



Pueo Project Survey Datasheet 2017

Western
Corner

Site: UH West Solar GPS point: 286 GPS coordinates: (D.dddd, -D.ddddd) 5965.7 2363571

Date: 9/26/17 Visit # (1, 2 or 3): 1 Survey Start Time: 5:35 Survey Stop Time: 6:50 Observers: JD

Temperature: 80 Cloud cover (Clear, PC, MC, Cloudy): PC Rain: None Wind (0-7): 0-1

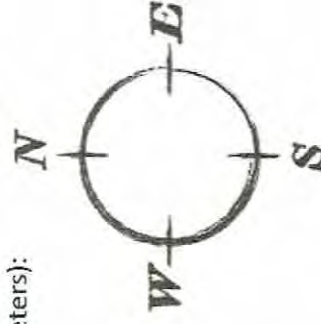
Detection start time	Detection end time	Number	Initial distance	Initial direction	Sounds	Behavior	Habitat
—	—	—	—	—	—	—	—
<u>No detections</u>							

% Habitat w/in 400 m or surveyed area (must be 100%):

Developed	Wetland	Agricultural Crops	Agricultural Dirt	Grass/short Grazed	Grass/short Golf	Grass/short Mowed
Grassland Fallow	Grasslands Tall > 75cm	Shrublands	Non Native Forest	Native Forest	Other	Total
<u>100%</u>						

Surveyed area (max visible meters):

N: <u>400</u>	S: <u>800</u>
NE: <u>1000+</u>	SW: <u>800</u>
E: <u>1000+</u>	W: <u>1000+</u>
SE: <u>1000+</u>	NW: <u>400</u>



Observations: Lots of cattle and pigs onsite



Pueo Project Survey Datasheet 2017



Site: UH West 5-lar GPS point: point GPS coordinates: (D.ddddd, D.ddddd) 0597019, 2363956 ± 4m

Date: 9-26-19 Visit # (1, 2 or 3): Survey Start Time: 5:15pm Survey Stop Time: 6:50pm Observers: Philip Taylor

Temperature: 82°F Cloud cover (Clear, PC, MC, Cloudy): PC Rain: 0 Wind (0-7): 1

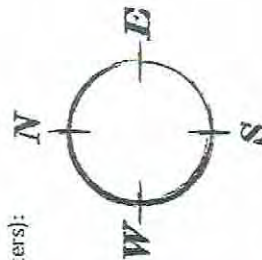
Detection start time	Detection end time	Number	Initial distance	Initial direction	Sounds	Behavior	Habitat

% Habitat w/in 400 m or surveyed area (must be 100%):

Developed	Wetland	Agricultural Crops	Agricultural Dirt	Grass/short Grazed	Grass/short Golf	Grass/short Mowed
Grassland Fallow	Grasslands Tall > 75cm	Shrublands	Non Native Forest	Native Forest	Other	Total
100%						

Surveyed area (max visible meters):

N: 250	S: 1000
NE: 600	SW: 500
E: 1000	W: 150
SE: 1000	NW 200



Observations: other species observed: cattle egret, zebra dove, red-vented bulbul,
red avadavat

Limited visibility after 6:40pm.



Pueo Project Survey Datasheet 2017

Western Pinta

596557 2363566 (299) *new?*

Site: UH West Salar GPS point: (286) GPS coordinates: (D.dddd, -D.ddddd) 596517 2363571 (286)

Date: 11/14/17 Visit # (1, 2 or 3): 2 Survey Start Time: 4:30 PM Survey Stop Time: 6:17 Observers: JD

Temperature: 78 Cloud cover (Clear, PC, MC, Cloudy): PC Rain: None Wind (0-7): 2 From South

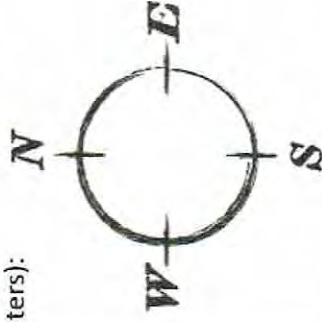
Detection start time	Detection end time	Number	Initial distance	Initial direction	Sounds	Behavior	Habitat
<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>

% Habitat w/in 400 m or surveyed area (must be 100%):

Developed	Wetland	Agricultural Crops	Agricultural Dirt	Grass/short Grazed	Grass/short Golf	Grass/short Mowed
Grassland Fallow	Grasslands Tall > 75cm	Shrublands	Non Native Forest	Native Forest	Other	Total
<u>100%</u>						

Surveyed area (max visible meters):

N: <u>400</u>	S: <u>800</u>
NE: <u>1000</u>	SW: <u>800</u>
E: <u>1200</u>	W: <u>1000</u>
SE: <u>1000</u>	NW: <u>400</u>



Observations: Good conditions, no detections



Pueo Project Survey Datasheet 2017



Site: UH West GPS point: _____ GPS coordinates: (D.dddd, -D.dddd) 0597016, 2363956 ± 3M
 Date: 11-14-19 Visit # (1, 2 or 3): 2 Survey Start Time: 4:45p Survey Stop Time: 6:30p Observers: Philip Taylor
 Temperature: 75°F Cloud cover (Clear, PC, MC, Cloudy): PC Rain: 0 Wind (0-7): 3

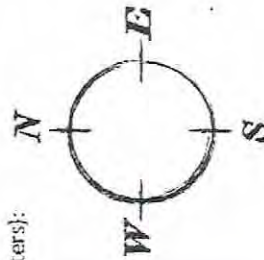
Detection start time	Detection end time	Number	Initial distance	Initial direction	Sounds	Behavior	Habitat

% Habitat w/in 400 m or surveyed area (must be 100%):

Developed	Wetland	Agricultural Crops	Agricultural Dirt	Grass/short Grazed	Grass/short Golf	Grass/short Mowed
Grassland Fallow	Grasslands Tall > 75cm	Shrublands	Non Native Forest	Native Forest	Other	Total

Surveyed area (max visible meters):

N: 300	S: 500+
NE: 500+SW: 100	
E: 500+W: 200	
SE: 500+NW: 250	



Observations: No pueo observed. Barn owl heard inside structure at bottom of survey area.



Pueo Project Survey Datasheet 2017

Western corner

Site: VH West Salina GPS point: (286) GPS coordinates: (D.ddddddd, -D.ddddddd) S96.577 236.3571

Date: 17/19/19 Visit # (1, 2 or 3): 3 Survey Start Time: 4:35 PM Survey Stop Time: 6:24 PM Observers: JD

Temperature: 86 Cloud cover (Clear, PC, MC, Cloudy): PC Rain: None Wind (0-7): 2-3

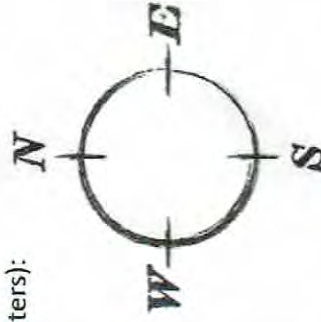
Detection start time	Detection end time	Number	Initial distance	Initial direction	Sounds	Behavior	Habitat
<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>

% Habitat w/in 400 m or surveyed area (must be 100%):

Developed	Wetland	Agricultural Crops	Agricultural Dirt	Grass/short Grazed	Grass/short Golf	Grass/short Mowed
Grassland Fallow	Grasslands Tall >75cm	Shrublands	Non Native Forest	Native Forest	Other	Total

Surveyed area (max visible meters):

N: 400	S: 500+
NE: 500+	SW: 500+
E: 500+	W: 500+
SE: 500+	NW: 400



Observations:

A little breezy but overall good survey conditions



Pueo Project Survey Datasheet 2017



Site: VH West GPS point: East GPS coordinates: (D.dddd, -D.ddddd) 0597019, 2363956 ± 4m
 Date: 12/19/19 Visit # (1, 2 or 3): 3 Survey Start Time: 4:30 P Survey Stop Time: 6:20 P Observers: Phil Taylor
 Temperature: 78°F Cloud cover (Clear, PC, MC, Cloudy): 0 Rain: 0 Wind (0-7): 4

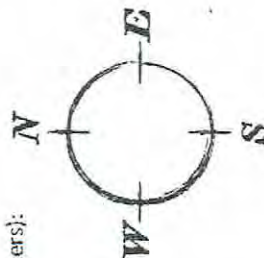
Detection start time	Detection end time	Number	Initial distance	Initial direction	Sounds	Behavior	Habitat

% Habitat w/in 400 m or surveyed area (must be 100%):

Developed	Wetland	Agricultural Crops	Agricultural Dirt	Grass/short Grazed	Grass/short Golf	Grass/short Mowed
Grassland Fallow	Grasslands Tall > 75cm	Shrublands	Non Native Forest	Native Forest	Other	Total
100%						

Surveyed area (max visible meters):

N: 300	S: 500
NE: 500	SW: 100
E: 500	W: 100
SE: 500	NW: 100



Observations: No pueo observed.

Attachment F
Archaeological Inventory Survey Report

Draft
Archaeological Inventory Survey Report for the
AES West O‘ahu Solar Project,
Honouliuli Ahupua‘a, ‘Ewa District, O‘ahu
TMK: [1] 9-2-002:007 (por.)

Prepared for
Tetra Tech, Inc.
on behalf of
AES Distributed Energy

Prepared by
Alison Welser, M.A.,
Scott Belluomini, B.A.,
Tyler Turran, B.A.,
David W. Shideler, M.A.,
and
Hallett H. Hammatt, Ph.D.

Cultural Surveys Hawai‘i, Inc.
Kailua, Hawai‘i
(Job Code: HONOULIULI 171)

February 2020

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Management Summary

Reference	Archaeological Inventory Survey Report for the AES West O‘ahu Solar Project, Honouliuli Ahupua‘a, ‘Ewa District, O‘ahu, TMK: [1] 9-2-002:007 (por.) (Welser et al. 2020)
Date	February 2020
Project Number(s)	Cultural Surveys Hawai‘i, Inc. (CSH) Job Code: HONOULIULI 171
Investigation Permit Number	CSH completed the archaeological inventory survey (AIS) fieldwork under archaeological fieldwork permit number 19-07, issued by the Hawai‘i State Historic Preservation Division (SHPD) per Hawai‘i Administrative Rules (HAR) §13-13-282.
Agencies	SHPD; Department of Planning and Permitting (DPP); Land Use Commission (LUC)
Land Jurisdiction	State of Hawai‘i
Project Proponent	AES Distributed Energy
Project Funding	AES Distributed Energy
Project Location	The project area is on undeveloped lands located in the southeastern foothills of the Wai‘anae Range, northeast of Pu‘u Makakilo and the Makakilo subdivision and about 600 m northwest of the intersection of the H-1 freeway and the Kualaka‘i Parkway. The project area is depicted on a portion of the Ewa and Schofield Barracks 2013 U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle.
Project Description	<p>The proposed AES West O‘ahu Solar project consists of construction and operation of an approximately 12.5 MW ground-mounted solar photovoltaic system, coupled with a 50 MWh battery energy storage system and related interconnection and ancillary facilities. Specifically, it includes the following major components: (1) solar photovoltaic system, (2) battery energy storage system, (3) substation and interconnection equipment, (4) a network of electrical wiring and collector lines, and (5) access roads and fencing. In addition to these facilities, the Project area would be made available for compatible agricultural activities.</p> <p>The solar photovoltaic system would consist of a series of solar modules mounted on a fixed-tilt racking system. The racking system would hold the modules at a fixed angle of 15 degrees facing toward the south and would be supported by steel posts, spaced approximately every 19 feet (5.8m) (varies). The posts would be installed using a hydraulic pile driver and/or augur for pre-drilling, with approximate depths of 6 feet (1.8m) (depending on soil conditions). In the event it is determined that the desired depth cannot be achieved, foundations would be pre-drilled and supported with concrete. Once mounted on the racking system, the highest point of the modules is expected to extend</p>

	<p>approximately 8.5 feet (2.6m) above the ground surface, with an average of approximately 3 feet (0.9m) of ground clearance below the modules. Electrical equipment (including inverters and transformers) and the battery units (housed in containers) would be installed on concrete equipment pads distributed throughout the Project area. A total of five concrete pads would be installed; each approximately 2,800 square feet (260.1 m²) in area. The Project would also include a substation and associated electrical equipment to facilitate interconnection with the Hawaiian Electric grid. These facilities would be constructed immediately adjacent to the existing Hawaiian Electric 'Ewa Nui #42 46kV sub-transmission line and would occupy a total of approximately 7,800 square feet (724.6m²). A short overhead electrical connection (approximately 300 feet or 91.4m in length), supported by approximately three 60-foot or 18.3m tall wood poles, would also be installed. Electrical wiring and collector lines connecting the solar modules with the equipment pads and the substation would be installed underground; approximately 14,000 linear feet (4.267 km) of trenching would be required, with widths ranging between 5-10 feet (1.5m to 3.0m) and depths up to 4 feet (1.2m). Perimeter fencing and new access roads would also be installed within the Project area. Equipment to support compatible agricultural activities would include four beekeeping stations (each approximately 40 square feet or 3.7m²) and two cattle pens (each with a small concrete slab for a water trough). In addition to construction of the facilities described above, grading would also occur in localized areas as needed to smooth the ground surface and for other civil engineering purposes (e.g., stormwater retention and management).</p>
Project Acreage	The project area is approximately 101.62 acres (41.12 hectares).
Historic Preservation Regulatory Context	<p>This AIS investigation fulfills the requirements of HAR §13-276. The AIS was conducted to identify, document, and assess the significance of historic properties within the project area, assess the potential for the project to adversely affect significant historic properties, and to provide agreed upon mitigation commitments to address any adverse impacts. This document is intended to support the proposed project's historic preservation review under Hawai'i Revised Statutes (HRS) §6E-42 and HAR §13-284, as well as the project's environmental review under HRS §343. It is also intended to support any project-related historic preservation consultation with stakeholders such as state and county agencies and interested Native Hawaiian Organizations (NHOs) and community groups. The AIS investigation was designed in consultation with the SHPD.</p> <p><i>An Archaeological Inventory Survey of the University of Hawai'i West O'ahu Campus, District of 'Ewa, Island of O'ahu, Hawai'i (TMKs: 9-2-02:01, 03, and 05) (Dega et al. 1998) that included the entirety of the</i></p>

	<p>present project area was previously accepted by SHPD on 3 February 1999 (LOG NO. 22959, DOC. NO. 9901EJ28; Appendix A). Due to the passage of time and given that the present project is different than that addressed by the 1998 report, it was agreed in consultation with Dr. Susan Lebo on 12 February 2019 that it would be appropriate to move forward with an AIS specific to this project.</p>
Fieldwork Effort	<p>CSH archaeologists Scott Belluomini, B.A., Alison Welser, M.A., Tyler Turran, B.A., Chris Konen, B.A., and David W. Shideler, M.A., conducted fieldwork between 4 and 6 February 2019 under the general supervision of Hallett H. Hammatt, Ph.D., Principal Investigator. This work required approximately 11 person-days to complete.</p> <p>Following the initial pedestrian inspection, the project area boundaries were altered slightly, extending to the north and the west, as well as south to encompass the existing access roads to be used for the project. Additional pedestrian inspection was conducted for these areas on 12 December 2019.</p>
Historic Properties Identified and Historic Property Significance	<p>The AIS further documented two previously identified historic properties within the project area:</p> <p>State Inventory of Historic Places (SIHP) # 50-80-08-5593 consists of an historic irrigation system and plantation infrastructure, including a mill building and pump station ("Pump Station 12"), bridges, troughs, transport ditches, culvert, pipes, culvert and sluice gate, and various other features related to water retention and movement. SIHP # 50-80-08-5593 was previously assessed by Dega et al. (1998) as significant under Hawai'i State historic property significance Criteria a (be associated with events that have made an important contribution to the broad patterns of our history) and d (has yielded, or may be likely to yield, information important for research on prehistory or history). The current study assesses SIHP # 50-80-08-5593 as significant under only HAR §13-284-6 Criterion d. This historic property has yielded information on land utilization and agricultural history of the 'Ewa Plain. However, it is not associated with specific impactful events in the area, unlike the Waiahole Ditch, which immeasurably altered the entirety of the landscape. The historic property retains integrity of location, design, materials, and workmanship.</p> <p>SIHP # 50-80-09-2268 consists of the Waiahole Ditch System, previously assessed by various studies. The historic property is assessed as significant pursuant to HAR §13-284-6 under Criteria a (be associated with events that have made an important contribution to the broad patterns of our history), c (embody the distinctive characteristics of a type, period, or method of construction, represent the work of a master, or possess high artistic value), and d (has yielded, or is likely to yield, information important for research on prehistory or history). The</p>

	<p>historic property has yielded information on agricultural history of the area and contributed greatly to the development and evolution of the 'Ewa Plain throughout its history. The historic property retains integrity of location, design, materials, and workmanship. However, within the project area, the historic property only retains sufficient integrity of location, which is also diminished in portions of the project area due to erosion and neglect. While there are some portions that retain some integrity of design, materials, and workmanship within the project area, this integrity is diminished. The overall ditch is significant, however, the remnant portion of SIHP # 50-80-09-2268 within the project area does not retain sufficient integrity to be considered significant.</p>
Effect Recommendations	<p>The portion of SIHP # 50-80-09-2268 within the project area does not retain sufficient integrity to be considered significant, and therefore no further work is recommended for the historic property.</p> <p>Sufficient information regarding the location, extent, function, and age of the portion of SIHP # 50-80-08-5593 within the project area have been generated by the current archaeological inventory survey investigation to mitigate any adverse effect caused by the proposed project.</p> <p>Pursuant to HAR §13-284-7, the project-specific effect determination is “no historic properties affected.”</p>
Mitigation Recommendations	<p>The proposed project will have no effect on significant historic properties within the project area, therefore no mitigation is required.</p>

Table of Contents

Management Summary	i
Section 1 Introduction	1
1.1 Project Background	1
1.2 Proposed Project Description.....	1
1.1 Historic Preservation Regulatory Context and Document Purpose	6
1.2 Environmental Setting	6
1.2.1 Natural Environment.....	6
1.2.2 Built Environment.....	9
Section 2 Methods	10
2.1 Field Methods	10
2.1.1 Pedestrian Survey	10
2.1.2 GPS Data Collection.....	10
2.2 Research Methods.....	12
2.3 Disposition of Materials	12
Section 3 Background Research	13
3.1 Traditional and Historical Background.....	13
3.1.1 Mythological and Traditional Accounts	13
3.1.2 Early Historic Period	15
3.1.3 The Māhele and the Kuleana Act	20
3.1.4 Mid- to Late 1800s.....	20
3.1.5 1900s.....	21
3.1.6 Contemporary Land Use.....	34
3.2 Previous Archaeological Research	38
3.2.1 Bordner 1977	38
3.2.2 Sinoto 1988.....	38
3.2.3 Spear 1996	38
3.2.4 Dega et al. 1998	38
3.2.5 Magnuson 1999	46
3.2.6 Tulchin et al. 2001	46
3.2.7 Tulchin and Hammatt 2004	46
3.2.8 Tulchin and Hammatt 2005	48
3.2.9 O'Hare et al. 2006.....	48
3.2.10 Rasmussen and Tomonari-Tuggle 2006	48
3.2.11 Tulchin and Hammatt 2007	48
3.2.12 Mooney and Cleghorn 2008	49
3.2.13 Groza et al. 2009.....	49
3.2.14 Hunkin and Hammatt 2009.....	49
3.2.15 Runyon et al. 2010.....	50
3.2.16 Runyon et al. 2011	50
3.2.17 Pacheco and Rieth 2014.....	50
3.2.18 Zapor et al. 2018	50
3.3 Background Summary and Predictive Model	50
Section 4 Results of Fieldwork	52

Section 5 Historic Property Descriptions	62
5.1 SIHP # 50-80-08-5593	62
5.1.1 Description of SIHP # -5593 by Dega et al. 1998	62
5.1.2 Description of SIHP # -5593 within and adjacent to the Current Project Area	67
5.1.3 Significance	86
5.2 SIHP # 50-80-09-2268 Waiahole Ditch System/ post-Contact Irrigation Ditch	91
5.2.1 Overview.....	91
5.2.2 Previously Identified Features of the Remnant Portion of SIHP # -2268 outside the Current Project Area	94
5.2.3 Features of the Remnant Portion of SIHP # -2268 within the Current Project Area	103
5.2.4 Significance	121
Section 6 Summary and Interpretation	132
Section 7 Significance Assessments	134
Section 8 Project Effect and Mitigation Commitments	140
8.1 Project Effect	140
8.2 Mitigation Commitments.....	140
Section 9 References Cited	141
Appendix A SHPD Acceptance of the Dega et al. 1998 AIS.....	149

List of Figures

Figure 1. Portion of the 2013 Ewa and Schofield Barracks USGS 7.5-minute topographic quadrangles showing the location of the project area	2
Figure 2. Tax Map Key (TMK) [1] 9-2-002 showing the location of the project area (Hawai'i TMK Service 2014)	3
Figure 3. Aerial photograph of the project area (Google Earth 2018)	4
Figure 4. AES West Oahu Overall Site Plan (supplied by client, dated 1/30/2019)	5
Figure 5. ESRI Aerial Imagery (2016) with overlay of <i>Soil Survey of the State of Hawaii</i> (Foote et al. 1972; USDA SSURGO 2001), indicating soil types within and surrounding the project area	8
Figure 6. Aerial photograph showing the project area with overlay of two of four archaeologists' GPS track logs (Google Earth 2018)	11
Figure 7. Portion of a USGS Orthoimagery aerial photograph (2011) showing place names, trails and streams of Honouliuli Ahupua'a with the location of the project area	14
Figure 8. Portion of the 1810 Rockwood map of trails of Leeward O'ahu with overlay of project area (T̄i 1959:96)	17
Figure 9. Portion of 1825 Malden map of the South Coast of Oahu (RM 640) showing the location of the project area	18
Figure 10. Portion of 1873 Alexander map of Honouliuli (RM 405) showing trail network in vicinity of project area	19
Figure 11. Portion of the 1906 Donn Hawaii Territory Survey map of Oahu with land use (RM 2374) showing breakdown of land use in southwest O'ahu	23
Figure 12. Portion of 1919 U.S. Army War Department fire control map, Nanakuli quadrangle showing the project area	24
Figure 13. Portion of 1922 Wall map of Honouliuli Forest Reserve (HTS Plat 2065) showing the location of the project area	25
Figure 14. 1922 Wall map of Honouliuli Forest Reserve (HTS Plat 2065) showing the location of the project area with annotations	26
Figure 15. 1925 Oahu Sugar Company plantation map showing project area (red) as largely within former Field 30 (Condé and Best 1973:317)	27
Figure 16. Portion of the 1936 U.S. Army War Department terrain map, Waianae quadrangle showing the location of the project area	28
Figure 17. Portion of the 1943 U.S. Army War Department terrain map, Waipahu quadrangle showing the project area	30
Figure 18. 1951 USGS aerial photograph (UH MAGIS) showing the project area	31
Figure 19. Portion of the 1953 Ewa and Schofield Barracks USGS topographic quadrangles showing the project area	32
Figure 20. Portion of the 1968 Ewa and 1969 Schofield Barracks USGS topographic quadrangles showing the project area	33
Figure 21. 1968 USGS aerial photograph (UH MAGIS) showing the project area	35
Figure 22. 1977 USGS Orthophotoquad aerial photograph, Ewa and Schofield Barracks quadrangles showing the project area	36
Figure 23. 1993 NOAA aerial photograph (UH MAGIS) showing the project area	37

Figure 24. Portion of the 1998 Ewa and Schofield Barracks USGS topographic quadrangles showing the locations of previous archaeological studies in the vicinity (within approximately 1.5 km) of the project area	39
Figure 25. Portion of the 1998 Ewa and Schofield Barracks USGS topographic quadrangles showing the locations of previously identified historic properties in the immediate vicinity of the project area (note the SIHP # -5593 property boundary is defined as the Dega et al. 1998 project area and not the true extent or location of its features)	43
Figure 26. Plan map of the AIS for the University of Hawai‘i, West O‘ahu Campus project area showing historic properties (as of 1998) with an overlay of the current project area (adapted from Dega et al. 1998:3). This overlay suggests “Pump Station 12 and Mill” and a ditch were documented as within the present project area and another ditch and road and “Stone stack” were adjacent to the north side of the present project area (note this is a sketch and locations are approximate)	47
Figure 27. Overview of southwest portion of project area, view to southwest	53
Figure 28. Overview of southwest portion of project area, view to west	53
Figure 29. Overview of northern portion of project area, view to northeast	54
Figure 30. Representative photo of fence posts noted in southwest portion of project area, view to southeast.....	54
Figure 31. Remnant water diversion flume in southern project area, view to northwest	56
Figure 32. Remnant water diversion flume in southern project area, view to north.....	56
Figure 33. Access road encompassed within the project area, paved and lined with concrete curb, view to southwest.....	57
Figure 34. Overview of dirt (or dirt-covered) access road, view to northeast	57
Figure 35. Overview of access road junction, view to south.....	58
Figure 36. Access road overview showing water manhole, view to northeast	58
Figure 37. Overview of modern concrete culvert at the base of the access road (junction with Palehua Road), view to northeast.....	59
Figure 38. Overview of concrete flume in central northern project area, view to southeast	59
Figure 39. Plan view of concrete flume in central northern project area.....	60
Figure 40. Overviews of the gulch inside the project area, view to southwest (left), view to northeast with observed metal debris (right)	61
Figure 41. Aerial photograph showing the historic properties identified during the AIS: SIHP # 50-80-08-2268 Feature E through Feature K (shown in green) and SIHP # 50-80-08-5593 Feature 1 and Features 2A through 2E (shown in orange) (Google Earth 2018)	63
Figure 42. Aerial photograph (Google Earth 2018) depicting the distribution of features of SIHP # 50-80-08-5593 (Feature 1 and Features 2A through 2E) within the project area.....	64
Figure 43. Figure from Dega et al. (1998) showing identified features of two historic properties (Dega et al. 1998:3), with overlay of current project area	65
Figure 44. Features of SIHP # 50-80-08-5593 documented by Dega et al. (1998:15)	66
Figure 45. Features of SIHP # 50-80-08-5593 documented by Dega et al. (1998:16)	68
Figure 46. Mill building immediately southeast of the project area boundary (downslope of Feature 2A complex), view to east	69

Figure 47. Pump House No. 12, southeast of the project area (mill building to the left), view to southeast.....	69
Figure 48. Upper portion of SIHP # 50-80-08-5593 Feature 1 showing concrete pipes, view to east (collapse to the southwest, at right, may have covered the second pipe)	71
Figure 49. Lower portion of SIHP # 50-80-08-5593 Feature 1 showing metal pipes, view to northwest.....	71
Figure 50. SIHP # 50-80-08-5593 Feature 1 plan map.....	72
Figure 51. Overview of SIHP # 50-80-09-2268 Waiahole Ditch portion, and SIHP # 50-80- 08-5593 Feature 2A complex, with the pump house and mill building at the base of the slope, view to southeast	73
Figure 52. Overview of SIHP # 50-80-09-2268 Waiahole Ditch portion, and SIHP # 50-80- 08-5593 Feature 2A complex, view to north	73
Figure 53. Plan view showing inscription in SIHP # 50-80-08-5593 Feature 2A complex	74
Figure 54. Overview of SIHP # 50-80-08-5593 Feature 2A and SIHP # 50-80-09-2268 Waiahole Ditch portion, with catchment basin (foreground) and drain pipes, view to east	74
Figure 55. Upper water retention area of SIHP # 50-80-08-5593 Feature 2A complex, view to west	75
Figure 56. Upper water retention areas (eastern portion) of SIHP # 50-80-08-5593 Feature 2A complex, view to northeast	75
Figure 57. Figure showing an example of a gravel trap on the Iao-Maniania ditch system on Maui (from Wilcox 1996:125).....	76
Figure 58. Center flume of SIHP # 50-80-08-5593 Feature 2A complex extending from upper catchment area into SIHP # 50-80-09-2268 Waiahole Ditch, view to west	77
Figure 59. Overview of SIHP # 50-80-08-5593 Feature 2A complex with eastern flume (right), extending into SIHP # 50-80-09-2268 Waiahole Ditch, view to northwest....	77
Figure 60. Water retention component of SIHP # 50-80-09-5593 Feature 2A complex, view to west	78
Figure 61. Plan view of SIHP # 50-80-09-5593 Feature 2A complex, water retention component, view to northwest	78
Figure 62. Plan map of SIHP # 50-80-08-5593 Feature 2A water diversion complex (just northwest of project area)	79
Figure 63. Overview of SIHP # 50-80-08-5593 Feature 2B, showing dividing wall between two large water storage components, view to northeast	81
Figure 64. Overview of SIHP # 50-80-08-5593 Feature 2B, showing two large water storage compartments (background) and smaller compartment containing pipes and valves (foreground), view to northwest	81
Figure 65. Overview of SIHP # 50-80-08-5593 Feature 2B, smaller southeast portion, view to northeast.....	82
Figure 66. SIHP 3 50-80-08-5593 Feature 2B plan map	82
Figure 67. SIHP # 50-80-08-5593 Feature 2C, water tank and associated components, view to northeast.....	83
Figure 68. Concrete valve components of SIHP # 50-80-08-5593 Feature 2C, view to west.....	83

Figure 69. Overview of concrete foundation and pipes component of SIHP # 50-80-08-5593 Feature 2C, view to southeast	84
Figure 70. Collapsed walls with pipe, component of SIHP # 50-80-08-5593 Feature 2C, view to southeast.....	84
Figure 71. Plan map of SIHP # 50-80-08-5593 Feature 2C, water tank remnants and associated components.....	85
Figure 72. Overview of SIHP # 50-80-08-5593 Feature 2D, northeast valve box, view to east ...	87
Figure 73. Overview of SIHP # 50-80-08-5593 Feature 2D, southwest valve box, view to southwest.....	87
Figure 74. SIHP # 50-80-08-5593 Feature 2D sluice gate and possible water overflow channel, view to northeast.....	88
Figure 75. Feature 2D plan view of southern retention area with sluice gate and possible overflow channel, view to southwest.....	88
Figure 76. SIHP # 50-80-08-5593 Feature 2D, northeast and southeast valve boxes (top left), and Feature 2E runoff channel (bottom right) plan map.....	89
Figure 77. SIHP # 50-80-08-5593 Feature 2E, culvert remnants, view to northwest.....	90
Figure 78. SIHP # 50-80-08-5593 Feature 2E, close-up of culvert remnants, view to west	90
Figure 79. Route of the Waiahole Ditch System in relation to the present project area, showing in-use and remnant portions, depicted on a 1992–1999 USGS topographic quadrangle map.....	92
Figure 80. Aerial photograph depicting the distribution of portions of SIHP # 50-80-09- 2268 Feature E through Feature K, as well as features of SIHP # 50-80-08-5593, identified within the current project area (Google Earth 2018).....	93
Figure 81. Portion of SIHP # 50-80-09-2268 documented by Dega et al. (1998:18).....	95
Figure 82. SIHP # 50-80-09-2268 showing the dressed basalt boulder and mortar Waiahole Ditch (top), and stacked basalt boulder and cobble retaining wall (below) (Tulchin and Hammatt 2004:53).....	96
Figure 83. Showing the eastern (top, view to east) and western (bottom, view to south) ends of the southern portion of SIHP # 50-80-09-2268 Feature A: flume bridge (Tulchin and Hammatt 2004:55).....	98
Figure 84. Plan view diagram (top) and profile (bottom) of SIHP # 50-80-09-2268 Feature A: flume bridge (Tulchin and Hammatt 2004:54)	99
Figure 85. SIHP # 50-80-09-2268 Feature B, showing stone and mortar flume support foundation, view to north (Hunkin and Hammatt 2009:50)	100
Figure 86. SIHP # 50-80-09-2268 Feature B flume, showing wooden flume extension (Hunkin and Hammatt 2009:50), view to southeast	100
Figure 87. Plan view of SIHP # 50-80-09-2268 Feature B (Hunkin and Hammatt 2009:48)	101
Figure 88. Photograph (top, view to east) and cross-section map (bottom) of SIHP # 50-80- 09-2268 Feature B flume (Hunkin and Hammatt 2009:49).....	102
Figure 89. SIHP # 50-80-09-2268 Feature C, view to south (Hunkin and Hammatt 2009:52)	104
Figure 90. SIHP # 50-80-09-2268 Feature C, showing partially intact wooden flume section, view to south (Hunkin and Hammatt 2009:52)	104
Figure 91. Plan view of SIHP # 50-80-09-2268 Feature C (Hunkin and Hammatt 2009:51)	105

Figure 92. SIHP # 50-80-09-2268 Feature D, earthen mound, view to southwest (Zapor et al. 2018:79)	106
Figure 93. SIHP # 50-80-09-2268 Feature D, stacked stone wall, view to southwest (Zapor et al. 2018:79)	106
Figure 94. Culvert of SIHP # 50-80-09-2268, Waiahole Ditch, northwest of (outside) the project area, view to southwest	107
Figure 95. Representative photo of SIHP # 50-80-09-2268, Waiahole Ditch outside (northwest) of the project area, view to east	107
Figure 96. Portion of SIHP # 50-80-09-2268, Waiahole Ditch outside (north) of project area, with date "1920" inscribed on basalt and mortar culvert, view to northeast	108
Figure 97. Portion of SIHP # 50-80-09-2268, Waiahole Ditch in northeastern project area, view to southwest.....	108
Figure 98. Representative photo of SIHP # 50-80-09-2268, Waiahole Ditch construction outside (northwest) of the project area, view to west	109
Figure 99. Representative photo of SIHP # 50-80-09-2268, Waiahole Ditch (left) in central project area, view to southwest	109
Figure 100. Representative photo of SIHP # 50-80-09-2268, Waiahole Ditch in southwest project area, dry-stacked basalt, view to north	110
Figure 101. Representative photo of SIHP # 50-80-09-2268, Waiahole Ditch in southwest project area, view to north	110
Figure 102. SIHP # 50-80-09-2268 Feature E, culvert and bridge components of the Waiahole Ditch in southern project area, view to northeast	112
Figure 103. SIHP # 50-80-09-2268 Feature E bridge overlying culvert of Waiahole Ditch in southern project area, view to east.....	112
Figure 104. SIHP # 50-80-09-2268 Feature E southwest face of culvert profile	113
Figure 105. SIHP # 50-80-09-2268 Feature E culvert and ditch plan map	114
Figure 106. SIHP # 50-80-09-2268 Feature F, basalt and mortar-lined ditch, with metal cross beam (right background), view to north	115
Figure 107. SIHP # 50-80-09-2268 Feature F, basalt and mortar ditch portion, with metal pipe and cross beam, view to south	115
Figure 108. Plan view of SIHP # 50-80-09-2268 Feature F, showing pipe, southeast channel, and sluice gate components	116
Figure 109. SIHP # 50-80-09-2268 Feature F, close-up of southeast channel and sluice gate component, view to north	116
Figure 110. SIHP # 50-80-09-2268 Feature F, west wall of ditch representative profile.....	117
Figure 111. SIHP # 50-80-09-2268 Feature F plan map	117
Figure 112. SIHP # 50-80-09-2268 Feature G, showing sluice gate component and two metal pipes, view to east	118
Figure 113. SIHP # 50-80-09-2268 Feature G plan map.....	118
Figure 114. Overview of SIHP # 50-80-09-2268 Feature H (left)	119
Figure 115. SIHP # 50-80-09-2268 Feature H plan map.....	120
Figure 116. SIHP # 50-80-09-2268 Feature H, drainage flume, along north edge of project area, view to northeast	122
Figure 117. Mortar and basalt pile south end of SIHP # 50-80-09-2268 Feature H, drainage flume, view to west	122

Figure 118. Collapsed bridge component of SIHP # 50-80-09-2268 Feature I, view to south.....	123
Figure 119. Collapsed bridge component of SIHP # 50-80-09-2268 Feature I, view to southwest.....	123
Figure 120. Close-up plan view showing metal portion, collapsed bridge component of SIHP # 50-80-09-2268 Feature I.....	124
Figure 121. Plan map of SIHP # 50-80-08-2268 Feature I, showing portion of the Waiahole Ditch, collapsed bridge components, and head wall	125
Figure 122. Overview of bridge component of SIHP # 50-80-09-2268, Feature J, view to southwest.....	126
Figure 123. Culvert component of SIHP # 50-80-09-2268 Feature J documented east of bridge component, view to north	127
Figure 124. Plan map of SIHP # 50-80-09-2268 Feature J, bridge component.....	128
Figure 125. SIHP # 50-80-09-2268 Feature K, culvert and tunnel feature, view to north	129
Figure 126. SIHP # 50-80-09-2268 Feature K, showing culvert with intact sluice gate, view to east	129
Figure 127. Plan map of SIHP # 50-80-09-2268 Feature K	130

List of Tables

Table 1. Previous archaeological studies within the vicinity (within approximately 1.5 km) of the project area.....	40
Table 2. Previously identified historic properties in the vicinity of the project area.....	44
Table 3. SIHP # 50-80-08-5593 (Dega et al. 1998 did not designate feature numbers).....	66
Table 4. Archaeological historic property integrity, significance, and project-specific mitigation commitments	135
Table 5. Significance evaluations for portions of the Waiahole Ditch	136

Section 1 Introduction

1.1 Project Background

At the request of Tetra Tech, Inc., and on behalf of AES Distributed Energy, Cultural Surveys Hawai‘i, Inc. (CSH) has prepared this archaeological inventory survey report (AISR) for the AES West O‘ahu Solar project, Honouliuli Ahupua‘a, ‘Ewa District, O‘ahu, TMK: [1] 9-2-002:007 (por). The project area is 101.62 acres (41.12 hectares) of undeveloped lands in the southeastern foothills of the Wai‘anae Range, northeast of Pu‘u Makakilo and the Makakilo subdivision, and 600 m northwest of the intersection of the H-1 Freeway and the Kualaka‘i Parkway. The project area is depicted on a portion of the 2013 Ewa and Schofield Barracks U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle (Figure 1), a tax map plat (Figure 2), and a 2018 aerial photograph (Figure 3).

1.2 Proposed Project Description

The proposed AES West O‘ahu Solar project consists of construction and operation of an approximately 12.5 MW ground-mounted solar photovoltaic system, coupled with a 50 MWh battery energy storage system and related interconnection and ancillary facilities (see Overall Site Plan, Figure 4). Specifically, it includes the following major components: (1) solar photovoltaic system, (2) battery energy storage system, (3) substation and interconnection equipment, (4) a network of electrical wiring and collector lines, and (5) access roads and fencing. In addition to these facilities, the Project area would be made available for compatible agricultural activities.

The solar photovoltaic system would consist of a series of solar modules mounted on a fixed-tilt racking system. The racking system would hold the modules at a fixed angle of 15 degrees facing toward the south and would be supported by steel posts, spaced approximately every 19 feet (5.8m) (varies). The posts would be installed using a hydraulic pile driver and/or augur for pre-drilling, with approximate depths of 6 feet (1.8m) (depending on soil conditions). In the event it is determined that the desired depth cannot be achieved, foundations would be pre-drilled and supported with concrete. Once mounted on the racking system, the highest point of the modules is expected to extend approximately 8.5 feet (2.6m) above the ground surface, with an average of approximately 3 feet (0.9m) of ground clearance below the modules. Electrical equipment (including inverters and transformers) and the battery units (housed in containers) would be installed on concrete equipment pads distributed throughout the Project area. A total of five concrete pads would be installed; each approximately 2,800 square feet (260.1 m²) in area. The Project would also include a substation and associated electrical equipment to facilitate interconnection with the Hawaiian Electric grid. These facilities would be constructed immediately adjacent to the existing Hawaiian Electric ‘Ewa Nui #42 46kV sub-transmission line and would occupy a total of approximately 7,800 square feet (724.6m²). A short overhead electrical connection (approximately 300 feet or 91.4m in length), supported by approximately three 60-foot or 18.3m tall wood poles, would also be installed. Electrical wiring and collector lines connecting the solar modules with the equipment pads and the substation would be installed underground; approximately 14,000 linear feet (4.267 km) of trenching would be required, with widths ranging between 5-10 feet (1.5m to 3.0m) and depths up to 4 feet (1.2m). Perimeter fencing and new access roads would also be installed within the Project area. Equipment to support compatible agricultural

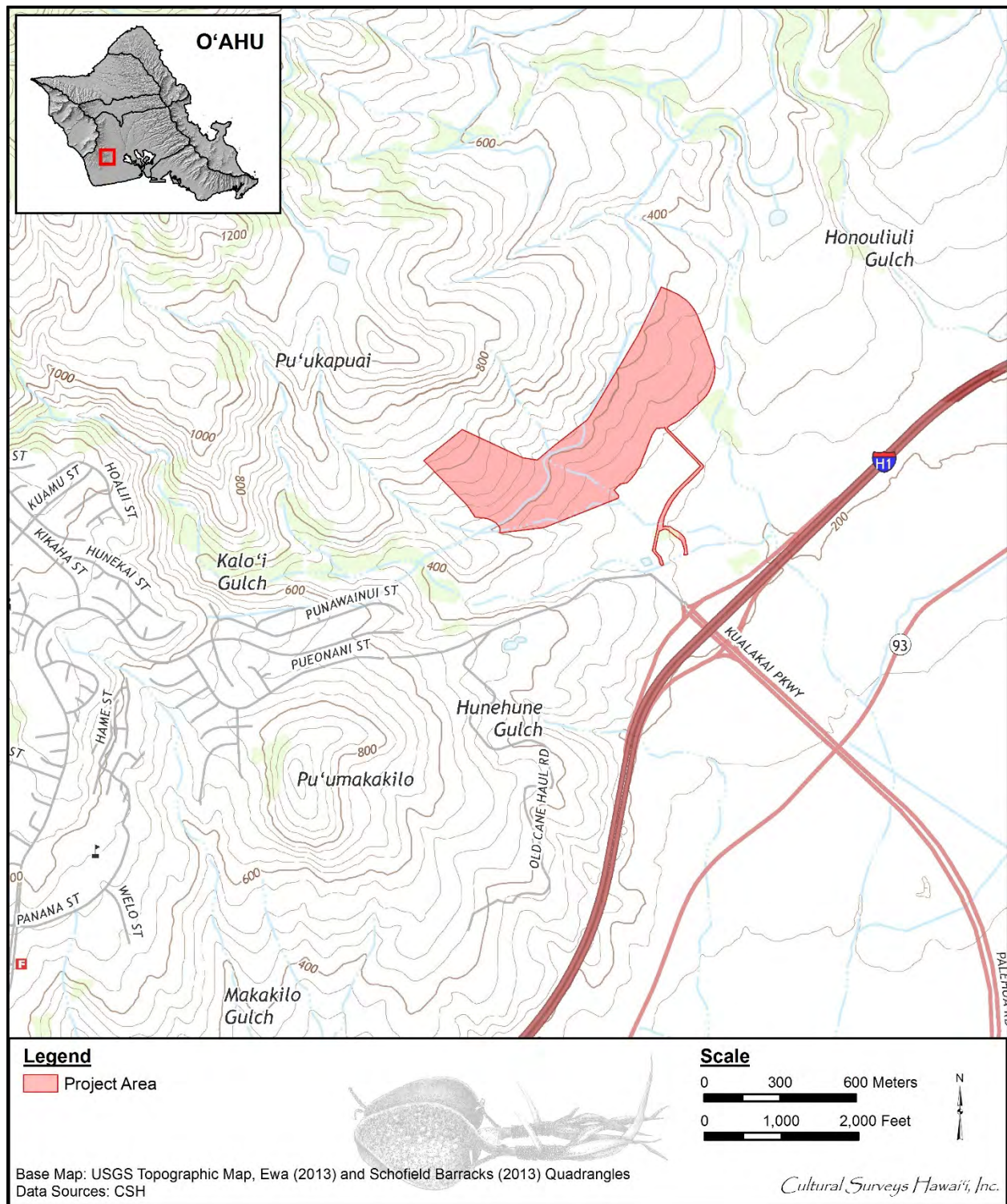


Figure 1. Portion of the 2013 Ewa and Schofield Barracks USGS 7.5-minute topographic quadrangles showing the location of the project area

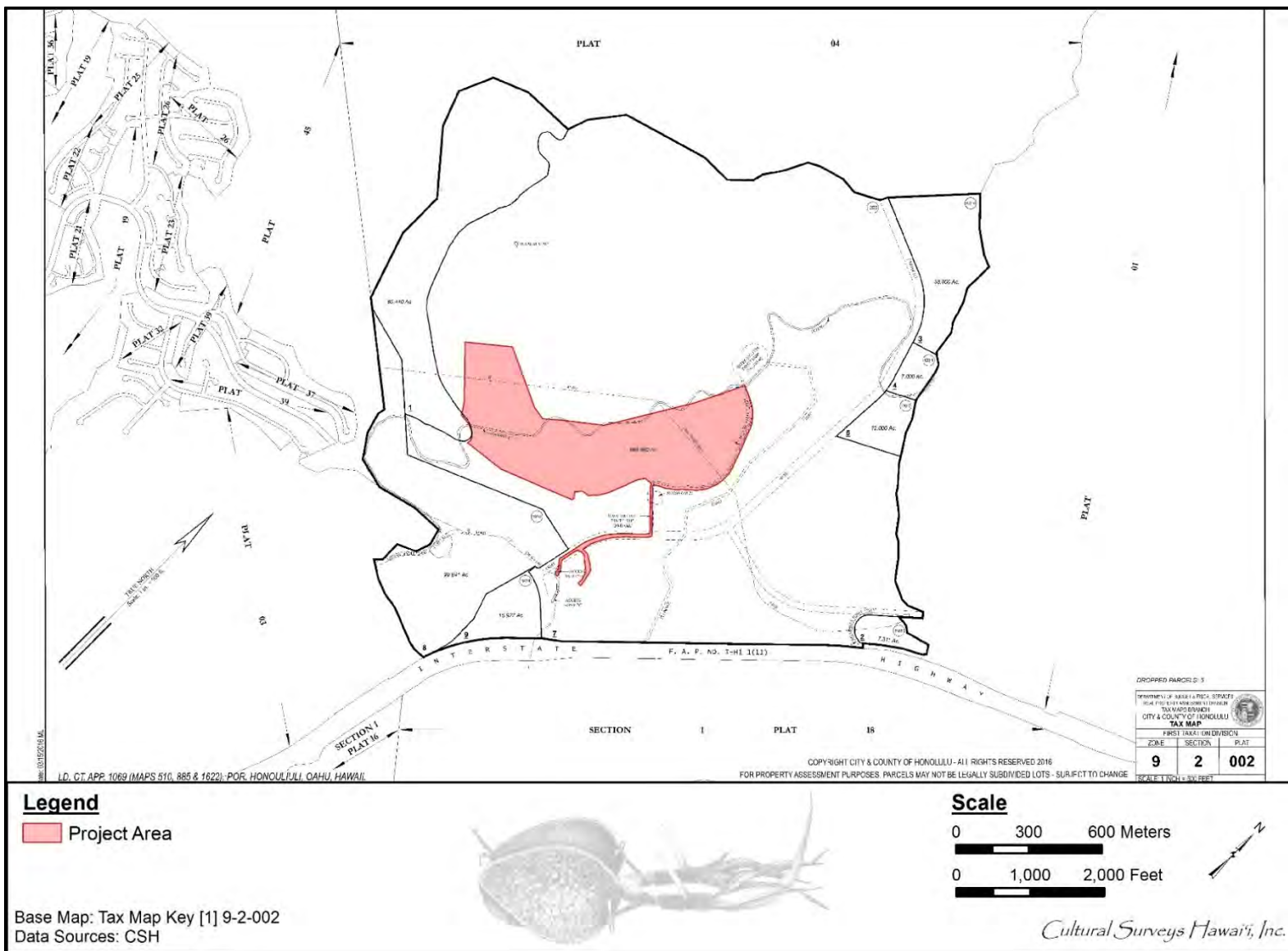


Figure 2. Tax Map Key (TMK) [1] 9-2-002 showing the location of the project area (Hawai'i TMK Service 2014)

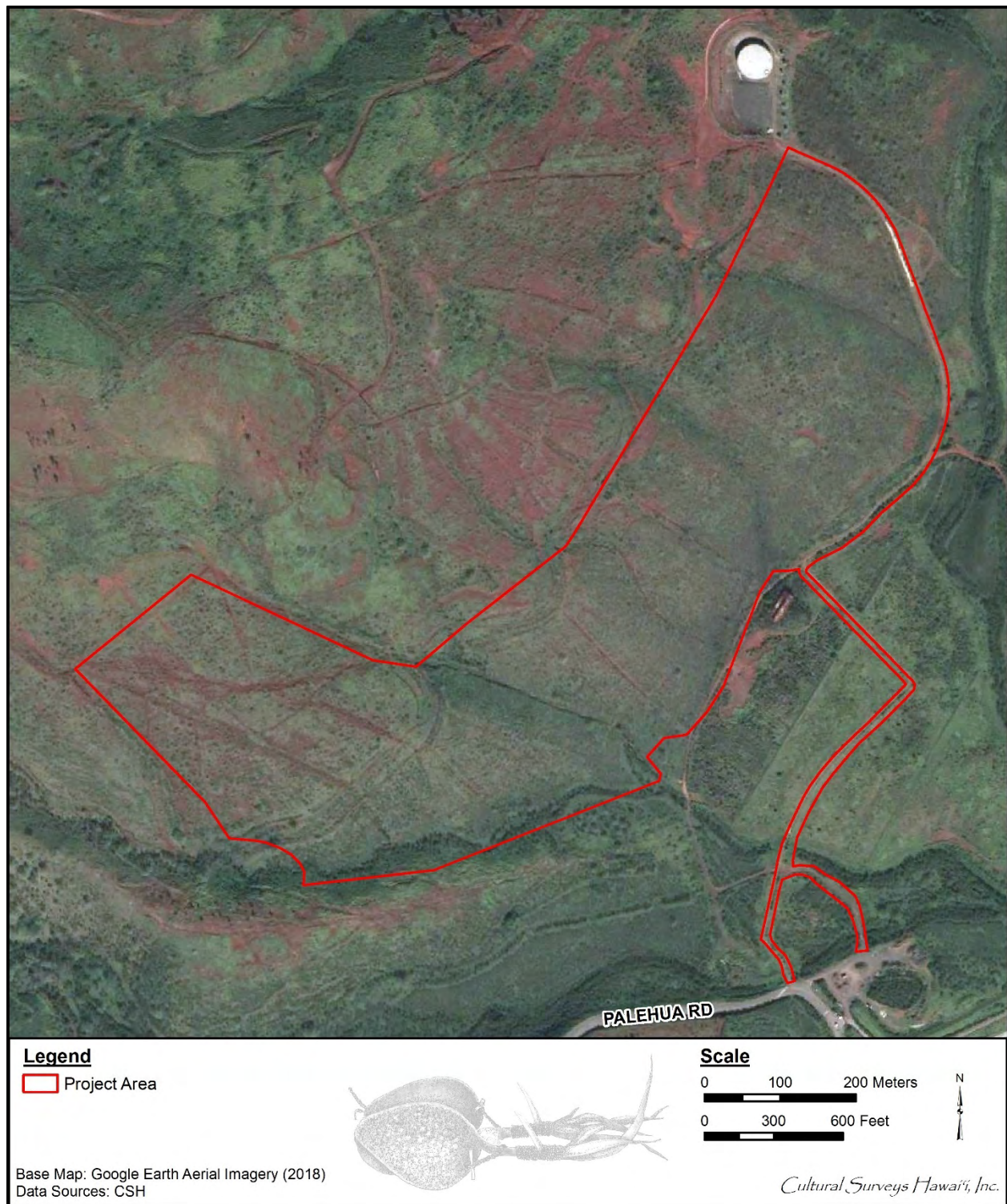


Figure 3. Aerial photograph of the project area (Google Earth 2018)

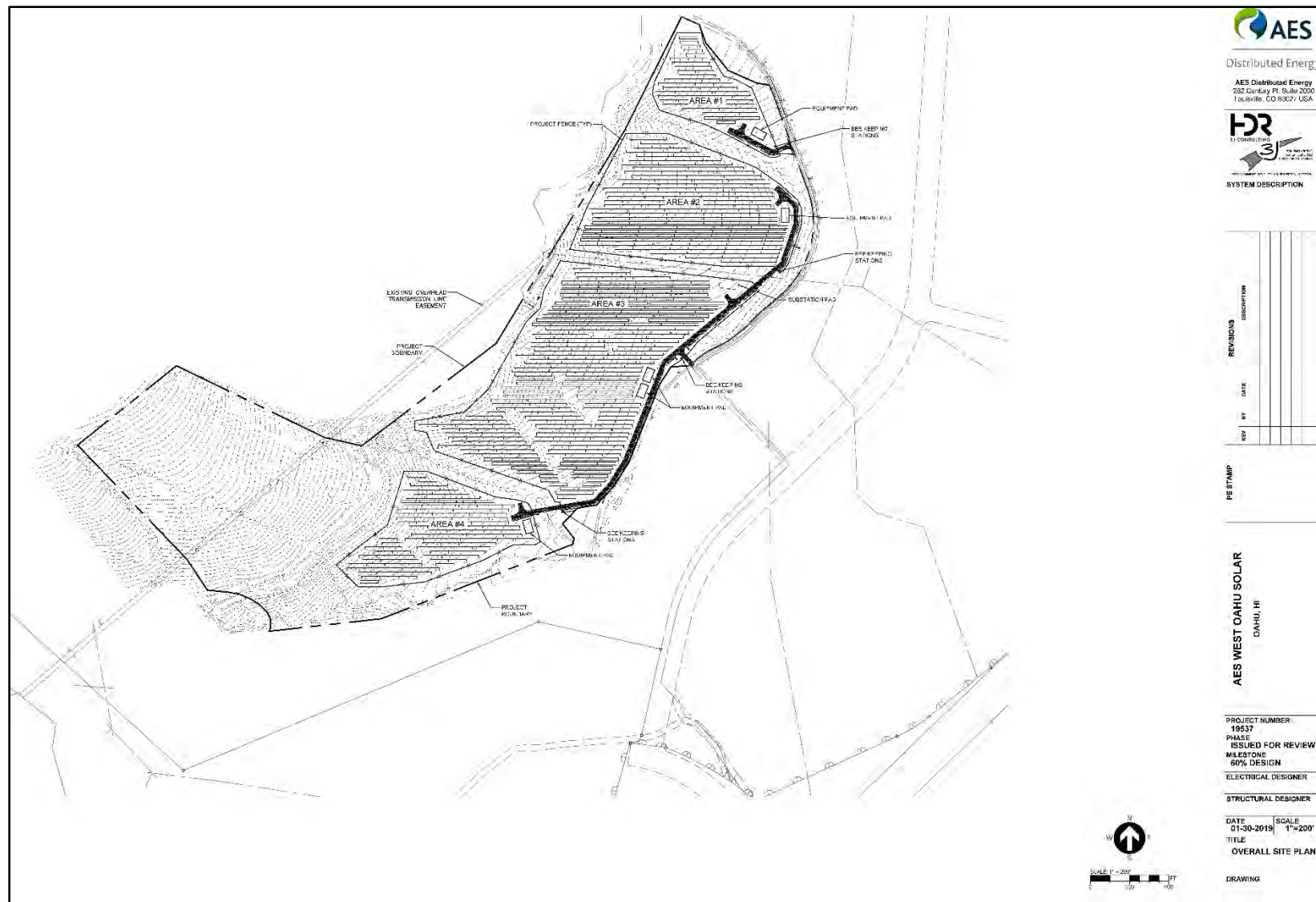


Figure 4 AES West Oahu Overall Site Plan (supplied by client, dated 1/30/2019)

AI for the AES West O'ahu Solar Project, Honouliuli, 'Ewa, O'ahu

TMK: [1] 9-2-002:007 (por.)

activities would include four beekeeping stations (each approximately 40 square feet or 3.7m²) and two cattle pens (each with a small concrete slab for a water trough). In addition to construction of the facilities described above, grading would also occur in localized areas as needed to smooth the ground surface and for other civil engineering purposes (e.g., stormwater retention and management).

1.1 Historic Preservation Regulatory Context and Document Purpose

The entire AES West O'ahu Solar project area was previously addressed within an *Archaeological Inventory Survey of the University of Hawai'i West O'ahu Campus, District of 'Ewa, Island of O'ahu, Hawai'i (TMK 9-2-02:01, 9-2-02:03, 9-2-02:05)* (Dega et al. 1998), which was accepted by the State Historic Preservation Division (SHPD) on 3 February 1999 (LOG NO. 22959, DOC. NO. 9901EJ28; Appendix A). Due to the passage of time and given that the present project is different than that addressed by the 1998 report, it was agreed in consultation with Dr. Susan Lebo on 12 February 2019 that it would be appropriate to move forward with an AIS specific to this project.

This AIS investigation fulfills the requirements of Hawai'i Administrative Rules (HAR) §13-13-276. The AIS was conducted to identify, document, and assess the significance of historic properties within the project area, assess the potential for the project to adversely affect significant historic properties, and to provide agreed upon mitigation commitments to address any adverse impacts. This document is intended to support the proposed project's historic preservation review under Hawai'i Revised Statutes (HRS) §6E-42 and HAR §13-284, as well as the project's environmental review under HRS §343. It is also intended to support any project-related historic preservation consultation with stakeholders such as state and county agencies and interested Native Hawaiian Organizations (NHOs) and community groups. The AIS investigation was designed in consultation with the SHPD.

1.2 Environmental Setting

1.2.1 Natural Environment

The project area is in the southeast Wai'anae Range at an elevation of approximately 280 to 640 feet (ft) above mean sea level. The Wai'anae Range comprises the eroded remnant of a great shield volcano, dating back in origin to approximately 2.2 to 3.8 million years ago, now in the form of a long narrow ridge shaped by erosion (Macdonald et al. 1983:420, 303). Pu'u Kapua'i is 0.5 km to the northwest and Pu'u Makakilo is 1.2 km to the southwest. These are understood as "very late cones [of the Wai'anae volcano] [...] composed of a varied mixture of cinder, spatter and lava flows" (Macdonald et al. 1983:429).

Topography of the area is moderately sloping. In terms of hydrology, the area is drained by two deeply dissected gulches, Kalo'i Gulch 300 m to the southwest and Honouliuli Gulch 700 m to the northeast. These gulches at a comparable elevation are believed to rarely run with water. Historic maps indicate a spring located approximately 2.2 km to the north. Such infrequent springs may have been key to the early human activity on the southeast Wai'anae slope. The project area is relatively dry with a mean annual rainfall at the neighboring Station Field 105 of 703 mm or 27.7 inches (Giambelluca et al. 2013). This rainfall would be marginal for non-irrigated agriculture. Average annual temperatures range from 38° to 75° Fahrenheit (Giambelluca et al. 2014).

According to the U.S. Department of Agriculture (USDA) Soil Survey Geographic (SSURGO) database (2001) and soil survey data gathered by Foote et al. (1972), the project area's soils consist of Kawaihapai clay loam (KIB), 2 to 6% slopes (KIaB), Mahana silt clay loam, 6 to 12% slopes, eroded (McC2), Mahana silt clay loam, 12 to 20% slopes, eroded (McD2), Mahana silt clay loam, 20 to 35% slopes, eroded (McE2), Molokai silty clay loam, 7 to 15% slopes (MUC) and Molokai silty clay loam, 15 to 25% slopes (MUD) soils (Figure 5).

Kawaihapai series soils are described as follows:

This series consists of well-drained soils in drainageways and on alluvial fans on the coastal plains on the islands of Oahu and Molokai. These soils formed in alluvium derived from basic igneous rock in humid uplands. They are nearly level to moderately sloping. Elevations range from nearly sea level to 300 feet. The annual rainfall amounts to 30 to 50 inches. [...] These soils are used for sugarcane, truck crops, and pasture. The natural vegetation consists of kiawe, koa haole, lantana, and bermudagrass. [Foote et al. 1972:63–64]

Further, Kawaihapai clay loam, 2 to 6% slopes soils (KIB), are described as having slow runoff and a slight erosion hazard (Foote et al. 1972).

Kawaihapai stony clay loam, 2 to 6% slopes (KIaB) is described as similar to Kawaihapai clay loam, but with “enough stones to hinder, but not prevent cultivation. Runoff is slow, and the erosion hazard is slight” (Foote et al. 1972:64).

Mahana series soils are described as follows:

This series consists of well-drained soils on uplands on the islands of Kauai and Oahu. These soils developed in volcanic ash. They are gently sloping to very steep. Elevations range from 1,000 to 3,000 feet. The annual rainfall amounts to 30 to 45 inches. [...] These soils are used for pasture, woodland, wildlife habitat, irrigated sugarcane, and water supply. The natural vegetation consists of puakeawe, aalii, ricegrass, molassesgrass, silver oak, yellow foxtail, lantana, joe, Japanese tea, passion flower, and associated plants. [Foote et al. 1972:85]

Mahana silt clay loam, 6 to 12% slopes, eroded (McC2) soils are described as follows:

This soil occurs on ridgetops and moderately sloping uplands [...] Permeability is moderately rapid. Runoff is slow, and the erosion hazard is slight. [...] In places roots penetrate to a depth of 5 feet or more. [...] This soil is used for pasture, woodland, wildlife habitat, pineapple, and sugarcane. [Foote et al. 1972:85–86]

Mahana silt clay loam, 12 to 20% slopes, eroded (McD2) soils, are described as having medium runoff and a moderate erosion hazard, used for pasture, woodland, wildlife habitat, and sugarcane (Foote et al. 1972).

Mahana silty clay loam, 20 to 35% slopes, eroded (McE2) soils are further described as follows:

Most of the surface layer has been removed by erosion. Runoff is very rapid, and the erosion hazard is very severe. Included in mapping were areas where all of the surface layer and part of the subsoil have been removed by erosion. Also included were small, stony areas and reddish-colored upland soils that are underlain by a

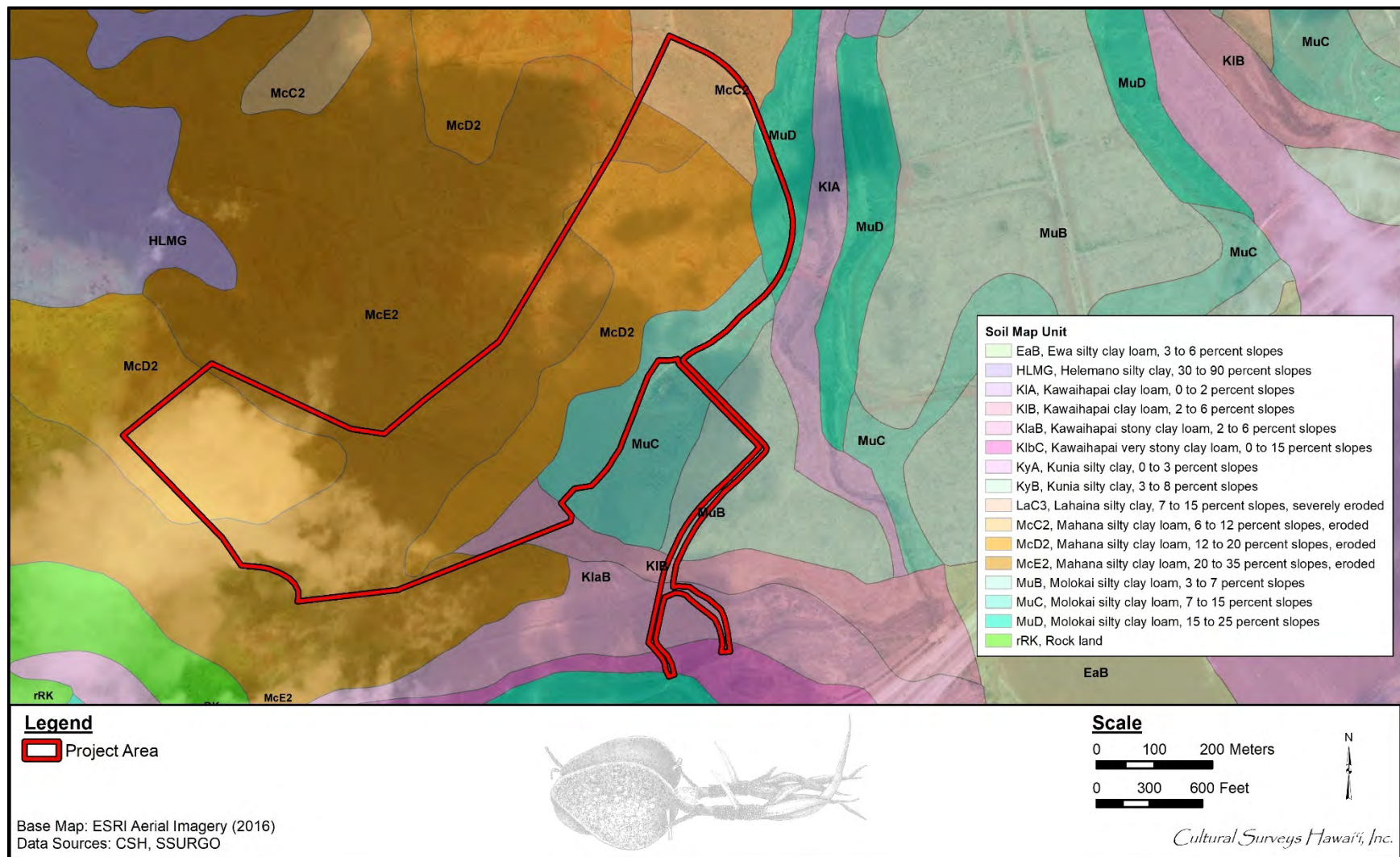


Figure 5. ESRI Aerial Imagery (2016) with overlay of *Soil Survey of the State of Hawaii* (Foote et al. 1972; USDA SSURGO 2001), indicating soil types within and surrounding the project area

panlike layer at a depth of 15 to 50 inches. This soil is used for pasture, pineapple, and irrigated sugarcane. [Foote et al. 1972:86]

Molokai series soils are described as follows:

This series consists of well-drained soils on uplands on the islands of Maui, Lanai, Molokai, and Oahu. These soils formed in material weathered from basic igneous rock. They are nearly level to moderately steep. Elevations range mainly from nearly sea level to 1,000 feet but are as much as 1,500 feet on Lanai. The annual rainfall amounts to 20 to 25 inches, most of which occurs between November and April [...] These soils are used for sugarcane, pineapple, pasture, wildlife habitat, and homesites. The natural vegetation consists of kiawe, ilima, uhaloa, feather fingergrass, and buffelgrass. [Foote et al. 1972:96]

Molokai silty clay loam, 3 to 7% slopes (MuB) are further described as having slight to moderate erosion hazard with slow to medium runoff.

Molokai silty clay loam, 7 to 15% slopes (MUC) soils, are described as occurring on knoll slope breaks, with medium runoff and a moderate erosion hazard (Foote et al. 1972). This material is used for sugarcane, pineapple, pasture, wildlife habitat, and home sites (Foote et al. 1972).

Molokai silty clay loam, 15 to 25% slopes (MUD) soils are further described as follows:

This soil occurs on Oahu. In most places the slope does not exceed 20 percent. Runoff is medium, and the erosion hazard is severe. Workability is slightly difficult because of the slope. Included in mapping were small areas where boulder cores are exposed. This soil is used for sugarcane and pineapple. [Foote et al. 1972:97]

Today the project area is largely covered with *haole koa* (*Leucaena leucocephala*) and exotic grasses. *Wiliwili* (*Erythrina sandwicensis*), sweet acacia or klu (*Acacia farnesiana*), and *kiawe* (*Prosopis pallida*) were also observed within the project area.

1.2.2 Built Environment

The project area was utilized for commercial sugarcane from the early twentieth century into the late 1970s. Some of the sugarcane plantation infrastructure in the vicinity was relatively elaborate, with the Waiahole Ditch transporting irrigation water from windward O'ahu into the foothills of the southern Wai'anae Range. The sugarcane fields have remained fallow for decades. Some plantation infrastructure is still present in the form of cane haul roads and remnant irrigation features (see Figure 3). The project area is otherwise undeveloped. The H-1 Freeway is approximately 800 m south of the project area.

Section 2 Methods

2.1 Field Methods

Fieldwork was completed under archaeological fieldwork permit number 19-07, issued by the SHPD pursuant to HAR §13-282. CSH archaeologists Scott Belluomini, B.A., Chris Konen, B.A., Tyler Turran, B.A., and Alison Welser, M.A., conducted fieldwork between 4 and 6 February 2019 under the direction of project manager David W. Shideler, M.A., and general supervision of Hallett H. Hammatt, Ph.D., Principal Investigator. Following the initial pedestrian inspection, the project area boundaries were extended slightly to the north and the west, as well as south to encompass the existing access roads to be used for the project. Additional pedestrian inspection was conducted for these areas on 12 December 2019. This work required approximately 12 person-days to complete.

2.1.1 Pedestrian Survey

Archaeologists undertook a 100%-coverage pedestrian inspection of the project area for the purpose of historic property identification and documentation. The pedestrian survey was accomplished through systematic sweeps of four CSH archaeologists spaced approximately 10 to 15 m apart based on ground visibility. Archaeologists walked transects beginning at the north end of the project area down to the southern border, oriented southwest (Figure 6). Additionally, archaeologists walked the length of the Waiahole Ditch within the project area. Archaeologists recorded the general characteristics of the project area, including vegetation, and took general photographs of the project area. Only minimal vegetation clearance was attempted for the purpose of feature documentation and photography.

When potential historic properties were identified, archaeologists documented their locations. This included GPS data collection of the historic property and associated features. All surface features visible within the project area were photographed with a scale and generally described, which often included descriptions of dimensions, shape, materials, method of construction, integrity, general condition, and evidence of age and function of the feature. Plan maps were completed for features, as well as profiles and cross-sections when appropriate. Additionally, archaeologists documented areas of the historic properties outside the project area boundaries and photographed and noted construction methods and components of the ditch for an overall description of the historic property. Note that historic property extents were defined by a 1-m radius surrounding the documented portions of all identified features.

2.1.2 GPS Data Collection

The locations of all documented components of historic properties were recorded using a Trimble Pro XH mapping grade GPS unit with real-time differential correction. This unit provides sub-meter horizontal accuracy in the field. GPS field data was post-processed, yielding horizontal accuracy between 0.5 and 0.1 m. GPS location information was converted into GIS shape files using Trimble's Pathfinder Office software, version 5.85, and graphically displayed using ESRI's ArcGIS 10.6.1. CSH utilizes the NAD 83 HARN datum and UTM Zone 4N coordinate system.

In addition to feature locations, archaeologists recorded data points, which were also recorded on illustrated plan maps. For feature complexes, GPS points were taken at several data points, which were recorded on plan maps to assist in the accurate mapping of the horizontal extent of the

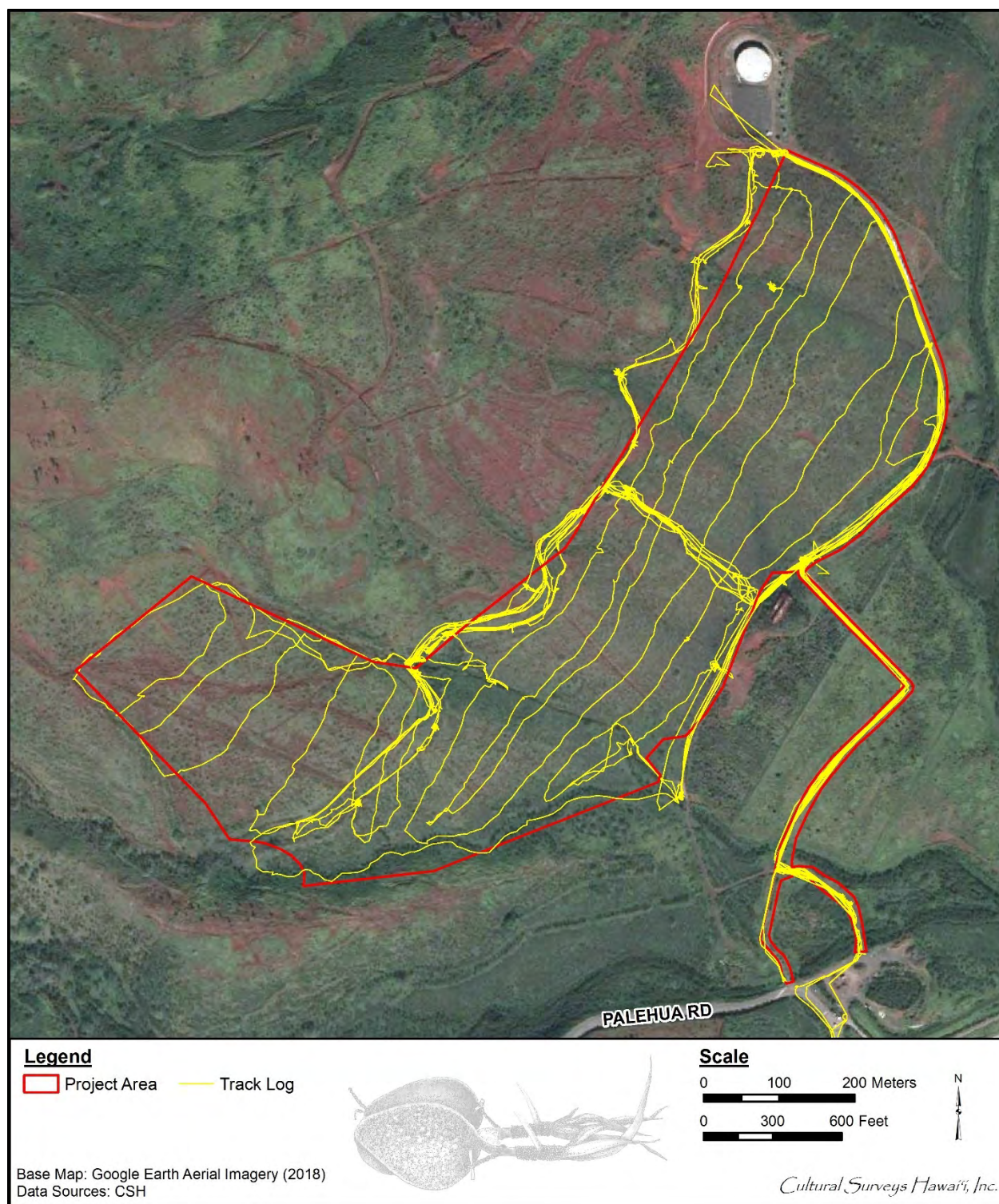


Figure 6. Aerial photograph showing the project area with overlay of two of four archaeologists' GPS track logs (Google Earth 2018)

historic property. The data points were used to geo-reference the historic properties’ location using scaled illustrated maps and field notes.

2.2 Research Methods

Background research included a review of previous archaeological studies on file at the SHPD; review of documents at Hamilton Library of the University of Hawai‘i, the Hawai‘i State Archives, the Mission Houses Museum Library, the Hawai‘i Public Library, and the Bishop Museum Archives; study of historic photographs at the Hawai‘i State Archives and the Bishop Museum Archives; and study of historic maps at the Survey Office of the Department of Land and Natural Resources. Historic maps and photographs from the CSH library were also consulted. In addition, Māhele records were examined from the Waihona ‘Aina database (Waihona ‘Aina 2020). This research provided the environmental, cultural, historic, and archaeological background for the project area. The sources studied were used to formulate a predictive model regarding the expected types and locations of historic properties in the project area.

2.3 Disposition of Materials

No materials were collected during AIS fieldwork. All data generated during the course of the AIS are stored at the CSH office in Waimānalo, O‘ahu.

Section 3 Background Research

3.1 Traditional and Historical Background

The *ahupua'a* (traditional land division) of Honouliuli is the largest, in total land area, *ahupua'a* on the island of O'ahu. It stretches across 16,446.4 hectares (40,640 acres) from the summit of the Wai'anae Range in the northwest, to the west shore of Pearl Harbor in the east. It is separated from the Pearl Harbor entrance channel and the ocean by Pu'uloa Ahupua'a on its southeast side.

Honouliuli Ahupua'a, as a traditional land unit, had tremendous and varied resources available for exploitation by early Hawaiians. Within Honouliuli Ahupua'a, not only is there a long coastline fronting the normally calm waters of leeward O'ahu, but there are also 4 miles of waterfront along the west side of the West Loch of Pearl Harbor. The "karstic desert" and marginal characterization of the limestone plain, which is the most readily visible terrain, does not do justice to the *ahupua'a* as a whole. Although the *ahupua'a* was rich in resources in many locations, the upper-middle portion of the Honouliuli Ahupua'a, where the project area is located, has little recorded traditional use.

Traditional sources, the earliest maps, and early archaeological studies do not display much land use in this portion of Honouliuli Ahupua'a. Kalo'i Gulch, which courses just south of the project area, and Pu'u Kapua'i just to the northwest are the only Hawaiian-named land forms in the vicinity of the project area that have been documented (Figure 7). Pukui et al. (1974:77) translate the name "Ka-lo'i" to mean "the taro patch" and Sterling and Summers (1978:35) relate a number of vignettes regarding the "Waihuna" or "Punahuna" hidden spring associated with Kalo'i Gulch. Ida E.K. von Holt (in Sterling and Summers 1978:35) relates in the account of "two old Hawaiians" that the hidden spring "had been one of the principal sources of water for all that country, which was quite heavily populated before the smallpox epidemic of 1840." "Pu'u Kapua'i" is translated as "footprint hill" (Pukui et al. 1974:199) but the association with that name is unclear.

The political and cultural center of the *ahupua'a* is understood to have been the relatively dense settlement and rich lands for irrigated taro cultivation at the *'ili* (land division smaller than an *ahupua'a*) of Honouliuli, located where Honouliuli Stream empties into the north portion of West Loch (east of the current project area). The name of the *ahupua'a*, translated as "dark bay" (Pukui et al. 1974:51), may refer to the nature of the waters of West Loch at the mouth of Honouliuli Stream. Early accounts and maps indicate a large settlement at the *'ili* of Honouliuli. It is possible the political power of this village was so great it was able to extend its jurisdiction well to the northwest, into an area which might have been anticipated to fall under the dominion of the Wai'anae ruling chiefs.

3.1.1 Mythological and Traditional Accounts

The traditions of Honouliuli Ahupua'a have been compiled and summarized in studies by Sterling and Summers (1978), Hammatt and Folk (1981), Kelly (1991), Charvet-Pond and Davis (1992), and Maly and Rosendahl (1993). Some of the themes of these traditions include connections with Kahiki (the traditional homeland of Hawaiians, probably in reference to central Polynesia) and the special character and relationship of the places known as Pu'u 'o Kapolei and Kualaka'i.

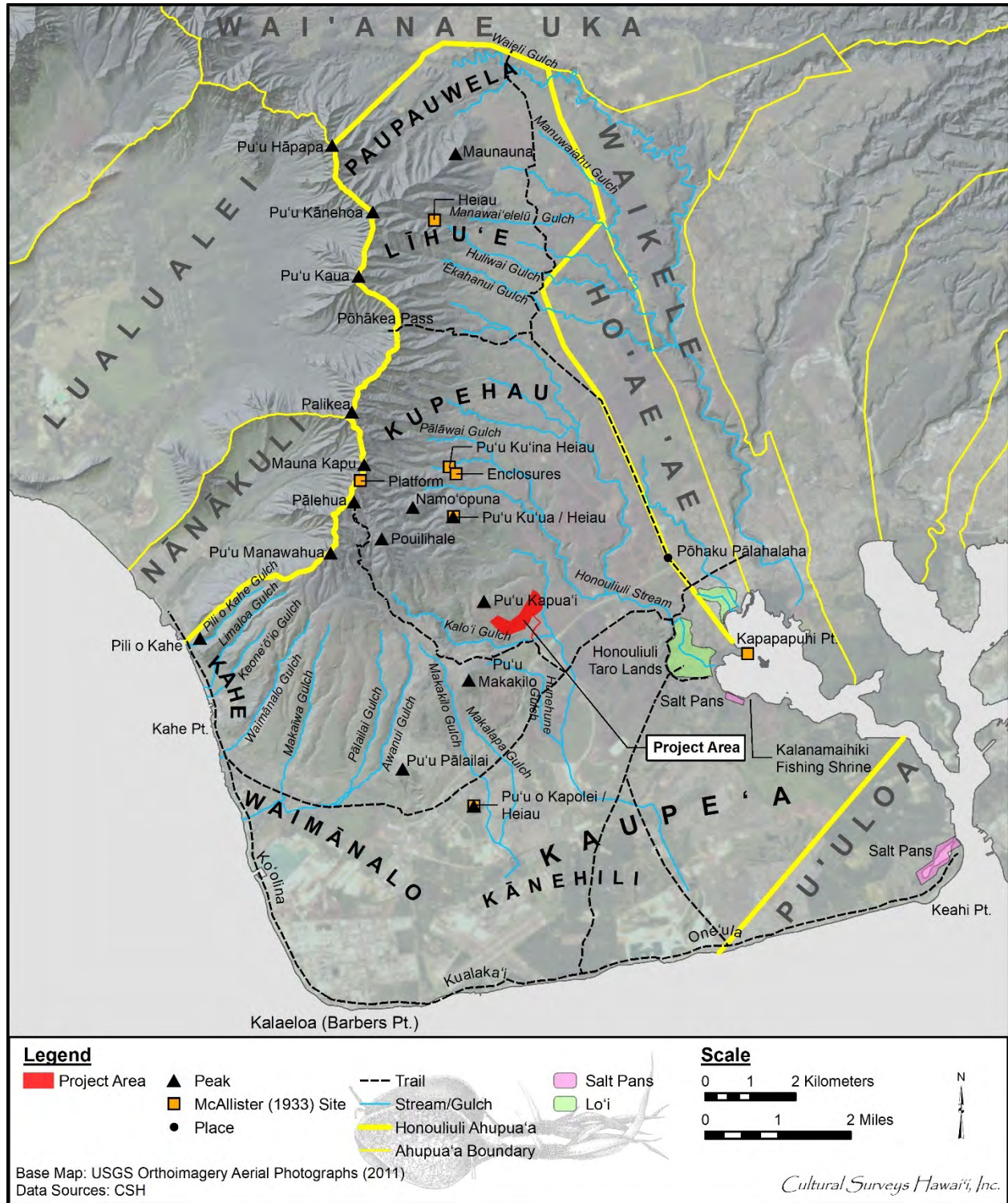


Figure 7. Portion of a USGS Orthoimagery aerial photograph (2011) showing place names, trails and streams of Honouliuli Ahupua'a with the location of the project area

Connections with Kahiki are found in numerous place names, traditional events, and in the beings associated with Honouliuli. There are several versions of Kaha'i leaving from Kalaeloa for a trip to Kahiki to bring breadfruit back to 'Ewa (Kamakau 1991:110). There are several stories that associate places in the region with Kamapua'a and the Hina family, as well as with Pele's sisters, all of whom have strong connections with Kahiki (Kamakau 1961:111; Pukui et al. 1974:200).

Pu'u 'o Kapolei (approximately 4 km southwest of the project area) was one of the more sacred places in Honouliuli (cf. Sterling and Summers 1978:33). Pu'u 'o Kapolei is connected with Kahiki, as the hill is noted as the home of Kamapua'a's grandmother, Kamaunuanoho, the Kahiki ancestor to the people of O'ahu (Fornander 1916:5:318; Kahiolo 1978:81, 107). By name, Kapolei is associated with the goddess Kapo, another connection with the Pele and Kamapua'a stories (Kamakau 1976:14).

McAllister (1933:108) records that a *heiau* (pre-Christian place of worship) was once located on Pu'u 'o Kapolei, but was destroyed before his survey of 1930. The *heiau* may have been associated with the sun, as the hill was used as a point of solar reference or as a place where such observations were made (Fornander 1916:3:292). Pu'u 'o Kapolei might have been understood as the gate of the setting sun. It is notable that the rising sun at the eastern gate of Kumukahi in Puna is associated with the Hawaiian goddess Kapo (Emerson 1978:41). There is little specific information for Pu'u 'o Kapolei, but the place name itself ("hill of beloved Kapo") is hard to ignore. It is mentioned in some cosmologies that Kū was the god of the rising sun, and Hina should be associated with the setting sun (Hina is the mother of Kamapua'a). Fornander (1916:3:292) states, Pu'u 'o Kapolei may have been a jumping off place (also connected with the setting sun) and associated with the dead who roamed the adjacent Plain of Kaupe'a.

Pu'u 'o Kapolei was the primary landmark for travelers between Pearl Harbor and the west O'ahu coast, with a main trail running inland of it ('Ī'i 1959:27, 29). Pu'u 'o Kapolei was probably the most common name used as a reference for the area of the 'Ewa Plain in traditional Hawai'i (Fornander 1916:2:318; Nakuina 1992:54; E.M. Nakuina 1904 in Sterling and Summers 1978:34).

3.1.2 Early Historic Period

Early historical accounts indicate the *ahupua'a* of Honouliuli was once widely inhabited by pre-Contact Hawaiian populations, including the Hawaiian *ali'i* (chiefly class). This substantial population can largely be attributed to the plentiful marine and estuarine resources available at the coast, along which several sites interpreted as permanent habitations were located. Other attractive subsistence-related features of the *ahupua'a* included irrigated lowlands suitable for wet land taro cultivation (Hammatt and Shideler 1990), as well as the lower forest area of the mountain slopes for the procurement of forest goods.

Exploitation of the forest resources along the slopes of the Wai'anae Range—as suggested by E.S. and E.G. Handy—probably acted as a viable subsistence alternative during times of famine:

The length or depth of the valleys and the gradual slope of the ridges made the inhabited lowlands much more distant from the *wao*, or upland jungle, than was the case on the windward coast. Yet the *wao* here was more extensive, giving greater opportunity to forage for wild foods during famine time. [Handy and Handy 1972:469–470]

These upper valley slopes may have also been a significant resource for opportunistic quarrying of basalt for the manufacturing of stone tools. This is evidenced in part by the existence of a probable quarrying site (State Inventory of Historic Places [SIHP] # 50-80-12-4322) in Makaīwa Gulch at 152 m (500 ft) above mean sea level, west of the current project area (Hammatt et al. 1991).

The Hawaiian *ali'i* were also attracted to the region. One historical account of particular interest refers to an *ali'i* residing in Ko Olina, southwest of the current project area:

Ko Olina is in Waimanalo near the boundary of Ewa and Waianae. This was a vacationing place for chief Kakuhihewa and the priest Napuaikamao was the caretaker of the place. Remember reader, this Ko Olina is not situated in the Waimanalo on the Koolau side of the island but the Waimanalo in Ewa. It is a lovely and delightful place and the chief, Kakuhihewa loved this home of his. [Sterling and Summers 1978:41]

John Papa 'Ī'i describes a network of Leeward O'ahu trails (Figure 8 through Figure 10) which in later historic times encircled and crossed the Wai'anae Range. These trails allowed passage from West Loch to the Honouliuli lowlands, past Pu'u 'o Kapolei and Waimānalo Gulch to the Wai'anae coast and onward circumscribing the shoreline of O'ahu ('Ī'i 1959:96–98). The main trail along the south shore of O'ahu would have been approximately 1.5 km to the southeast. A main trail extending up the central valley of O'ahu would have been approximately 3 km to the east. The 1825 Malden map (see Figure 9) shows a trail extending from the main trail along the south shore of O'ahu into the uplands in the Pālehua area, passing just a couple hundred meters to the southwest of the project area. The 1873 Alexander map (see Figure 10), one of the earliest detailed maps of the vicinity, shows no development near the project area.

Other early historical accounts of the general region typically refer to the more populated areas of the 'Ewa district, where missions and schools were established, and subsistence resources were perceived to be greater. However, the presence of archaeological sites along the coral plains and coast of southwest Honouliuli Ahupua'a indicate prehistoric and early historic populations also adapted to less inviting areas, despite the environmental hardships.

Subsequent to Western Contact in the area, the landscape of the 'Ewa Plain and Wai'anae slopes was adversely affected by the removal of the sandalwood and other trees, and the introduction of domesticated animals and new vegetation. Goats, sheep, and cattle were brought to the Hawaiian Islands by Vancouver in the early 1790s and allowed to graze freely about the land for some time after. L.A. Henke reports the existence of a longhorn cattle ranch in Wai'anae by at least 1840 (Frierson 1972:10). During this time, perhaps as early as 1790, exotic vegetation species were introduced to the area. These typically included vegetation best suited to a terrain disturbed by the logging of sandalwood forest and eroded by animal grazing. The following dates for the introduction of exotic vegetation are given by R. Smith and outlined by Frierson (1972:10–11):

1. 'early,' c. 1790: for the establishment of Prickly pear cactus, (*Opuntia tuna*), *Haole koa*, (*Leucaena leucocephala*) and Guava (*Psidium guajava*)
2. 1835-1840: Burmuda [*sic*] grass (*Cynodon dactylon*) and Wire grass (*Eleusine indica*)
3. 1858: Lantana (*Lantana camara*)

The *kiawe* tree (*Prosopis pallida*) was also introduced during this period, either in 1828 or 1837 (Frierson 1972:11).

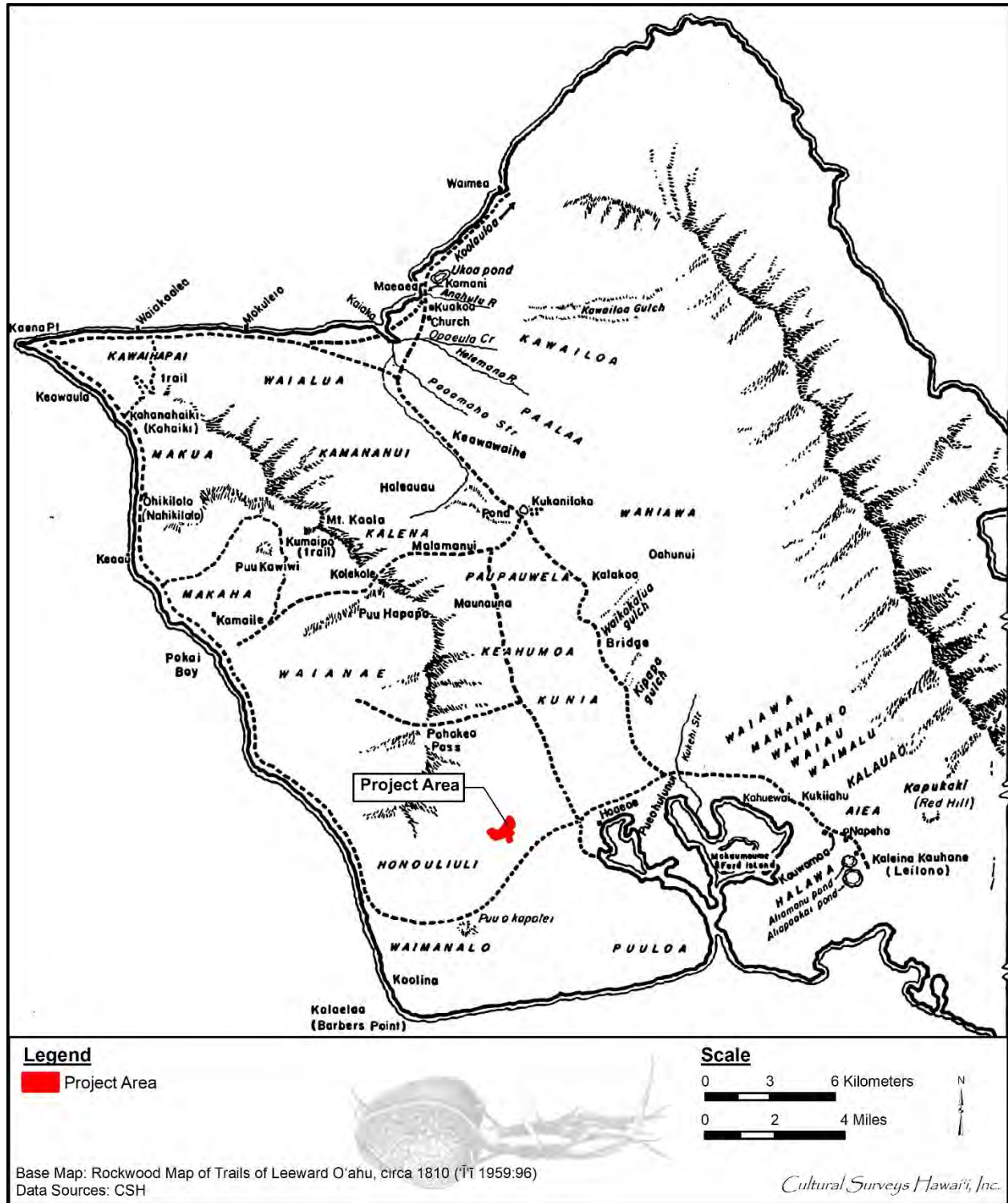


Figure 8. Portion of the 1810 Rockwood map of trails of Leeward O'ahu with overlay of project area (IT 1959:96)

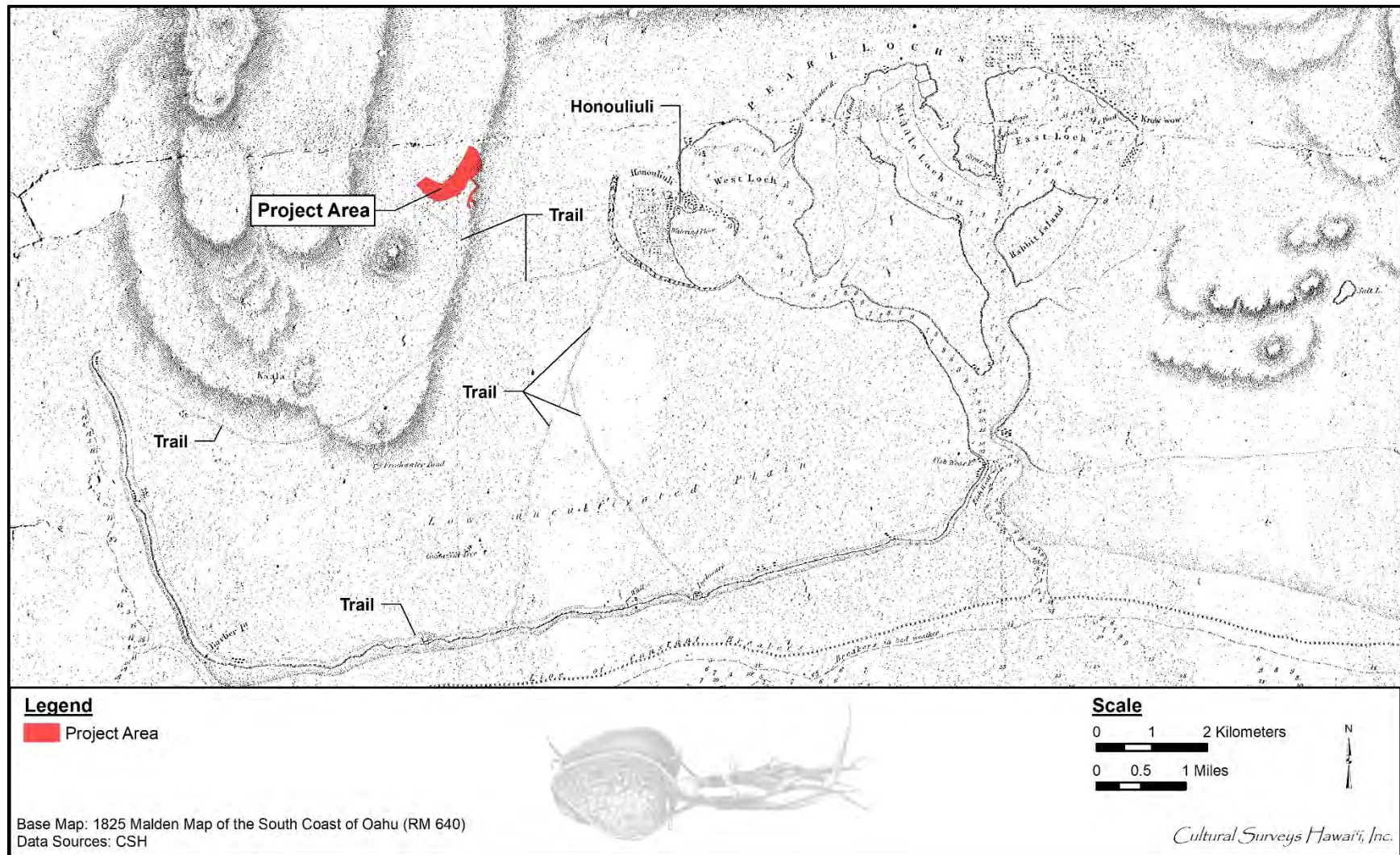


Figure 9. Portion of 1825 Malden map of the South Coast of Oahu (RM 640) showing the location of the project area

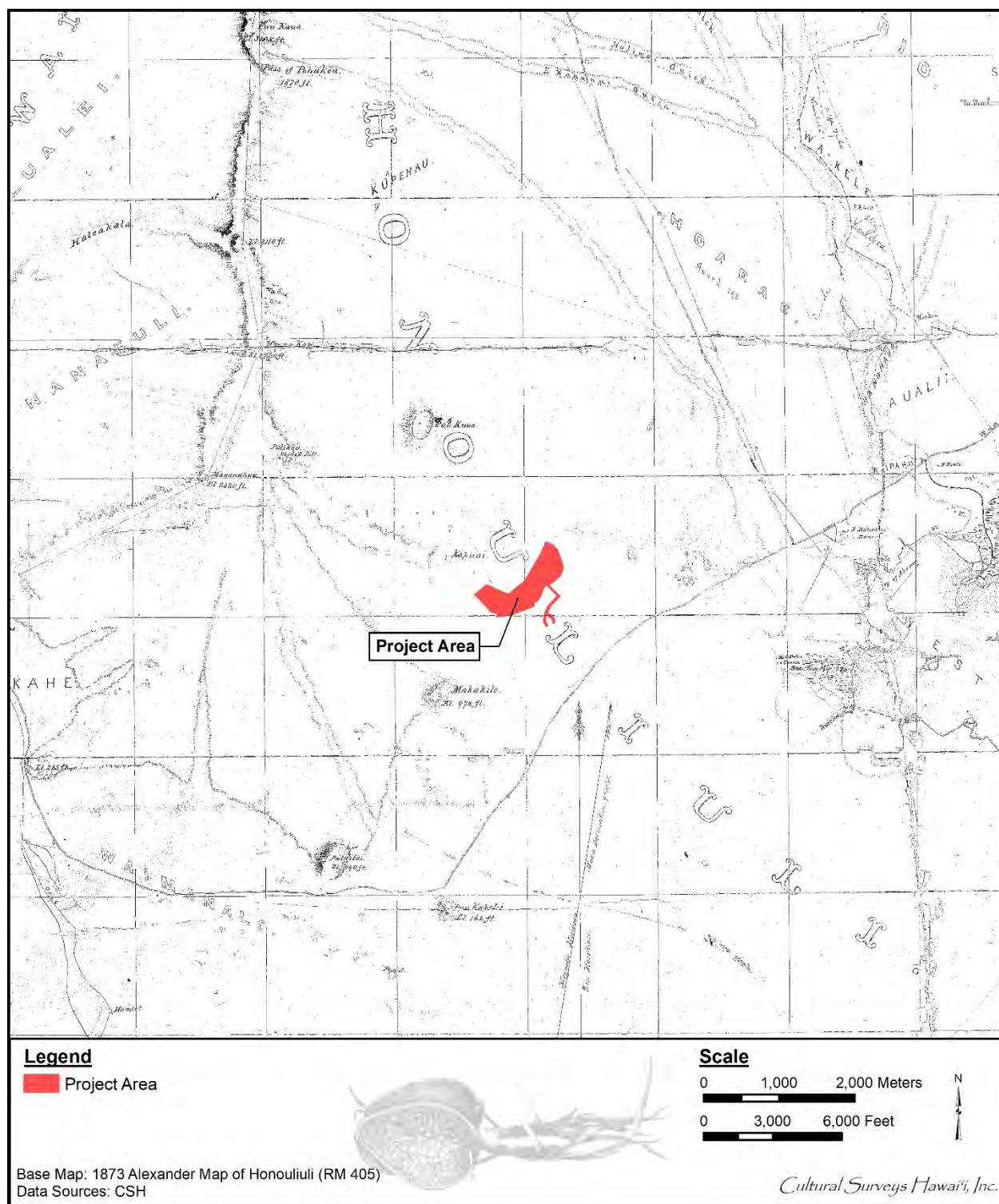


Figure 10. Portion of 1873 Alexander map of Honouliuli (RM 405) showing trail network in vicinity of project area

3.1.3 The Māhele and the Kuleana Act

During the Māhele of 1848, 99 individual land claims in the *ahupuaʻa* of Honouliuli were registered and awarded by King Kamehameha III. No *kuleana* land claims were made for land within the current project area or vicinity. The vast majority of the Land Commission Awards (LCA) were located in Honouliuli near the taro lands of the *ʻili* of Puʻuloa and the Puʻuloa Salt Works. The largest award (Royal Patent 6071, LCA 11216, *ʻĀpana* [parcel] 8) in Honouliuli Ahupuaʻa was granted to Miriam Keʻahi-Kuni Kekauʻonohi on January 1848 (Native Register 1848). Kekauʻonohi acquired a deed to all unclaimed land within the *ahupuaʻa*, including 43,250 acres encompassing the present project area.

Samuel Kamakau relates the following about Kekauʻonohi as a child:

Kamehameha's granddaughter, Ke-ahi-Kuni Kekau-onohi [...] was also a tabu chiefess in whose presence the other chiefesses had to prostrate and uncover themselves, and Kamehameha would lie face upward while she sat on his chest. [Kamakau 1961:208–209]

Kekauʻonohi was one of Liholiho's (Kamehameha II's) wives, and after his death, she lived with her half-brother, Luanuʻu Kahalaʻiʻa, who was governor of Kauaʻi (Kamakau 1961:20). Subsequently, Kekauʻonohi ran away with Queen Kaʻahumanu's stepson, Keliʻi-ahonui, and then became the wife of Chief Levi Haʻalelea. Upon her death on 2 June 1851, all her property passed to her husband and his heirs. When Levi Haʻalelea died, the property went to his surviving wife, who in turn leased it to James Dowsett and John Meek in 1871 for stock running and grazing.

3.1.4 Mid- to Late 1800s

In 1877, James Campbell purchased most of Honouliuli Ahupuaʻa for a total of \$95,000. He then drove off 32,347 head of cattle belonging to Dowsett, Meek, and James Robinson and constructed a fence around the outer boundary of his property (Bordner and Silva 1983:C-12). In 1879, Campbell brought in a well-driller from California to search the ʻEwa Plain for water and successfully “tapped artesian water which, from internal pressure, forced its way to the surface without being pumped” (Hitch 1992:79). Following this discovery, plantation developers and ranchers drilled numerous wells in search of the valuable resource. By 1881, the Campbell property of Honouliuli prospered as a cattle ranch with “abundant pasturage of various kinds” (Briggs in Haun and Kelly 1984:45). Within ten years of the first drilled well in ʻEwa, the addition of a series of artesian wells throughout the island supplied most of Honolulu's water needs (Armstrong and Bier 1983).

In 1889, Campbell leased his property to Benjamin Dillingham, who subsequently formed the Oahu Railway & Land Company (OR&L) in 1890. To attract business to his new railroad system, Dillingham subleased all land below 200 ft elevation to William Castle who in turn sublet the area to the Ewa Plantation Company for sugarcane cultivation (Frierson 1972:15). Dillingham's Honouliuli lands above 200 ft elevation that were suitable for sugarcane cultivation were sublet to the Oahu Sugar Company.

Ewa Plantation Company was incorporated in 1890 and operated into modern times. The plantation grew quickly with the abundant artesian water. As a means to generate soil deposition on the coral plain and increase arable land in the lowlands, the Ewa Plantation Company installed

ditches running from the lower slopes of the mountain range to the lowlands, then plowed the slopes vertically just before the rainy season to induce erosion (Frierson 1972:17).

The Oahu Sugar Company was incorporated in 1897 and included lands in the foothills above the 'Ewa Plain and Pearl Harbor. Prior to commercial sugar cultivation, the lands occupied by the Oahu Sugar Company were described as being "of near desert proportion until water was supplied from drilled artesian wells and the Waiahole Water project" (Condé and Best 1973:313). The Oahu Sugar Company took control of the Ewa Plantation lands in 1970 and continued operations into the 1990s.

Dillingham's *mauka* (inland, toward the mountains) lands in western Honouliuli that were unsuitable for commercial sugar production remained pasture for grazing livestock. From 1890 to 1892, the Ranch Department of the OR&L Company desperately sought water for their herds of cattle, tapping plantation flumes and searching for alternative sources of water. Ida von Holt shared the following account of her husband Harry's (Superintendent of the OR&L Ranch Department) search for water in the foothills of the Wai'anae Range:

One of those places is on the old trail to Pālehua, and had evidently been a place of which the Hawaiians had known, for its name is Kalo'i (the taro patch), and even in dry weather water would be standing in the holes made by the cattle, as they tried to get a drop or two. [von Holt 1985:136]

It is believed that the spring depicted in this account may have been identified during an inventory survey for the adjacent Pālehua East B project (Tulchin and Hammatt 2005). The spring was located along the upper slopes of the southern face of Kalo'i Gulch. A second account is given of the discovery of spring water in an area over the ridge on the north side of Kalo'i Gulch:

Shouting to the men to come over with their picks and shovels, he [Harry von Holt] soon got them busy clearing away lots of small stones and earth. Almost at once they could see that there were evidences of a paved well, and at about three feet down they came upon a huge flat rock, as large around as two men could span with their arms. Digging the rock loose and lifting it to one side, what was their astonishment to find a clear bubbling spring! [von Holt 1985:138]

Following the discovery, two old Hawaiians began to ask Von Holt about the spring:

Finally he [Harry von Holt] got them to explain that the spring, called 'Waihuna' (Hidden Spring) had been one of the principal sources of water for all that country, which was quite heavily populated before the smallpox epidemic of 1840 [...] A powerful Kahuna living at the spring had hidden it before he died of the smallpox, and had put a curse on the one who disturbed the stone, that he or she would surely die before a year was out. [von Holt 1985:138–140]

3.1.5 1900s

In 1913, the Waiahole Water Company, a subsidiary of the Oahu Sugar Company, began a project to transport irrigation water from the well-watered windward side of O'ahu, through the Ko'olau Range, to the fields and mill of the Oahu Sugar Company in 'Ewa. The water system, named the Waiahole Ditch System, was declared "an engineering feat of epic proportion for those times" (Condé and Best 1973:37). The original system, when completed, collected water from

stream intakes and water tunnels from Kahana Valley in the north to Waiāhole Valley in the south. The main tunnel extended through Waiāhole Valley to Waiawa, and water was then transported by ditch westward to Honouliuli, covering approximately 22 miles (Condé and Best 1973:37). The ditch system was completed in 1916 and, with some modifications, much of the ditch is in use today. This active portion of the ditch extends from the windward side of the island into Honouliuli. Remnant, inactive portions of the system extend southwest onto the 'Ewa Plain. The remnant portion of the Waiahole Ditch crosses through the southwestern portion of the present project area.

Much of the *mauka* lands in western Honouliuli, including ridges and deep gulches, were unsuitable for commercial sugar cultivation and remained pasture land for grazing livestock. The Donn 1906 map suggests the present project area was at the edge of sugarcane cultivation at that time (Figure 11). By 1920, however, much of the lands of Honouliuli were used for commercial sugarcane cultivation (Frierson 1972:18).

A 1919 map (Figure 12) shows ditches, reservoirs, roads, and railroad lines downslope of the project area. This map shows an unimproved road alignment just south of the project area, understood as the Pālehua Road, approximating a traditional Hawaiian footpath into the uplands. However, a 1922 map (Figure 13 and Figure 14 showing annotations), shows the called out Pālehua trail as jogging into the southwest portion of the project area. This 1922 map shows pineapple fields in at least 13 locations among the foothills of the southeast Wai'anae Range. The nearest of these pineapple fields wrapped around Pu'u Kapua'i some 500 m to the northwest. At least six (typically quite small) plantation camps were scattered along the bottom of these foothills with the nearest being about 500 m to the north of the project area. The Kupihau Ranch Station is shown about 2.6 km to the north. The water troughs and tanks shown upslope of the ranch station attest to the cattle operations in the vicinity at that time.

By 1925, most of the project area is depicted as within Oahu Sugar Company plantation Field 30 (Figure 15). The extreme upslope end of the project area still appears to be outside the area of sugarcane cultivation, in keeping with the depiction on the 1906 Donn map (compare with Figure 11).

In the late 1920s, the main residential communities were at the northeast edge of the 'Ewa Plain and the largest community was still located at Honouliuli Village. 'Ewa was primarily a plantation town, focused around the sugar mill, with a public school as well as a Japanese school. Additional settlement, in Waipahu, centered around the Waipahu sugar mill operated by the Oahu Sugar Company. However, small plantation camps were scattered within the extensive sugarcane fields (as indicated in Figure 14).

By 1936, however, "Pump Camp 5" had been established on either side of a pipeline that bisected the present project area, as seen on a 1936 U.S. Army War Department map (Figure 16). The 1936 map indicates approximately seven houses on the northeast side of the pipeline and 17 houses on the southwest side of the pipeline within the present project area at that time. The central pipeline extended downslope from the Waiahole Ditch to a large pump house structure that still exists just southeast (outside) of the project area. The alignment of the Waiahole Ditch crossing the western portion of the project area, and a roughly parallel road just upslope, are clearly depicted. It appears a spur plantation railroad serviced Pump Camp 5 connecting to the northeast and continuing a short distance to the southeast.

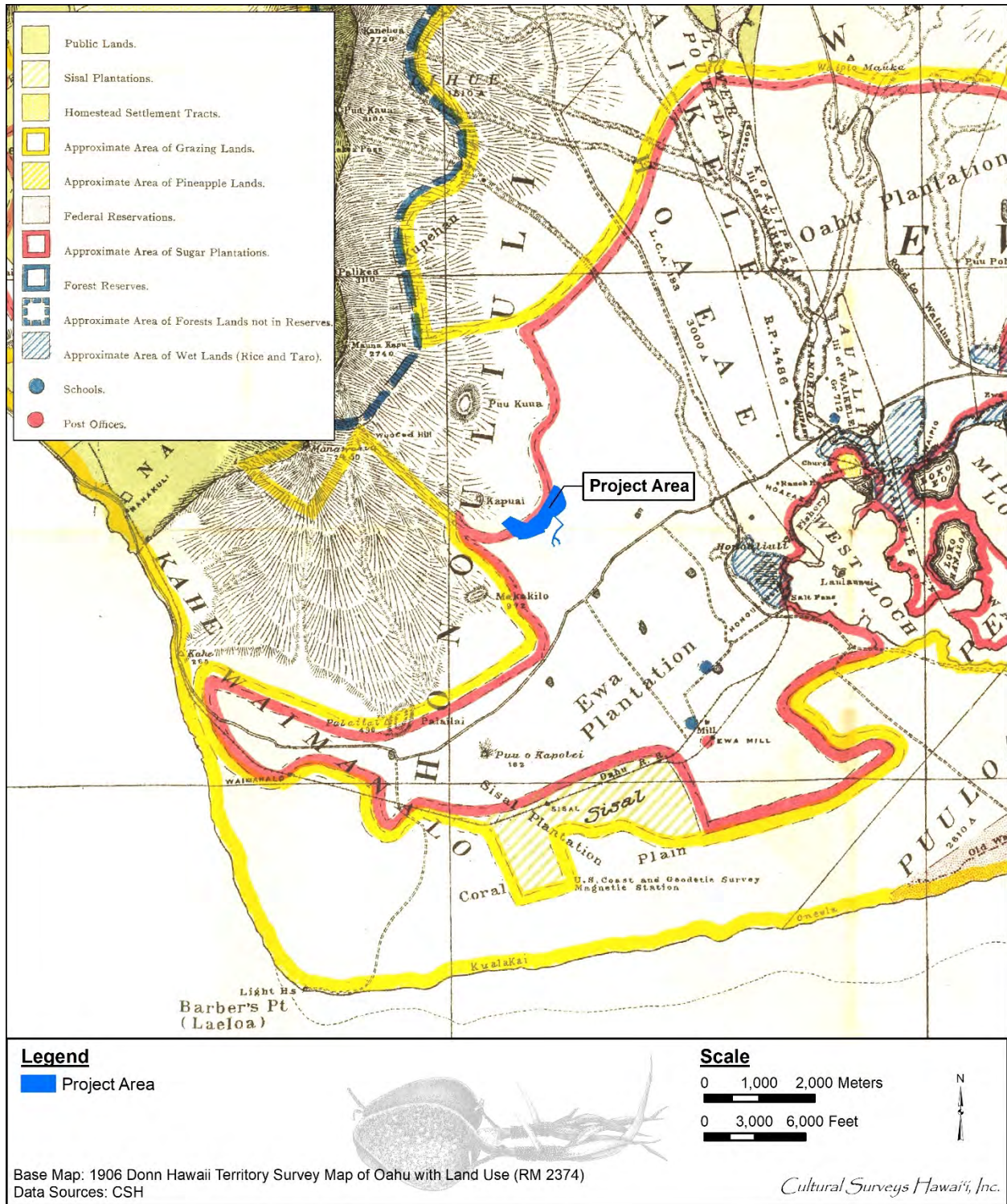


Figure 11. Portion of the 1906 Donn Hawaii Territory Survey map of Oahu with land use (RM 2374) showing breakdown of land use in southwest O'ahu

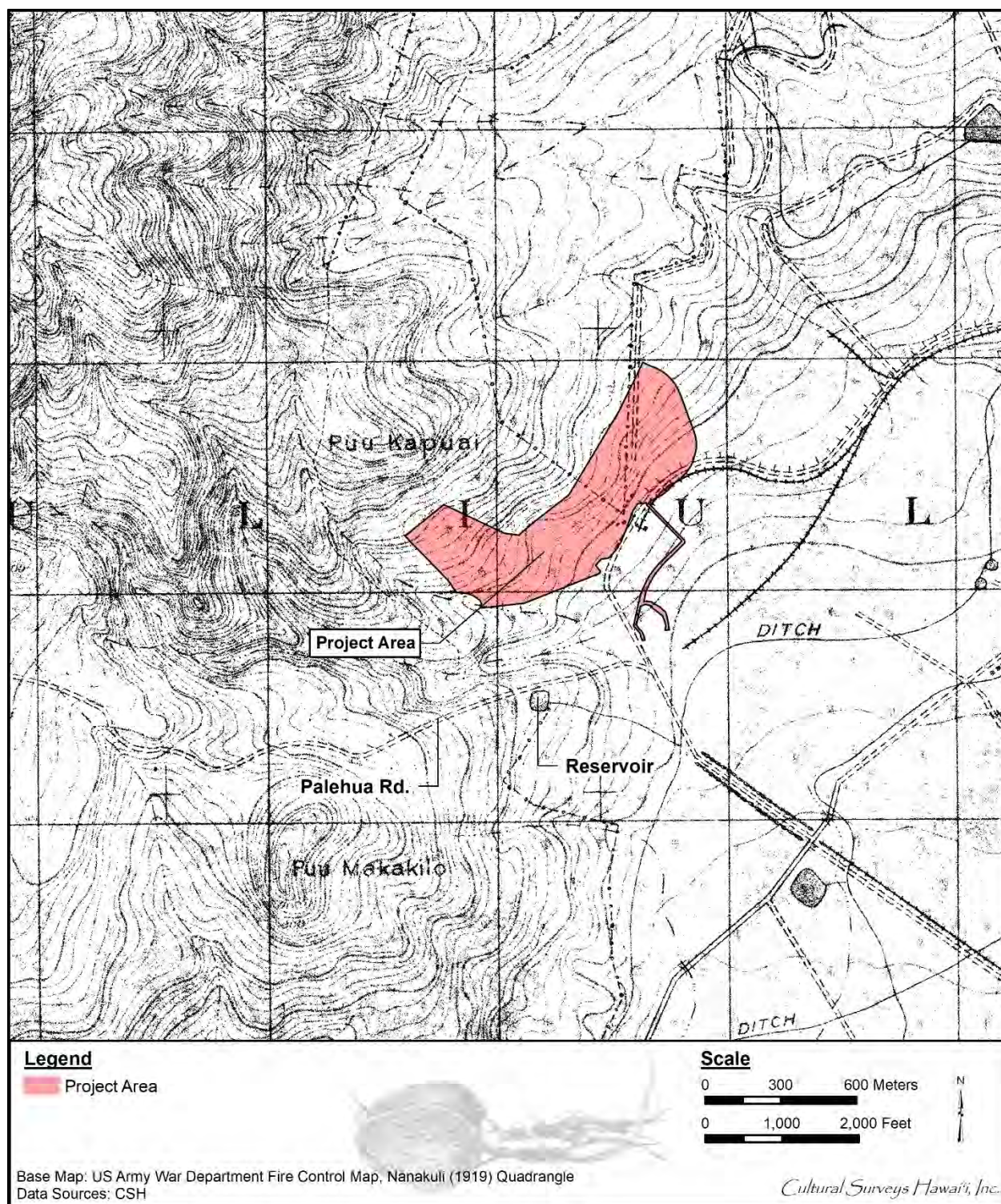


Figure 12. Portion of 1919 U.S. Army War Department fire control map, Nanakuli quadrangle showing the project area

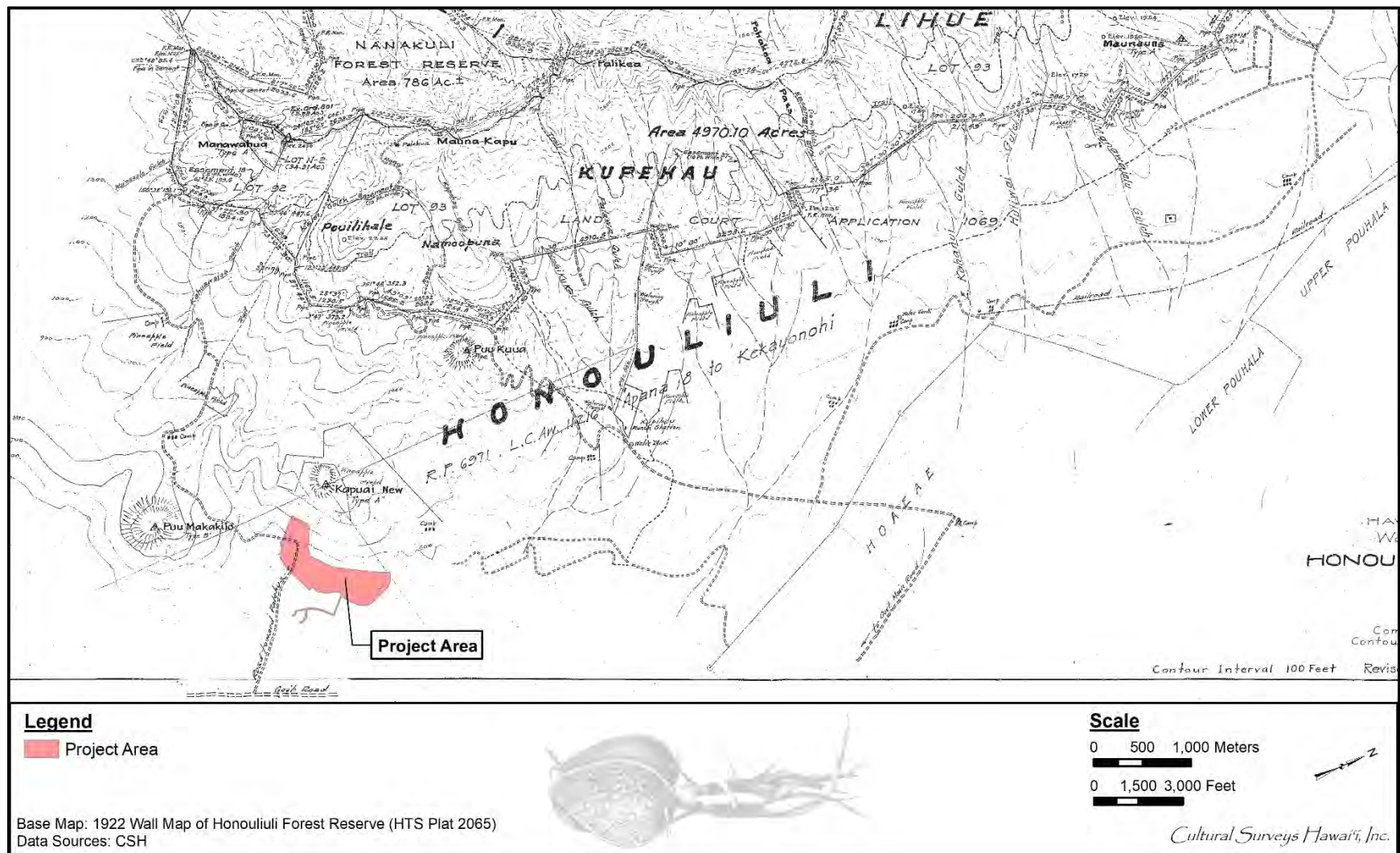


Figure 13. Portion of 1922 Wall map of Honouliuli Forest Reserve (HTS Plat 2065) showing the location of the project area

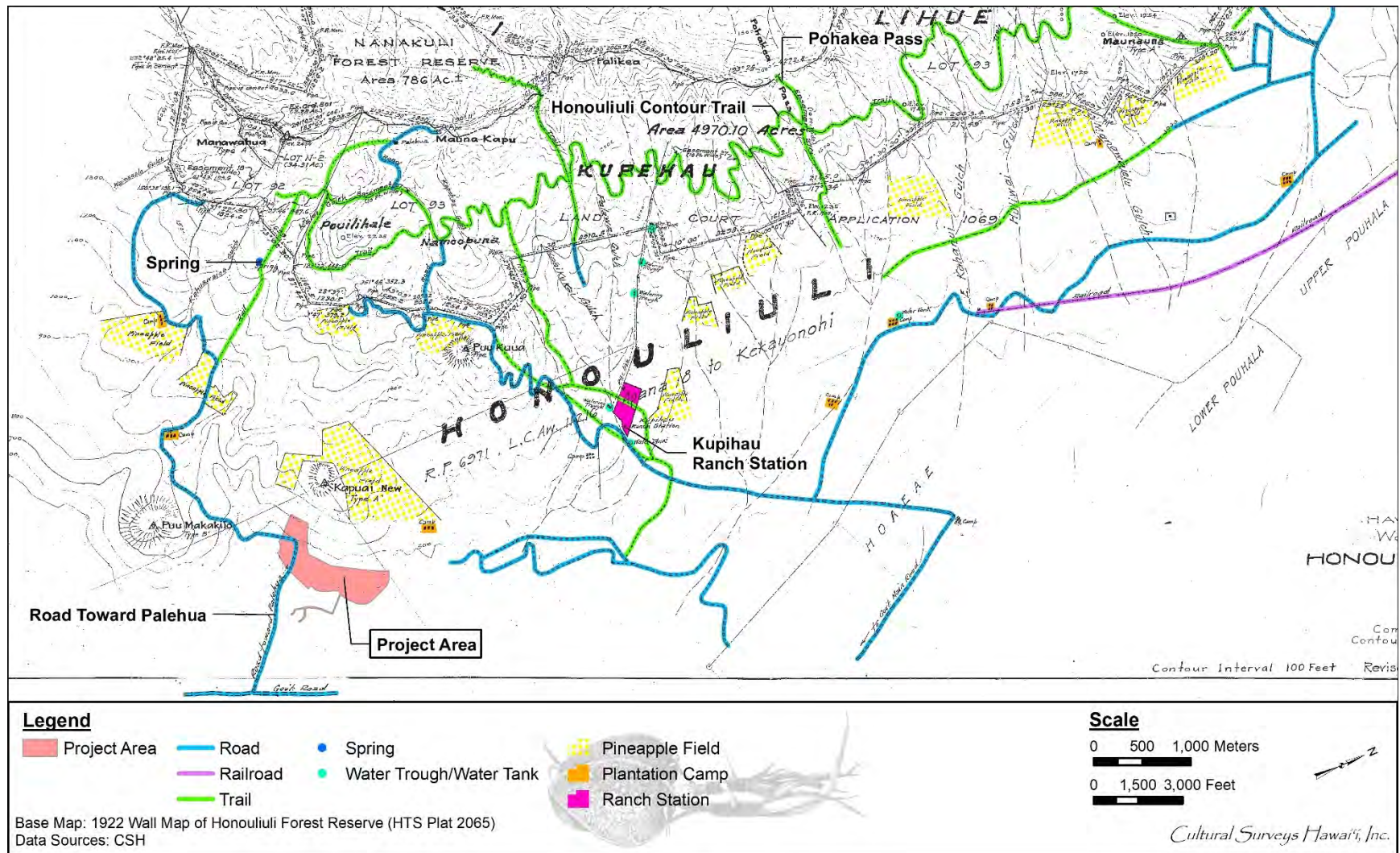


Figure 14. 1922 Wall map of Honouliuli Forest Reserve (HTS Plat 2065) showing the location of the project area with annotations

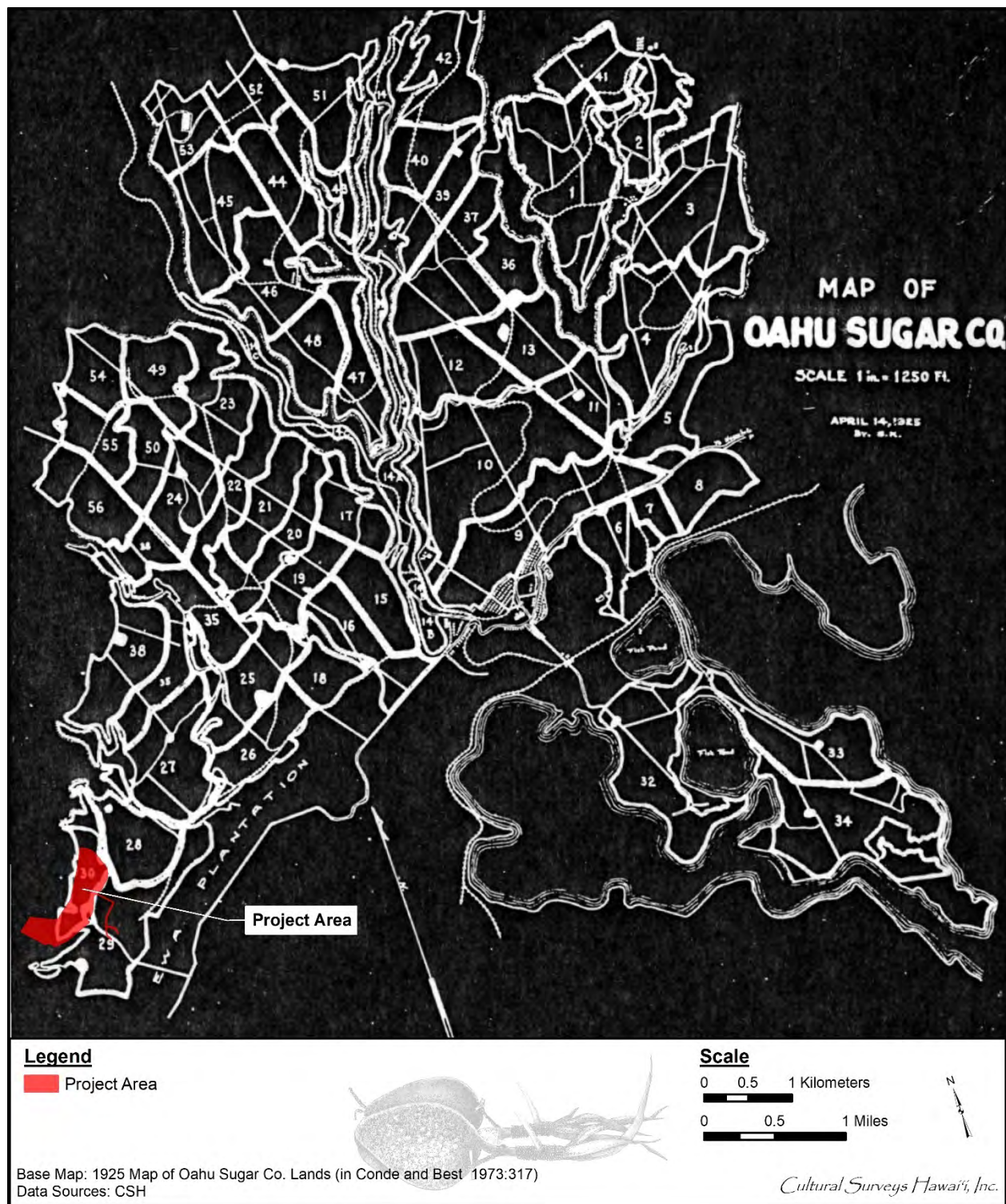


Figure 15. 1925 Oahu Sugar Company plantation map showing project area (red) as largely within former Field 30 (Condé and Best 1973:317)

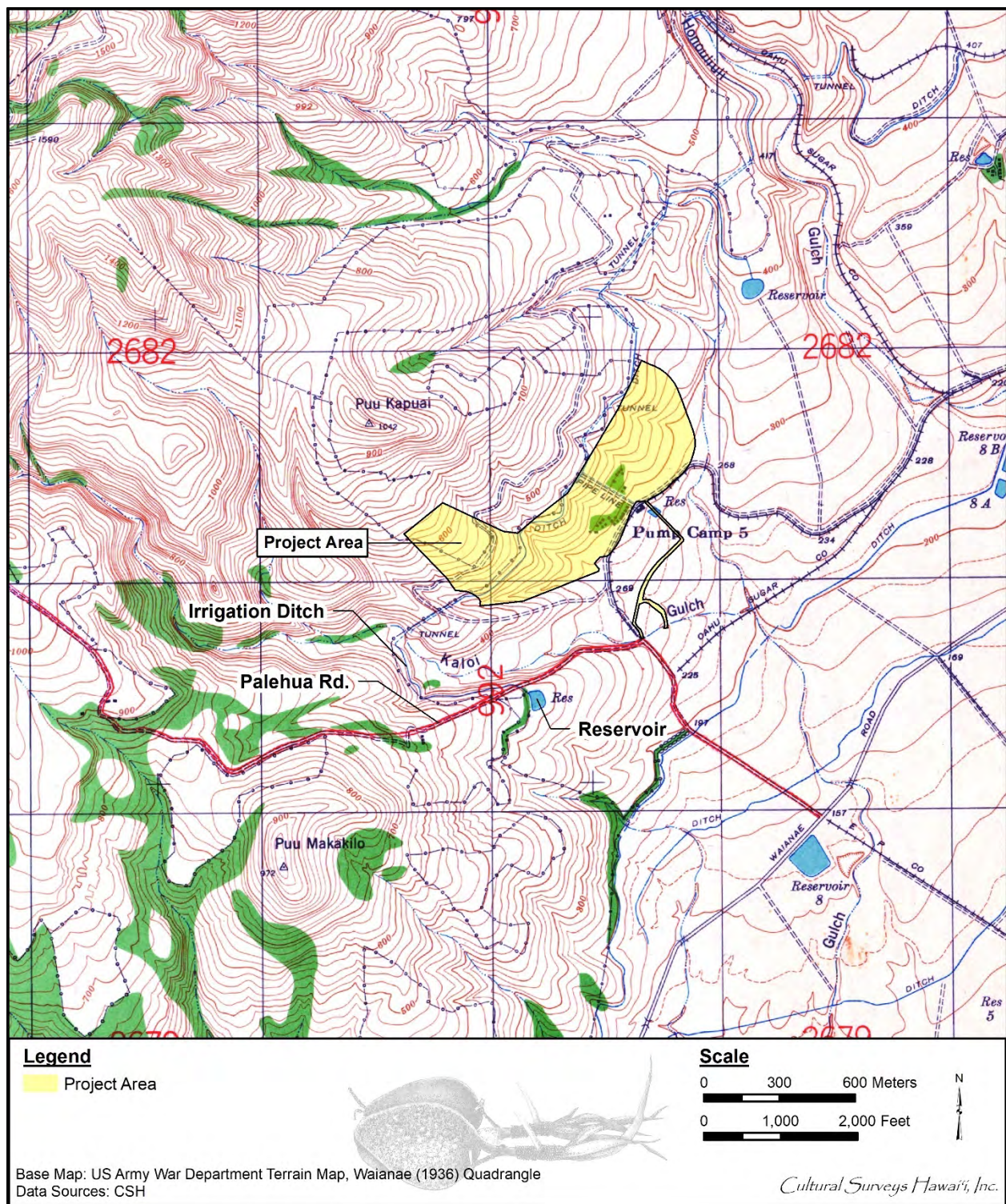


Figure 16. Portion of the 1936 U.S. Army War Department terrain map, Waianae quadrangle showing the location of the project area

A 1943 U.S. Army War Department map (Figure 17) shows much the same scene, though the unimproved road crossing the western portion of the project area now wraps around Pu'u Kapua'i. Additional new, unimproved roads suggest the expansion of sugarcane fields. The extensive system of fences depicted upslope indicates cattle ranching was still a significant enterprise.

Historic maps of the Makakilo area indicate a lack of any other significant development in the area into the 1940s. Major land use changes came to western Honouliuli when the U.S. Military began development in the area. Military installations were constructed near the coast as well as in the foothills and upland areas. Barbers Point Military Reservation (a.k.a. Battery Barbers Point from 1937–1944), located at Barbers Point Beach, was used beginning in 1921 as a training area for firing 155 mm guns (Payette 2003). Also in the vicinity were Camp Malakole Military Reservation (a.k.a. Honouliuli Military Reservation), used from 1939, and Gilbert Military Reservation, used from 1922–1944. Barbers Point Naval Air Station (NAS), in operation from 1942 into the 1990s, was the largest and most significant base built in the area. It housed numerous naval and defense organizations, including maritime surveillance and anti-submarine warfare aircraft squadrons, a U.S. Coast Guard Air Station, and components of the U.S. Pacific Fleet.

Fort Barrette (a.k.a. Kapolei Military Reservation and Battery Hatch), located atop Pu'u 'o Kapolei to the southwest, was used from 1931 to 1948 for housing four 3-inch anti-aircraft batteries (Payette 2003). In the 1950s, the site was used as a Nike missile base. Palailai Military Reservation, located atop Pu'u Pāla'ila'i in Makakilo to the west, was in service from 1921, housing Battery Palailai and Fire Control Station B (Payette 2003). Fire Control Station A was located atop Pu'u Makakilo approximately 1.4 km to the southwest of the project area. From 1942 to 1945 the Pu'u Makakilo Training Area, including lands in and around Pu'u Makakilo, was used for military training during World War II (Environment Hawai'i 1992).

The 1951 aerial photograph (Figure 18) clearly shows the two neighboring housing areas of Pump Camp 5 within the central portion of the project area (just northwest and southwest of the pump house building or pumping station which remains just outside the project area). While the majority of the project area was under sugarcane cultivation, it appears the southwest portion, west or upslope of the Waiahole Ditch, was not under cultivation at that time, used instead as grazing lands. The west portion of the project area appears to have been previously cultivated but appears fallow. Extensive areas north of Pu'u Kapua'i appear to be under pineapple cultivation.

The 1953 USGS map (Figure 19) shows much the same landscape as the 1943 map (see Figure 17) except the railroads have now all disappeared—quickly replaced by trucking after World War II. A naval reservation is shown on the southeast base of Pu'u Makakilo. An access road developed to service the present quarry is now depicted running up the mouth of Kalo'i Gulch, parallel to and just north of the Kalo'i Stream channel. The initial date of construction of an industrial quarry within Kalo'i Gulch—depicted to the south (outside) of the current project area—is uncertain, though historic maps indicate a construction window between 1943 and 1952. In 2004, CSH conducted an archaeological inventory survey whereby the quarry was documented and designated an historic property, SIHP # 50-80-12-6680.

The 1968/1969 USGS map (Figure 20) no longer shows Pump Camp 5, which had been prominent at least as early as 1936 (see Figure 16) and lasted until at least 1953 (see Figure 19). The “Pumping Station” immediately southeast of the project area is still labeled and in general the plantation infrastructure (other than the train lines) appears active. The road up Kalo'i Gulch,

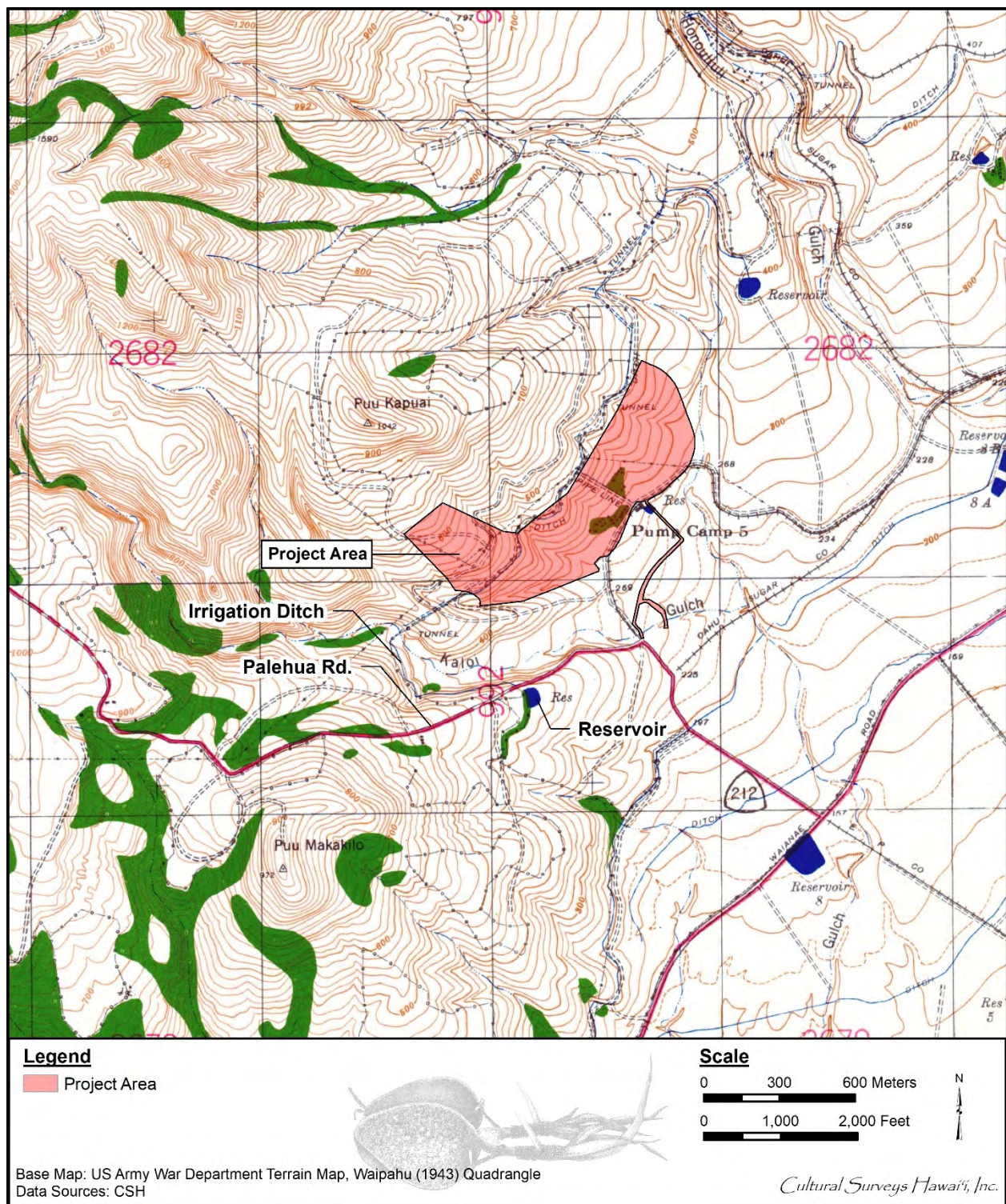


Figure 17. Portion of the 1943 U.S. Army War Department terrain map, Waipahu quadrangle showing the project area

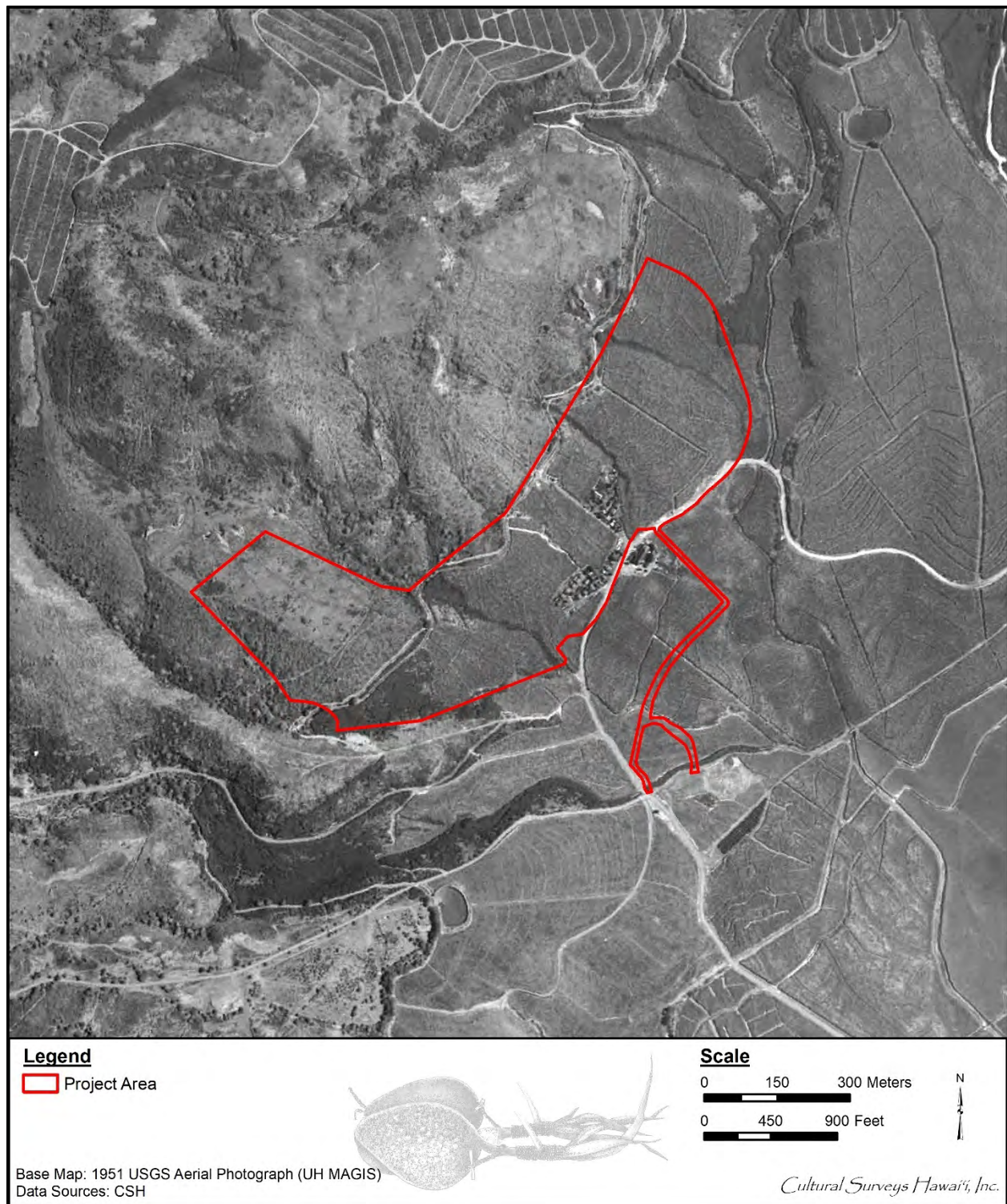


Figure 18. 1951 USGS aerial photograph (UH MAGIS) showing the project area

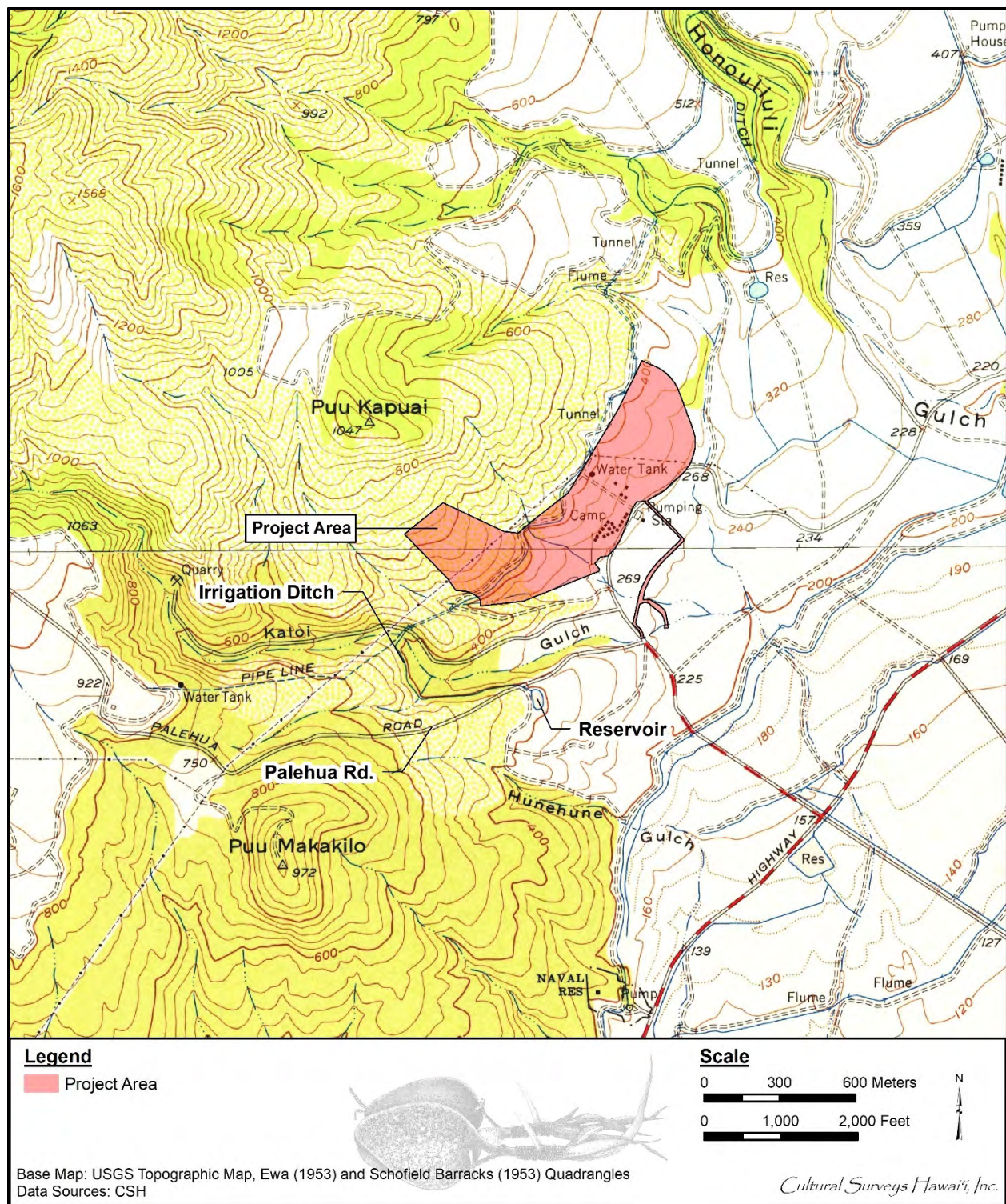


Figure 19. Portion of the 1953 Ewa and Schofield Barracks USGS topographic quadrangles showing the project area

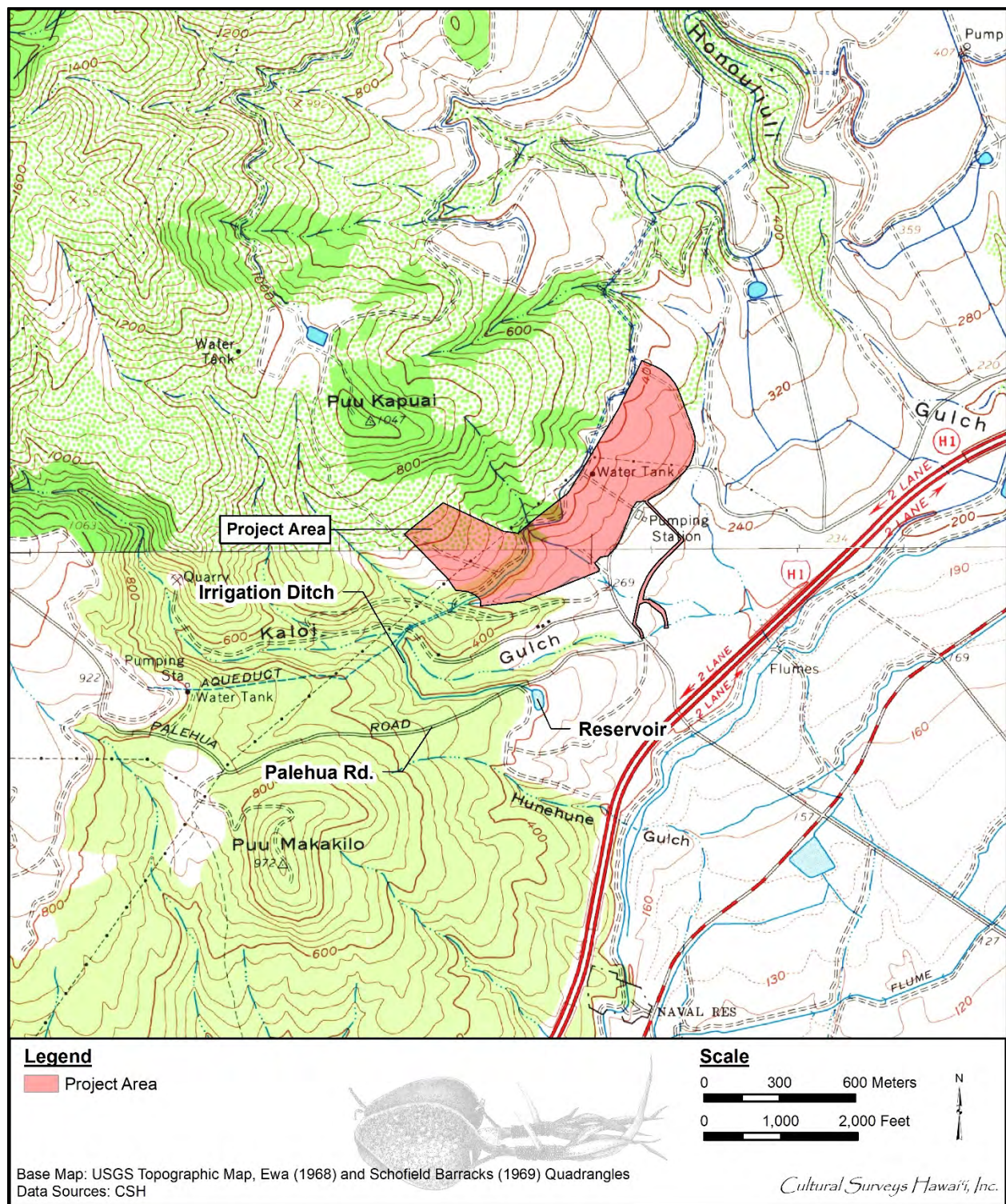


Figure 20. Portion of the 1968 Ewa and 1969 Schofield Barracks USGS topographic quadrangles showing the project area

depicted as improved in 1953, is now shown as unimproved, suggesting abandonment of some quarrying operations.

3.1.6 Contemporary Land Use

Modern maps of the Makakilo area indicate vast changes to the project area and surrounding lands, including the retreat of the sugarcane fields, the construction of the H-1 Freeway, and the partial construction of the Pu'u Makakilo Golf Course and Grace Pacific Makakilo Quarry.

A 1968 USGS aerial photograph (Figure 21) shows virtually the entire project area still utilized for sugarcane, though there is no trace of the former Pump Camp 5 residential areas that appear to be entirely covered with cane. Many of these plantation homes are understood to have been slightly raised on "tofu-block" foundations that allowed for relatively complete demolition, leaving only the remnants of privies and trash pits. The 1968 photograph also shows new fields to the northwest (see Figure 21).

In 1969 and 1970, Pacific Concrete and Rock Company, Ltd. began subsurface drilling on the southward facing slopes of Pu'u Makakilo for a new quarry location. The company's previous quarry in Pu'u Pāla'ila'i that had been in operation for the past 22 years was nearly exhausted. The newly proposed Makakilo Quarry would "encompass 72 acres of actual total quarry area and 188 acres of green belt buffer. Of the 72 acres of actual quarry area, only a maximum of 18 acres will be under active quarrying at any given time" (Cerny 1972:1).

A 1977 USGS aerial photograph (Figure 22) appears to display decreased sugarcane cultivation in the Wai'anae foothills. It is not clear if the project area is in active cultivation or not. Clearly by 1993 (Figure 23) sugarcane cultivation within the project area is finished, although it remains active immediately southeast of the project area.

Sometime in the early 1990s, a group of Japanese investors poured \$70 million into the development of the Pu'u Makakilo Golf Course. The golf course's exact date of construction is unclear; however, the proposed area was surveyed by Sinoto in 1988 (Sinoto 1988). The golf course was situated on the slopes of Pu'u Makakilo just north of the rock quarry. During a burst bubble in the Japanese investment market the project foundered, and the course and buildings were purchased by Grace Pacific in 1994 (*Honolulu Advertiser*, May 2004:31). Construction of the golf course resulted in grading and terracing of a large area southwest of the present project area for fairway construction.

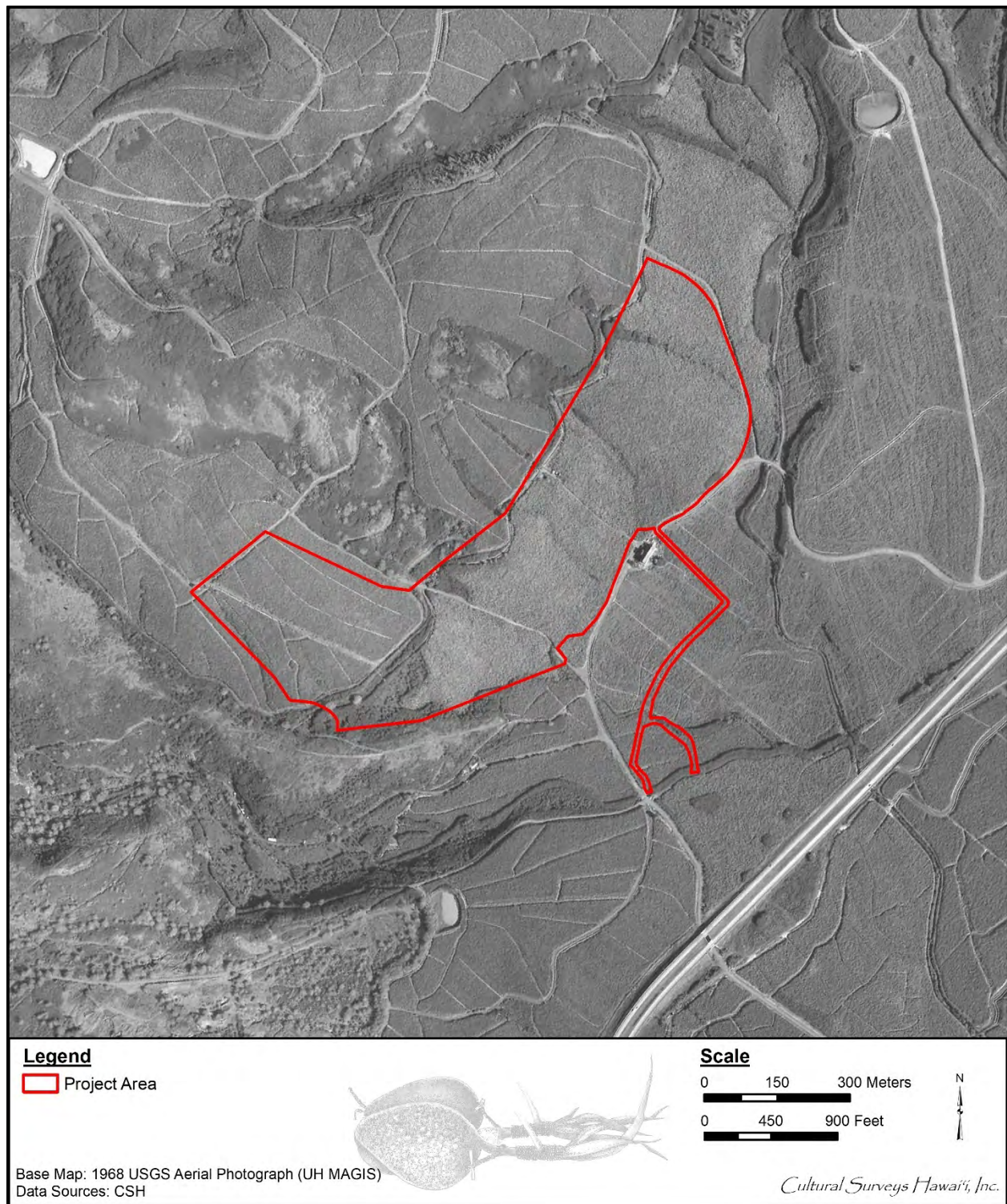


Figure 21. 1968 USGS aerial photograph (UH MAGIS) showing the project area

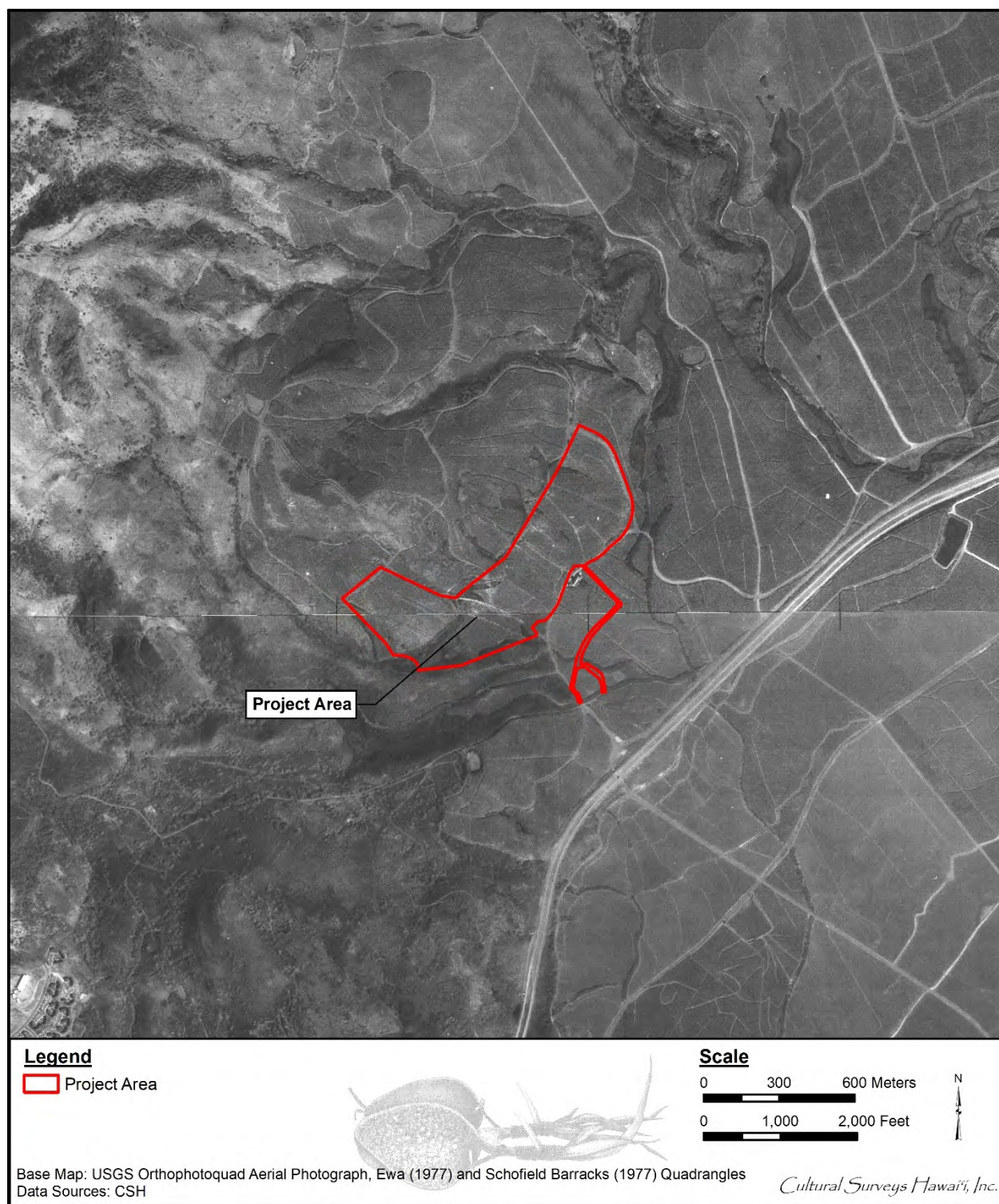


Figure 22. 1977 USGS Orthophotoquad aerial photograph, Ewa and Schofield Barracks quadrangles showing the project area

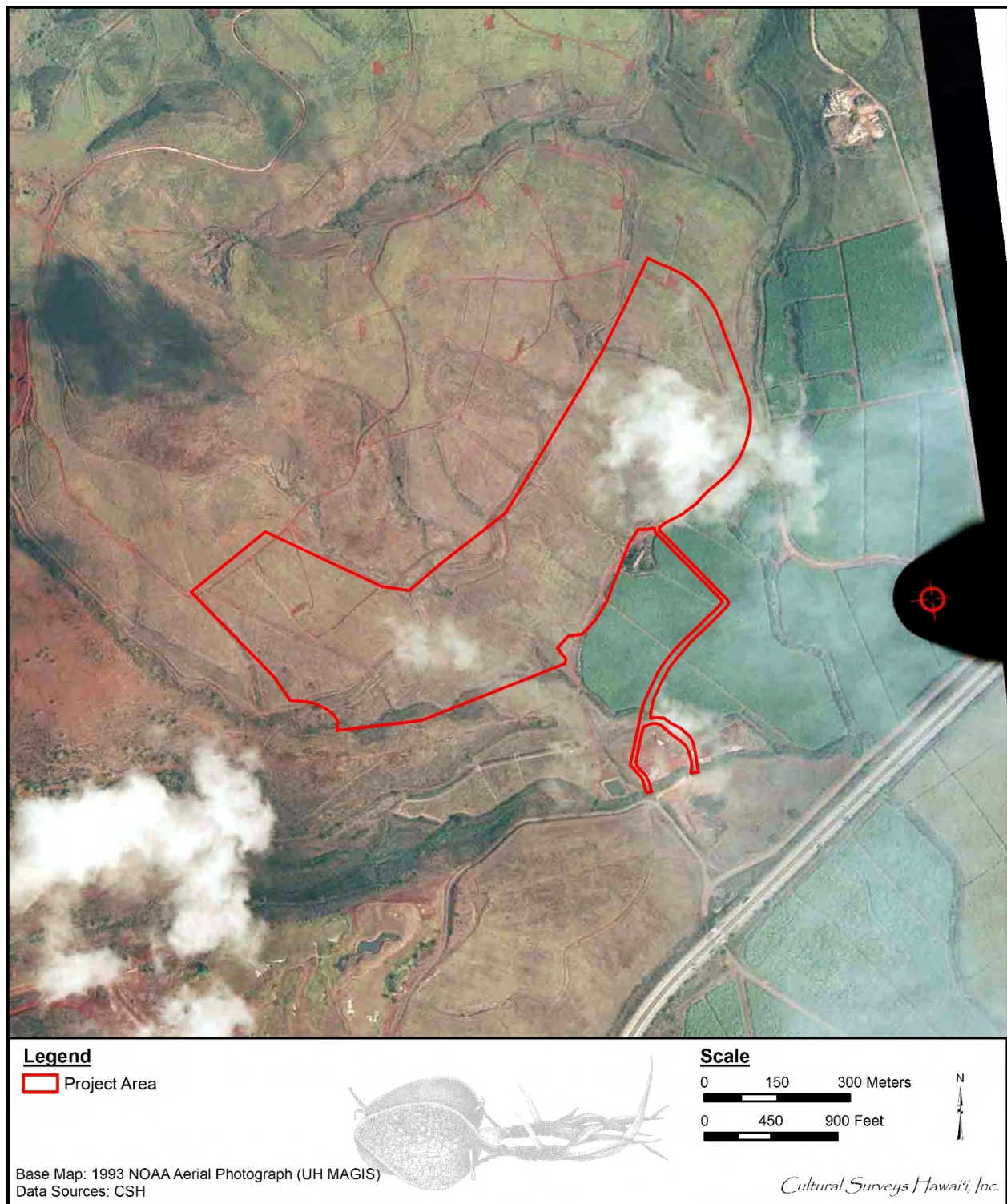


Figure 23. 1993 NOAA aerial photograph (UH MAGIS) showing the project area

3.2 Previous Archaeological Research

Previous archaeological studies in the vicinity (within approximately 1.5 km) of the current project area are shown in Figure 24 and Table 1, and a summary of these studies follows. Figure 25 and Table 2 show the locations of historic properties in the vicinity of the project area. There are no sites documented by McAllister (1933) in his early archaeological reconnaissance study of O'ahu in the vicinity of the project area.

3.2.1 Bordner 1977

In 1977, the Archaeological Research Center Hawaii, Inc. (Bordner 1977) conducted an archaeological reconnaissance survey of a then proposed Kalo'i Gulch landfill location, approximately 500 m west of the present project area. The study concluded the lower section of the gulch had been extensively modified through quarrying operations and cattle ranching. Foundations of both crushing and loading facilities were noted. In the upper reaches of the property, three walls of possible pre-Contact origin were documented between 1,250 and 1,300 ft elevation and designated as SIHP #s 50-80-12-2600, -2601 and -2602. These three historic properties were in the extreme, upslope end of the large property more than 1.5 km from the present project area. SIHP # 50-80-12-2600 was a low (only 0.61 m, or 2 ft high) wall of poorly stacked *pāhoehoe*, approximately 7.62 m (25 ft) long set on top of a small knoll jutting out from the slope. SIHP # 50-80-12-2601 is described as a wall built on the stream terrace cut following the course of the stream and constructed of stacked *pāhoehoe* with a total length of 67.70 m (222.1 ft), an average height of 0.91 m (3.0 ft) and incorporating in situ boulders into the wall. The wall appeared to have been constructed so as to protect a stream terrace from erosion. It also retained a terrace measuring approximately 12 m (39.4 ft) by 31 m (101.7 ft). SIHP # 50-80-12-2602 was a free-standing 18.2 m (59.7 ft) wall of stacked *pāhoehoe* that had the appearance of being a boundary wall. The historic properties were regarded as of "a marginal status" and no further archaeological work was recommended for the area covered by the reconnaissance survey.

3.2.2 Sinoto 1988

In 1988, the Bishop Museum Applied Research Group conducted a surface survey for a then proposed Makakilo Golf Course just southwest of the current project area (Sinoto 1988). The study concluded the majority of the project area had been damaged by severe erosion. No surface historic properties were documented and subsurface testing was deemed unnecessary. Just west (outside) of the golf course property, one deteriorated wall segment was documented on the northeast slope of Pu'u Makakilo. The wall, designated SIHP # 50-80-12-1975, may have served as an "historic erosional control feature" (Sinoto 1988:1). Due to the deteriorated condition of the wall remnant, no further work was recommended.

3.2.3 Spear 1996

Scientific Consultant Services, Inc. conducted an archaeological reconnaissance survey of a large area extending from south of the H-1 freeway to the north side of Renton Road (Spear 1996). No historic properties were identified.

3.2.4 Dega et al. 1998

In 1998, Scientific Consultant Services, Inc. (SCS) conducted an archaeological inventory survey for the University of Hawai'i, West O'ahu Campus project area (Dega et al. 1998). The

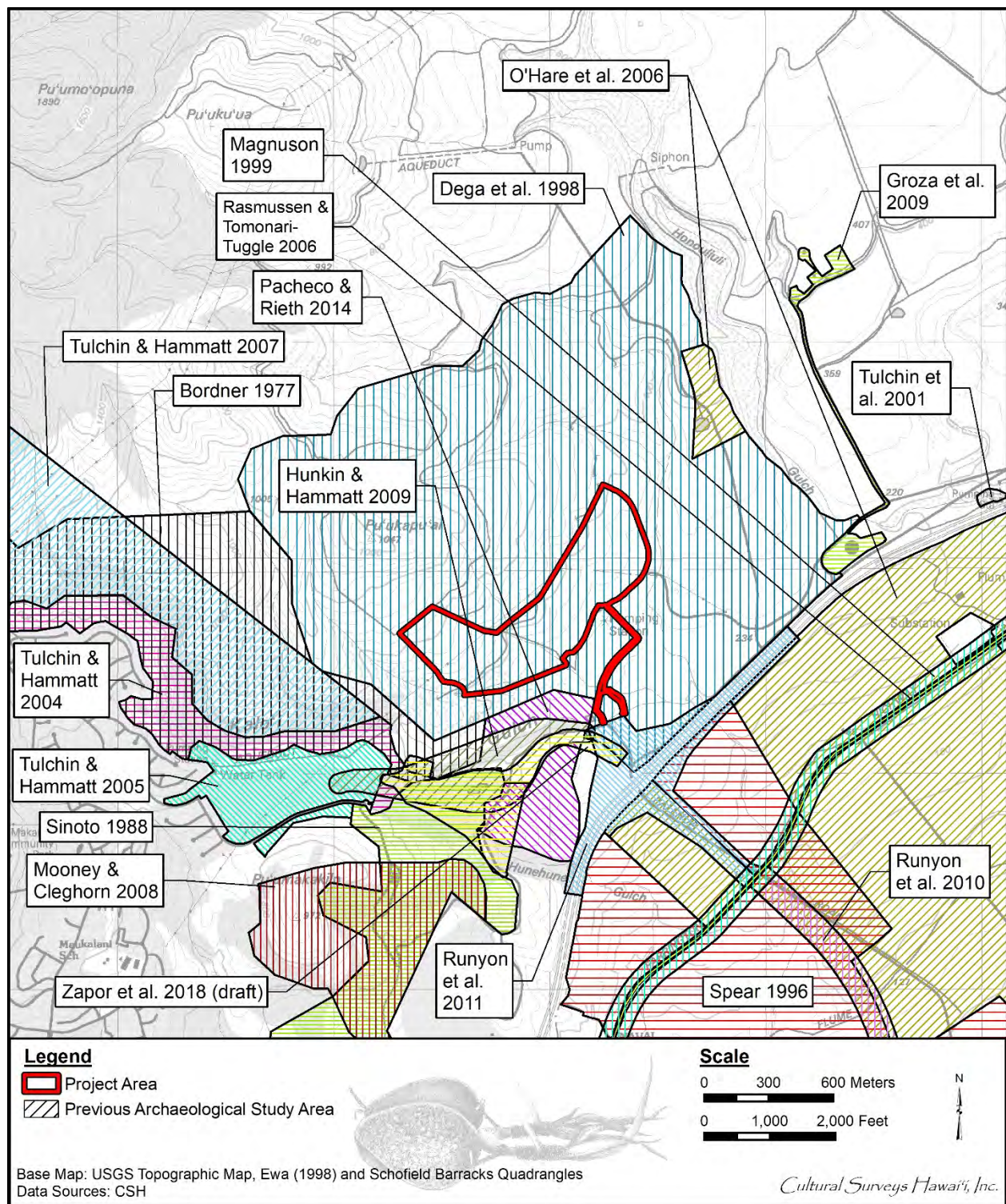


Figure 24. Portion of the 1998 Ewa and Schofield Barracks USGS topographic quadrangles showing the locations of previous archaeological studies in the vicinity (within approximately 1.5 km) of the project area

Table 1. Previous archaeological studies within the vicinity (within approximately 1.5 km) of the project area

Reference	Type of Study	Location	Results
Bordner 1977	Archaeological reconnaissance survey	Proposed Kalo'i Gulch landfill location	Three walls designated as SIHP #s 50-80-12-2600, -2601 and -2602 in extreme west, upslope end of property, more than 1.5 km from present project area (hence not depicted in Figure 25)
Sinoto 1988	Archaeological reconnaissance survey	Makakilo Golf Course	Documented a low stacked boulder wall outside the property: SIHP # 50-80-09-1975
Spear 1996	Archaeological reconnaissance survey	East Kapolei, TMK: [1] 9-1-016:017	No historic properties identified
Dega et al. 1998	Archaeological inventory survey	UH West O'ahu, TMK: [1] 9-2-002:001	Documented two historic property complexes: historic irrigation and plantation infrastructure system (SIHP # 50-80-08-5593) and Waiahole Ditch System (SIHP # 50-80-09-2268)
Magnuson 1999	Archaeological reconnaissance survey	'Ewa Plain	Identified six concrete bridges, a railroad track, and a set of unidentified concrete features; no SIHP #s assigned
Tulchin et al. 2001	Archaeological inventory survey	Proposed 'Ewa Shaft Renovation project, Honouliuli Gulch, adjacent to west-bound lanes of H-1, TMK: [1] 9-2-001	Identified one historic property: SIHP # 50-80-08-6370, stone wall alignment; also documented large pumping station and shaft building
Tulchin and Hammatt 2004	Archaeological inventory survey	86-acre proposed Pālehua Community Association, TMKs: [1] 9-2-003:078 por. and 079	Four historic properties identified: a complex of concrete and iron structures associated with industrial rock quarry operations (SIHP # 50-80-12-6680); three boulder mounds believed related to land clearing or ditch construction by Oahu Sugar Co. (SIHP # 50-80-12-6681); a small terrace believed to function as historic water diversion feature (SIHP # 50-80-12-6682); and a remnant portion of Waiahole Ditch (SIHP # 50-80-09-2268)

Reference	Type of Study	Location	Results
Tulchin and Hammatt 2005	Archaeological inventory survey	71-acre proposed Pālehua East B project, Makakilo, TMKs: [1] 9-2-003:076 and 078	Three historic properties identified: pre-Contact agricultural alignment and mound (SIHP # 50-80-12-6666), plantation-era stacked basalt boulder walls and a ditch (SIHP # 50-80-12-6667), and single alignment of upright basalt boulders and small, low terrace (SIHP # 50-80-12-6668)
O'Hare et al. 2006	Archaeological inventory survey	Ho'opili East Kapolei	Documented six previously identified historic properties: plantation infrastructure (SIHP # 50-80-12-4344); railroad berm (SIHP # 50-80-12-4345); northern pumping station (SIHP # 50-80-12-4346); central pumping station (SIHP # 50-80-12-4347); southern pumping station (SIHP # 50-80-12-4348); and documented four newly identified features of SIHP # 50-80-12-4344: a linear wall, stone-faced berm, concrete ditch, and concrete catchment
Rasmussen and Tomonari-Tuggle 2006	Archaeological monitoring	Waiau Fuel Pipeline corridor	No historic properties identified
Tulchin and Hammatt 2007	Archaeological literature review and field inspection	Approx. 790-acre parcel, TMK: [1] 9-2-003:002 por. and 005 por.	Documented features interpreted as related to pre-Contact indigenous Hawaiian habitation (SIHP #s 50-80-08-2316 and 50-80-12-2602); historic ranching and related features (SIHP # 50-80-12-2601); and historic quarrying and related features (SIHP # 50-80-12-6680) and various pre- and post-Contact features (designated with temporary #s CSH1–CSH22)
Mooney and Cleghorn 2008	Archaeological reconnaissance survey	TMK: [1] 9-2-003:018	No historic properties identified
Groza et al. 2009	Archaeological inventory survey	TMKs: [1] 9-2-001:001 por., 004, 005, 006, 007 por.; 9-2-002:002	No historic properties identified

Reference	Type of Study	Location	Results
Hunkin and Hammatt 2009	Archaeological inventory survey	TMKs: [1] 9-2-002:006; 9-2-003:079	Documented two newly identified historic properties: irrigation ditches (SIHP #s 50-80-12-6950 and -6951); and one previously identified historic property, Waiahole Ditch (SIHP # 50-80-09-2268)
Runyon et al. 2010	Archaeological monitoring	TMKs: [1] 9-2-002:006; 9-2-003:079	No historic properties identified
Runyon et al. 2011	Archaeological monitoring	TMKs: [1] 9-1-018:001, 003, 004, 005; 9-2-002:001, 006	Documented two historic properties: a water diversion and a trash deposit (SIHP #s 50-80-12-4664 and -7128)
Pacheco and Rieth 2014	Archaeological inventory survey	East Kapolei Solar Farm, TMK: [1] 9-2-002:006 por.	Documented SIHP # 50-80-12-7433, an unpaved early twentieth century agricultural (ranching and/or sugarcane cultivation) road, understood as created between 1918 and 1928
Zapor et al. 2018	Archaeological inventory survey	Makakilo Dr extension project, TMKs: [1] 9-2-002:007, 009, 009; 9-2-003:074, 092; 9-2-039:110, 114; and 9-2-045:001	Documented two historic properties: SIHP # 50-80-09-2268, remnant portion of Waiahole Ditch, and SIHP # 50-80-12-6951, irrigation ditches; identified one new feature of Waiahole Ditch, an earthen mound and stacked stone wall, interpreted as likely remnants of a reservoir (Feature D)

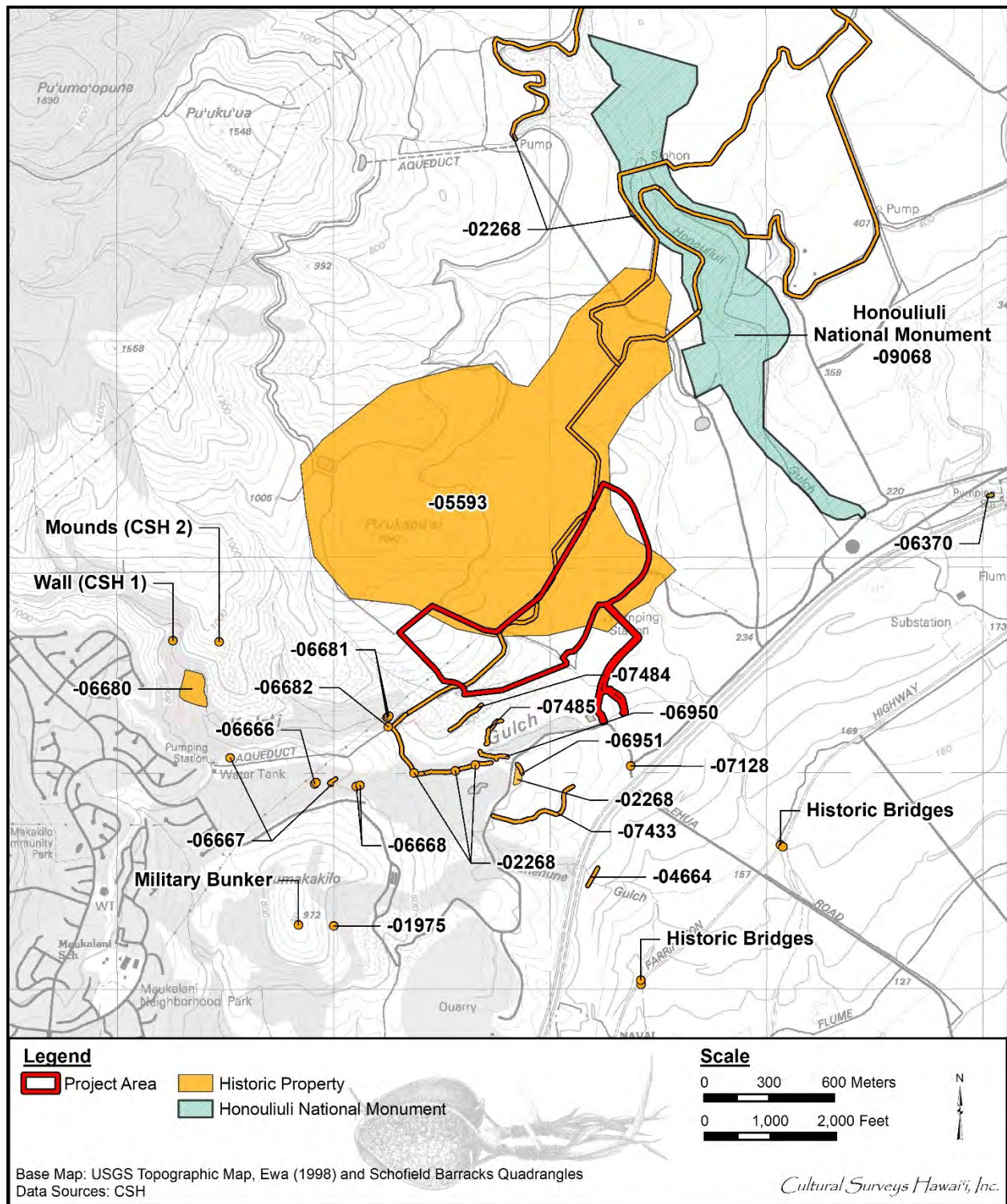


Figure 25. Portion of the 1998 Ewa and Schofield Barracks USGS topographic quadrangles showing the locations of previously identified historic properties in the immediate vicinity of the project area (note the SIHP # -5593 property boundary is defined as the Dega et al. 1998 project area and not the true extent or location of its features)

Table 2. Previously identified historic properties in the vicinity of the project area

SIHP #	Description	Reference
50-80-12-1975	Low-stacked boulder wall segment	Sinoto 1988
50-80-09-2268	Waiahole Ditch System	Goodman and Nees 1991; Hammatt et al. 1996; Dega et al. 1998; Tulchin and Hammatt 2005; Hunkin and Hammatt 2009; Zapor et al. 2018; Shideler and Hammatt 2018
50-80-12-4664	Historic water diversion structure	Nakamura et al. 1993; Runyon et al. 2011
50-80-08-5593	Plantation-era “flumes, aqueducts, ditches, pumps, and other irrigation features”	Dega et al. 1998
50-80-08-6370	Stone wall alignment, likely associated with cattle ranching or pumping station	Tulchin et al. 2001
50-80-12-6666	Alignment and mound	Tulchin and Hammatt 2005
50-80-12-6667	Two walls	Tulchin and Hammatt 2005
50-80-12-6668	Alignment and terrace	Tulchin and Hammatt 2005
50-80-12-6680	Complex of concrete and iron structures associated with industrial rock quarry operations	Tulchin and Hammatt 2005
50-80-12-6681	Three boulder mounds believed related to land clearing or ditch construction by Oahu Sugar Company	Tulchin and Hammatt 2005
50-80-12-6682	Terrace believed to function as an historic water diversion feature	Tulchin and Hammatt 2005
50-80-12-6950	Portion of a plantation-era irrigation ditch	Hunkin and Hammatt 2009
50-80-12-6951	Portion of a plantation-era irrigation ditch	Hunkin and Hammatt 2009
50-80-12-7128	Burned trash fill layer	Runyon et al. 2011

SIHP #	Description	Reference
50-80-12-7433	Unpaved early twentieth century agricultural (ranching and/or sugarcane cultivation) road, understood as created between 1918 and 1928	Pacheco and Rieth 2014
50-80-12-7484	Post-Contact irrigation ditch portion	Pacheco and Rieth 2014
50-80-12-7485	Post-Contact irrigation ditch portion	Pacheco and Rieth 2014
50-80-08-9068	Honouliuli National Monument (Internment Camp)	National Register
Historic Bridges	No SIHP #s assigned, no further documentation or mitigation recommended	Magnuson 1999
Military Bunker	WWII-era bunker	Mooney and Cleghorn 2008
CSH 1	Post-Contact wall related to historic ranching	Tulchin and Hammatt 2007
CSH 2 (Mounds)	Two basalt mounds interpreted as possible trail markers	Tulchin and Hammatt 2007

survey encompassed the entirety of the current project area. Several plantation-era “flumes, aqueducts, ditches, pumps, and other irrigation features occurring within the heavily modified landscape” were noted (Dega et al. 1998:i). The features represented an extensive complex of sugarcane irrigation features used from the 1920s through more recent times. The irrigation complex was designated SIHP # 50-80-08-5593. A portion of the Waiahole Ditch System (SIHP # 50-80-09-2268) (previously recorded by Goodman and Nees 1991) was also documented crossing through the northwest section of the subject parcel and continuing southwest through the lower agricultural fields. No artifacts were recovered from the project area. No further work was recommended for SIHP # 50-80-08-5593.

An overlay of the present project area on the Dega et al. (1998) plan map (Figure 26) indicates it lies entirely within the south/central portion of the 1998 AIS project. While the Dega et al. (1998) plan map should probably be understood as a sketch, it does indicate certain remnants of plantation infrastructure (designated as SIHP # 50-80-08-5593) were present in the property in 1998. Dega et al. (1998) defined the entire project area as the boundaries of SIHP # 50-80-08-5593. However, the identified features represent a substantially smaller area than the overall boundary.

3.2.5 Magnuson 1999

In 1999, an archaeological reconnaissance survey was completed by International Archaeological Research Institute, Inc. (IARII) for a Farrington Highway Expansion project extending along 5.3 km (3.3 miles) of Farrington Highway between Golf Course Road and Fort Weaver Road with a roughly 61-m (200-ft) wide corridor on each side (Magnuson 1999). The project identified six concrete bridges, one railroad track, and “a set of unidentified concrete features” (Magnuson 1999:17). The study concluded the following:

The sites observed in the Farrington Highway Expansion project are neither exemplary sites of their kind nor unique. Therefore these sites have been adequately recorded during the investigations and no further work is necessary should preservation not be possible. [Magnuson 1999:25]

3.2.6 Tulchin et al. 2001

CSH archaeologists completed an archaeological inventory survey in support of a proposed ‘Ewa Shaft Renovation project. The ‘Ewa Shaft project is within Honouliuli Gulch, adjacent to the west-bound lanes of the H-1 Interstate Highway, approximately 1.7 km east of the present project area. That property included a pumping station enclosure and the surrounding area of approximately 1 acre. The survey documented one historic property, a stone wall alignment designated SIHP # 50-80-08-6370. Subsurface testing was conducted adjacent to the wall. The study interpreted the wall alignment as associated with cattle ranching or the pumping station. The study also documented a portion of the large pumping station and shaft building on the property.

3.2.7 Tulchin and Hammatt 2004

In 2004, CSH conducted an archaeological inventory survey to the west of the current project area for the Pālehua Community Association (PCA) in Makakilo (Tulchin and Hammatt 2004). Three overhang shelters were observed and tested, however, no cultural material was identified during excavation. The study documented several historic properties, including a complex of

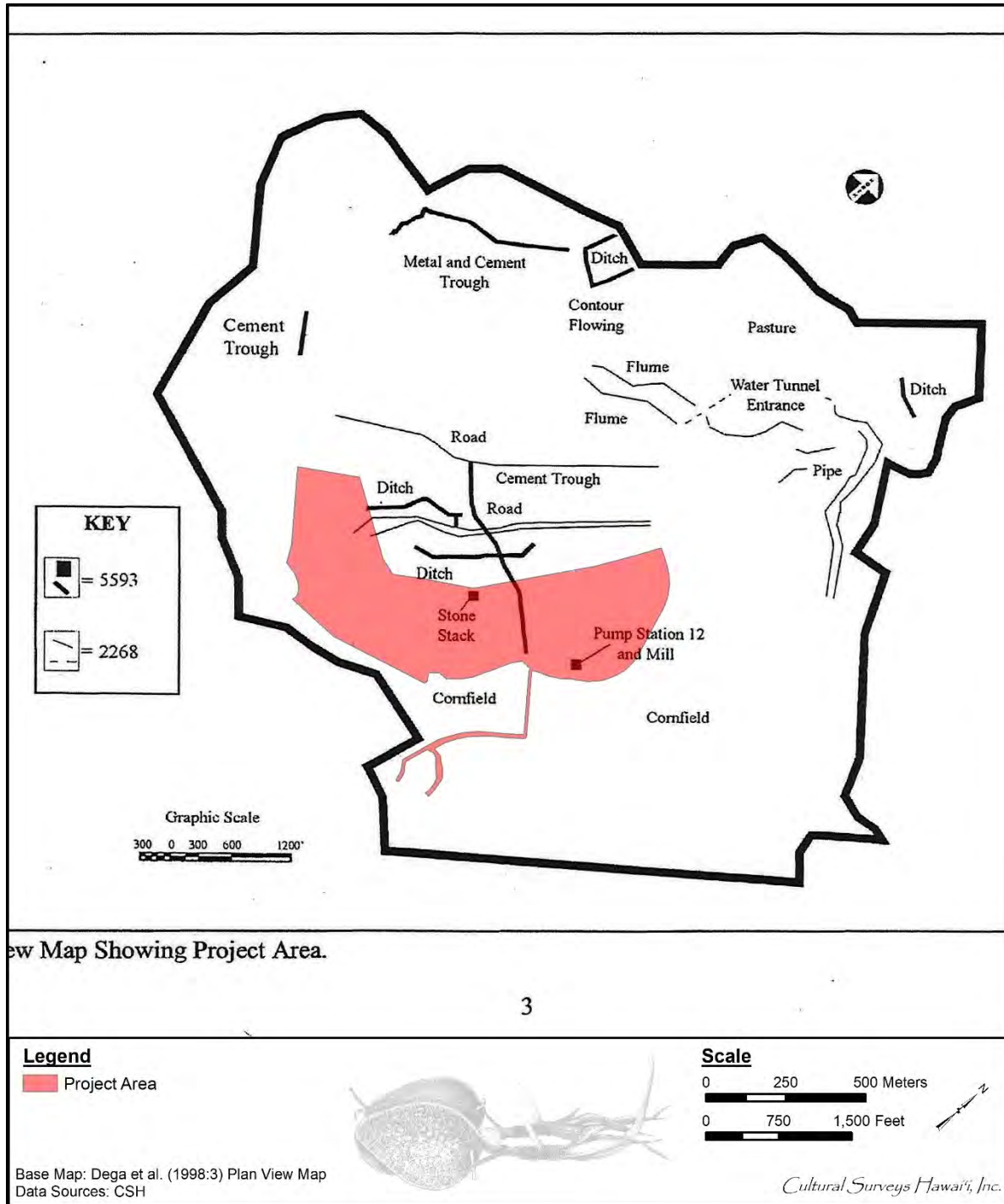


Figure 26. Plan map of the AIS for the University of Hawai'i, West O'ahu Campus project area showing historic properties (as of 1998) with an overlay of the current project area (adapted from Dega et al. 1998:3). This overlay suggests "Pump Station 12 and Mill" and a ditch were documented as within the present project area and another ditch and road and "Stone stack" were adjacent to the north side of the present project area (note this is a sketch and locations are approximate)

concrete and iron structures associated with industrial rock quarry operations (SIHP # 50-80-12-6680); three boulder mounds believed to be related to land clearing or ditch construction by the Oahu Sugar Company (SIHP # 50-80-12-6681); a small terrace believed to function as an historic water diversion feature (SIHP # 50-80-12-6682); and a remnant portion of the Waiahole Ditch (SIHP # 50-80-09-2268).

3.2.8 Tulchin and Hammatt 2005

In 2005, CSH conducted an archaeological inventory survey west of the current project area for the proposed Pālehua East B project in Makakilo (Tulchin and Hammatt 2005). The study identified three historic properties, including an alignment and a mound (SIHP #s 50-80-12-6666A and B), two walls (SIHP #s 50-80-12-6667A and B), and an alignment and terrace (SIHP #s 50-80-12-6668A and B). SIHP # 50-80-12-6667 is thought to contain remnants of plantation infrastructure. The historic properties were documented in an unnamed gully south of Kalo'i Gulch.

3.2.9 O'Hare et al. 2006

In 2006, CSH conducted an archaeological inventory survey of approximately 1,600 acres for the East Kapolei project (subsequently known as the Ho'opili project) to the southeast of the present project area (O'Hare et al. 2006). The Ho'opili project was bounded on the east by Fort Weaver Road, *makai* (seaward) by Mango Tree Road, and *mauka* by the H-1 Freeway.

Several historic properties documented by the O'Hare et al. (2006) study were previously identified during an archaeological survey in 1990 (Hammatt and Shideler 1990). These previously identified historic properties included SIHP # 50-80-12-4344, plantation infrastructure; SIHP # 50-80-12-4345, railroad berm; SIHP # 50-80-12-4346, northern pumping station; SIHP # 50-80-12-4347, central pumping station; and SIHP # 50-80-12-4348, southern pumping station.

The survey identified four additional features of SIHP # 50-80-14-4344. These additional features include Feature D, a linear wall along the east bank of Honouliuli Stream; Feature E, a linear wall along the west bank of Honouliuli Stream; Feature F, a stone-faced berm constructed perpendicular to the orientation of the stream; and Feature G, a concrete ditch and concrete masonry catchment basement on the west bank of Honouliuli Gulch. None of the historic properties identified in the O'Hare et al. study (2006) were near the present project area.

3.2.10 Rasmussen and Tomonari-Tuggle 2006

In 2006, IARII conducted archaeological monitoring along the Waiau Fuel Pipeline corridor, extending from the Hawaiian Electric Company's Barbers Point Tank Farm to the Waiau Generating Station (Rasmussen and Tomonari-Tuggle 2006). The Waiau Fuel Pipeline corridor follows Farrington Highway to Kunia Road, angles *makai* near Kunia Road, then continues east along the OR&L right-of-way near the Pearl Harbor coast. It appears no archaeological monitoring was conducted west of Waipi'o Peninsula, as the corridor to the west was determined to not be archaeologically sensitive. No historic properties were identified during archaeological monitoring.

3.2.11 Tulchin and Hammatt 2007

In 2007, CSH completed an archaeological literature review and field inspection of an approximately 790-acre parcel at Pālehua, Makakilo (Tulchin and Hammatt 2007). The inspection

covered portions of Makaīwa Gulch, Awanui Gulch, and Kalo'i Gulch. Overall, 26 historic properties were identified during the field inspection. The study included further documentation of four previously identified historic properties: SIHP # 50-80-08-2316, a *ku'ula* stone; SIHP # 50-80-12-2601, a pre-Contact wall utilized as a water control feature; SIHP # 50-80-12-2602, a pre-Contact wall possibly utilized for agriculture; and SIHP # 50-80-12-6680, a complex of concrete and iron structures associated with industrial rock quarry operations.

Newly identified historic features (designated with temporary CSH site #s) included CSH 1, wall; CSH 2, mounds; CSH 3, large enclosure; CSH 4, platform; CSH 5, mounds; CSH 6, adze; CSH 7, platform; CSH 8, terraces; CSH 9, enclosure and two small caves; CSH 10, enclosure; CSH 11, mound; CSH 12, platform; CSH 13, enclosure; CSH 14 terrace; CSH 15, wall remnant, hearth, and military "foxhole"; CSH 16, terrace and *hau* thicket; CSH 17, level soil along ridge; CSH 18, enclosure; CSH 19, trail; CSH 20 water tunnel; CSH 21, large boulder with petroglyphs; and CSH 22, enclosure with stone uprights. These potential historic properties were not assigned SIHP #s.

Other than the previously reported SIHP # -6680 complex of structures associated with industrial rock quarry operations, none of the identified historic properties were in the vicinity of the present project area.

3.2.12 Mooney and Cleghorn 2008

In 2008, Pacific Legacy, Inc. conducted an AIS (recorded as an archaeological assessment due to lack of finds) for the proposed Makakilo Quarry expansion (Mooney and Cleghorn 2008). No historic properties were identified; however, the remnants of a modern, abandoned golf course were noted.

3.2.13 Groza et al. 2009

In 2009, CSH conducted an AIS (recorded as an archaeological assessment) for the Ho'opili project 440-Ft Elevation Reservoir and Water Line project (Groza et al. 2009). No historic properties were identified.

3.2.14 Hunkin and Hammatt 2009

In 2009, CSH completed an archaeological inventory survey for an approximately 62-acre Makakilo Drive extension project (Hunkin and Hammatt 2009). The project documented two newly identified historic properties (SIHP #s 50-80-12-6950 and -6951). Both historic properties are portions of plantation irrigation ditches. The ditches functioned to transport water for irrigation of the sugarcane fields.

In addition to the newly identified historic properties, the project documented a portion of the previously identified SIHP # 50-80-09-2268 alignment. A meeting was held on site within the project area with CSH staff, SHPD staff, and Mr. Shad Kane on 10 February 2009 to discuss the alignment. Mr. Kane led the group along the graded alignment of SIHP # 50-80-09-2268, within the property, indicating the ditch had been constructed over the alignment of an ancient Hawaiian trail. SHPD staff observed the plantation irrigation ditch and associated infrastructure and concurred the alignment was a portion of the Waiahole Ditch System. SHPD staff also concluded the ditch was most likely constructed over the alignment of a pre-Contact Hawaiian trail. SHPD staff expressed a concern that documentation make it clear the pre-Contact Hawaiian trail function

was the dominant function of this designated site in the vicinity (which was then developed as the Waiahole Ditch in the early twentieth century). This discussion of a Hawaiian trail function was understood to apply only to that portion of the Waiahole Ditch System at Kalo'i Gulch.

Two new features (SIHP # 50-80-09-2268 Features B and C) associated with the main ditch were also documented. These features are drainage-related, with the function of preventing storm water and sediment from entering the main Waiahole Ditch.

3.2.15 Runyon et al. 2010

In 2010, CSH conducted archaeological monitoring for Phase 1B of the North-South Road project (Runyon et al. 2010). No historic properties were identified.

3.2.16 Runyon et al. 2011

In 2011, CSH completed archaeological monitoring for phase 1C of the North-South Road project (Runyon et al. 2011). Two historic properties were identified. A previously identified historic water diversion structure (SIHP # 50-80-12-4664), originally documented by Nakamura et al. (1993), was observed on the southwest edge of Ramp C. A newly identified burnt trash fill layer (SIHP # 50-80-12-7128) was documented directly under Pālehua Road on the west edge of Ramp A.

3.2.17 Pacheco and Rieth 2014

In 2014, IARII conducted an archaeological inventory survey (Pacheco and Rieth 2014) for an East Kapolei Solar Farm project (on approximately 19 acres of TMK: [1] 9-2-002:006). The study documented one historic property: SIHP # 50-80-12-7433, an unpaved early twentieth century road related to ranching and/or sugarcane cultivation in the area, understood as created between 1918 and 1928.

3.2.18 Zapor et al. 2018

CSH conducted a supplemental archaeological inventory survey for the Makakilo Drive Extension project (Zapor et al. 2018). The survey identified two historic properties: remnant portions of the Waiahole Ditch (SIHP # 50-80-09-2268) and irrigation ditches (SIHP # 50-80-12-6951). The project documented an additional feature of the Waiahole Ditch, an earthen mound and stacked stone wall, interpreted as likely remnants of a reservoir (Feature D). SIHP # 50-80-12-6951 was observed as an irrigation ditch and associated retaining wall, pipe, valve, and sluice gate remnants.

3.3 Background Summary and Predictive Model

Background research of Honouliuli Ahupua'a indicated pre-Contact settlement was centered around the rich cultivated lands of Honouliuli 'Ili for extensive wetland taro cultivation and abundant coastal resources. The extensive limestone plain also included recurrent use habitations for fishermen and gatherers, and sometimes gardeners. The upland dry forest areas were used for hunting and gathering of forest resources, but likely not for widespread permanent settlement. In the intermediate area between the limestone plain and the upland forests, in the vicinity of the current study area, indigenous Hawaiian activities would have been limited to dryland agriculture within gulches or near springs, and *mauka* to *makai* trails and associated temporary shelters.

Within the “Makaīwa Hills” area, which is southwest of the project area, pre-Contact habitation sites were found clustered in higher elevations above 1,000 ft, and in lower elevations below 500 ft (Hammatt et al. 1991). The higher elevations, where the current study is located, do not contain forest subsistence resources.

In Von Holt’s (1985) accounts of discovering spring water southwest of the study area, it is noted that Kalo’i had “been a place of which the Hawaiians had known” and the area “had been quite heavily populated before the smallpox epidemic of 1840” (von Holt 1985:138–140). However, there was no mention of observations of any physical evidence of Hawaiian settlement, other than the paved well (Hidden Spring). It is quite possible ranching or agricultural activities destroyed any remnants of Hawaiian occupation prior to the late 1800s.

By 1920, the lands of Honouliuli were used primarily for commercial sugarcane cultivation and ranching (Frierson 1972). Much of the *mauka* lands in western Honouliuli, including ridges and deep gulches, were unsuitable for commercial sugar cultivation and remained pasture land for grazing livestock. Historic maps indicate a lack of any significant development within the study area into the 1940s. Modest constructions in the area included Pālehua Road, allowing access to the uplands of western Honouliuli, as well as plantation infrastructure within and to the south of the study area.

Previous archaeological research in the vicinity of the project area has identified pre-Contact sites including habitation structures (temporary and permanent) and agricultural features (terrace and mounds). Of particular interest are three pre-Contact historic properties located within the *mauka* reaches of Kalo’i Gulch. All three were determined to be related to erosion control and water management and suggest that in the past water was available, at least on a seasonal basis, in the Kalo’i Gulch area. Historic properties identified in the vicinity of the study area include plantation-era infrastructure (ditches, flumes, clearing mounds, etc.) related to the Ewa Plantation Company and Oahu Sugar Company.

Based on background research, archaeologists expected to document historic features related to sugarcane cultivation and ranching, including walls, fences, maintained springs, and water tunnels as well as irrigation infrastructure including ditches and flumes related to the Ewa Plantation Company, Oahu Sugar Company, and the Waiahole Ditch System.

Section 4 Results of Fieldwork

The project area consists of a largely undeveloped property with rolling hills and several gulch areas. In general, the sloping lands within the project area are dry, fallow lands that appear to have undergone significant erosion of topsoil. Much of the nearly 101.62-acre project area is covered in thick vegetation including California grass (*Brachiaria mutica*), koa haole (*Leucaena leucocephala*), wiliwili (*Erythrina sandwicensis*), sweet acacia or *klu* (*Acacia farnesiana*), and *kiawe* (*Prosopis pallida*) (Figure 27 through Figure 29). The hillside within the project area also exhibited land modification in the form of graded access roads, bulldozed clearings, a portion of the Waiahole Ditch System, and remnants of the abandoned historic irrigation system and plantation infrastructure. Modern barbed wire fences were also observed surrounding the southern border of the project area, indicative of the continued use of portions of the project area for grazing livestock. Cow paths were identified meandering throughout the project area. Various fence posts were observed in the southwest project area, determined not to be associated with those fence lines noted on historic maps of the area based on their location and alignment (Figure 30).

The 1936 U.S. Army War map (see Figure 16) shows a camp ("Pump Camp 5") located in the central portion of the project area. The camp is last depicted on the 1953 USGS map (see Figure 19). On the 1968 USGS map (see Figure 20) the camp is no longer depicted. An effort was made to identify any remnants of the former camp during fieldwork, but no remnants were identified during the pedestrian inspection.

The pedestrian survey identified two historic properties within the project area: SIHP # 50-80-08-5593, identified as remnant structures associated with water allocation related to plantation activities, and SIHP # 50-80-09-2268, identified as a portion of the Waiahole Ditch System, which extends along the northern boundary of the project area, crossing into the southwest project area and exiting at the southern boundary. Both of these historic properties were previously identified in the immediate area by Dega et al. (1998). The current project documented two features of SIHP # 50-80-08-5593 (Features 1 through 2E), which include retention basins, drain pipes, culvert, sluice gates, and various other components related to water control and retention. Most features of SIHP # 50-80-08-5593 were identified extending northwest to southeast down a slope in the north portion of the project area, designated as a complex related to water control. The complex is related to—and in line with—the pump station and mill building at the base of the hill, just outside the southern boundary of the project area. The complex consists of various water retention components, runoff features, a remnant water tower, pipes, and concrete features likely housing additional pipes. The uppermost components in this complex of features were constructed around a portion of the Waiahole Ditch, and would have utilized water from the ditch, channeling it down the slope to the pump station and mill, where it would have been pumped out to irrigate the surrounding sugarcane fields. One additional feature was identified in the north/central project area.

A remnant portion of the Waiahole Ditch (SIHP # 50-80-09-2268) extends along the northern boundary of the project area. Toward the western portion of the project area, the Waiahole Ditch crosses through the project area and extends to the southwest. The ditch extends underground through much of the project area. Observed portions of the ditch displayed culverts, bridges, tunnels, and flumes. Composition of the ditch varied from entirely earthen portions to concrete