube	Temporary Habitation				1					1			186798	2177057
-	26897	Complex(2)	Temporary Habitation				2					2			186782	2176999
-	26898	Lava Tube	Temporary Habitation				1					1			186757	2177016
-	26899	Lava Tube	Temporary Habitation				1					1			186719	2177009
-	26900	Complex(2)	Temporary Habitation				2					2			186650	2176957
-	26901	Lava Tube	Temporary Habitation				1					1			186630	2176962
-	26902	Lava Tube	Temporary Habitation/Burial				1						1		186592	2176945
-	26903	Lava Tube	Temporary Habitation				1					1			186529	2176923
-	26909	Complex(14)	Agriculture	12	2					14					see Table 3	
-	26910	Complex(5)	Resource Procurement			5					5				see Table 3	
			Subtotal	**12**	**2**	**5**	**10**	**0**	**0**	**14**	**5**	**9**	**1**	**0**		
Transect 2																
-	26904	Terrace	Temporary Habitation						1			1			186334	2176265
-	26905	Lava Blister	Temporary Habitation					1				1			186538	2176369
-	26909	Complex(2)	Agriculture	1	1					2					see Table 3	
-	26910	Pahoehoe Excavation	Resource Procurement			1					1				186467	2176343
			Subtotal	**1**	**1**	**1**	**0**	**1**	**1**	**2**	**1**	**2**	**0**	**0**		
Transect 3																
-	26906	Lava Tube	Burial				1							1	186991	2176060
-	26907	Lava Blister	Temporary Habitation					1				1			186954	2176040
-	26908	Lava Tube	Temporary Habitation				1					1			186876	2175988
-	26909	Complex(82)	Agriculture	49	33					82					see Table 3	
-	26910	Complex(2)	Resource Procurement			2					2				see Table 3	
			Subtotal	**49**	**33**	**2**	**2**	**1**	**0**	**82**	**2**	**2**	**0**	**1**		
			Grand Total	**62**	**36**	**8**	**12**	**2**	**1**	**98**	**8**	**13**	**1**	**1**		

excavations are assigned feature designations within Site 26910. The results of the transect survey are presented below.

Transect 1

Transect 1 extends across the northern portion of the project area from c. 300 to 565 ft elevation. The transect is 961.0 m long and encompasses an area of 11.4 acres (*Figure 5*). The archaeological survey of Transect 1 identified 10 sites with 29 features and 24 non-cultural caves. The sites are comprised of consist of five single feature temporary habitation lava tubes (Sites 26896, 26898, 26899 and 26901), a temporary habitation/burial lava tube (Site 26902), two complexes of two temporary habitation lava tubes (Sites 26897 and 26900), a complex of 14 agricultural features (Site 26909) and a complex of five pahoehoe excavations (Site 26910). The sites are discussed below.

Site 26896

Site 26896 is a lava tube with an entrance located along the north side of a pahoehoe outcrop at c. 539 ft elevation. The entrance is U-shaped and is 5.5 m wide (northeast by southwest), 1.4 m in height and is partially filled with roof fall (*Figure 6*). The entrance opens onto a linear chamber that extends 9.7 m to the south then angles to the south-southwest for 11.9 m. The tube then turns to the west for an additional 6.1 m where it terminates.

There is a small skylight opening 4.0 m south of the dripline. Roof fall is present below the skylight. The floor in this chamber is comprised of bare lava with ceiling heights ranging from 0.75 to 1.4 m. There are three concentrations of goat bones in this passage and with a fragment of charcoal. All of the goat bones probably are the result of non-cultural events.

A side passage extends to the west from the main chamber, 4.8 m south of the entrance. This narrow passage is 2.9 m long (east-west) and from 0.7 to 1.3 m wide, with a 0.6 m high ceiling. The floor in this passage slopes down to the west and a *kukui* nut shell is present at the west end. This passage opens onto an irregularly-shaped chamber that extends to the southwest for 15.5 m, where it splits into two tubes. This passage is 2.3 to 4.75 m wide and 0.6 to 1.25 m high, with a bare lava floor. A fragment of charcoal is present in the central portion of this chamber, with a concentration of charcoal and wood present further to the southwest.

The passage divides into two tubes at its southwest end. One tube extends to the west and the other to the south. The western passage extends 8.8 m west, then angles to the southwest for 7.9 m where it terminates. The passage is 2.6 to 6.9 m wide and 0.35 to 1.6 m in height. The floor is bare lava and there is a raised shelf along the northern side that is 0.6 m in height. A pig bone is present on the surface of the shelf and there is a concentration of marine shells and pig bones below the shelf on the floor of the tube. An area of roof fall is located to the south of the shelf and there are seven small rock rings on the lava floor to the north, west and southeast of the roof fall. A fragment of charcoal is present adjacent to the rings to the south.

The passage that extends to the south from the split begins as a 1.25 m wide chamber, then it widens to 4.1 m wide. This ceiling is very low (0.1 m) and could not be accessed, although it appears to continue. The floor is bare lava and no cultural remains were observed.

Site 26896 is interpreted as a temporary habitation shelter based on its formal type and on the presence of the cultural remains. The rock rings noted in the tube indicate that the site also was used to collect water. These rock rings are served as stands for a gourd or other water collection vessel placed to catch water dripping from the ceiling of the tube. The tube has an overall length of 68.7 linear meters and an area of 114.6 sq m. The site is unaltered and in good condition and is assessed as significant for its information content.

Site 26897

Site 26897 is a lava tube with two separate chambers (Features A and B) located at elevations ranging from c. 503-528 ft. The main entrance to the site is through an oval-shaped sinkhole that is 7.1 m long (west-northwest by east-southeast), 4.7 m wide and 1.0 m in depth (*Figure 7*). The entrance to the Feature A chamber is located along the southeastern side of the sink. This entrance passage is 4.2 m long (north-northwest by south-southeast), 1.5 to 2.0 m wide and 0.45 to 0.5 m in height. There is an ashy soil deposit on the floor of this passage.

The entry passage opens onto a large, irregularly-shaped chamber that is 51.5 m in length (northeast by southwest) and from 4.7 to 11.5 m wide. There is a raised shelf (1.4 m in height) just south of the entry passage with a concentration of charcoal on it. The floor throughout the large chamber is bare lava with an area of scattered roof fall at the southwestern end. Several isolated areas of roof fall are also present. The ceiling heights range from 0.45 to 2.3 m. This chamber is bisected by two floor to ceiling columns, one to the south of the entry passage and one at the northeastern end. A concentration of bird bones is located on the south side of the column to the south of the entry passage and goat bones are located

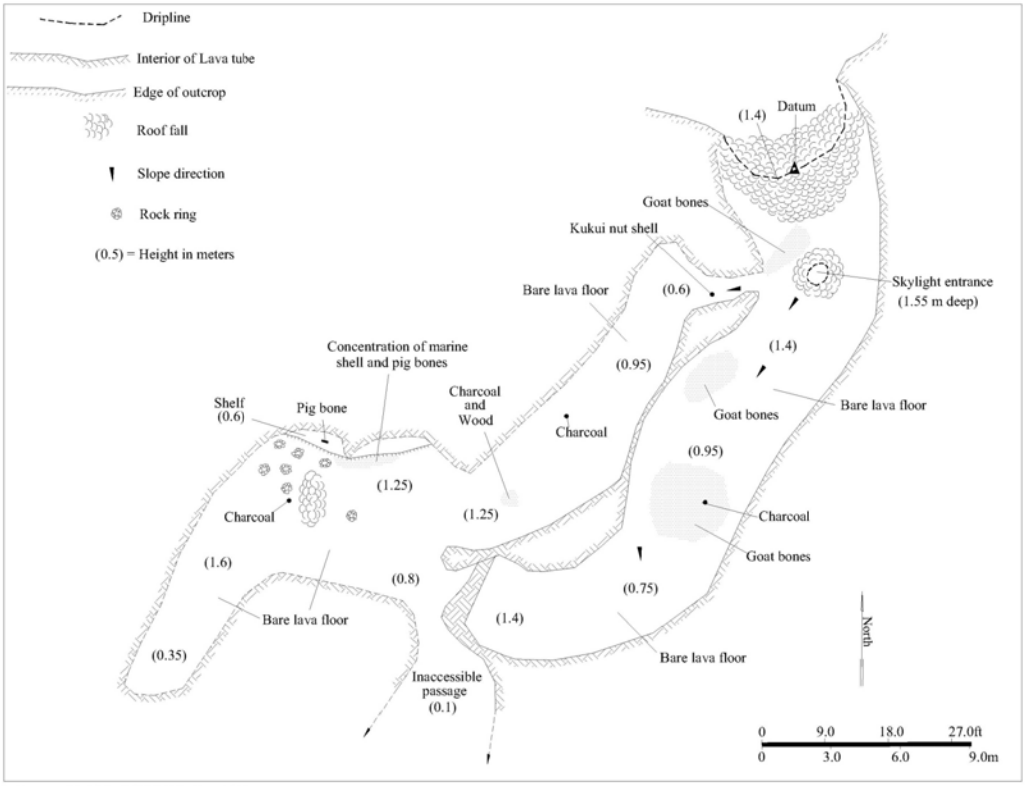

Figure 6. Site 26896 Plan Map

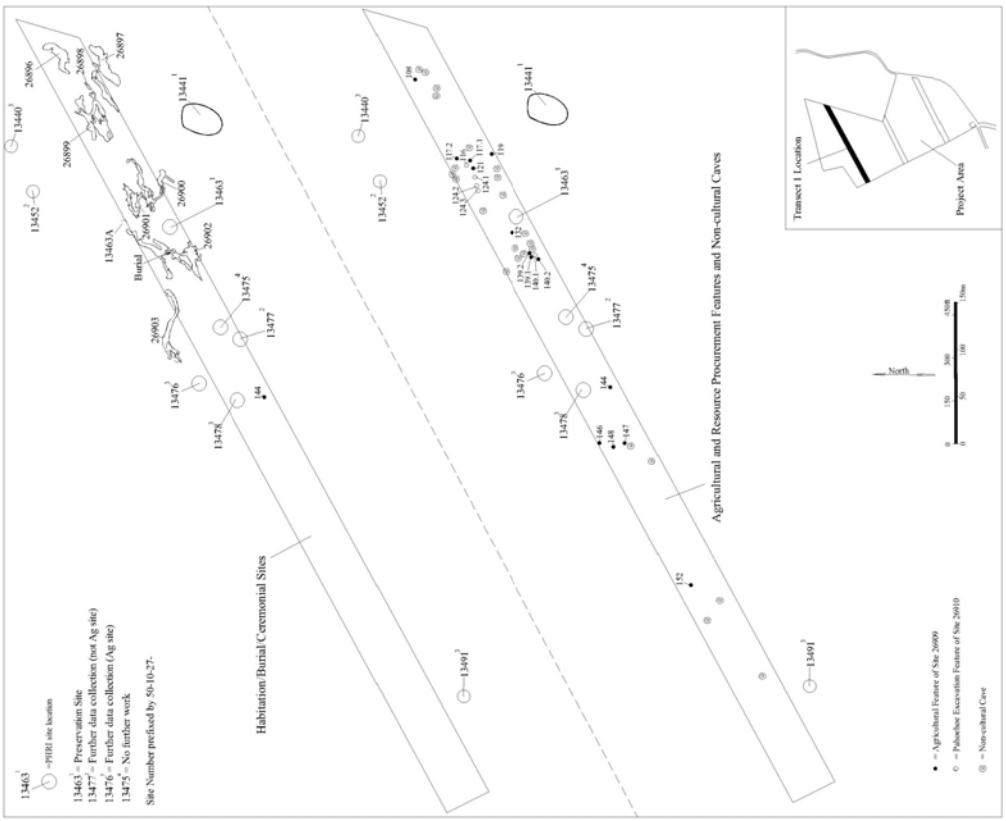

Figure 5. Location of Sites and Non-cultural Caves in Transect 1

amidst the roof fall in the southwestern portion. The bird and goat bones were likely deposited by non-cultural events.

There is a secondary vertical entrance in this large chamber that is 3.0 m long (northwest by southeast), 2.5 m wide and 1.5 m deep below the surrounding ground surface. Two passages extend off this large chamber, one to the north and one at the northeastern end. The north passage is 7.75 m long, 1.6 to 2.2 m wide with a bare lava floor and no cultural remains. The tube continues to the north but its low ceiling (0.1 m) made it inaccessible. The passage at the northeast end of the large chamber is also inaccessible due to its low ceiling height (0.2 m). It appears to continue in this direction though no cultural remains were noted.

The entrance to the Feature B lava tube is through a 1.4 m wide by 0.7 m, opening on the western side of the main sinkhole. This opens onto a linear chamber that is 46.2 m in length (northeast by southwest) and from 2.7 to 6.3 m wide. The floor throughout this chamber is bare lava and slopes to the west and southwest near the entrance. The ceiling heights range from 0.4 m at the southwest end to 1.5 m in the center and there is an area of roof fall along the northwestern side of the tube. There is a small secondary vertical entrance located 11.0 m southwest of the main Feature B entrance. This opening is 1.8 m long (northeast by southwest), 0.9 m wide and 1.5 m in depth below the surrounding ground surface. The tube is bisected by a floor to ceiling column 9.8 m to the southwest of the small entrance.

A concentration of charcoal is situated on the floor at the northeast end of the chamber, with several goat bones located to the southwest, along the northwestern wall. A small soil deposit (2.2 m long by 1.1 m wide) with bird bones and charcoal is located adjacent to the goat bones to the south. A concentration of marine shells and charcoal is located to the south of the secondary vertical entrance and a small area of charcoal is on the tube floor to the southwest of the column.

Site 26897 is interpreted as a temporary habitation shelter based on its formal type and on the presence of the cultural remains. The Feature A tube evidences an overall length of 75.0 linear meters and an area of 467.7 sq m and Feature B is 46.5 m long with an area of 121.6 sq m. The site is unaltered and in good condition and is assessed as significant for its information content.

Site 26898

Site 26898 is a small lava tube with two vertical entrances situated at c. 515-519 ft elevation (*Figure 8*). These entrances are 1.3 to 1.6 m long, 1.0 to 1.05 m wide, with dripline heights that range from 1.3 to 1.4 m. The interior of the tube is roughly linear in shape and is 7.65 m in length (northeast by southwest) and 0.45 to 2.5 m wide. The ceiling heights range from 0.3 to 1.0 m. The floor of the tube slopes slightly to moderately to the southwest and is comprised of bare lava in the northeastern portion and soil and scattered roof fall in the southwestern portion. A low (0.4 m tall) raised shelf is present at the southwestern end of the tube.

There is an area of level soil, free of roof fall in the approximate center of the tube that is 1.8 m long (northeast by southwest) and 1.4 m wide. Charcoal, *kukui* nut shells and marine shells are present on this soil surface. There is a concentration of bones from a large, unidentified bird present at the southwestern end of the tube, to the north of the low shelf.

Site 26898 is interpreted as a temporary habitation shelter. This is based on its formal type and on the presence of the cultural remains in the interior. The site contains an overall length of 8.6 linear meters and an area of 17.2 sq m. The site is unaltered and in good condition and is assessed as significant for its information content.

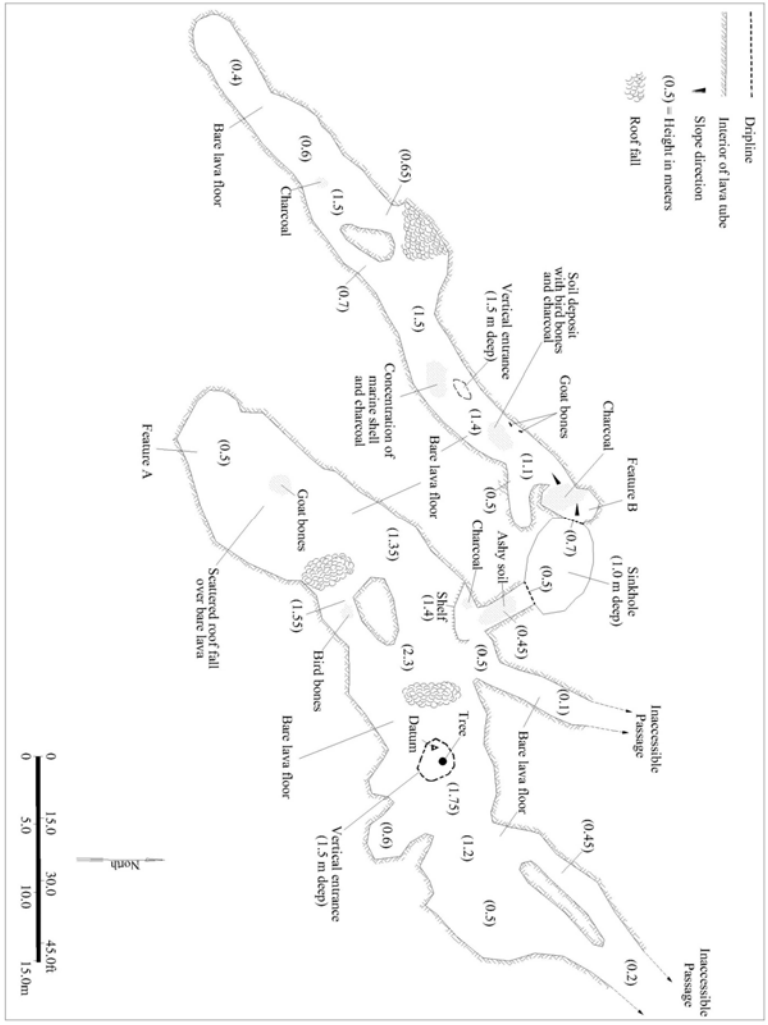

Figure 7. Site 26897 Plan Map

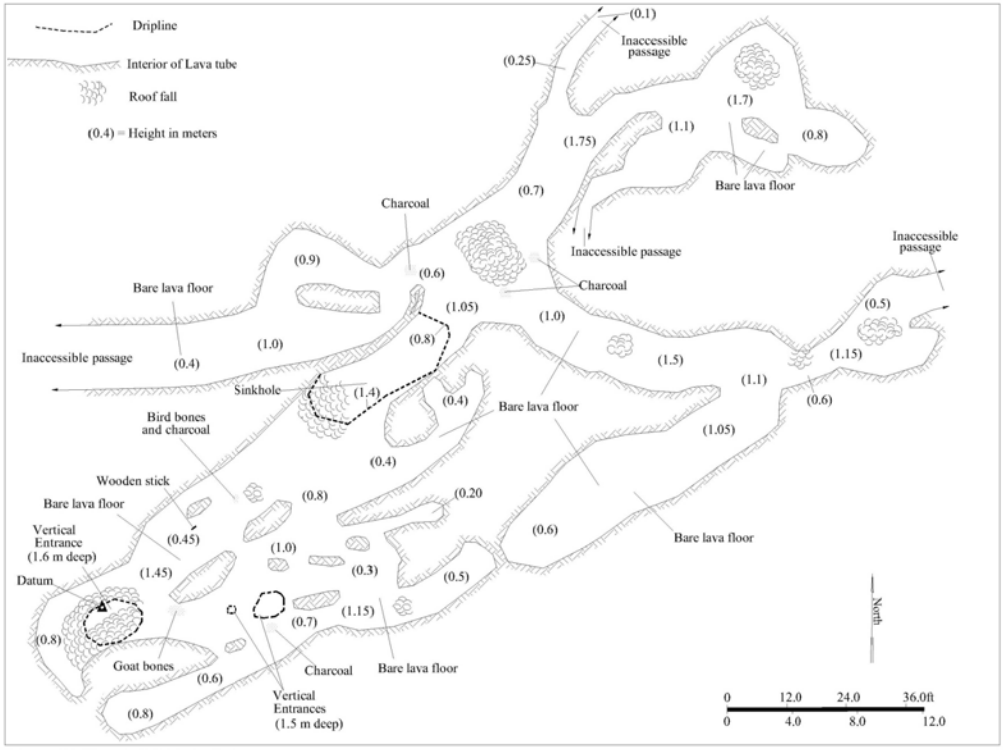

Figure 9. Site 26899 Plan Map

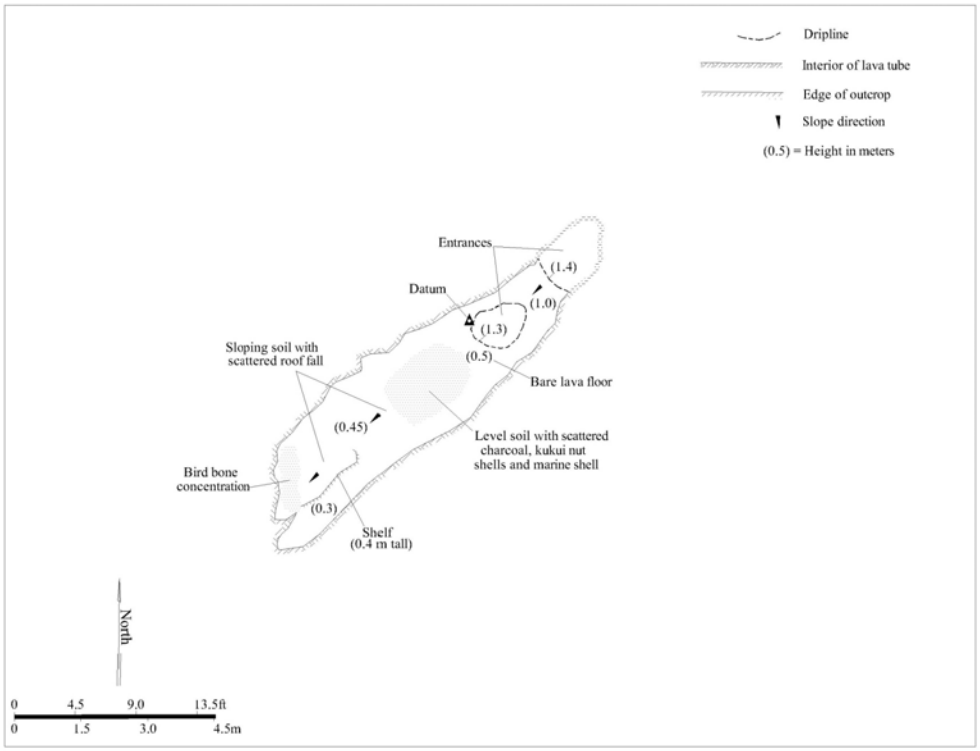

Figure 8. Site 26898 Plan Map

Site 26899

Site 26899 is a complex lava tube located between c. 495 to 515 ft elevation. The main entrance to the tubes through a sinkhole that is 9.5 m long (northeast by southwest) and 2.7 to 3.2 m wide (*Figure 9*). Passages extend to the northeast and to the southwest from this sinkhole. The tube to the northeast extends in one to the north-northeast and one to the east-southeast. Concentrations of charcoal are present on the floor of the tube to the east, south and west of this roof fall.

The passage to the west extends in this direction for 22.5 m where it becomes inaccessible because of a dangerous, unstable ceiling. This chamber is 2.2 to 7.9 m wide with a bare lava floor and ceiling heights that range from 0.4 to1.0 m. There is a floor to ceiling column at the eastern end of this passage and no cultural remains were observed.

The passage that extends to the north-northeast from the roof fall area continues in this direction for 9.5 m then divides into two tubes. One tube extends to the north-northeast and one turns to the northeast. The tube to the north-northeast is 6.1 m long, 1.1 m wide and 0.25 m in height with a bare lava floor and no cultural remains. The northeast end of this chamber is inaccessible due to a low (0.1 m) ceiling height. The tube to the northeast extends in this direction for 4.3 m then opens onto a large irregularly-shaped chamber that is 14.7 m long (east-west) and 3.0 to 8.9 m wide. The floor in this room is bare lava and the ceiling heights range from 0.8 to 1.7 m. This room is bisected by a floor to ceiling column in the eastern portion and there is a pile of roof fall located to the north. A narrow passage extends to the south from the southwest corner of this room, measuring 2.0 m long and 1.2 m wide. This passage becomes inaccessible due to a dangerous, unstable ceiling.

The passage that extends to the east-southeast from the roof fall area is 14.8 m long, 3.0 to 3.6 m wide and 1.0 to 1.5 m in height. The floor is bare lava and there is an area of roof fall in the center. This tube diverges into two passages at its southeast end with one extending to the southwest and one to the northeast. The southwest passage is 17.9 m long, 3.5 to 4.9 m wide and 0.6 to 1.05 m in height with a bare lava floor. The passage to the northeast is 9.4 m long, 1.8 to 5.6 m wide and 0.5 to 1.15 m in height. Several areas of roof fall are present in this chamber. A low inaccessible passage extends to the east-northeast from the eastern end of this chamber. No cultural remains were present within this portion of the site.

The passage to the southwest from the sinkhole entrance opens onto a large, irregularly-shaped chamber that is 11.3 to 31.5 m long (northeast by southwest0 and 2.0 to 14.3 m wide. This large room is bisected by eight floor to ceiling columns and there are areas of roof fall present at the entrance and 4.7 m to the southwest. A third area of roof fall is located in the southeastern portion of the chamber. There is an oval-shaped vertical entrance (1.6 m deep) at the western end of this room that is 3.6 m long (northeast by southwest) and 2.6 m wide. Two smaller vertical entrances are located along the southern side of this room averaging 1.5 m in depth below the surrounding ground surface.

There is a concentration of bird bones and charcoal present on the floor of the tube along the northern side and a wooden stick located 3.1 m to the southwest. The stick is 0.5 m in length and 0.03 to 0.05 m in diameter. There is a concentration of charcoal present along the south side of the chamber and a concentration of goat bones located 5.0 m to the west.

Site 26899 is interpreted as a temporary habitation shelter. This is based on its formal type and on the presence of the cultural remains in the interior. The site has an overall length of 166.1 m and an area of 734.0 sq m. The site is unaltered and in good condition and is assessed as significant for its information content.

Site 26900

Site 26900 is a lava tube complex with separate chambers (Features A and B) located at elevations ranging from c. 465 to 485 ft. There are two entrances to the Feature A chamber, with one located along the eastern side of a raised pahoehoe outcrop and a second one 4.7 m to the southwest on the south side of the same outcrop (*Figure 10*) The eastern entrance is 3.1 m wide and 1.1 m in height and the southern entrance is 1.0 m wide and 0.5 m in height. These open onto a long, curvilinear chamber. The tube extends to the west from the entrance for 16.4 m where it is bisected by a linear floor to ceiling column. This column divides the chamber into two passages along the north and south sides and extends an additional 12.6 m west. The tube then angles to the north-northwest for 13.5 m then angles to the northeast for 18.4 m where the tube is again bisected by a large floor to ceiling column, There is a secondary vertical entrance located along the west side of this column that is 1.75 m long (north-south), 1.0 m wide and 1.1 m in depth below the surrounding ground surface.

The tube continues to the west, past the north and south sides of the column for 18.5 m then angles to the northeast for 9.1 m where it becomes inaccessible due to roof fall blocking the passage. The Feature B tube (discussed below) is located on the northeastern side of this blockage.

The floor throughout most of the Feature A chamber is comprised of bare lava and the ceiling heights range from 0.4 to 2.1 m. There is a raised shelf along the south wall of the tube adjacent to the southern entrance. This shelf is 1.2 m in height above the main tube floor and is 12.2 m long (north-northeast by south-southwest), 1.4 to 1.7 m wide and 0.3 to 0.45 m wide. The floor of the shelf is bare lava and no cultural remains were present.

There is an area of shallow ashy soil located on the floor of the tube to the west of the eastern Feature A entrance. Charcoal and *kukui* nut shells are situated 10.5 m to the west of this soil, along the south side of the floor to ceiling column. There is a *kukui* nut shell present 2.2 m west of the column with a *kukui* nut, charcoal and a crab claw situated c. 6.7 m to the northwest.

There are two small floor to ceiling columns located at the western extent of the tube, with the northernmost column incorporated a raised shelf. This shelf is 5.3 m wide (northeast by southwest) and 0.65 m in height and opens onto an irregularly-shaped room that is 13.1 m long (east-northeast by west-south-west) and from 1.2 to 3.6 m wide. The floor is bare lava and the ceiling heights range from 0.5 to 1.8 m. A fragment of charcoal is present on the surface. There are two low, narrow passages that extend 1.1 to 3.3 m to the north and northwest from this room.

The entrance to a lower chamber is located along the southeastern side of the irregularly-shaped room. This entrance opens onto a chamber that is 10.9 m long (east-west) and from 1.0 to 3.3 m wide. The floor in this lower chamber is bare lava and the ceiling heights range from 0.6 to 1.2 m. Charcoal is present on the floor adjacent to the entrance.

Another raised shelf is present along the south side wall of Feature A, 10.0 m to the west from the small columns. This shelf is 3.7 m wide and 0.5 m in height and opens onto an L-shaped room that is 9.3 m long, 1.5 to 1.8 m wide and 0.4 to 1.0 m in height. The floor is bare lava and no cultural remains were present. A fragment of charcoal is located on the floor of the main tube to the north of this shelf and to the west of the secondary vertical entrance. Another fragment of charcoal is located on the floor 6.5 m west of the eastern end of the large floor to ceiling column in this area. An area of roof fall is located adjacent to the charcoal to the east.

The entrance to the Feature B chamber is 35.5 m north-northeast of the eastern Feature A entrance. This is comprised of an oval-shaped vertical opening that is 1.5 m long (north-south), 1.0 m wide and 0.6 m in depth. This opens onto an irregularly-shaped chamber that is 5.0 m long (north-northwest by south-southeast), 1.4 to 2.5 m wide with a ceiling height that averages 0.6 m. The floor is comprised of bare lava. A fragment of charcoal is present on the floor at the north end of the chamber and a rodent bone is located to the west of the entrance. The blocked inaccessible passage leading to Feature A is situated at the south end of the Feature B chamber.

Site 26900 is interpreted as a temporary habitation shelter. This is based on its formal type and on the presence of the cultural remains within the interior. The site has an overall length of 133.5 linear meters and an area of 434.5 sq m. The site is unaltered, in good condition and is assessed as significant for its information content.

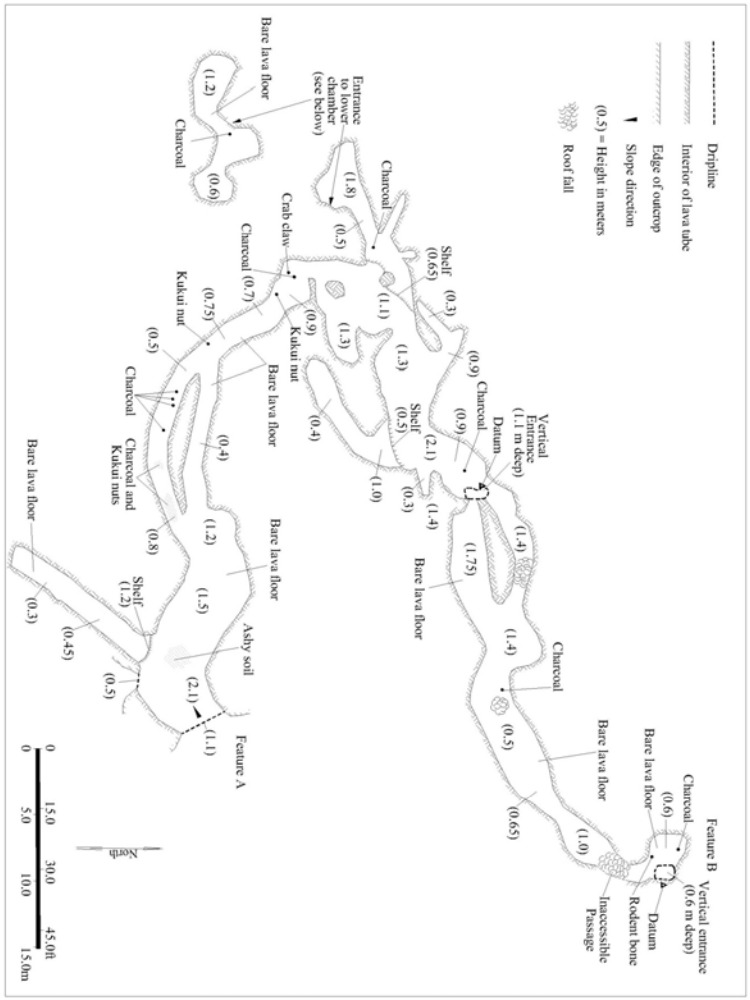

Figure 10. Site 26900 Plan Map

Site 26901

Site 26901 is a lava tube accessed through a vertical entrance at c. 468 ft elevation. This entrance is circular and is 2.8 m long (north-northwest by south-southeast), 2.7 m wide and 1.7 m in depth below the surrounding ground surface (*Figure 11*). Passages extend to the east and west from the entrance.

The passage to the east extends 7.8 m in this direction, where it bisects into two chambers, one extending to the east-northeast and one to the east-southeast. The passage is 1.9 to 3.55 m wide with a bare lava floor and ceiling heights that range from 1.2 to 1.7 m. A burnt *kukui* nut shell is located to the east of the vertical entrance and a goat skeleton is adjacent to the entrance to the northeast.

The passage that extends to the east-northeast from the split is 5.0 m in length and 1.0 to 1.2 m wide. The floor is bare lava and the ceiling height average 0.3 m. The passage to the east-southeast extends in this direction for 7.3 m where it becomes inaccessible due to a low ceiling height (0.2 m). This chamber is 1.0 to 2.0 m wide and 0.6 to 0. 7 m in height with a bare lava floor. No cultural remains were present in either of these passages.

The portion of the lava tube that extends to the west from the vertical entrance continues in this direction for 7.4 m then angles to the north for 4.7 m. The tube then turns to the northeast and extends for 34.8 m where it terminates. This portion of the tube is 1.3 to 4.5 m wide with ceiling heights that range from 0.3 to 2.5 m. The floor throughout this chamber is bare lava.

There are four raised shelves in this passage. The first is located at the western end, located 1.6 m above the main floor of the tube. It is 3.8 m long (northeast by southwest) and 1.4 m wide and 0.15 m in height. The second shelf is situated along the north wall of the tube, 8.3 m to the northeast from the first. It is 0.4 m above the main floor and is 7.0 m wide (northeast by southwest) and 1.25 to 1.5 m deep. The ceiling height is 0.4 m in height. A low, narrow (0.4 m wide) passage extends 1.9 m to the northeast from the east end of the shelf. A burnt *kukui* nut shell is present on the floor of the main tube below this shelf and a small rock ring is located 3.3 m to the east of the *kukui*.

The third shelf is situated on the north tube wall 7.4 m northeast of the second. The shelf is 0.5 m in height above the main floor and is 2.6 m long (northwest by southeast), 0.45 m wide and 0.25 m in height. The fourth shelf is located in the south side wall, on the opposite side of the tube from the third shelf. It is 0.7 m in height above the main floor and is 2.2 m long (northwest by southeast), 0.45 m wide and 0.2 m in height. No cultural remains were present on the surface of any of the shelves.

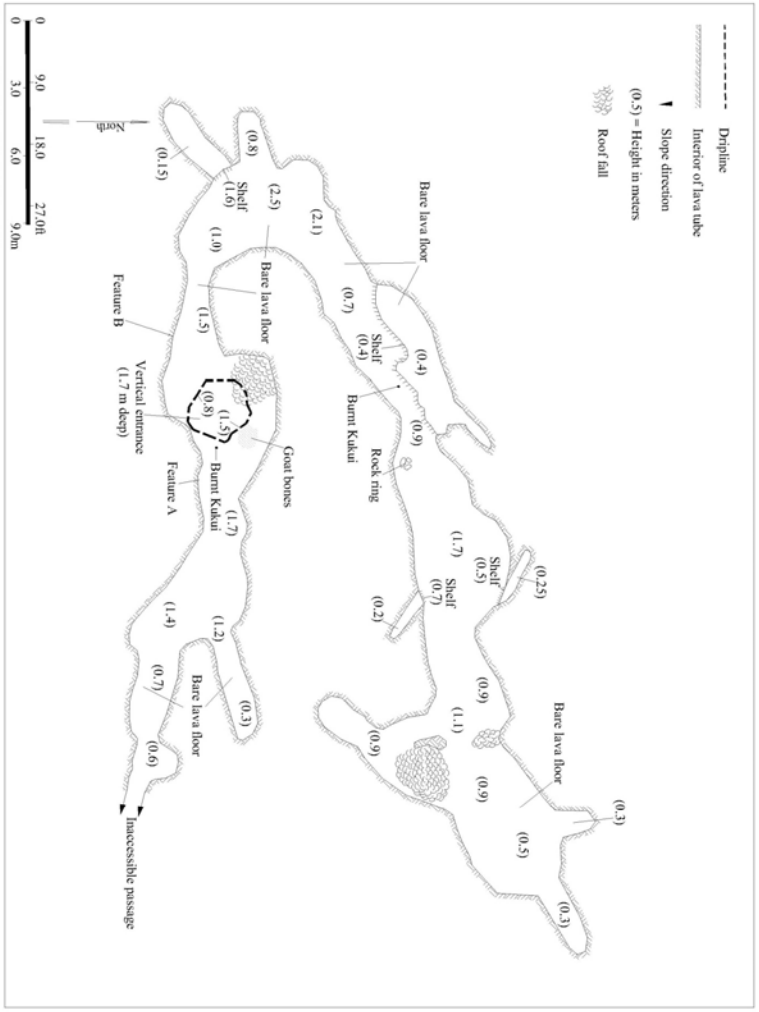

Figure 11. Site 26901 Plan Map

There is a floor to ceiling column located at the eastern end of this portion of the site, with an area of roof fall adjacent to it to the east. A second area of roof fall is located to the north of the column, against the north tube wall. A passage extends 5.4 m to the southwest from the column. It is 1.1 to 3.8 m wide and 0.9 m in height, with a bare lava floor and no cultural remains.

Site 26901 is interpreted as a temporary habitation shelter. This is based on its formal type and on the presence of the cultural remains in the interior. The rock ring in the tube indicates that the site was also used to collect water. The site has an overall length of 87.6 linear meters and an area of 216.1 sq m. The site is unaltered, in good condition and is assessed as significant for its information content.

Site 26902

Site 26902 is a large complex lava tube with two main sinkhole entrances, located at elevations ranging from c. 435-460 ft (*Figure 12*). The northern-most entrance is 3.4 m long (north-south) and 2.9 m wide and 1.7 m deep. Passages extend to the north-northeast and to the south-southwest from this entrance. The north-northeast passage opens onto a chamber contain a bare lava floor and no cultural remains.

The passage to the south-southwest from the northern-most sinkhole extends in this direction for 7.75 m, where the second sinkhole entrance is located. This passage is 3.4 to 3.9 m wide and 1.2 to 1.4 m in height, with a bare lava floor. Roof fall is present at the north end of this passage, with a goat skeleton located to the south.

The second sinkhole is 6.4 m long (west-northwest by east-southeast) and 5.9 m wide. The floor of the sinkhole is partially covered in roof fall with dripline heights ranging from 1.4 to 1.5 m. There is a concentration of goat bones to the west of this sink, and a small skylight entrance to the west of the bones. Passages extend to the west and southwest from the second sinkhole.

The passage to the southwest extends in this direction for 13.7 m where it splits into two passages, one extending to the south and one continuing to the southwest. This chamber is 1.4 to 7.5 m wide and 0.8 to 1.4 m in height with a bare lava floor. There are three concentrations of human remains located on the floor of this passage, located 4.4 m southwest of the sinkhole. The first concentration consists of a clavicle, several vertebrae and unidentified bone fragments. The second concentration is located 0.7 m to the west of the first. This contains a human tooth and several unidentified bone fragments. The third concentration is situated adjacent to the second to the north. This contains metatarsals, teeth, phalanges and a calcaneous. The remains likely represent the remains of a single individual.

There is a raised ledge along the eastern side of this passage, 5.0 m southwest of the human remains. It is 1.0 m in height above the floor of the tube and is irregularly-shaped. It is 6.3 m long (northeast by southwest) and 0.65 to 2.5 m wide, with a bare lava floor and no cultural remains present. The ceiling heights in this chamber average 0.3 m.

The passage that extends to the southwest from the split extends in this direction for 14.9 m, and is 1.2 to 2.9 m wide and 0.45 to 1.1 m in height. The floor is bare lava and no cultural remains are present. There is a hole at the southwest end of this chamber that is 3.3 m long (northeast by southwest), 1.1 m wide and 2.3 m deep. This hole opens onto a lower chamber that is 9.3 m in length (northeast by southwest), 3.3 m wide and 1.0 to 1.4 m in height. The floor consists of bare lava with no cultural remains.

The passage that extends to the south from this split continues in this direction for 8.7 m where it opens onto a large room. A low, narrow passage extends to the east-northeast from this chamber for 6.2 m where it terminates. This passage is 0.7 to 1.1 m wide with and 0.2 m in height. The large room is 12.0 m in length (northeast by southwest) and 8.7 m wide and is bisect by a floor to ceiling column. The floor is bare lava and the ceiling heights range from 0.5 to 1.5 m. Passages extend to the west, southwest and east from this room.

Figure 12. Site 26902 Plan Map

The passage to the west extends in this direction for 12.1 m where it is bisected by a floor to ceiling column. This chamber is 4.4 to 6.5 m wide and 1.3 m in height. There is an area of roof fall at the west end and a crab claw along the northern wall. The tube extends around the column to the north and south and continues to the southwest for 12.6 m where it terminates. This portion of the passage is 1.0 to 3.8 m wide and 0.4 to 0.7 m in height.

The passage to the southwest from the large room is accessed through a 1.0 m wide by 0.25 m high opening. This leads to an irregularly-shaped chamber that is 9.5 m long (northeast by southwest) and 1.75 to 8.4 m wide. The floor in this chamber is bare lava with no cultural remains and the ceiling heights average 0.2 m.

The passage to the east of the large room is irregularly-shaped and is 15.3 m long (east-west) and from 0.8 to 12.2 m wide. A narrow, inaccessible passage extends to the northwest and northeast from this irregularly-shaped chamber. A passage also extends to the south, opening onto a raised ledge that has a secondary opening above the floor of the large room. This chamber is 6.0 m long (north-south), 1.1 to 4.75 m wide and 0.2 to 0.7 m in height. The floor is bare lava and no cultural remains were present.

The passage that extends to the west from the second sinkhole entrance continues in this direction for 2.5 m where it divides into two chambers, one extending to the northeast and one to the southwest. The northeast passage continues for 28.9 m, then it angles to the east for 10.0 m. It then turns to the north for 5.2 m and turns to the east-northeast for an additional 23.4 m where it terminates. This passage is 1.2 to 7.8 m in width with ceiling heights that vary from 0.2 m at the northeastern end to 3.2 m at its highest point. The floor is bare lava with several areas of roof fall. Charcoal and a crab claw were present on the floor of the tube in this area.

Two raised shelves are present in this passage, one on the east side and one opposite it on the west side. These shelves range in length from 1.3 to 4.4 m, in width from 1.0 to 2.5 m and in height from 0.65 to 2.2 m.

The passage to the southwest from the split extends in this direction for 27.2 m where it becomes inaccessible at a low restricted passage. This chamber is 2.1 to 7.0 m wide and 0.6 to 4.0 m in height, with a floor to ceiling column located at the southwestern end. The floor is bare lava and no cultural remains were present. A second inaccessible passage extends an undetermined distance to the east from this chamber.

Site 26902 is interpreted as a temporary habitation shelter that was also utilized as a burial site. The temporary habitation function is indicated by its formal type and on the presence of the cultural remains and the burial function is evidenced by the human remains. The site has an overall length of 230.0 m and an area of 990.0 sq m. The site is unaltered, in good condition and is assessed as significant for its information content and its cultural value.

Site 26903

Site 26903 is a lava tube accessed through a rubble filled sinkhole located at c. 435 ft elevation. This entrance is oval-shaped and is 6.3 m long (northeast by southwest), 3.75 m wide and 1.5 m deep (*Figure 13*). Passages extend to the northeast and west-southwest from this sinkhole. The passage to the northeast is accessed through a 0.5 m tall opening. It is irregularly-shaped and is 6.2 m long (north-south) and 1.3 to 4.0 m wide. A second sinkhole opening (6.4 m long, 3.8 m wide and 1.3 m deep) borders this chamber along the east side. The floor is bare lava and the ceiling height averages 1.0 m. There is a concentration of goat bones present along the northern side wall.

The passage that extends to the west-southwest from the main sinkhole is accessed through a 0.8 m high opening. The tube extends in this direction for 13.1 m then angles to the northwest for 32.9 m. The tube then turns to the west-southwest for an additional 20.6 m where it terminates. This linear chamber is 2.7 to 6.6 m wide and 0.5 to 2.1 m in height. The floor throughout this tube is bare lava. A passage

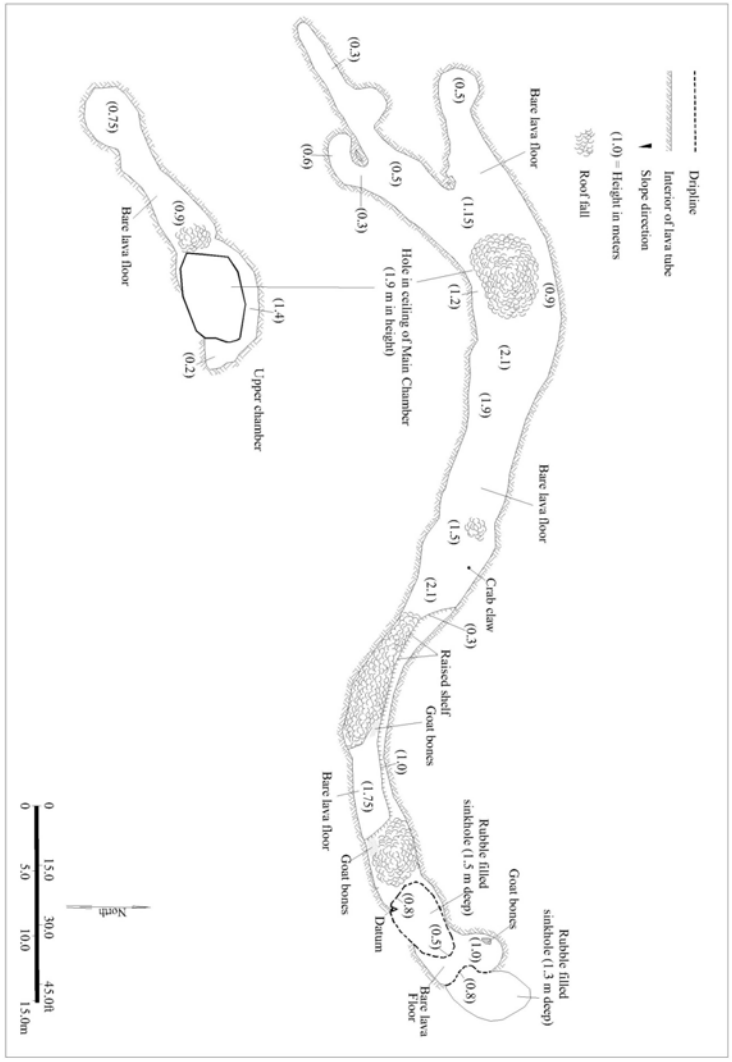

Figure 13. Site 26903 Plan Map

extends to the south-southwest from the western end of this passage. It is 20.3 m long, 1.5 to 3.7 m wide and 0.3 to 0.6 m in height with a bare lava floor.

There is a raised shelf present along the north side of the tube 5.0 to 21.0 m west of the entrance. This shelf is 0.3 to 1.0 m in height above the floor of the passage. There are areas of roof fall to the east and south of this shelf with concentrations of goat bones present in each roof fall area. There is a crab claw present on the tube floor to the northwest of the raised shelf.

There is a large oval-shaped hole in the ceiling of this chamber at the western end that is 7.6 m long (northeast by southwest), 4.8 m wide and 1.9 m in height. This opens onto an upper chamber that is 23.7 m long (northeast by southwest) and 1.95 to 4.0 m wide, with a bare lava floor and ceiling heights that vary from 0.2 to 1.4 m. No cultural remains were present.

Site 26903 is interpreted as a possible temporary habitation shelter. This is based on its formal type and on the presence of the crab claw within the interior. The site contains an overall length of 125.0 m and an area of 461.5 sq m. The site is unaltered and in good condition and is assessed as significant for its information content.

Agricultural Features

The survey of Transect 1 identified 14 agricultural features consisting of 12 modified outcrops and 2 mounds that are categorized as elements of an agricultural complex that extends throughout the project area (Site 26909 - see *Table 7* and *Figure 5*). The majority of the Site 26909 features in Transect 1 are constructed of piled cobbles and small boulders and are irregular in shape. No cultural remains were present. These features, and the ones noted in Transects 2 and 3 (discussed below) were interpreted to be agricultural clearing piles based on formal type, informal construction and absence of cultural remains. The features are unaltered, in fair condition and are assessed as significant for their information content.

The modified outcrops range in length from 1.0 to 5.0 m (average of 2.06 m), from 0.6 to 2.5 m wide (average of 1.4 m) and from 0.2 to 0.6 m in height (average of 0.37). The mounds are 1.3 to 1.4 m long, 1.0 to 1.2 m wide and 0.4 to 0.7 m in height.

One of the mounds was subjected to detailed recording and subsurface testing during the study. Feature T-119 is a mound situated at c. 482 ft elevation. The mound is oval shaped and is built adjacent to the south side of a raised bedrock outcrop (*Figure 14*). The mound is 1.65 m long (east-west) and 1.4 m wide, with sides comprised of stacked and faced cobbles and small boulders that vary in height from 0.44 to 0.88 m above the surrounding ground surface. The eastern side has collapsed outward and the surface is level but unpaved. No cultural remains were present on the surface.

A 0.5 by 1.0 m test unit (TU-3) was excavated into the mound during the present project to determine its function. The excavation revealed two layers over bedrock (see *Figure 14*). Layer I consisted of 0.52 to 0.58 m of tightly packed pebbles, cobbles and small boulders with no cultural remains present. Layer II was comprised of 0.01 to 0.05 m of a very dark grayish brown (10YR 3/2) silt with 40% pebble inclusions. A fragment of charcoal and an unburned *kukui* nut shell was recovered from Layer II. Feature T-119 was assigned an agricultural function based on the limited amount of cultural remains recovered from TU-3.

Pahoehoe Excavations

The survey of Transect 1 identified five pahoehoe excavations. These features and the ones documented in Transects 2 and 3 are designated as components of a complex of pahoehoe excavations that span the project area (Site 26910). These features are comprised of areas that have been excavated into the surface of pahoehoe outcrops with the stone material removed from the excavations usually piled around their perimeters. These features are summarized in *Table 7* and their locations are depicted in *Figure 5*. They range in length from 1.0 to 3.0 m (average 1.87 m), in width from 0.4 to 1.2 m (average 0.91 m) and in depth from 0.2 to 0.5 m (average 0.34 m). These features are all irregular in shape and no cultural remains were present.

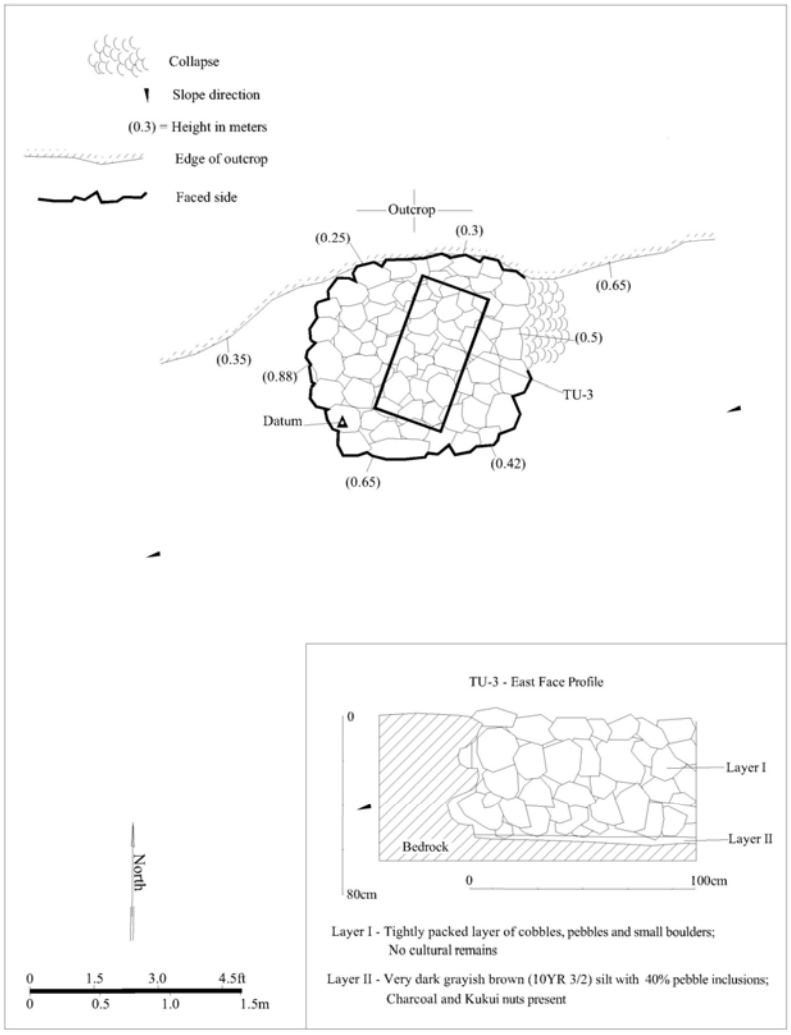

Figure 14. Site 26909, Feature T-119 Plan Map and TU-3 East Face Profile

Pahoehoe excavations have been documented throughout western Hawaii Island and have been assigned a variety of functional interpretations. These interpretations consists of agricultural features (Carter 1986, O'Hare and Goodfellow 1994, Hammatt et al. 1987, and Reinecke 1930), quarries for vesicular lava for making abraders (Donham 1987), quarries for fine-grained basalt (Haun and Henry 2002), and the result of stone removal to obtain juvenile dark rumped petrels from nests in crevices in the lava (Nakamura et al. 1998). Nakamura et al. (1998) hypothesize that the excavated areas artificially enhanced natural nesting areas and increased the predictability of the birds as a food resource.

Dye (2002) recorded over 1,200 excavated pahoehoe pits at Manini'owali and Kuki'o 2 in North Kona. He convincingly argues that traditional Hawaiian cultivation in excavated pits was in a'a lava and concludes that agricultural use of the pits in his arid project area would have been too marginal to warrant the apparent intensive effort put into excavating the pits. Dye evaluated the hypothesis that the pits were used to obtain stone for construction and discounts it as a primary purpose for pahoehoe excavations. He also evaluated the hypothesis that the pits were used as nesting sites. This was confirmed for a very small number (19) of pits where gravel-size pieces of pumice that had been digested by sea birds were recovered. Radiocarbon dates on a sea bird bones from habitation sites in Dye's project area indicated that the birds were being used as food sometime in the A.D 1500-1600s.

Dye interpreted the presence of large waterworn cobble hammerstones associated with pahoehoe excavations and found in temporary habitation sites as indicting that pit excavation was a recurrent activity. Dye was not able to make a strong case for any specific dominant use for the pits with data limited to his project area, concluding that "the importance of the pits might not have been that any one function was particularly useful, but rather that they served a wide variety of functions - seabird nest, water catchment, sweet potato planter, construction material quarry, and others – which, in aggregate, improved the quality of life…" (2002:96).

The five pahoehoe excavations recorded in Transect 1 and those documented in Transects 2 and 3 (discussed below) are assigned a possible resource procurement function created to obtain vesicular lava for the manufacture of abraders. These features resemble those found in the extensive abrader quarrying and production sites documented at 'Anaeho'omalu where the entire process from raw material extraction to abrader shaping occurred in the same locale (Donham 1987, Donham and Jensen 1988, Welch 1989, Jensen 1989a-e, 2001, Burgett et al. 1999, Landrum et al. 2002, and Haun and Henry 2004); however, unlike the quarry and production sites at 'Anaeho'omalu no abraded surfaces, which were used to shape the abraders, were identified. This suggests that either the manufacturing activity occurred elsewhere, or the excavations are the result of prospecting activity that did not yield suitable material.

PHRI Sites within Transect 1

PHRI plotted four sites that fall within the boundaries of Transect 1 (Sites 13463, 13475, 13477 and 13478). These sites consist of a ceremonial/burial/habitation complex with five features (Site 13463), an agricultural blister (Site 13475), an agricultural/habitation complex with four features (Site 13477) and an agricultural complex with six features (see *Table 6*). Unfortunately, no plan maps depicting all features of these sites were presented in the Donham (1990) report. With the exception of the Feature A platform at Site 13463, none of these sites could be positively correlated with the sites identified in Transect 1 during the present study.

Four additional sites are located within 70.0 m of Transect 1. These consist of an agriculture complex with three features (Site 13440), a habitation/agricultural complex with 21 features (Site 13441), a trail (Site 13452) and a complex comprised of ten pahoehoe excavations (Site 13476). None of these sites correspond to those documented within Transect 1. Site 13441 was re-located during the present study, although it is situated well south of Transect 1.

Transect 2

Transect 2 extends through the central portion of the project area from c. 319 to 410 ft elevation. It is 557.5 m in length and encompasses an area of 6.5 acres (*Figure 15*). The survey of Transect 2 identified five sites and five non-cultural caves. The sites consist of a temporary habitation terrace (Site 26904), a

Table 7. Agricultural/Resource Procurement Sites and Non-cultural Caves in Transects*

H & A Temp. Site No.	Formal Type	Function	Length (m)	Width (m)	Height/ Depth (m)	Shape	Construction	East UTM	North UTM
Transect 1									
10	Non-cultural Cave	Non-site	-	-	-	-	Natural	186579	2176924
105	Non-cultural Cave	Non-site	-	-	-	-	Natural	186765	2177028
107	Non-cultural Cave	Non-site	-	-	-	-	Natural	186761	2177021
108	Modified outcrop	Agriculture	1.00	0.60	0.60	Irregular	PC&B**	186752	2177035
110	Non-cultural Cave	Non-site	-	-	-	-	Natural	186744	2177009
111	Non-cultural Cave	Non-site	-	-	-	-	Natural	186733	2177010
113	Non-cultural Cave	Non-site	-	-	-	-	Natural	186658	2176993
114	Non-cultural Cave	Non-site	-	-	-	-	Natural	186679	2176979
116	Pahoehoe Excavation	Resource Procurement	1.10	1.10	-0.35	Irregular	Excavated	186661	2176980
117.1	Modified outcrop	Agriculture	1.60	0.90	0.30	Irregular	PB&C	186666	2176976
117.2	Mound	Agriculture	1.30	1.00	0.70	Irregular	PB&C	186668	2176990
118	Non-cultural Cave	Non-site	-	-	-	-	Natural	186650	2176994
119	Mound	Agriculture	1.65	1.40	0.88	Oval	Stacked and faced cobbles and small boulders - Tested with TU-3	186679	2176956
121	Modified outcrop	Agriculture	5.00	1.20	0.40	Irregular	PB&C	186657	2176973
122	Non-cultural Cave	Non-site	-	-	-	-	Natural	186647	2176992
124.1	Pahoehoe Excavation	Resource Procurement	2.00	1.00	-0.35	Irregular	Excavated	186648	2176971
124.2	Pahoehoe Excavation	Resource Procurement	1.00	0.40	-0.20	Irregular	Excavated	186639	2176969
124.3	Pahoehoe Excavation	Resource Procurement	3.00	1.20	-0.25	Irregular	Excavated	186635	2176968
126	Non-cultural Cave	Non-site	-	-	-	-	Natural	186658	2176947
127	Non-cultural Cave	Non-site	-	-	-	-	Natural	186648	2176947
129	Non-cultural Cave	Non-site	-	-	-	-	Natural	186629	2176941
130	Non-cultural Cave	Non-site	-	-	-	-	Natural	186613	2176963
132	Modified outcrop	Agriculture	1.60	1.10	0.30	Irregular	PB&C	186589	2176931
133	Non-cultural Cave	Non-site	-	-	-	-	Natural	186588	2176916
135.1	Non-cultural Cave	Non-site	-	-	-	-	Natural	186572	2176909
135.2	Non-cultural Cave	Non-site	-	-	-	-	Natural	186577	2176911

Table 7. Agricultural/Resource Procurement Sites and Non-cultural Caves in Transects (cont.)

H & A Temp. Site No.	Formal Type	Function	Length (m)	Width (m)	Height/ Depth (m)	Shape	Construction	East UTM	North UTM
136	Non-cultural Cave	Non-site	-	-	-	-	Natural	186562	2176928
137	Non-cultural Cave	Non-site	-	-	-	-	Natural	186567	2176918
138	Non-cultural Cave	Non-site	-	-	-	-	Natural	186549	2176938
139.1	Modified outcrop	Agriculture	2.50	2.50	0.20	Irregular	PB&C	186563	2176910
139.2	Modified outcrop	Agriculture	1.80	1.80	0.30	Irregular	PB&C	186567	2176911
140.1	Pahoehoe Excavation	Resource Procurement	2.00	1.10	-0.50	Irregular	Excavated	186565	2176906
140.2	Modified outcrop	Agriculture	1.80	1.00	0.35	Irregular	PB&C	186561	2176902
144	Modified outcrop	Agriculture	1.20	1.10	0.25	Irregular	PB&C	186425	2176825
146	Modified outcrop	Agriculture	1.00	1.00	0.35	Irregular	PB&C	186365	2176837
147	Modified outcrop	Agriculture	2.00	2.00	0.40	Irregular	PB&C	186365	2176810
148	Modified outcrop	Agriculture	2.00	2.00	0.55	Irregular	PB&C	186361	2176822
150	Non-cultural Cave	Non-site	-	-	-	-	Natural	186362	2176804
151	Non-cultural Cave	Non-site	-	-	-	-	Natural	186346	2176782
152	Modified outcrop	Agriculture	1.30	1.30	0.35	Irregular	PB&C	186214	2176740
153	Non-cultural Cave	Non-site	-	-	-	-	Natural	186198	2176710
154	Non-cultural Cave	Non-site	-	-	-	-	Natural	186177	2176723
155	Non-cultural Cave	Non-site	-	-	-	-	Natural	186118	2176664
Transect 2									
86	Non-cultural Cave	Non-site	-	-	-	-	Natural	186250	2176237
87	Non-cultural Cave	Non-site	-	-	-	-	Natural	186241	2176242
91	Non-cultural Cave	Non-site	-	-	-	-	Natural	186329	2176239
93	Non-cultural Cave	Non-site	-	-	-	-	Natural	186413	2176324
95	Pahoehoe Excavation	Resource Procurement	1.60	0.40	-0.40	Irregular	Excavated	186467	2176343
99	Modified outcrop	Agriculture	1.30	1.10	0.70	Irregular	PB&C	186589	2176424
100	Non-cultural Cave	Non-site	-	-	-	-	Natural	186626	2176424
101	Mound	Agriculture	1.00	1.00	0.70	Irregular	PB&C	186654	2176434
Transect 3									
12	Modified outcrop	Agriculture	5.50	3.80	1.50	Irregular	PB&C	187085	2176114
13	Mound	Agriculture	2.00	1.50	0.50	Irregular	PB&C	187074	2176112
14.1	Mound	Agriculture	2.10	1.30	0.50	Irregular	PB&C	187076	2176078

Table 7. Agricultural/Resource Procurement Sites and Non-cultural Caves in Transects (cont.)

H & A Temp. Site No.	Formal Type	Function	Length (m)	Width (m)	Height/ Depth (m)	Shape	Construction	East UTM	North UTM
14.2	Mound	Agriculture	1.70	1.50	0.45	Irregular	PB&C	187074	2176075
14.3	Mound	Agriculture	1.40	1.20	0.55	Irregular	PB&C	187076	2176072
16	Mound	Agriculture	1.80	1.40	0.50	Irregular	PB&C	187058	2176097
18.1	Modified outcrop	Agriculture	4.00	1.60	0.70	Linear	PB&C	187060	2176067
18.2	Modified outcrop	Agriculture	2.40	1.30	0.60	Irregular	PB&C	187062	2176072
19	Modified outcrop	Agriculture	5.20	1.50	0.70	Linear	PB&C	187056	2176075
21.1	Mound	Agriculture	1.40	1.30	0.65	Irregular	PB&C	187030	2176061
21.2	Modified outcrop	Agriculture	2.20	1.90	0.80	Irregular	PB&C	187021	2176067
22.1	Mound	Agriculture	1.50	1.50	0.40	Irregular	PB&C	187035	2176060
23.1	Mound	Agriculture	2.00	2.00	0.40	Irregular	PB&C	187043	2176057
23.2	Mound	Agriculture	2.20	2.00	0.60	Irregular	PB&C	187045	2176053
24	Mound	Agriculture	2.00	2.00	0.65	Irregular	PB&C	187027	2176054
25.1	Modified outcrop	Agriculture	4.00	1.30	0.80	Linear	PB&C	187028	2176047
25.2	Mound	Agriculture	2.00	1.60	0.80	Irregular	PB&C	187032	2176044
25.3	Modified outcrop	Agriculture	1.40	1.00	0.45	Irregular	PB&C	187028	2176050
25.4	Modified outcrop	Agriculture	3.20	1.70	0.60	Irregular	PB&C	187021	2176051
26.1	Modified outcrop	Agriculture	3.70	1.40	0.55	Linear	PB&C	186996	2176077
26.2	Mound	Agriculture	2.00	2.00	0.70	Irregular	PB&C	186996	2176075
27	Modified outcrop	Agriculture	3.50	3.00	0.60	Irregular	PB&C	187018	2176057
28	Modified outcrop	Agriculture	2.00	1.90	0.65	Irregular	PB&C	187015	2176043
29	Modified outcrop	Agriculture	2.50	1.30	0.70	Irregular	PB&C	187009	2176048
30	Mound	Agriculture	3.30	3.00	0.65	Irregular	PB&C	186994	2176057
32.1	Mound	Agriculture	2.70	2.20	1.00	Irregular	PB&C	186982	2176044
32.2	Non-cultural Cave	Non-site	-	-	-	-	Natural	186988	2176042
33	Modified outcrop	Agriculture	3.30	3.00	0.75	Irregular	PB&C	186984	2176041
34	Mound	Agriculture	2.40	2.00	1.20	Irregular	PB&C	186975	2176049
35	Non-cultural Cave	Non-site	-	-	-	-	PB&C	186968	2176054
37.1	Mound	Agriculture	2.20	1.40	0.60	Irregular	PB&C	186966	2176038
37.2	Mound	Agriculture	2.00	1.70	0.65	Irregular	PB&C	186972	2176036
37.3	Modified outcrop	Agriculture	2.60	1.80	1.00	Irregular	PB&C	186966	2176034
37.4	Mound	Agriculture	1.50	1.00	0.50	Irregular	PB&C	186965	2176044
37.5	Mound	Agriculture	1.50	1.20	0.50	Irregular	PB&C	186968	2176045

Table 7. Agricultural/Resource Procurement Sites and Non-cultural Caves in Transects (cont.)

H & A Temp. Site No.	Formal Type	Function	Length (m)	Width (m)	Height/ Depth (m)	Shape	Construction	East UTM	North UTM
38.1	Mound	Agriculture	2.00	1.40	0.70	Irregular	PB&C	186961	2176047
38.2	Modified outcrop	Agriculture	3.50	1.70	0.60	Irregular	PB&C	186962	2176043
38.3	Modified outcrop	Agriculture	1.40	1.00	0.50	Irregular	PB&C	186956	2176047
38.4	Modified outcrop	Agriculture	1.60	1.30	0.55	Irregular	PB&C	186955	2176050
38.5	Modified outcrop	Agriculture	1.20	1.20	0.50	Irregular	PB&C	186952	2176057
38.6	Modified outcrop	Agriculture	1.80	1.10	0.70	Irregular	PB&C	186946	2176054
39	Modified outcrop	Agriculture	2.10	1.90	0.55	Irregular	PB&C	186959	2176056
40.1	Modified outcrop	Agriculture	6.00	5.00	1.50	Irregular	PB&C	186965	2176030
40.2	Modified outcrop	Agriculture	2.60	1.70	0.50	Irregular	PB&C	186959	2176034
40.3	Mound	Agriculture	2.40	1.20	0.85	Irregular	PB&C	186966	2176038
41.1	Modified outcrop	Agriculture	2.40	1.60	0.60	Irregular	PB&C	186972	2176031
41.2	Modified outcrop	Agriculture	1.00	0.70	0.65	Irregular	PB&C	186973	2176030
43.1	Mound	Agriculture	1.70	1.20	0.45	Irregular	PB&C	186952	2176047
43.2	Mound	Agriculture	2.30	1.20	0.50	Irregular	PB&C	186952	2176054
43.3	Non-cultural Cave	Non-site	-	-	-	-	Natural	186961	2176041
44	Modified outcrop	Agriculture	1.60	1.00	0.70	Irregular	PB&C	186975	2176020
45	Mound	Agriculture	2.50	2.00	0.70	Irregular	PB&C	186953	2176023
46.1	Modified outcrop	Agriculture	2.10	1.70	0.50	Irregular	PB&C	186950	2176024
46.2	Modified outcrop	Agriculture	2.90	1.30	0.45	Irregular	PB&C	186939	2176030
46.3	Mound	Agriculture	1.60	1.40	0.60	Irregular	PB&C	186942	2176028
47	Mound	Agriculture	2.00	1.70	0.40	Irregular	PB&C	186942	2176037
48.1	Modified outcrop	Agriculture	3.80	1.60	1.10	Irregular	PB&C	186937	2176029
48.2	Modified outcrop	Agriculture	3.00	1.50	0.60	Irregular	PB&C	186933	2176023
50	Modified outcrop	Agriculture	3.40	1.40	0.65	Irregular	PB&C	186925	2176031
51.1	Modified outcrop	Agriculture	1.70	1.60	1.20	Irregular	PB&C	186887	2175991
51.2	Modified outcrop	Agriculture	6.00	1.00	0.80	Linear	PB&C	186881	2175987
51.3	Modified outcrop	Agriculture	2.60	1.20	0.65	Irregular	PB&C	186884	2175997
53.1	Modified outcrop	Agriculture	1.50	1.30	0.45	Irregular	PB&C	186894	2175985
53.2	Modified outcrop	Agriculture	2.20	1.40	0.60	Irregular	PB&C	186889	2175983
54	Modified outcrop	Agriculture	2.80	2.00	0.75	Irregular	PB&C	186889	2175981
56	Mound	Agriculture	1.30	1.00	0.60	Irregular	PB&C	186858	2175990

Table 7. Agricultural/Resource Procurement Sites and Non-cultural Caves in Transects (cont.)

H & A Temp. Site No.	Formal Type	Function	Length (m)	Width (m)	Height/ Depth (m)	Shape	Construction	East UTM	North UTM
57	Non-cultural Cave	Non-site	-	-	-	-	PB&C	186871	2175975
59	Modified outcrop	Agriculture	2.00	1.20	0.75	Irregular	PB&C	186846	2175991
60	Modified outcrop	Agriculture	1.50	1.20	0.70	Irregular	PB&C	186842	2175993
61	Mound	Agriculture	1.00	1.00	0.55	Irregular	PB&C	186841	2175984
63	Modified outcrop	Agriculture	3.00	3.00	0.40	Irregular	PB&C	186829	2175964
64	Mound	Agriculture	1.70	1.60	0.40	Irregular	PB&C	186816	2175951
65	Modified outcrop	Agriculture	1.00	1.00	0.45	Irregular	PB&C	186793	2175976
66	Mound	Agriculture	3.20	2.00	0.55	Irregular	PB&C	186809	2175955
67	Modified outcrop	Agriculture	1.70	1.50	0.50	Irregular	PB&C	186790	2175950
68	Mound	Agriculture	1.20	1.00	0.55	Irregular	PB&C	186797	2175942
69	Non-cultural Cave	Non-site	-	-	-	-	Natural	186764	2175952
70	Mound	Agriculture	2.00	1.60	0.60	Irregular	PB&C	186732	2175935
71	Non-cultural Cave	Non-site	-	-	-	-	Natural	186723	2175928
72.1	Modified outcrop	Agriculture	2.30	2.10	0.40	Irregular	PB&C	186717	2175910
72.2	Pahoehoe Excavation	Resource Procurement	1.00	1.00	-0.20	Irregular	Excavated	186691	2175902
72.3	Mound	Agriculture	1.30	1.00	0.50	Irregular	PB&C	186681	2175886
75	Pahoehoe Excavation	Resource Procurement	2.00	1.50	-0.30	Irregular	Excavated	186582	2175849
79	Modified outcrop	Agriculture	2.20	1.40	0.85	Irregular	PB&C	186557	2175816
81.1	Modified outcrop	Agriculture	1.90	1.00	0.45	Irregular	PB&C	186514	2175784
81.2	Modified outcrop	Agriculture	2.50	1.00	0.70	Irregular	PB&C	186517	2175788
81.3	Modified outcrop	Agriculture	1.10	0.90	0.45	Irregular	PB&C	186516	2175782
82	Modified outcrop	Agriculture	2.30	2.10	0.30	Irregular	PB&C	186505	2175792
83	Non-cultural Cave	Non-site	-	-	-	-	Natural	186493	2175788
84.1	Modified outcrop	Agriculture	2.50	1.80	0.35	Irregular	PB&C	186454	2175802
84.2	Modified outcrop	Agriculture	2.10	2.10	0.50	Irregular	PB&C	186457	2175804

Agricultural features are components of Site 26909 complex . Resource Procurement features are components of Site 26910 complex

****PC&B=Piled cobbles and small boulders**

temporary habitation lava blister (Site 26905), two features of the agricultural complex present within the project area (Site 26909, Features T-99 and T-101), and one feature of the pahoehoe excavation complex (Site 26910, Feature T-95).

Site 26904

Site 26904 is a small terrace built on top of the northern side of a raised bedrock outcrop at c. 341 elevation. The terrace is rectangular in shape and is 4.5 to 5.4 m long (west-northwest by east-southeast) and from 1.5 to 2.3 m wide (*Figure 16*). There is a roughly stacked and faced cobble and small boulder retaining wall extending along the north side of the structure that is 0.3 to 0.65 m in height. The eastern side has collapsed outward and the western side is level with the surface of the outcrop. The southern side abuts the edge of the raised bedrock outcrop.

The surface of the terrace is comprised of a level cobble pavement. A waterworn basalt cobble is situated on the surface along the southern side. A 1.0 by 1.0 m test unit (TU-2) was excavated into the surface of the terrace revealing two layers over bedrock (see *Figure 16*). Layer I consisted of 0.07 to 0.36 m of tightly packed cobbles and small boulders. Cultural remains from Layer I consisted of a waterworn basalt cobble. Layer II consisted of 0.02 to 0.24 m of a very dark grayish brown (10YR 3/2) silt with 10% pebble inclusions. Cultural remains from this deposit were comprised of charcoal, *kukui* nut shells and marine shell.

Site 26904 is interpreted as the foundation for a temporary habitation structure. The site is unaltered, in fair condition and is assessed as significant for its information content.

Site 26905

Site 26905 is a lava blister accessed through a horizontal opening on the eastern side of a raised bedrock outcrop at c. 383 ft elevation (*Figure 17*). The entrance is 2.1 m long (north-northeast by south-southwest) and is 0.3 to 0.8 m in height. This opens onto a roughly oval-shaped chamber that is 6.0 m in length (northeast by southwest) and from 1.0 to 3.8 m wide. The ceiling heights range from 0.3 to 1.0 m and the floor is comprised of a shallow soil deposit over bedrock with scattered roof fall present at the northeast and southwest ends. Several *kukui* nut shells and a *Cypraea sp.* shell are present on the blister floor.

Site 26905 is interpreted as a temporary habitation shelter. This is based on its formal type and on the presence of the cultural remains in the interior. The site has an overall length of 6.00 m and an area of 15.7 sq m. The site is unaltered and in good condition and is assessed as significant for its information content.

Agricultural Features

Two agricultural features of the Site 26909 complex were identified during the survey of Transect 2 (see *Table 7* and *Figure 15*). These consist of a modified outcrop (Feature T-99) and a mound (Feature T-101). Feature T-99 is 1.3 m long, 1.1 m wide and 0.7 m in height and Feature T-101 is 1.0 m long, 1.0 m wide and 0.7 m in height. Both features are constructed of piled cobbles and small boulders and both are irregular in shape. No cultural remains were present.

Pahoehoe Excavations

The survey of Transect 2 identified one pahoehoe excavation feature of the Site 26910 complex (see *Table 7* and *Figure 15*). Feature T-95 is located on a surface outcrop at c. 367 elevation. It is irregular in shape and is 1.6 m in length and 0.4 m wide. The base of the site is 0.4 m below the surface of the outcrop with the excavated stones piled around its perimeter. No cultural remains were present.

PHRI Sites within Transect 2

No PHRI sites were located within the boundaries of Transect 2. The closest sites to Transect 2 consist of Site 13418, located 32.0 m to the north and Site 134174 situated 97.0 m north. Both of these sites consist of pahoehoe excavations.

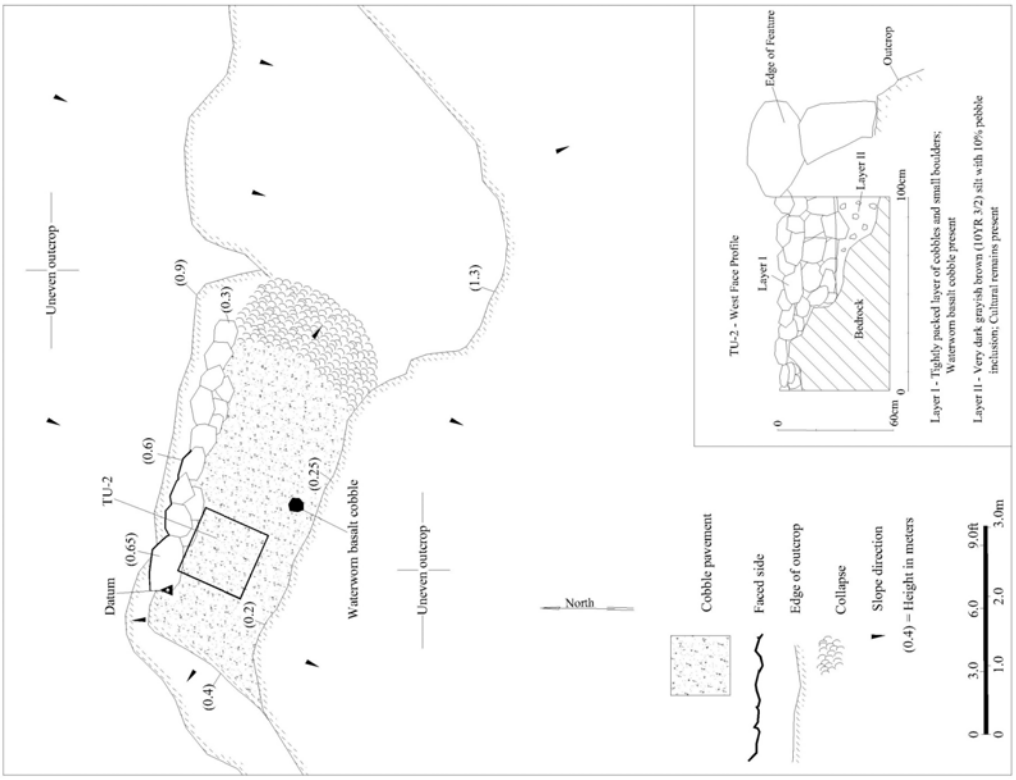

Figure 16. Site 26904 Plan Map and TU-2 West Face Profile

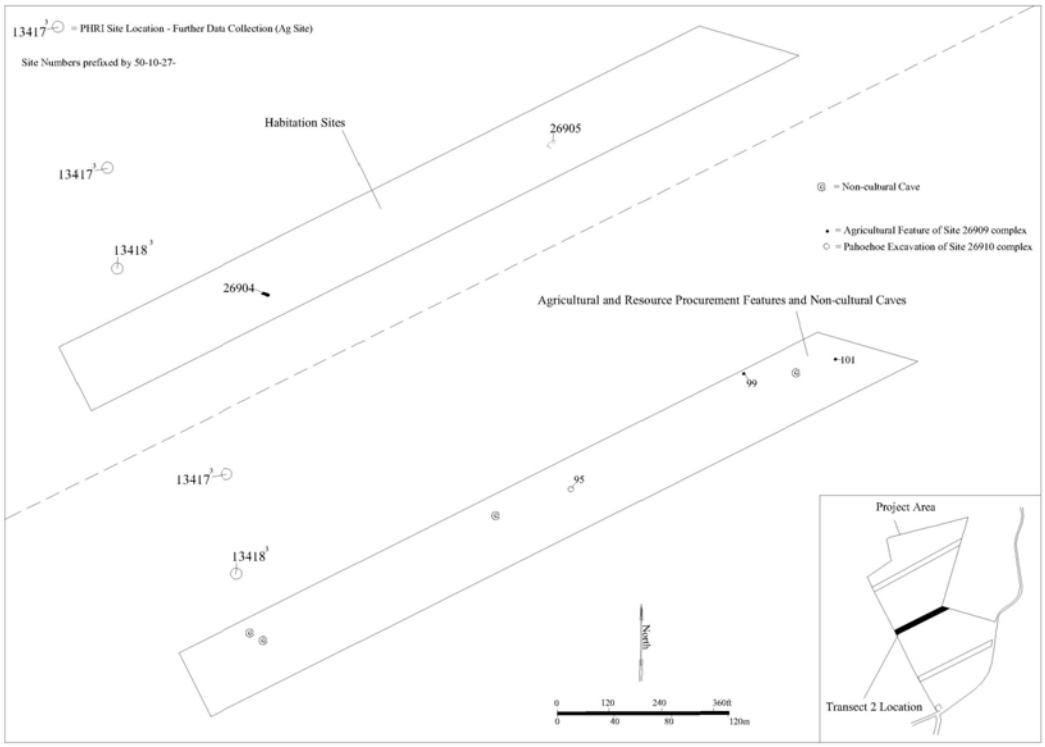

Figure 15. Location of Sites and Non-cultural Caves within Transect 2

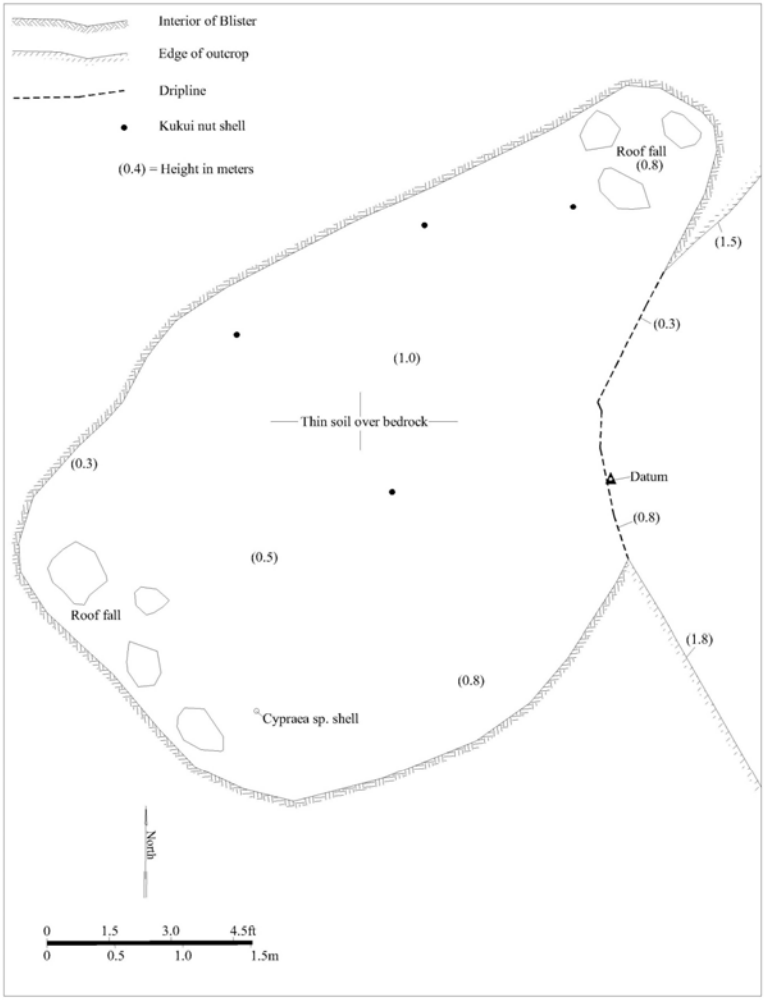

Figure 17. Site 26905 Plan Map

Transect 3

Transect 3 extends through the southern portion of the project area at elevations that range from c. 305 to 476 ft. It is 784.0 m in length and encompasses an area of 9.4 acres (*Figure 18*). The archaeological survey of Transect 3 identified three sites, 82 agricultural features of the Site 26909 complex, two pahoehoe excavation features of the Site 26910 complex and seven non-cultural caves. The sites consist of a burial lava tube (Site 26906), a temporary habitation lava blister (Site 26907) and a temporary habitation lava tube (Site 26908). The sites are described below.

Site 26906

Site 26906 is a small lava tube situated along the northern side of a raised bedrock outcrop at c. 421 ft elevation. The main entrance to the tube is through a U-shaped opening that is 0.85 m wide (northwest by southeast) and 0.6 m in height (*Figure 19*). Cobbles and small boulders have been piled at the entrance, concealing it. A secondary entrance is located on top of the outcrop, consisting of a vertical hole that is 2.3 m long (north-south), 0.2 to 0.45 m wide and 0.5 to 0.6 m deep. Cobbles, small boulders and slabs concealed this opening.

The interior of the tube was examined by removing several stones from the secondary, vertical entrance. Human remains consisting of a mandible, a tibia, a femur and a concentration of unidentifiable bone fragments were noted on the floor of the lava tube below the entrance to the northeast. The interior of the tube is 0.35 to 0.55 m in height. The floor is comprised of level soil. No cultural remains were noted on the surface. After identification of the human remains and the completion of the field map, the stones removed from the vertical entrance were carefully repositioned.

Site 26906 is interpreted as a burial site based the presence of the human remains. The absence of any additional cultural remains suggests that the tube did not function as a temporary habitation shelter. The site contains an overall length of 9.0 m and an area of 18.5 sq m. The site is unaltered and in good condition and is assessed as significant for its information content and for its cultural value.

Site 26907

Site 26907 is a lava blister accessed through a vertical opening on top of a bedrock outcrop at c. 410 ft (*Figure 20*). The entrance is roughly oval-shaped and is 1.05 m long (east-west), 0.75 m wide and 1.2 m deep. There is a stacked and roughly faced cobble and small boulder wall built on top of the outcrop along the north side of the entrance. This wall is slightly curved and is 1.3 m long (east-west), 0.2 to 0.3 m wide and 0.5 m in height.

The interior of the blister is irregular in shape and measures 9.2 m long (west-northwest by east-southeast) and from 0.5 to 5.0 m wide. Areas of roof fall are present at the east and west ends, potentially deposited there in an effort to remove surface stones from the central floor area. There is an area of level soil along the southwest side of the interior, with the remainder of the floor consisting of bare lava. A small area of roof fall is present in the northern portion. No cultural remains were present inside the interior.

Site 26907 is interpreted as a possible temporary habitation shelter. Although no cultural remains were present inside the blister, the structural modifications consisting of the wall on the surface of the site and the cleared interior floor, suggest it may have functioned in this capacity. The site has an overall length of 9.2 m and an area of 22.7 sq m. The site is unaltered, in good condition and is assessed as significant for its information content.

Site 26908

Site 26908 is a small lava tube accessed through a vertical opening located at c. 381-383 ft elevation (*Figure 21*). The opening is oval-shaped and is 1.5 m long (northeast by southwest), 1.1 m wide and 0.9 m deep. The interior of the tube extends to the northeast from the entrance. It is comprised of a linear chamber that is 8.9 m long (northeast by southwest) and from 0.65 to 2.0 m wide. The ceiling heights range from 0.6 to 0.7 m. There are areas of level soil present just inside the entrance and at the northeastern end of the tube. The remainder of the tube's floor consists of bare lava. Roof fall has been cleared from the soil

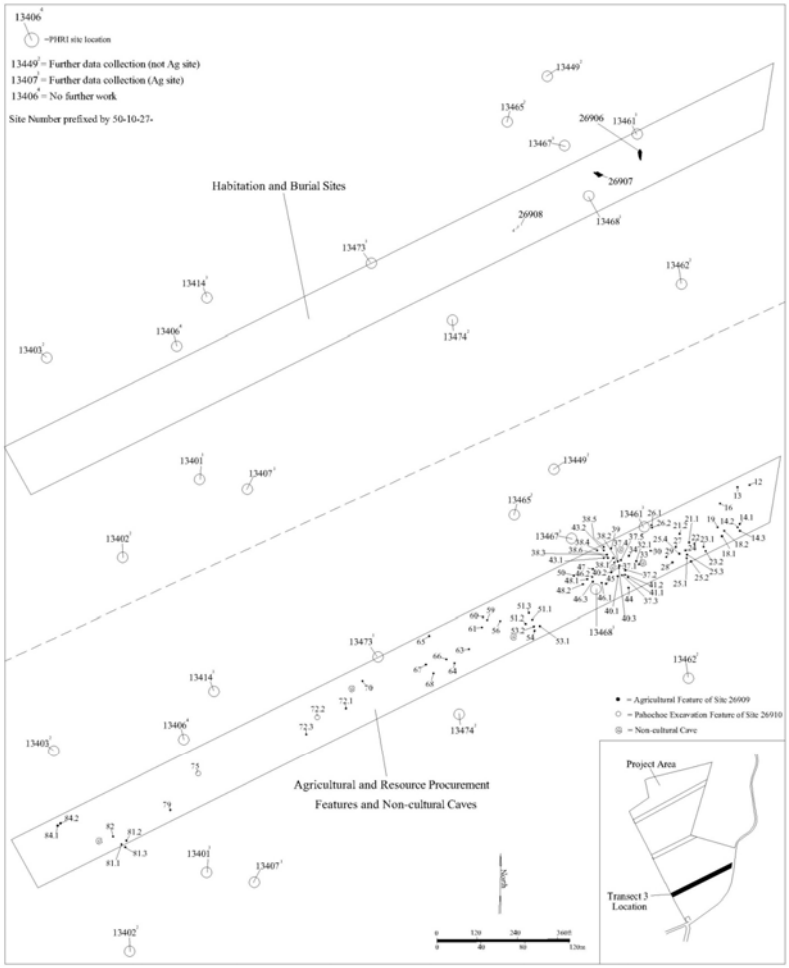

Figure 18. Location of Sites and Non-cultural Caves in Transect 3

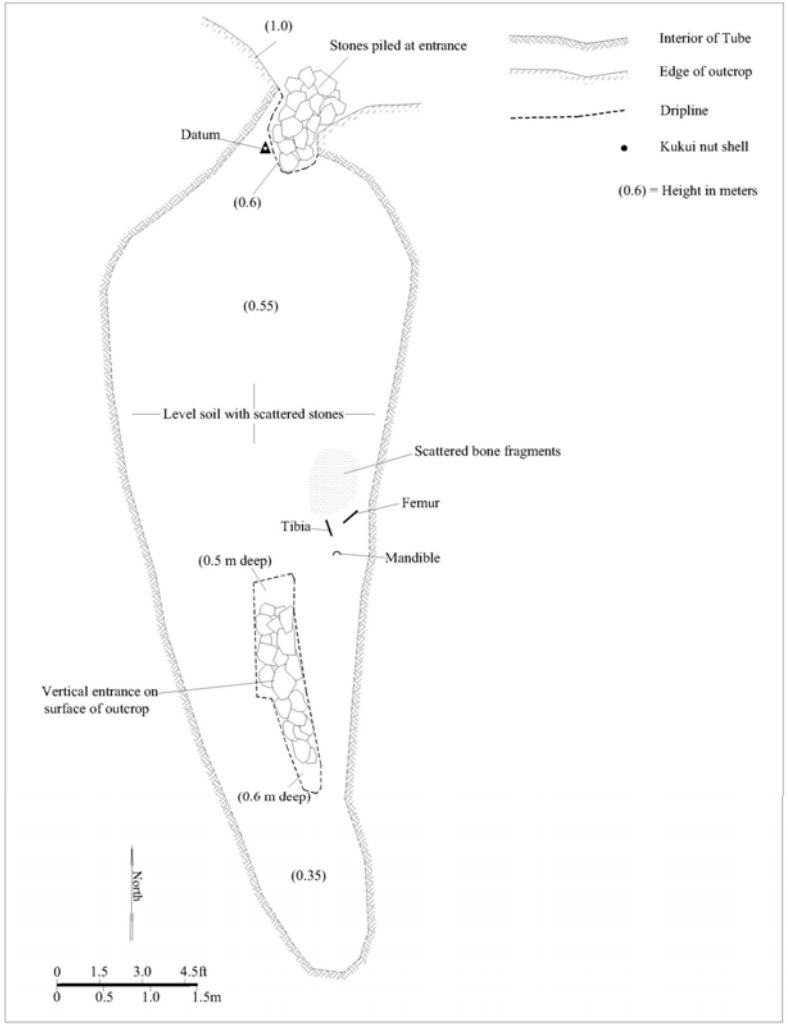

Figure 19. Site 26906 Plan Map

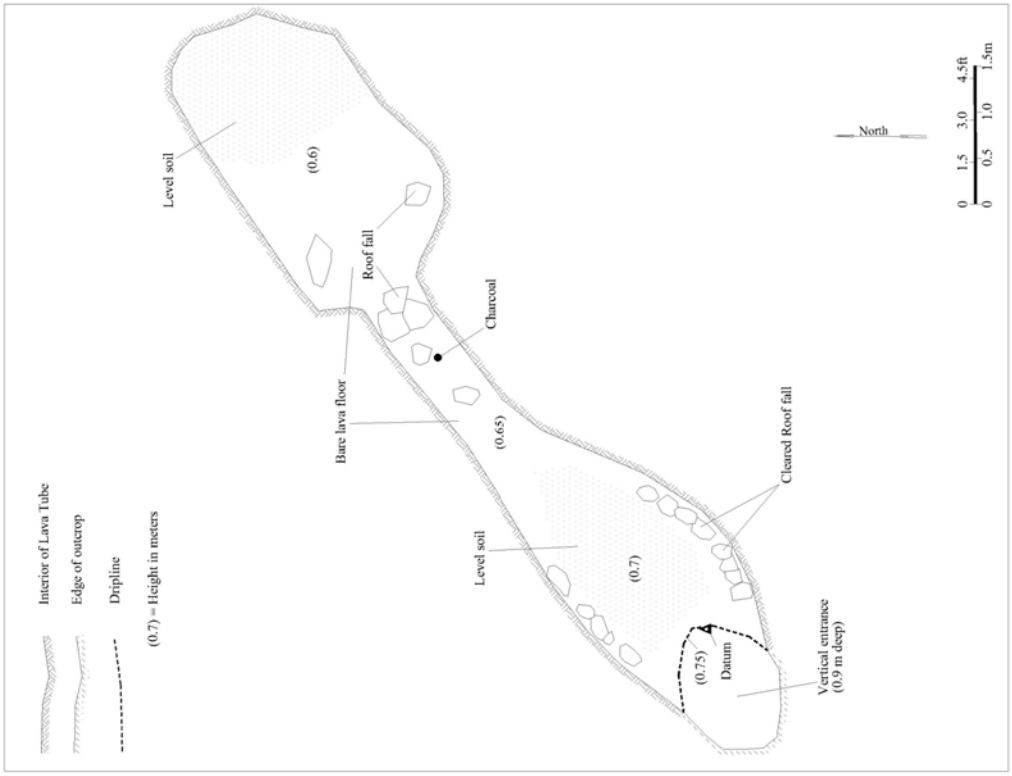

Figure 21. Site 26908 Plan Map

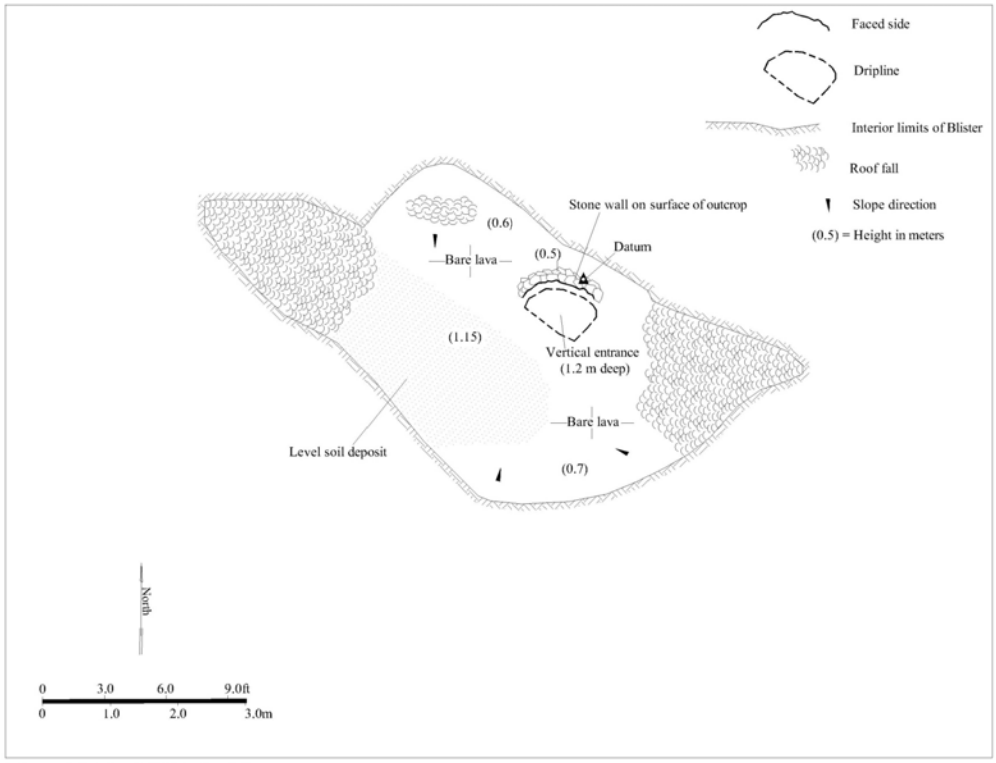

Figure 20. Site 26907 Plan Map

area by the entrance and placed along the north and south sides of the tube. Scattered roof fall is also present in the central portion of the tube.

A fragment of charcoal was noted on the bare lava floor in the approximate center of the tube. No other cultural remains were present. Site 26908 is interpreted as a possible temporary habitation shelter. This is based on its formal type, on the presence of the charcoal and on the cleared soil area in the interior. The site has an overall length of 8.9 m and an area of 11.8 sq m. The site is unaltered, in good condition and is assessed as significant for its information content.

Agricultural Features

The survey of Transect 3 identified 82 agricultural features of the Site 26909 complex. These consist of 49 modified outcrops and 33 mounds (see *Table 7* and *Figure 18)*. The modified outcrops are all constructed of piled cobbles and small boulders and they range in length from 1.0 to 6.0 m (average 2.66 m), in width from 0.7 to 5.0 m (average 1.7 m) and in height from 0.3 to 1.5 m (average 0.67 m). The majority of these features are irregularly-shaped. Five are linear (Features T-18.1, T-19, T-25.1, T-26.1 and T-51.2). No cultural remainswere present.

The 33 mounds are irregular in shape and constructed of piled cobbles and small boulders with no cultural remains present. These features vary in length from 1.0 to 3.3 m (average 1.94 m), in width from 1.0 to 3.0 m (average 1.55 m) and in height from 0.4 to 1.2 m (average 0.6 m).

Pahoehoe Excavations

Two pahoehoe excavations of the Site 26910 complex were identified (see *Table 7* and *Figure 18*). Feature T-72.2 is situated at c. 340 elevation and T-75 is located at c. 331 ft. The excavations are both irregularly-shaped and range in length from 1.0 to 2.0 m and in width from 1.0 to 1.5 m. The base of the excavations are 0.2 to 0.3 m deep below the surface of the outcrop with the excavated stones piled around their perimeters. No cultural remains were found in association with either feature.

PHRI Sites within Transect 3

PHRI plotted three sites that fall within the boundaries of Transect 3 (Sites 13461, 13468 and 13473). These sites consist of an agricultural terrace (Site 13461), and agricultural enclosure (Site 13468) and an agricultural complex with 73 features (Site 13473 - see *Table 2*). It is possible that some of the 82 agricultural features noted in Transect 3 may correspond to features of the Site 13473 complex, but there is insufficient information in the PHRI report to correlate the features.

There are an additional 11 sites that are located within 100.0 m of the north and south sides of Transect 3 (*see Figure 18*). These consist of an agriculture/boundary complex with two features (Site 13401), a boundary complex with one feature (Site 13402), a habitation cave (Site 13403), a pahoehoe excavation (Site 13406), an agricultural complex with two features (Site 13407), a complex of 20 pahoehoe excavations (Site 13414), a complex of 37 habitation, transportation and ceremonial features (Site 13449), a complex of four pahoehoe excavations (Site 13462), a complex of eight habitation, agricultural and ceremonial features (Site 13465), an agricultural complex with nine features (Site 13467) and a habitation cave (Site 13474). None of these sites could be correlated with the sites identified within Transect 3.

Relocation of PHRI Preservation and Data Recovery Sites

As discussed previously, fifty-one sites were recommended for preservation or data recovery by Donham (1990). One of the tasks of the present project was the relocation of these sites and an evaluation of the accuracy of documentation. This effort focused on the twenty-five sites with non-agricultural features that were recommended for data recovery and/or preservation. *Table 8* lists the sites with proposed treatments. The 1990 treatment is from the original survey report (Donham 1990). The 1992 treatment is based on Jensen et al. (1992) and Walker (1993). The 2009 treatment is the current recommendation. The table also indicates the available, original PHRI documentation for each site (Site Form and/or map).

Table 8. Search Results for PHRI Sites with Non-Agricultural Features

SIHP Site	Type	1990 Treatment*	1992 Treatment	2009 Treatment	Form	Map	Relocated
13390	Habitation/Agriculture Complex	FDC, PID	FDC, PID	FDC			Poss. Found
13394	Indeterminate Alignment	PID	PID	NFW			No
13395	Possible Burial	FDC, PID	FDC, PID	NFW			Yes
13396	Habitation Platform	FDC, PID	NFW	FDC			Poss. Found
13398	Habitation/Agriculture/Poss. Burial Complex	FDC, PID	FDC, PID	FDC, PID			Yes
13400	Agriculture/Boundary Complex	FDC, PID	FDC, PID	FDC, PID			Poss. Found
13402	Boundary Complex	FDC	NFW	NFW			No
13403	Habitation Cave (Burial 2009)	FDC	NFW	PAI	1		26831 CSH
13404	Agriculture/Poss. Habitation Enclosure	FDC	NFW	NFW	1		26832 CSH
13408	Agriculture/Habitation/Poss. Ceremonial Complex	FDC, PID	FDC, PID	FDC, PID			Yes
13409	Habitation/Agriculture/Poss. Burial complex	FDC, PID	FDC, PID	FDC, PID			Yes
13410	Habitation Platform	FDC	FDC	FDC, PAI			Yes
13413	Habitation Platform	FDC, PID	PID	PID			Poss. Found
13441	Habitation/Agriculture Complex	FDC, PID	FDC, PID	FDC, PID		1	Yes
13449	Habitation/Transportation/ Poss. Ceremonial Complex	FDC	NFW	FDC	1		No
13450	Stepping Stone Trail	FDC	FDC	FDC	1		Yes
13451	Habitation Cave	FDC	NFW	NFW	1		No
13452	Paved Trail	FDC	FDC	FDC	1		Yes
13459	Habitation/Poss. Burial Complex	FDC	NFW	FDC (PIA?)	1		No (Burial?)
13462	Agriculture/Habitation Complex	FDC	NFW	NFW	1	1	Yes
13463	Ceremonial/Burial/Habitation Complex	FDC, PAI	PAI	PAI	1	1	Yes
13465	Habitation/Agriculture/Ceremonial Complex	FDC	NFW	FDC	1		Yes
13471	Agriculture/Habitation Complex	FDC	FDC	FDC		1	Yes
13474	Habitation Cave	FDC	FDC	FDC (PIA?)	1	1	No (Burials?)
13477	Agriculture/Habitation Complex	FDC	FDC	FDC	1		No

Shaded entries are sites relocated by Haun & Associates

*Treatments: NFW=No Further Work, FDC=Further Data Collection, PID=Preservation with Interpretative Development, PAI=Preserve As Is

Site 13390

Site 13390 is a complex of agricultural and habitation features (Donham 1990: A-109). The site consists of 15 features including two platforms (Features A and I), an enclosure (Feature B), a wall (Feature C), four terraces (Features D-F and H), four mounds (Feature G), three linear mounds (Feature J). The site was not mapped. The report provides abbreviated feature descriptions for only five of the fifteen features, which describe only the feature dimensions. Additional data collection was recommended, including detailed site documentation and excavation, followed by interpretive development.

Corbin and Wong-Smith (2007) reported that the site was destroyed by a construction of a firebreak road, but no evidence of this was noted in the road through the site during Haun & Associates inspection of the site location. The area was recently cleared of vegetation in conjunction with a Pacific Legacy, Inc. (PLI) study of the proposed Ane Keohokalole Highway corridor (Cleghorn and Reeve 2009). Although the descriptive data presented in the PHRI report was insufficient to correlate the features identified in 1990 with the features recently documented by PLI (R. Reeve personal communication), it is likely that the PLI study documented most of the features that originally composed the site as documented in 1990.

PLI identified 41 features at six sites (Sites 26862-26866) in the vicinity of Site 13390. All of the features except one (Site 26866, Feature F), were interpreted as agricultural mounds, modified outcrops, walls, platforms,

and a terrace. Feature F was interpreted as a habitation enclosure. Data recovery was recommended for all six sites. None were recommended for preservation.

Site 13394

Site 13394 is a stone alignment of indeterminate function at approximately 330 ft elevation (Donham 1990: A-109). No other information is provided. PHRI recommended further data collection for the site including detailed documentation followed by interpretive development. The site could not be confidently relocated despite several efforts to find it. There are numerous agricultural features in the vicinity; however, the lack of a plan map, photograph and adequate description of the site make its relocation problematic. Haun & Associates does not recommend further work or preservation for the site.

Site 13395

Site 13395 is a possible burial platform at approximately 333 ft elevation (Donham 1990: A-109). The platform dimensions were reported as 3.0 m long, 2.5 m wide and 0.95 m high. The site was relocated by Haun & Associates based on the presence of a metal site tag from the original PHRI survey. It was mapped and subjected to subsurface testing during the present project. The site is oval in shape and is 2.7 m in length (northeast by southwest) and 1.7 to 1.9 m in width, built on and adjacent to a raised bedrock outcrop (*Figure 22)*. The northwest, west and southwest sides of the structure are comprised of stacked and piled cobbles and small boulder though the northeast and southeast sides have collapsed outward. The sides vary in height from 0.2 to 0.9 m and the surface is comprised of uneven cobbles and small boulders with no cultural remains present,

A 0.5 by 0.5 m test unit (TU-1) was excavated in the center of the site during the present project, revealing a single layer over bedrock (see *Figure 22*). Layer I consisted of 0.13 to 0.37 m of tightly packed cobbles, pebbles and small boulders with no cultural remains present.

The examination of Site 13395 during the present project has resulted in its re-interpretation as an agricultural mound. The structure is crudely constructed of stacked and piled stones with an uneven surface and does not exhibit the characteristics of a typical platform (i.e. vertical sides, level surface). The absence of human bone, food remains or artifacts from the test unit indicate it probably was an agricultural feature. The site is unaltered and in fair condition and is assessed as significant solely for its information content. No further work or preservation is recommended.

Site 13396

Site 13396 is a habitation platform at approximately 317 ft elevation (Donham 1990: A-109). The platform dimensions were documented as 8.0 m long, 4.0 m wide and 1.0 m high. No map or photograph of the site was included in the PHRI report. PHRI recommended further data collection for the site including detailed documentation followed by interpretive development. Haun & Associates staff inspected the reported site location. The area was recently cleared of vegetation in conjunction with PLI's study of the proposed highway corridor (Cleghorn and Reeve 2009). The descriptive data presented in the PHRI report was insufficient to correlate the features identified in 1990 with the features recently documented by PLI (R. Reeve personal communication). It is likely that the PLI study documented the site, possibly as Feature A of Site 26860, which is of roughly similar dimensions. PLI recommended data recovery, but not preservation for Site 26860.

Site 13398

Site 13398 is described as a complex of habitation and agricultural features with a possible burial feature situated at approximately 320 ft elevation (Donham 1990: A-111). The features consist of a platform (Feature A), a wall (Feature B), and two cairns (Features C and D). Dimensions are only given for the platform, which was interpreted as a possible burial, and one cairn (Feature C). No map, photograph, or other information is provided in the PHRI report. PHRI recommended further data collection for the site including detailed documentation followed by interpretive development. The Feature A platform was relocated by Haun & Associates staff based the presence of a metal site tag. The site is situated within a large enclosure that also contains Sites 13408, 13409, and 13410 that is proposed for preservation.

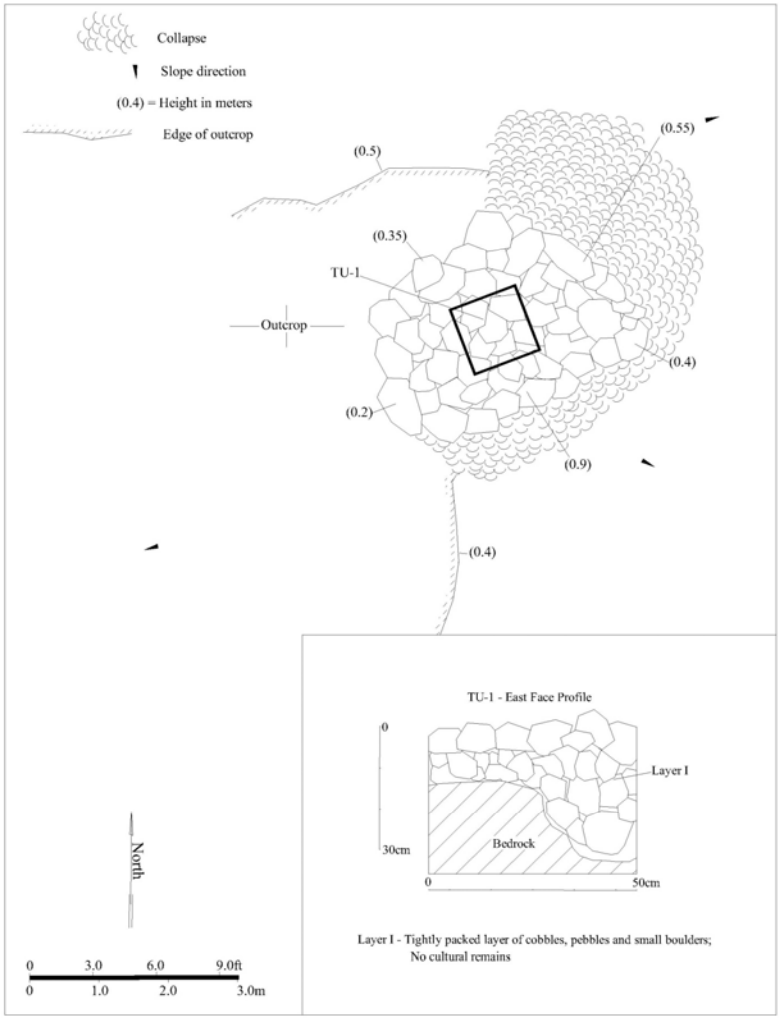

Figure 22. Site 13395 Plan Map and TU-1 East Face Profile

Site 13400

Site 13400 is a complex of two features at approximately 319 ft elevation (Donham 1990: A-111). The features consist of a boundary wall and an agricultural enclosure. "The wall is oriented E-W and has a 90 degree corner, turning to the north. The enclosure is large and located at the end of the wall" (*ibid.*). No map, photograph, or other information is provided in the report. PHRI recommended further data collection for the site including detailed documentation followed by interpretive development. Haun & Associates staff relocated blue flagging tape on the site bearing the number 13400 that probably was placed there during the Corbin and Wong-Smith (2007) relocation effort.

Site 13402

Site 13402 was described as a collapsed section of wall situated at approximately 317 ft elevation (Donham 1990: A-110). PHRI assigned the site a land division function and recommended it for further data collection. No map, photograph, or other information is provided in the PHRI report. Haun & Associates staff were unable to relocate the site.

Site 13403/26831

Site 13403 was described as a modified cave situated at approximately 320 ft elevation (Donham 1990: A-110). PHRI described the site as

> "[A] large pahoehoe blister that is collapsed at one end and with a terrace wall opposite the blister opening. The blister opening faces northeast and is 3.70 m wide by 1.1 m high. The terrace measures 3.00m by 0.60-1.00 m wide and 0.60 m in height. It is constructed of pahoehoe boulders and cobbles, 3 to 4 courses high, and is oriented N-S. The south end of the terrace connects with the edge of the tube/blister opening.
>
> Cowrie shell, *kukui* and faunal remains are present (Donham 1990:110).

PHRI reported the presence of marine shell (cowrie), *kukui* (nut shell?) and faunal remains at the site. PHRI assigned the site a habitation function and recommended it for further data collection. No map, photograph, or other information is provided in the PHRI report.

Haun & Associates staff relocated a site in the vicinity of the reported location of Site 13403 that was documented by Cultural Surveys Hawaii (CSH) during a survey for the proposed Ane Keohokalole Highway corridor (Tulchin and Hammatt 2009). Flagging tape on the site bore the label "CSH 3". The site appears to have been assigned site number 26831 (no temporary field number is provided in the CSH report). CSH described the site as follows:

> SIHP #50-10-28-26831 is located at the southern end of the project area and is approximately 376 m (656 ft) northwest of Palani Road... The topography of the immediate area is level, while the geology consists of a large collapsed lava blister that has created a circular depression with shallow caves formed around the perimeter. *Koa haole,* cactus, and exotic grasses dominate the surrounding landscape.
>
> SIHP #50-10-28-26831 consists of a shallow cave created from the collapse of a lava blister (Figure 25 & Figure 26). The cave measures approximately 3.5 m deep by 2.7 m wide by 0.7 m high. The opening to the cave appears to have been partially walled off by basalt boulders pilled approximately 90 cm high, in an attempt to disguise the cave entrance.
>
> Human skeletal remains were observed approximately 2 m into the cave within a small crevice that has been partially covered with basalt boulders. Observed skeletal material consisted of the following: teeth, vertebrae, pelvis, a clavicle, and a patella. No grave goods were observed. Burial context suggests that the burial is of traditional Hawaiian (probably pre-contact) origin and of Native Hawaiian ethnicity.

> The remains were in poor condition and appear to have been crushed as a result of previous disturbance from animals, as evidenced by the numerous non-human mammal remains observed scattered throughout the cave (Tulchin and Hammatt 2009:49).

The terrace reported by PHRI roughly matches the dimensions of the wall reported by CSH (Tulchin and Hammatt 2009:50; Figure 25). Both descriptions place the site in a large collapsed blister with mammal bones. Tulchin and Hammatt (2009) recommended the site for preservation.

Site 13404/26832

Site 13404 was described as an enclosure situated at approximately 311 ft elevation (Donham 1990: A-111). PHRI described the site as follows:

> "circular enclosure wall which becomes a terrace at the southwest end. The wall is somewhat collapsed, rubble filled, and 1-4 courses high. It is faced along the interior and exterior edges and is 1.00--1.50 m wide. The terrace portion at the southwest end measures 4.00 by 4.00 m" (Donham:1990:111).

PHRI assigned the site an "agriculture/possible habitation" function and recommended it for further data collection. No map, photograph, or other information is provided in the PHRI report.

Haun & Associates staff relocated a site marked with flagging tape bearing the label "CSH 4" in the vicinity of the reported location of Site 13404. The site appears to correlate with CSH Site 26832, described as follows:

> SIHP #50-10-28-26832 is located at the southern end of the project area and is approximately 456 m (1496 ft) northwest of Palani Road.....The topography of the immediate area is level, while the geology consists of exposed basalt bedrock outcrops with pockets of shallow soil. *Koa haole,* cactus, and exotic grasses dominate the surrounding landscape.
>
> SIHP #50-10-28-26832 consists of a low square terrace abutting a bedrock outcrop... The terrace measures approximately 3.0 m long by 2.8 m wide by 0.4 m high. The terrace has two faced retaining walls constructed of basalt boulders and cobbles stacked 1 to 2 courses high. The walls support a level cobble pavement that abuts a bedrock outcrop.
>
> SIHP #50-10-28-26832 is understood as a traditional Hawaiian construction (probably of pre-contact origin). This is based on the construction techniques utilized to construct the site and its proximity to other pre-contact sites. The site's architectural style, relatively small size, and lack of substantive cultural material observed during test excavation... indicate that the site likely functioned as a temporary habitation (Tulchin and Hammatt 2009:52).

Tulchin and Hammatt (2009:79) recommended the site for no further study and no preservation. Although the two descriptions differ with regard to the presence of a collapsed enclosure and the terrace dimensions, the topographic location of the site on the original PHRI aerial photograph and the CSH locations appear to be the same.

Site 13408

Site 13408 is a complex of more than 19 features at approximately 350 ft elevation (Donham 1990: A-111). The site was interpreted as having agricultural, possible habitation, and possible ceremonial functions. "The complex includes a platform (15.00 by 10.00 m), a terrace, five walls, two enclosures, and at least 10 pahoehoe excavations. Two of the walls are connected to the platform" (*ibid.*). No map, photograph, or other information is provided in the PHRI report. PHRI recommended further data collection for the site including detailed documentation followed by interpretive development. Haun & Associates staff relocated the 1990 metal site tag within a large enclosure that is proposed for preservation.

Site 13409

Site 13409 is a complex of nine features at approximately 354 ft elevation (Donham 1990: A-111). The site was interpreted as having agricultural, habitation, and possible burial functions. "The site consists of three platforms (Features A, G, and H), two walls (Features B and I), and enclosure (Feature C), and three terraces (Features D-F)"

(*ibid.*). Dimensions are only provided for the platforms. Features G and H were interpreted as possible burial platforms. No map, photograph, or other information is provided in the report. PHRI recommended further data collection for the site including detailed documentation followed by interpretive development. Haun & Associates staff relocated the site, which is situated within a large enclosure that is proposed for preservation.

Site 13410

Site 13410 is described as a large platform with a C-shape wall on top situated at approximately 349 ft elevation (Donham 1990: A-111). The platform is described as being 16 m long and 14 m wide. A piece of "hand-blown glass" was observed by PHRI staff within the C-shape. The site was assigned a habitation function by PHRI. No map, photograph, or other information is provided in the report. PHRI recommended further data collection for the site. Haun & Associates staff relocated the site, which is situated within a large enclosure that is proposed for preservation. PHRI recommended the site for data recovery; however, the current landowner proposes preservation of the site.

Site 13413

Site 13413 is described as a 4.0 m square platform with faced sides up to 80 cm in height and a paved surface at approximately 336 ft elevation (Donham 1990: A-112). The site was assigned a "habitation/agriculture" function. No map, photograph, or other information is provided in the report. After extensive searching, Haun & Associates staff identified a low platform with approximately the same dimensions c. 30-40 m from the reported location of the site (Donham 1990:16, Figure 1). A very faded and brittle piece of pink flagging tape, but no metal tag, was found on the surface of the platform suggesting that it was previously identified.

Site 13441

Site 13441 is described by PHRI as follows:

> The overall complex area measures c. 108.0 m (E- W) by 88.0 m (N-S). The site consists of 20 principal features and additional modified outcrops and pahoehoe excavations. The principal features include seven platforms (Features A, C, D, J, K, N and O), five terraces (Feature B and Features E-H), a wall remnant (Feature I), a wall (Feature L), a mound (Feature M), a cave (Feature P) and an enclosure (Feature Q). The Feature Q enclosure surrounds the complex. The site is very unique in its containment and high concentration of highly structured features" (Donham 1990: A-112).

The site was assigned a "habitation/agriculture" function and was recommended for preservation. Haun & Associates staff relocated the site and found the previous recording (maps and written description) adequately characterizes the site (*Figure 23*).

Site 13449

Site 13449 is described as a complex consisting of lava tube (Feature A), a cairn, (Feature B), and a steppingstone trail segment (Feature C; Donham 1990: A-140). The lava tube is described as being "oriented in a SW direction" and extending to Site 13458. The site was assigned possible agriculture, habitation, and transportation functions by PHRI. PHRI recommended the site for further data collection. No map or photograph is provided in the report. Haun & Associates staff were unable to relocate the site. . It is possible that the site is situated further inland outside of the project area.

Site 13450

Site 13450 is described as a stepping stone trail segment consisting of aligned pahoehoe slabs across an a'a lava flow at c. 499 ft elevation (Donham 1990: A-140). The site was assigned a transportation function by PHRI. No map or photograph is provided in the report. Haun & Associates staff relocated the site that PHRI recommended for further data collection.

Site 13451

Site 13451 is described as three lava tubes connected to a central collapsed blister (Donham 1990: A-140). Two of the tubes extending to the southwest from the blister had shallow cultural deposits and contained portable remains including "pieces of waterworn coral, waterworn basalt cobbles, *kukui* nut shell, charcoal flecks, and a waterworn basalt canoe breaker" (Donham 1990: A-140). The site was assigned a habitation function by PHRI and was

recommended for further data collection. No map or photograph is provided in the report. Haun & Associates staff were unable to relocate the site.

Site 13452

Site 13452 is described as a paved cobble trail segment at c. 486 ft elevation (Donham 1990: A-140). The site was assigned a transportation function by PHRI. No map or photograph is provided in the report. Haun & Associates staff relocated the site. PHRI recommended the site for further data collection.

Site 13459

Site 13459 is described as consisting of a cave (Feature A) and a modified outcrop (Feature B; Donham 1990: A-142). Two unidentified mammal bones were present in the cave. The site was assigned a habitation function by PHRI (Donham 1990: A-142). PHRI recommended the site for further data collection. The site also was assigned a possible burial function by PHRI (Donham 1990: C-25). No map or photograph is provided in the report. Haun & Associates staff were unable to relocate the site. It is possible that the site is situated further inland outside of the project area.

Site 13462

Site 13462 is described as consisting of modified outcrop (Feature A), alignment (Feature B), a C-shaped wall (Feature C), and a large enclosure (Feature D) that surrounds the site (Donham 1990: A-143). The site was assigned an agricultural/possible habitation function by PHRI. Haun & Associates staff relocated the site with the assistance of a map that adequately depicts the major features of the site (*Figure 24*). PHRI recommended the site for further data collection.

Site 13463

Site 13463 is described as consisting of an enclosed platform (Feature A), two caves (Features B and C), a trail segment (Feature D) and a pavement (Feature D; Donham 1990: A-145). Feature C contained human skeletal remains. The site was assigned burial, habitation, and possible ceremonial functions by PHRI. No map or photograph is provided in the report. PHRI recommended the site for further data collection and preservation. PHRI field records include a scaled plan map of Feature A and sketch maps of Features B and C. Haun & Associates staff relocated Features A and C, but were unable to locate Feature B.

Site 13465

Site 13465 is described as consisting of a platform Feature A), a terrace (Feature B), wall segments (Features C and D), a pavement with an upright stone (Feature E), a lava tube (Feature F) and a pavement (Feature G; Donham 1990: A-146-148). The site was assigned agriculture, habitation, and possible ceremonial functions by PHRI. PHRI recommended the site for further data collection. . Haun & Associates staff relocated the site with the assistance of a map that adequately depicts the major features of the site (*Figure 25*).

Site 13471

Site 13471 is described as a complex consisting of an upright stone (Feature A), a platform (Feature B) and a cave (Feature C; Donham 1990: A-150). The site was assigned agriculture, habitation, and possible ceremonial functions by PHRI. No map or photograph is provided in the report. Haun & Associates staff relocated the site (metal tag found). PHRI recommended the site for further data collection.

Site 13474

Site 13474 is described as a 55 m long by 3.2 m wide habitation cave situated at c. 365 ft elevation (Donham 1990: A-152). No map or photograph is provided in the report. The original PHRI site form indicates that poorly preserved skeletal remains from 5-6 individuals were observed when the site was

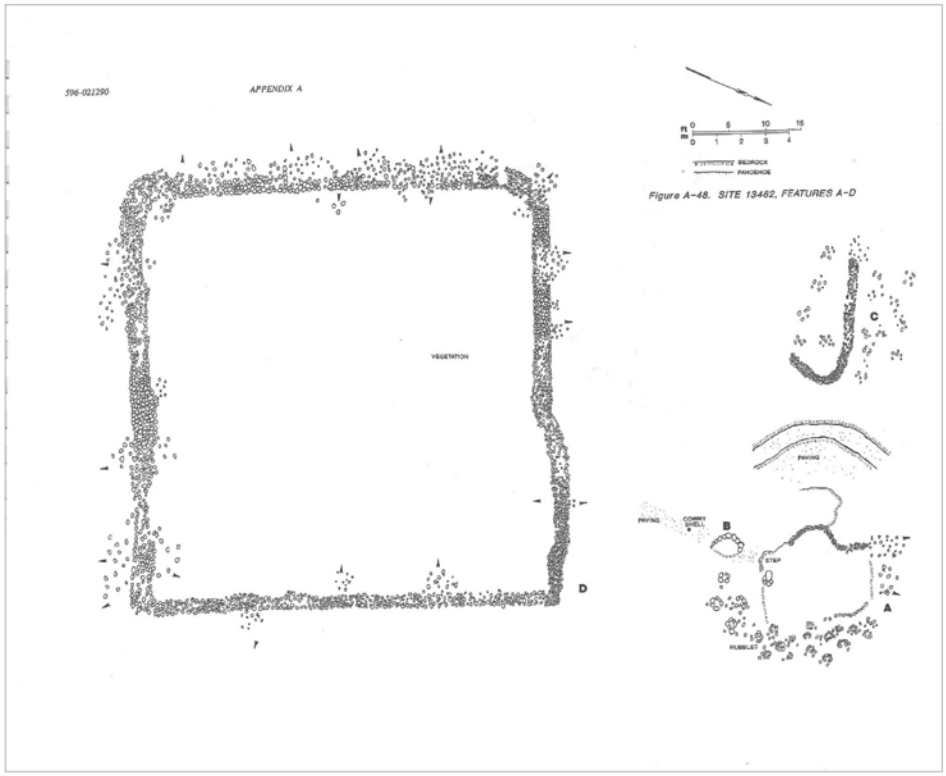

Figure 24. Site 13462 Plan Map from Donham (1990:A-144)

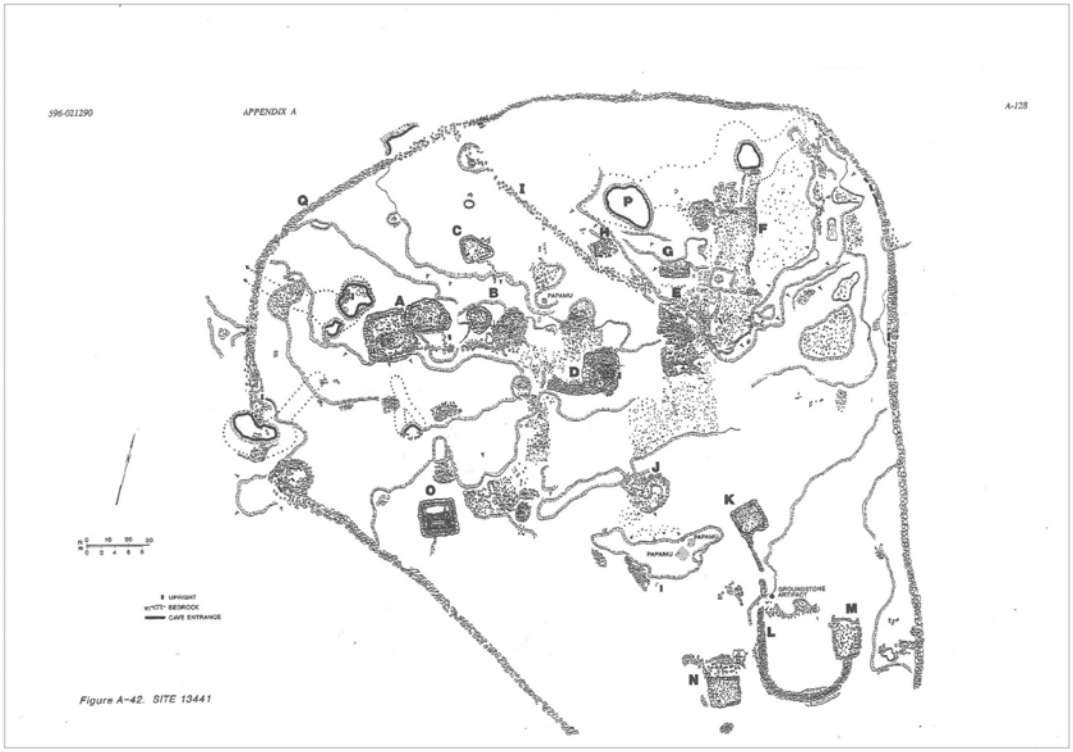

Figure 23. Site 13441 Plan Map from Donham (1990:A-128)